SEMESTER I

MAT 101	LINEAR ALGEBRA AND CALCULUS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarises students with some basic techniques in matrix theory which are essential for analysing linear systems. The calculus of functions of one or more variables taught in this course are useful in modelling and analysing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

Prerequisite: A basic course in one-variable calculus and matrix theory**.**

Course Outcomes: After the completion of the course the student will be able to

CO 1	solve systems of linear equations, diagonalize matrices and characterise quadratic forms
CO 2	compute the partial and total derivatives and maxima and minima of multivariable functions
CO 3	compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas
CO 4	perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent
CO 5	determine the Taylor and Fourier series expansion of functions and learn their applications.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	2	3	2	1	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks
Assignments: Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): Solve systems of linear equations, diagonalize matrices and characterise quadratic forms

1. A is a real matrix of order $3 \times 3$and $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. What can you say about the solution of $AX = 0$if rank of A is 1? 2 ?3?
2. Given$A = \begin{bmatrix} 3 & 0 & 2 \\ 0 & 2 & 0 \\ -2 & 0 & 0 \end{bmatrix}$, find an orthogonal matrix Pthat diagonalizes A.
3. Find out what type of conic section the following quadratic form represents

$$17x^2 - 30x_1x_2 + 17x_2^2 = 128$$

4. The matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$has an eigen value5 with corresponding Eigen vector$X = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$. Find A^5X

Course Outcome 2 (CO2): compute the partial and total derivatives and maxima and minima of multivariable functions

1. Find the slope of the surface $z = x^2y + 5y^3$in the x-direction at the point (1,-2)

2. Given the function $w = xy + z$, use chain rule to find the instantaneous rate of change of $w$at each point along the curve $x = cost, y = sint, z = t$

3. Determine the dimension of rectangular box open at the top , having a volume 32 cubic ft and requiring the least amount of material for it's construction.

Course Outcome 3(CO3): compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas.

1. Evaluate $\iint_D (x + 2y)\, DA$where D is the region bounded by the parabolas $y = 2x^2$and $y = 1 + x^2$

2. Explain how you would find the volume under the surface $z = f(x,y)$and over a specific region Din the xyplane using (i) double integral (ii) triple integral?

3. Find the mass and centre of gravity of a triangular lamina with vertices (0,0), (2,1), (0,3) if the density function is $f(x,y) = x + y$

4. Use spherical coordinates to evaluate $\iiint_B (x^2 + y^2 + z^2)^3\, dV$where B is the unit ball defined by $B = \{(x,y,z): x^2 + y^2 + z^2 \leq 1\}$

Course Outcome 4 (CO4): perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent.

1. What is the difference between a sequence and a series and when do you say that they are convergent? Divergent?

2. Determine whether the series $\sum_{n=1}^{n=\infty} \frac{5}{2n^2+4n+3}$converges or diverges.

3. Is the series $\sum_{n=1}^{n=\infty} \frac{(-1)^{n-1}}{n}$convergent? Absolutely convergent? Conditionally convergent?

Course Outcome 5 (CO5): determine the Taylor and Fourier series expansion of functions and learn their applications.

1. Assuming the possibility of expansion find the Maclaurin series expansion of

   $f(x) = (1 + x)^k$for$|x| < 1$where $k$is any real number. What happens if $k$is a positive

   integer?

2. Use Maclaurin series of $ln(1 + x), -1 < x \leq 1$to find an approximate value of$ln2$.

3. Find the Fourier series of the function$f(x) = x^2, -2 \leq x < 2, f(x + 4) = f(x)$. Hence using Parseval's identity prove that $1 + \frac{1}{2^4} + \frac{1}{3^4} + \ \dots\ = \frac{\pi^4}{90}$

4. Expand the function $f(x) = x\ (0 < x < 1/2)$ into a (i) Fourier sine series (ii) Fourier cosine series.

Model Question paper

QP CODE: PAGES:3

Reg No:_______________

Name :_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

***Course Code:* MAT 101**

Max. Marks: 100 **Duration: 3 Hours**

LINEAR ALGEBRA AND CALCULUs

(2019-Scheme)

(Common to all branches)

PART A

(Answer **all** questions, **each** question carries 3 marks)

1. Determine the rank of the matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ -2 & -4 & 2 \\ 3 & 6 & -3 \end{bmatrix}$.
2. Write down the eigen values of $= \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$. What are the eigen values of $P^{-1}AP$ where $P = \begin{bmatrix} -4 & 2 \\ 3 & -1 \end{bmatrix}$?
3. Find $f_x(1,3)$ and $f_y(1,3)$ for the function $f(x,y) = 2x^3y^2 + 2y + 4x$.
4. Show that the function $u(x,t) = \sin(x - ct)$ is a solution of the equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$.
5. Use double integral to find the area of the region enclosed between the parabolas $y = \frac{1}{2}x^2$ and the line $y = 2x$.
6. Use polar coordinates to evaluate the area of the region bounded by $x^2 + y^2 = 4$, the line $y = x$ and the y axis in the first quadrant
7. Test the convergence of the series $\sum_{k=1}^{\infty} \frac{k}{k+1}$.
8. Test the convergence of the alternating series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{1}{k}$ using Leibnitz test.
9. Find the Taylor series expansion of $sin\pi x$about$x = \frac{1}{2}$.
10. Find the values to which the Fourier series of

    $f(x) = x$for$-\pi < x < \pi$, with $f(x + 2\pi) = f(x)$ converges (10x3=30)

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module -I

11. (a) Solve the following system of equations

$$y + z - 2w = 0$$
$$2x - 3y - 3z + 6w = 2$$
$$4x + y + z - 2w = 4$$

(b) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$

12. (a) Diagonalize the matrix $\begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$

(b) What kind of conic section the quadratic form $3x_1^2 + 22x_1x_2 + 3x_2^2 = 0$ represents? Transform it to principal axes.

Module - II

13. (a) Find the local linear approximation to $f(x, y) = \sqrt{x^2 + y^2}$ at the point $(3, 4)$.Use it to approximate $f(3.04, 3.98)$

(b) Let $w = \sqrt{x^2 + y^2 + z^2}$, $x = cos\theta, y = sin\theta, z = tan\theta$. Use chain rule to find $\frac{dw}{d\theta}$ when $\theta = \frac{\pi}{4}$.

14. (a) Let $z = f(x, y)$ where $x = rcos\theta, y = rsin\theta$, prove that $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial z}{\partial \theta}\right)^2$.

(b) Locate all relative maxima, relative minima and saddle points $f(x, y) = xy + \frac{a^3}{x} + \frac{b^3}{y} (a \neq 0, b \neq 0)$.

Module - III

15. (a) Evaluate $\iint_D (2x^2y + 9y^3)\, dxdy$ where D is the region bounded by $y = \frac{2}{3}x$ and $y = 2\sqrt{x}$

(b) Evaluate $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3}\, dxdy$ changing the order of integration.

16. (a) Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$..

(b) Evaluate $\iiint \sqrt{1 - x^2 - y^2 - z^2}\, dxdydz$, taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$, by transforming to spherical polar coordinates

Module - IV

17. (a) Test the convergence of the series

(i) $\sum_{k=1}^{\infty} \frac{k^k}{k!}$ (ii) $\sum_{k=2}^{\infty} \left(\frac{4k-5}{2k+1}\right)^k$

(b) Determine the convergence or divergence of the series $\sum_{k=1}^{\infty} (-1)^k \frac{(2k-1)!}{3^k}$

18. (a) Check whether the series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{(2k)!}{(3k-2)!}$ is absolutely convergent, conditionally convergent or divergent.

(b) Test the convergence of the series $1 + \frac{1.2}{1.3} + \frac{1.2.3}{1.3.5} + \frac{1.2.3.4}{1.3.5.7} + \cdots$

Module - V

19. (a) Obtain the Fourier series of for $f(x) = e^{-x}$, in the interval $0 < x < 2\pi$.with $f(x + 2\pi) = f(x)$. Hence deduce the value of $\sum_{n=2}^{\infty} \frac{(-1)^n}{1+n^2}$.

(b) Find the half range sine series of $f(x) = \begin{cases} \frac{2kL}{x} & if\ 0 < x < \frac{L}{2} \\ \frac{2k(L-x)}{L} & if\ \frac{L}{2} < x < L \end{cases}$

20. (a)Expand $(1 + x)^{-2}$.as a Taylor series about $x = 0$and state the region of convergence of the series.

(b) Find the Fourier series for $f(x) = x^2$ in the interval $-\pi < x < \pi$

with $f(x + 2\pi) = f(x)$.Hence show that $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \cdots = \frac{\pi^4}{90}$. (14X5=70)

Syllabus

Module 1 (Linear algebra)

(Text 2: Relevant topics from sections 7.3, 7.4, 7.5, 8.1,8.3,8.4)

Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof), Eigen values and eigen vectors. Diagonaliztion of matrices, orthogonal transformation, quadratic forms and their canonical forms.

Module 2 (multivariable calculus-Differentiation)

(Text 1: Relevant topics from sections 13.3, 13.4, 13.5, 13.8)

Concept of limit and continuity of functions of two variables, partial derivatives, Differentials, Local Linear approximations, chain rule, total derivative, Relative maxima and minima, Absolute maxima and minima on closed and bounded set.

Module 3(multivariable calculus-Integration)

(Text 1: Relevant topics from sections 14.1, 14.2, 14.3, 14.5, 14.6, 14.8)

Double integrals (Cartesian), reversing the order of integration, Change of coordinates (Cartesian to polar), finding areas and volume using double integrals, mass and centre of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates (computations involving spheres, cylinders).

Module 4 (sequences and series)

(Text 1: Relevant topics from sections 9.1, 9.3, 9.4, 9.5, 9.6)

Convergence of sequences and series, convergence of geometric series and p-series(without proof), test of convergence (comparison, ratio and root tests without proof); Alternating series and Leibnitz test, absolute and conditional convergence.

Module 5 (Series representation of functions)

(Text 1: Relevant topics from sections 9.8, 9.9. Text 2: Relevant topics from sections 11.1, 11.2, 11.6)

Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formulas, Convergence of Fourier series (without proof), half range sine and cosine series, Parseval's theorem (without proof).

Text Books

1. H. Anton, I. Biven,S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, John Wiley & Sons, 2016.

Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint, 2002.
3. Peter V. O'Neil, Advanced Engineering Mathematics , Cengage, 7th Edition, 2012
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Linear Algebra (10 hours)**	
1.1	Systems of linear equations, Solution by Gauss elimination	1
1.2	Row echelon form, finding rank from row echelon form, fundamental theorem for linear systems	3
1.3	Eigen values and eigen vectors	2
1.4	Diagonaliztion of matrices, orthogonal transformation, quadratic forms	4

	and their canonical forms.	
2	**Multivariable calculus-Differentiation (8 hours)**	
2.1	Concept of limit and continuity of functions of two variables, partial derivatives	2
2.2	Differentials, Local Linear approximations	2
2.3	Chain rule, total derivative	2
2.4	Maxima and minima	2
3	**Multivariable calculus-Integration (10 hours)**	
3.1	Double integrals (Cartesian)-evaluation	2
3.2	Change of order of integration in double integrals, change of coordinates (Cartesian to polar),	2
3.3	Finding areas and volumes, mass and centre of gravity of plane laminas	3
3.4	Triple integrals	3
4	**Sequences and series (8 hours)**	
4.1	Convergence of sequences and series, geometric and p-series	2
4.2	Test of convergence(comparison, ratio and root)	4
4.3	Alternating series and Leibnitz test, absolute and conditional convergence	2
5	**Series representation of functions (9 hours)**	
5.1	Taylor series, Binomial series and series representation of exponential, trigonometric, logarithmic functions;	3
5.2	Fourier series, Euler formulas, Convergence of Fourier series(Dirichlet's conditions)	3
5.3	Half range sine and cosine series, Parseval's theorem.	3

PHT 100	ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Classify the properties of magnetic materials and apply vector calculus to static magnetic fields and use Maxwell's equations to diverse engineering problems
CO 5	Analyze the principles behind various superconducting applications, explain the working of solid state lighting devices and fibre optic communication system

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3	1						1	2			1
CO 5	3	1						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.

2. Distinguish between transverse and longitudinal waves.

3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.

   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.

2. Distinguish between Fresnel and Fraunhofer diffraction.

3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.

   (b) A liquid of refractive index μ is introduced between the lens and glass plate.

What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function ?

2. What are excitons ?

3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.

   (b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Compare displacement current and conduction current.

2. Mention any four properties of ferro magnetic materials.

3. (a) Starting from Maxwell's equations, derive the free space electromagnetic wave equation and show that velocity of electromagnetic wave is $1/(\mu_o \varepsilon_o)^{1/2}$

   (b) An electromagnetic wave is described by $E = 100 \exp 8\pi i [10^{14} t - (10^6 z / 3)]$ V/m. Find the direction of propagation of the wave,speed of the wave and magnetic flux density in the wave.

Course Outcome 5 (CO5):

1. Explain the working of a solar cell.

2. Distinguish between Type I and Type II super conductors.

3. (a) Define numerical aperture and derive an expression for it.

   (b) Explain the working of intensity modulated fibre optic sensor.

Model Question paper

QP CODE: PAGES:3

Reg No:_______________

Name :_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 100

Course Name: Engineering Physics A

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators
2. Distinguish between longitudinal and transverse waves
3. Write a short note on antireflection coating.
4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.
5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.
6. Explain surface to volume ratio of nanomaterials.
7. State Faraday's laws of electromagnetic induction.
8. Compare displacement current and conduction current
9. List four important applications of superconductors.
10. Give the working principle of LED. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution.Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is 7×10^{4}. Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value.(4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t)m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv)Velocity of the wave. (4)

Module 2

13.(a)Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid. (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given β = 0.0555 cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15.(a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16.(a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17.(a) State Poynting's Theorem. Calculate the value of Poynting vector at the surface of the sun if the power radiated by the sun is 3.8×10^{26} W and its radius is 7×10^{8} m. (5)

(b) Distinguish between paramagnetic, diamagnetic and ferromagnetic materials. (9)

18.(a) Starting from Maxwell's Equations, derive electromagnetic wave equations in free space. (10)

(b) If the magnitude of **H** in a plane wave is 1 A/m, find the magnitude of **E** in free space. (4)

Module 5

19.(a) Show that superconductors are perfect diamagnets. Distinguish between Type I and Type II superconductors with suitable examples. (10)

(b) Write a short note on high temperature superconductors. (4)

20.(a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33. (4)

(14x5=70)

Syllabus

ENGINEERING PHYSICS A
(FOR CIRCUIT BRANCHES)

Module 1
Oscillations and Waves
Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2
Wave Optics
Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3
Quantum Mechanics & Nanotechnology
Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4
Magnetism & Electro Magnetic Theory
Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux, Magnetic permeability and susceptibility, Classification of magnetic materials-para, dia and ferromagnetic materials

Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem, Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)

Module 5

Superconductivity & Photonics

Superconducting phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II, BCS Theory (Qualitative), High temperature superconductors-Applications of super conductivity

Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics, Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors.

Text Books

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition 2019

2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition 2017

Reference Books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. Halliday, Resnick, Walker, "Fundamentals of Physics'', John Wiley & Sons.Inc, 2001
8. David J Griffiths, "Introduction to Electrodynamics'', Addison-Wesley publishing, 3rd Edition, 1999
9. Premlet B., "Advanced Engineering Physics", Phasor Books,10th edition,2017
10. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves. Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hr
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Magnetism & Electro Magnetic Theory (9 hours)**	
4.1	Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux	2 hrs

	density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux	
4.2	Explanation for Magnetic permeability and susceptibility Classification of magnetic materials- para, dia and ferromagnetic materials	1 hr
4.3	Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem	2 hrs
4.4	Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)	4 hrs
5	**Superconductivity &Photonics (9hours)**	
5.1	Super conducting Phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II	2 hrs
5.2	BCS Theory (Qualitative), High temperature superconductors, Applications of super conductivity	2 hrs
5.3	Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics	2 hrs
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

PHT 110	ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)	Category	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Apply the knowledge of ultrasonics in non-destructive testing and use the principles of acoustics to explain the nature and characterization of acoustic design and to provide a safe and healthy environment
CO 5	Apply the comprehended knowledge about laser and fibre optic communication systems in various engineering applications

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3							1	2			1
CO 5	3	2						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50

Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE MARKS	ESE MARKS	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.
   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.
   (b) A liquid of refractive index μ is introduced between the lens and glass plate. What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function?

2. What are excitons ?
3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.
   (b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Explain reverberation and reverberation time.
2. How ultrasonic waves are used in non-destructive testing.
3. (a) With a neat diagram explain how ultrasonic waves are produced by a piezoelectric oscillator.
   (b) Calculate frequency of ultrasonic waves that can be produced by a nickel rod of length 4 cm. (Young's Modulus = 207 G Pa, Density = 8900 Kg /m^3)

Course Outcome 5 (CO 5):

1. Distinguish between spontaneous emission and stimulated emission.
2. Explain optical resonators.
3. (a) Explain the construction and working of Ruby Laser.
   (b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33.

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Model Question paper

QP CODE: PAGES:3

Reg No:_______________

Name :_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 110

Course Name: Engineering Physics B

Max.Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators.

2. Distinguish between longitudinal and transverse waves.

3. Write a short note on antireflection coating.

4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.

5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.

6. Explain surface to volume ratio of nanomaterials.

7. Define sound intensity level. Give the values of threshold of hearing and threshold of pain.

8. Describe the method of non-destructive testing using ultra sonic waves

9. Explain the condition of population inversion

10. Distinguish between step index and graded index fibre. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution. Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is 7×10^{4}. Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value. (4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t) m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of the wave. (4)

Module 2

13. (a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid? (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given β = 0.0555 cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15. (a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16. (a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17. (a) Explain reverberation and reverberation time? What is the significance of Reverberation time. Explain the factors affecting the acoustics of a building and their corrective measures? (10)

(b) The volume of a hall is 3000 m^3. It has a total absorption of 100m^2 sabine. If the hall is filled with audience who add another 80 m^2sabine, then find the difference in reverberation time. (4)

18. (a) With a neat diagram explain how ultrasonic waves are produced by piezoelectric oscillator. Also discuss the piezoelectric method of detection of ultrasonic waves. (10)

(b) An ultrasonic source of 0.09 MHz sends down a pulse towards the sea bed which returns after 0.55 sec. The velocity of sound in sea water is 1800 m/s. Calculate the depth of the sea and the wavelength of the pulse. (4)

Module 5

19. (a) Outline the construction and working of Ruby laser. (8)

(b) What is the principle of holography? How is a hologram recorded? (6)

20. (a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) An optical fibre made with core of refractive index 1.5 and cladding with a fractional index difference of 0.0006. Find refractive index of cladding and numerical aperture. (4)

(14x5=70)

SYLLABUS

ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)

Module 1

Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2

Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton’s rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3

Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening Mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4

Acoustics & Ultrasonics

Acoustics, Classification of sound-Musical sound-Noise, Characteristics of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine’s formula (no derivation), Factors affecting architectural acoustics and their remedies

Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator –Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods, Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid , Applications of ultrasonic waves -SONAR,NDT and Medical

Module 5

Laser and Fibre optics

Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle, Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) ,Applications of laser, Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications

Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors

Text Books

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition, 2019.

2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition, 2017.

Reference Books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. B. B. Laud, "Lasers and Non linear optics", New age International Publishers, 2nd Edition ,2005
8. Premlet B., "Advanced Engineering Physics", Phasor Books,10^{th} edition ,2017
9. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hrs
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Acoustics & Ultrasonics (9hrs)**	
4.1	Acoustics, Classification of sound-Musical sound-Noise, Characteristics	3 hrs

	of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation)	
4.2	Factors affecting architectural acoustics and their remedies	1 hr
4.3	Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods	3hrs
4.4	Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid ,Applications of ultrasonic waves -SONAR,NDT and Medical.	2 hr
5	**Laser and Fibre optics (9hours)**	
5.1	Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle	2 hrs
5.2	Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) Applications of laser	3 hrs
5.3	Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications	1 hr
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

CYT 100	ENGINEERING CHEMISTRY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like spectroscopy, electrochemistry, instrumental methods etc. Also familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, SEM, stereochemistry, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

Prerequisite: Concepts of chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Apply the basic concepts of electrochemistry and corrosion to explore its possible applications in various engineering fields.
CO 2	Understand various spectroscopic techniques like UV-Visible, IR, NMR and its applications.
CO 3	Apply the knowledge of analytical method for characterizing a chemical mixture or a compound. Understand the basic concept of SEM for surface characterisation of nanomaterials.
CO 4	Learn about the basics of stereochemistry and its application. Apply the knowledge of conducting polymers and advanced polymers in engineering.
CO 5	Study various types of water treatment methods to develop skills for treating wastewater.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1									
CO 2	1	1		1	2							
CO 3	1	1		1	2							
CO 4	2	1										
CO 5	1			1			3					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

End Semester Examination Pattern: There will be two parts- **Part A** and **Part B. Part A** contains **10** questions (**2** questions from each module), having **3** marks for each question. Students should answer **all** questions. **Part B** contains **2** questions from each module, of which student should answer any one. Each question can have maximum **2** subdivisions and carries **14** marks.

Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is calomel electrode? Give the reduction reaction (3 Marks)

2. List three important advantages of potentiometric titration (3 Marks)

3. (a) Explain how electroless plating copper and nickel are carried out (10 Marks)

(b) Calculate the emf of the following cell at 30°C, Z n / Zn $^{2+}$ (0.1M) // Ag^+ (0.01M) // Ag.

Given E^0 Zn^{2+}/Zn = -0.76 V, E^0 Ag^+/Ag = 0.8 V. (4 Marks)

Course Outcome 2 (CO 2)

1. State Beer Lambert's law (3 Marks)

2. List the important applications of IR spectroscopy (3 Marks)

3. (a) What is Chemical shift? What are factors affecting Chemical shift? How ^1H NMR spectrum of CH_3COCH_2Cl interpreted using the concept of chemical shift. (10 Marks)

(b) Calculate the force constant of HF molecule, if it shows IR absorption at 4138 cm^{-1}. Given that atomic masses of hydrogen and fluorine are 1u and 19u respectively. (4 Marks)

Course Outcome 3 (CO 3):

1. Distinguish between TGA and DTA (3 Marks)

2. Give two differences between GSC and GLC (3 Marks)

3. (a) Explain the principle, instrumentation and procedure of HPLC (10 Marks)

(b) Interpret TGA of CaC_2O_4. H_2O (4 Marks)

Course Outcome 4 (CO 4):

1. Explain the geometrical isomerism in double bonds (3 Marks)

2. What are the rules of assigning R-S notation? (3 Marks)

3. (a) What are conducting polymers? How it is classified? Give the preparation of polyaniline (10 Marks)

(b) Draw the stereoisomers possible for CH_3-$(CHOH)_2$-COOH (4 Marks)

Course Outcome 5 (CO 5):

1. What is degree of hardness? (3 Marks)

2. Define BOD and COD (3 Marks)

3. (a) Explain the EDTA estimation of hardness (10 Marks)

(b) Standard hard water contains 20 g of CaCO3 per liter,50 mL of this required 30mL of EDTA solution, 50mL of sample water required 20mL of EDTA solution. 50mL sample water after boiling required 14 mL EDTA solution. Calculate the temporary hardness of the given sample of water, in terms of ppm. (4 Marks)

MODEL QUESTION PAPER

Total Pages:

Reg No.:________________ Name:____________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER B.TECH DEGREE EXAMINATION

Course Code: CYT100,

Course Name: ENGINEERING CHEMISTRY

Max. Marks: 100 Duration: 3 Hours

PART A

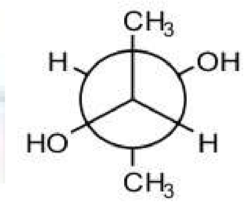
Answer all questions, each carries 3 marks Marks

1	What is potentiometric titration? How the end point is determined graphically?	(3)
2	What is Galvanic series? How is it different from electrochemical series?	(3)
3	Which of the following molecules can give IR absorption? Give reason?	(3)
	(a) O_2 (b) H_2O (c) N_2 (d) HCl	
4	Which of the following molecules show UV-Visible absorption? Give reason.	(3)
	(a) Ethane (b) Butadiene (c) Benzene	

5 What are the visualization techniques used in TLC? (3)

6 Write the three important applications of nanomaterials. (3)

7 Draw the Fischer projection formula and find R-S notation of (3)



8 Write the structure of a) Polypyrroleb) Kevlar. (3

9 What is break point chlorination? (3)

10 What is reverse osmosis? (3)

PART B

Answer any one full question from each module, each question carries 14 marks

Module 1

11 a) Give the construction of Li-ion cell. Give the reactions that take place at the electrodes during charging and discharging. What happens to anodic material when the cell is 100% charged. (10)

b) Calculate the standard electrode potential of Cu, if its electrode potential at 25 °C is 0.296 V and the concentration of Cu^{2+} is 0.015 M. (4)

OR

12 a) Explain the mechanism of electrochemical corrosion of iron in oxygen rich and oxygen deficient acidic and basic environments. (10)

b) Given below are reduction potentials of some species (4)

$MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O$; $E^0 = +1.51$ V

$Cl_2 + 2e \rightarrow 2Cl^-$; $E^0 = +1.36$ V

$S_2O_8^{2-} + 2e \rightarrow 2SO_4^{2-}$; $E^0 = +1.98$ V

Use the above data to examine whether the acids, dil. HCl and dil. H_2SO_4 , can be used to provide acid medium in redox titrations involving $KMnO_4$.

Module 2

13 a) What is spin-spin splitting? Draw the NMR spectrum of (i) CH_3 CH_2CH_2 Br (ii) $CH_3CH(Br)CH_3$ Explain how NMR spectrum can be used to identify the two isomers. (10)

b) A dye solution of concentration 0.08M shows absorbance of 0.012 at 600 nm; while a test solution of same dye shows absorbance of 0.084 under same conditions. Find the concentration of the test solution. (4)

OR

14 a) Explain the basic principle of UV-Visible spectroscopy. What are the possible electronic transitions? Explain with examples. (10)

b) Sketch the vibrational modes of CO_2 and H_2O. Which of them are IR active? (4)

Module 3

15	a)	Explain the principle, instrumentation and procedure involved in gas chromatography.	(10)
	b)	Explain the DTA of $CaC_2O_4.H_2O$ with a neat sketch.	(4)

OR

16	a)	Explain the various chemical methods used for the synthesis of nanomaterial	(10)
	b)	How TGA is used to analyse the thermal stability of polymers?	(4)

Module 4

17	a)	What are conformers? Draw the*cis* and *trans*isomers of 1, 3-dimethylcylohexane. Which conformer (chair form) is more stable in each case?	(10)
	b)	What is ABS? Give properties and applications.	(4)

OR

18	a)	Explain the various structural isomers with suitable example.	(10)
	b)	What is OLED? Draw a labelled diagram.	(4)

Module 5

19	a)	What are ion exchange resins? Explain ion exchange process for removal of hardness of water? How exhausted resins are regenerated?	(10)
	b)	50 mL sewage water is diluted to 2000 mL with dilution water; the initial dissolved oxygen was 7.7 ppm. The dissolved oxygen level after 5 days of incubation was 2.4 ppm. Find the BOD of the sewage.	(4)

OR

20	a)	What are the different steps in sewage treatment? Give the flow diagram. Explain the working of trickling filter.	(10)
	b)	Calculate the temporary and permanent hardness of a water sample which contains $[Ca^{2+}]$ = 160 mg/L, $[Mg^{2+}]$ = 192 mg/L and $[HCO_3^-]$ = 122 mg/L.	(4)

Syllabus

Module 1

Electrochemistry and Corrosion

Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes - SHE - Calomel electrode - Glass Electrode - Construction and Working. Single electrode potential - definition - Helmholtz electrical double layer -Determination of E^0 using calomel electrode.Determination of pH using glass electrode.Electrochemical series and its applications. Free energy and EMF - Nernst Equation - Derivation - single electrode and cell (Numericals) -Application - Variation of emf with temperature. Potentiometric titration - Introduction -Redox titration only.Lithiumion cell - construction and working.Conductivity- Measurement of conductivity of a solution (Numericals).

Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.

Module 2

Spectroscopic Techniques and Applications

Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications. ^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).

Module 3

Instrumental Methods and Nanomaterials

Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$. Chromatographic methods - Basic principles and applications of column and TLC-Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.

Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).

Module 4

Stereochemistry and Polymer Chemistry

Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.

Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications.Kevlar-preparation, properties and applications.Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.

Module 5

Water Chemistry and Sewage Water Treatment

Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.

Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.

Text Books

1. B. L. Tembe, Kamaluddin, M. S. Krishnan, "Engineering Chemistry (NPTEL Web-book)", 2018.

2. P. W. Atkins, "Physical Chemistry", Oxford University Press, 10th edn., 2014.

Reference Books

1. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 4thedn., 1995.
2. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
3. B. R. Puri, L. R. Sharma, M. S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 47th Edition, 2017.
4. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7th Edition, 2005.
5. Ernest L. Eliel, Samuel H. Wilen, "Stereo-chemistry of Organic Compounds", WILEY, 2008.
6. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc; 4th Revised Edition, 1996.
7. MuhammedArif, Annette Fernandez, Kavitha P. Nair "Engineering Chemistry", Owl Books, 2019.
8. Ahad J., "Engineering Chemistry", Jai Publication, 2019.
9. Roy K. Varghese, "Engineering Chemistry", Crownplus Publishers, 2019.
10. Soney C. George,RinoLaly Jose, "Text Book of Engineering Chemistry", S. Chand & Company Pvt Ltd, 2019.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures (hrs)
1	**Electrochemistry and Corrosion**	9
1.1	Introduction - Differences between electrolytic and electrochemical cells- Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes- SHE - Calomel electrode - Glass Electrode - Construction and Working.	2
1.2	Single electrode potential – definition - Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF - Nernst Equation – Derivation - single electrode and cell (Numericals) -Application -Variation of emf with temperature.	3
1.3	Potentiometric titration - Introduction -Redox titration only. Lithiumion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals).	2
1.4	Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	2
2	**Spectroscopic Techniques and Applications**	9
2.1	Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals).	2
2.2	UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.	2
2.3	IR-Spectroscopy – Principle - Number of vibrational modes -Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications.	2
2.4	^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).	3
3	**Instrumental Methods and Nanomaterials**	9
3.1	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$.	2

3.2	Chromatographic methods - Basic principles and applications of column and TLC-Retention factor.	**2**
3.3	GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.	**2**
3.4	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).	**3**
4	**Stereochemistry and Polymer Chemistry**	**9**
4.1	Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations).	**2**
4.2	R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.	**1**
4.3	Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.	**2**
4.4	Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	**4**
5	**Water Chemistry and Sewage Water Treatment**	**9**
5.1	Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	**3**
5.2	Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.	**2**
5.3	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals).	**2**
5.4	Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process.	**2**

EST 100	ENGINEERING MECHANICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	1	0	3	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to:

CO 1	Recall principles and theorems related to rigid body mechanics
CO 2	Identify and describe the components of system of forces acting on the rigid body
CO 3	Apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	Choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	Solve problems involving rigid bodies, applying the properties of distributed areas and masses

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	15
Understand	10	10	15
Apply	30	30	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

<u>End Semester Examination Pattern:</u> There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

<u>Course Level Assessment Questions:</u>

Part A

Course Outcome 1 (CO1): (One question from each module to meet the course objective 1: *To recall principles and theorems related to rigid body mechanics***)**

1. Explain D'Alembert's principle

2. Distinguish static and dynamic friction

3. State and explain perpendicular axis theorem

Course Outcome 2 (CO2) (One question from each module to meet the course objective 2: *To identify and describe the components of system of forces acting on the rigid body***)**

1. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

2. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

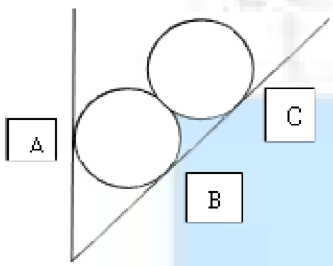
3. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

Part B

All the questions under this section shall assess the learning levels corresponding to the course outcomes listed below.

CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses

1. Two rollers each of weight 100 N are supported by an inclined plane and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth.

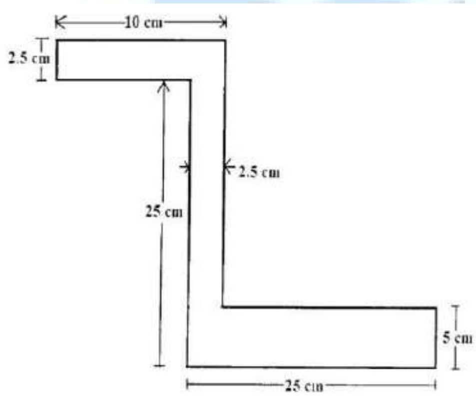


Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent equilibrium state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

2. A cylindrical disc, 50 cm diameter and cm thickness, is in contact with a horizontal conveyor belts running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s. Also compute the moment acting about the axis of the disc in both cases.

Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

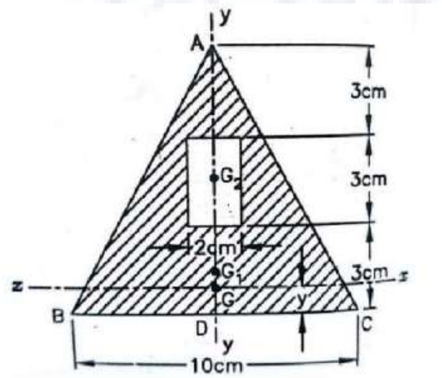
3. Determine the centroid of the given section



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of centroid for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed	Applying (Solve the problem based on the descriptions	6

	areas and masses	given in CO3 and CO4)	
Total			14

4. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC.



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of moment of inertia for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

Model Question Paper

QP CODE:

Reg No.:_______________

Name:___________________________ ___

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 100

ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 hours

Part A

(Answer all questions; each question carries 3 marks)

1. Explain D'Alembert's principle

2. Distinguish static and dynamic frictioni.

3. State and explain perpendicular axis theorem.

4. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

5. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

6. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

7. Compare damped and undamped free vibrations.

8. State the equation of motion of a rotating rigid body, rotating about its fixed axis.

9. Illustrate the significance of instantaneous centre in the analysis of rigid body undergoing rotational motion.

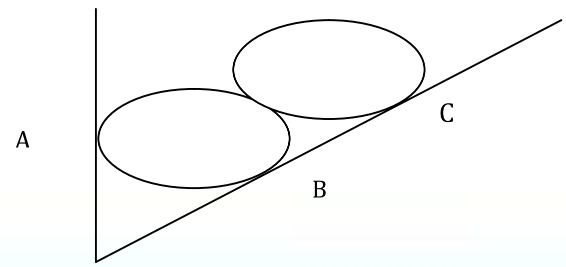
10. Highlight the principles of mechanics applied in the evaluation of elastic collusion of rigid bodies.

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module -I

11. Two identical rollers each of weight 100 N are supported by an inclined plane, making an angle of 30^{o} with the vertical, and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth. (14 marks)

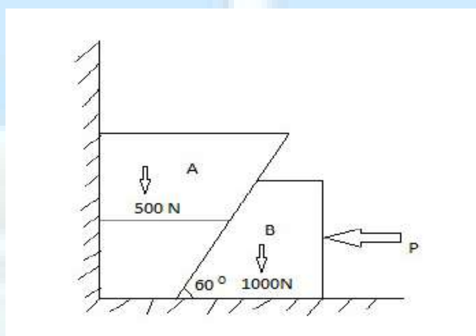


12. A string tied to a wall is made to pass over a pulley placed 2m away from it. A weight P is attached to the string such that the string stretches by 2m from the support on the wall to the location of attachment of weight. Determine the force P required to maintain 200 kg body in position for $\theta = 30^o$, The diameter of pulley B is negligible. (14 marks)

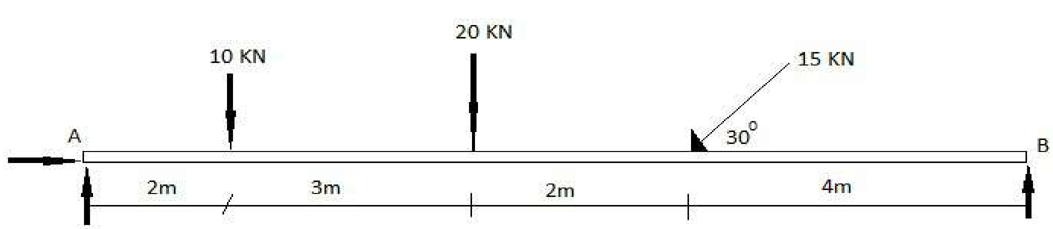
Module – 2

13. Two blocks A & B are resting against a wall and the floor as shown in figure below. Find the value of horizontal force P applied to the lower block that will hold the system in equilibrium. Coefficient of friction are : 0.25 at the floor, 0.3 at the wall and 0.2 between the blocks.

(14 marks)

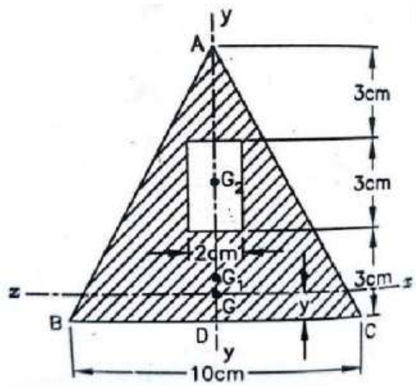


14. A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below. Find the reactions at A & B. (14 marks)

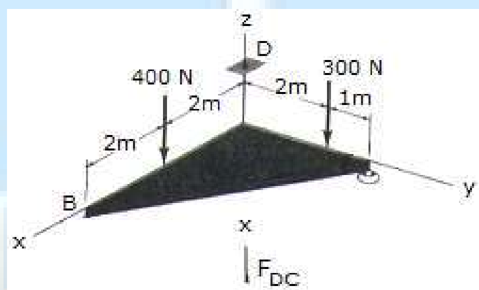


Module – 3

15. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC. (14 marks)



16. Support A has ball and socket connection. Roller support at B prevents motion in the —z direction. Corner *C* is tied to *D* by a rope. The triangle is weightless. Determine the unknown force components acting at *A*, *B*, and *C*. (14 marks)



Module - 4

17. A cricket ball is thrown by a fielder from a height of 2m at an angle of 30^0 to the horizontal with an initial velocity of 20 m/s , hits the wickets at a height of 0.5 m from the ground. How far was the fielder from the wicket? (14 marks)

18. An engine of weight 500 kN pull a train weighing 1500 kN up an incline of 1 in 100. The train starts from rest and moves with constant acceleration against a resistance of 5 N/kN. It attains a maximum speed of 36 kmph in 1 km distance. Determine the tension in the coupling between train and engine and the traction force developed by the engine. (14marks)

Module – 5

19. A cylindrical disc, 50 cm diameter and 10 cm thickness having mass of 10 kg, is in contact with a horizontal conveyor belt running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s in 10 seconds. Also compute the moment acting about the axis of the disc in both cases. (14 marks)

20. A wheel rotating about fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find the (i) angular velocity at the end of this interval and (ii) time required for the velocity to reach 100 revolutions per minute. (14 marks)

SYLLABUS

Module 1

Introduction to Engineering Mechanics-statics-basic principles of statics-Parallelogram law, equilibrium law, principles of superposition and transmissibility, law of action and reaction(review) free body diagrams.

Concurrent coplanar forces-composition and resolution of forces-resultant and equilibrium equations – methods of projections – methods of moments – Varignon's Theorem of moments.

Module 2

Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –wedges, ladder-analysis of connected bodies .

Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads. General coplanar force system - resultant and equilibrium equations.

Module 3

Centroid of composite areas- – moment of inertia-parallel axis and perpendicular axis theorems. Polar moment of inertia,radius of gyration,mass moment of inertia-ring,cylinder and disc.

Theorem of Pappus Guldinus(demonstration only)

Forces in space - vectorial representation of forces, moments and couples –resultant and equilibrium equations – concurrent forces in space (simple problems only)

Module 4

Dynamics – rectilinear translation - equations of kinematics(review)

kinetics – equation of motion – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies. Impulse momentum equation and work energy equation (concepts only).

Curvilinear translation - equations of kinematics –projectile motion(review), kinetics – equation of motion. Moment of momentum and work energy equation (concepts only).

Module 5

Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – rotation under a constant moment.

Plane motion of rigid body – instantaneous centre of rotation (concept only).

Simple harmonic motion – free vibration –degree of freedom- undamped free vibration of spring mass system-effect of damping(concept only)

Text Books

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.

References

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.

2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications

3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers

4. F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill

5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.

Course Contents and Lecture Schedule:

Module	Topic	Course outcomes addressed	No. of Hours
1	**Module 1**		**Total: 7**
1.1	Introduction to engineering mechanics – introduction on statics and dynamics - Basic principles of statics – Parellogram law, equilibrium law – Superposition and transmissibility, law of action and reaction (review the topics)	CO1 and CO2	1
1.2	Free body diagrams. Degree of freedom-types of supports and nature of reactions - exercises for free body diagram preparation – composition and resolution of forces, resultant and equilibrium equations (review the topics) - numerical exercises for illustration.	CO1 and CO2	1
1.3	Concurrent coplanar forces - analysis of concurrent forces -methods of projections – illustrative numerical exercise – teacher assisted problem solving.	CO1 and CO2	1
1.4	Analysis of concurrent forces -methods of moment-Varignon's Theorem of Moments - illustrative numerical exercise– teacher assisted problem solving.	CO1 and CO2	1
1.5	Analysis of concurrent force systems – extended problem solving - Session I.	CO3,CO4 and CO5	1
1.6	Analysis of concurrent force systems – extended problem solving - Session II – learning review quiz.	CO3,CO4 and CO5	1
1.7	Analysis of concurrent force systems – extended problem solving - Session III.	CO3,CO4 and CO5	1
2	**Module 2**		**Total: 7**
2.1	Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –illustrative examples on wedges and ladder-teacher	CO1 and CO2	1

	assisted problem solving tutorials using problems from wedges and ladder.		
2.2	Problems on friction - analysis of connected bodies. illustrative numerical exercise– teacher assisted problem solving.	CO3, CO4 and CO5	1
2.3	Problems on friction-extended problem solving	CO3,C04 and CO5	1
2.4	Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads.	CO1 and CO2	1
2.5	General coplanar force system - resultant and equilibrium equations - illustrative examples- teacher assisted problem solving.	CO1 and CO2	1
2.6	General coplanar force system-resultant and equilibrium equations - illustrative examples	CO3, CO4 and CO5	1
2.7	General coplanar force system - Extended problem solving - Quiz to evaluate learning level.	CO3, CO4 and CO5	1
3	**Module 3**		**Total: 7**
3.1	Centroid of simple and regular geometrical shapes – centroid of figures in combination - composite areas- examples for illustration – problems for practice to be done by self.	CO1 and CO2	1
3.2	Moment of inertia- parallel axis theorem –examples for illustration - problems for practice to be done by self.	CO1 and CO2	1
3.3	Moment of inertia - perpendicular axis theorem - example for illustration to be given as hand out and discussion on the solved example.	CO1 and CO2	1
3.4	Solutions to practice problems – problems related to centroid and moment of inertia - problems for practice to be done by self.	CO3, CO4 and CO5	1
3.5	Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, cylinder and uniform disc. Theorem of Pappus Guldinus - Demonstration	CO1 and CO2	1
3.6	Introduction to forces in space – vectorial representation of forces, moments and couples – simple problems to illustrate vector representations of forces, moments and couples to be done in class.	CO1,and CO2	1
3.7	Solution to practice problems - resultant and equilibrium equations for concurrent forces in space – concurrent forces in space - 2 simple problems to illustrate the application of resultant and equilibrium equations for concurrent forces in space.	CO3,CO4 and CO5	1
4	**Module 4**		**Total: 7**

4.1	Introduction to dynamics – review of rectilinear translation - equations of kinematics – problems to review the concepts – additional problems involving extended application as exercises .	CO1 and CO2	1
4.2	Solutions to exercises with necessary explanation given as hand out – introduction to kinetics – equation of motion – D'Alembert's principle – illustration of the concepts using one numerical exercise from motion on horizontal and inclined surfaces.	CO1 and CO2	1
4.3	Motion of connected bodies - example for illustration to be given as hand out and discussion on the solved example – problems for practice to be done by self.	CO3, CO4 and CO5	1
4.4	Motion of connected bodies-extended problem solving.	CO3, CO4 & CO5	1
4.5	Curvilinear translation - Review of kinematics –projectile motion – simple problems to review the concepts – introduction to kinetics – equation of motion – illustration of the concepts using numerical exercises.	CO3, CO4 & CO5	1
4.6	Extended problem solving – rectilinear and curvilinear translation.	CO3, CO4 & CO5	1
4.7	Concepts on Impulse momentum equation and work energy equation (rectilinear translation – discussions to bring out difference between elastic and inelastic collusions). Concepts on Moment of momentum and work energy equation (curvilinear translation).	CO1 and CO2	1
5	**Module 5**		**Total: 7**
5.1	Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	CO1 and CO2	1
5.2	Rotation under a constant moment – teacher assisted problem solving.	CO3,CO4 and CO5	1
5.3	Rotation under a constant moment - extended problem solving.	CO3, CO4 and CO5	1
5.4	Plane motion of rigid body- instantaneous centre of rotation (concept only).	CO1 and CO2	1
5.5	Introduction to harmonic oscillation –free vibrations - simple harmonic motion – differential equation and solution. Degree of freedom – examples of single degree of freedom (SDOF) systems – Idealisation of mechanical systems as spring-mass systems (concept only).	CO1 and CO2	1

5.6	SDOF spring mass system –equation of motion – undamped free vibration response - concept of natural frequency. Free vibration response due to initial conditions. Simple problems on determination of natural frequency and free vibration response to test the understanding level.	CO1 and CO2	1
5.7	Free vibration analysis of SDOF spring-mass systems – Problem solving Effect of damping on free vibration response (concept only).	CO1and CO2	1

EST 110	ENGINEERING GRAPHICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	0	2	3	2019

Preamble: To enable the student to effectively perform technical communication through graphical representation as per global standards.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Draw the projection of points and lines located in different quadrants
CO 2	Prepare multiview orthographic projections of objects by visualizing them in different positions
CO 3	Draw sectional views and develop surfaces of a given object
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.
CO 5	Convert 3D views to orthographic views
CO 6	Obtain multiview projections and solid models of objects using CAD tools

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3											
CO 3	3	1										
CO 4	3									1		
CO 5	3									2		
CO 6	3				3					3		

<u>Assessment Pattern</u>

Bloom's Category	Continuous Assessment Tests		End Semester Examination (100 Marks)
	Test 1 (15 Marks)	Test 2 (15 Marks)	
Remember			
Understand	5		20
Apply	10	10	80
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
CIA for section A carries 25 marks (15 marks for 1 test and Class work 10 marks)
CIA for section B carries 15 marks (10 marks for 1 test and Class work 5 marks)

End Semester Examination Pattern:

ESE will be of 3 hour duration on A4 size answer booklet and will be for 100 marks. The question paper shall contain two questions from each module of Section A only. Student has to answer any one question from each module. Each question carries 20 marks.

Course Level Assessment Questions

(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes .
3. Find True length, Inclinations and Traces of lines.

Course Outcome 2 (CO2)

1. Draw orthographic views of solids and combination solids
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.

Course Outcome 3 (CO3):

1. Draw views of solids sectioned by a cutting plane
2. Find location and inclination of cutting plane given true shape of the section
3. Draw development of lateral surface of solids and also its sectioned views

Course Outcome 4 (CO4):

1. Draw Isometric views/projections of soilds
2. Draw Isometric views/projections of combination of soilds
3. Draw Perspective views of Soilds

Course Outcome 5 (CO5):

1. Draw Orthographic views of solids from given three dimensional view

Course Outcome 6 (CO6):

1. Draw the given figure including dimensions using 2D software
2. Create 3D model using modelling software from the given orthographic views or 3D figure or from real 3D objects

Model Question paper

QP CODE: PAGES:3

Reg No:______________

Name :______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 110

ENGINEERING GRAPHICS

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

Instructions: Retain necessary Construction lines
Show necessary dimensions
Answer any ONE question from each module
Each question carries 20 marks

MODULE I

1. The end point A of a line is 20mm above HP and 10mm in front of VP. The other end of the line is 50mm above HP and 15mm behind VP. The distance between the end projectors is 70mm. Draw the projections of the line. Find the true length and true inclinations of the line with the principal planes. Also locate the traces of the line.

2. One end of a line is 20mm from both the principal planes of projection. The other end of the line is 50mm above HP and 40mm in front of VP. The true length of the line is 70mm. Draw the projections of the line. Find its apparent inclinations, elevation length and plan length. Also locate its traces.

MODULE II

3. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30^{o} to VP. Draw the projections of the solid.

4. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30^o to HP and 45^o to VP. Draw the projections of the solid.

MODULE III

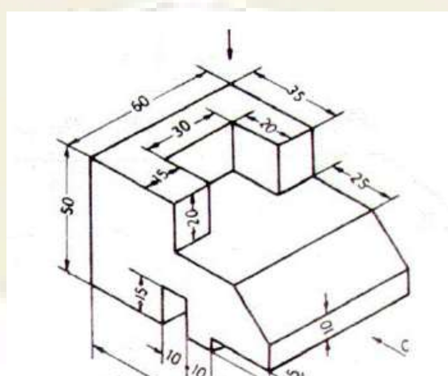
5. A triangular prism of base side 40mm and height 70mm is resting with its base on the ground and having an edge of the base perpendicular to VP. Section the solid such that the true shape of the section is a trapezium of parallel sides 30mm and 10mm. Draw the projections showing the true shape. Find the inclination of the cutting plane with the ground plane.
6. Draw the development of a pentagonal pyramid of base side 30mm and height 50mm. A string is wound from a corner of the base round the pyramid and back to the same point through the shortest distance. Show the position of the string in the elevation and plan.

MODULE IV

7. The frustum of a cone has base diameter 50mm and top diameter 40mm has a height of 60mm. It is paced centrally on top of a rectangular slab of size 80x60mm and of thickness 20mm. Draw the isometric view of the combination.
8. A hexagonal prism has base side 35mm and height 60mm. A sphere of diameter 40mm is placed centrally on top of it. Draw the isometric projection of the combination.

MODULE V

9. Draw the perspective view of a pentagonal prism, 20mm side and 45mm long lying on one of its rectangular faces on the ground and having its axis perpendicular to picture plane. One of its pentagonal faces touches the picture plane and the station point is 50mm in front of PP, 25mm above the ground plane and lies in a central plane, which is 70mm to the left of the center of the prism.
10. Draw three orthographic views with dimensions of the object shown in figure below.



(20X5=100)

Time : 3 hours **EST110 ENGINEERING GRAPHICS** **Max. Marks: 100**

SCHEME OF VALUATION

1. Locating the points and drawing the projections of the line – 4 marks
   Finding true length by any one method – 6 marks
   Finding true inclination with VP – 2 marks
   Finding true inclination with HP – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

2. Locating the points and drawing true length of the line – 4 marks
   Finding projections by any method – 6 marks
   Finding length of elevation and plan – 2 marks
   Finding apparent inclinations – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

3. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used.
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

4. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

5. Drawing initial position plan and elevation – 4 marks
   Locating section plane as per given condition – 5 marks
   Drawing true shape -5 marks
   Finding inclination of cutting plane – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

6. Drawing initial position plan and elevation – 4 marks
   Development of the pyramid – 6 marks

Locating string in development -2 marks
Locating string in elevation – 3 marks
Locating string in plan – 3 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

7. Drawing initial positions – 4 marks
Isometric View of Slab -6 marks
Isometric View of Frustum – 10 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

(Initial position is optional, hence redistribute if needed.
Reduce 4 marks if Isometric scale is taken)

8. Drawing initial positions – 4 marks
Isometric scale – 4 marks
Isometric projection of prism -5 marks
Isometric projection of sphere – 5 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

(Initial position is optional, hence redistribute if needed.

9. Drawing the planes and locating the station point – 4 marks
Locating elevation points – 2 marks
Locating plan points – 2 marks
Drawing the perspective view – 10 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

10. Drawing the elevation – 8marks
Drawing the plan – 4 marks
Drawing the side view – 4 marks
Marking invisible edges – 2 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

SYLLABUS

General Instructions:

- First angle projection to be followed
- Section A practice problems to be performed on A4 size sheets
- Section B classes to be conducted on CAD lab

SECTION A

Module 1

Introduction : Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.

Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

Module 2

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

Module 3

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given.

Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

Module 4

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

Module 5

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane.

Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

SECTION B

(To be conducted in CAD Lab)

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory)

Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.

Reference Books

1. Anilkumar, K.N., Engineering Graphics, Adhyuth narayan Publishers
2. Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill Publishers.
3. Benjamin, J., Engineering Graphics, Pentex Publishers- 3rd Edition, 2017
4. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.
5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., Engineering Graphics with AutoCAD, PHI.
6. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.
7. Varghese, P.I., Engineering Graphics, V I P Publishers
8. Venugopal, K., Engineering Drawing and Graphics, New Age International Publishers.

Course Contents and Lecture Schedule

No	**SECTION A**	No. of Hours
1	**MODULE I**	
1.1	Introduction to graphics, types of lines, Dimensioning	1
1.2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	2
1.3	Projection of lines, inclined to one plane. Lines inclined to both planes, trapezoid method of solving problems on lines.	2
1.4	Problems on lines using trapezoid method	2
1.5	Line rotation method of solving, problems on line rotation method	2
2	**MODULE II**	
2.1	Introduction of different solids, Simple position plan and elevation of solids	2
2.2	Problems on views of solids inclined to one plane	2
2.3	Problems on views of solids inclined to both planes	2
2.4	Practice problems on solids inclined to both planes	2

3	**MODULE III**	
3.1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	2
3.2	Problems on sections of different solids	2
3.3	Problems when the true shape is given	2
3.4	Principle of development of solids, sectioned solids	2
4	**MODULE IV**	
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	2
4.3	Problems on combination of different solids	2
5	**MODULE V**	
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
5.2	Perspective problems on prisms	2
5.3	Practice on conversion of pictorial views into orthographic views	2
	SECTION B *(To be conducted in CAD lab)*	
1	Introduction to CAD and software. Familiarising features of 2D software. Practice on making 2D drawings	2
2	Practice session on 2D drafting	2
3	Introduction to solid modelling and software	2
4	Practice session on 3D modelling	2

EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

To introduce the students to the basic principles of mechanical engineering

Prerequisite: NIL

Course Outcomes: After completion of the course, the student will be able to

CO 1	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
CO 2	Explain different types of buildings, building components, building materials and building construction
CO 3	Describe the importance, objectives and principles of surveying.
CO 4	Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps
CO 5	Discuss the Materials, energy systems, water management and environment for green buildings.
CO 6	Analyse thermodynamic cycles and calculate its efficiency
CO 7	Illustrate the working and features of IC Engines
CO 8	Explain the basic principles of Refrigeration and Air Conditioning
CO 9	Describe the working of hydraulic machines
CO 10	Explain the working of power transmission elements
CO 11	Describe the basic manufacturing, metal joining and machining processes

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	3	2	2	-	-	-	-
CO2	3	2	-	1	3	-	-	3	-	-	-	-
CO3	3	2	-	-	3	-	-	-	2	-	-	-

CO4	3	2	-	-	3	-	-	-	2	-	-	-
CO5	3	2	-	-	3	2	3	-	2	-	-	-
CO6	3	2										
CO7	3	1										
CO8	3	1										
CO9	3	2										
CO10	3	1										
CO11	3											

Assessment Pattern

	Basic Civil Engineering			**Basic Mechanical Engineering**		
Bloom's Category	**Continuous Assessment**		**End Semester Examination (marks)**	**Continuous Assessment**		**End Semester Examination (marks)**
	Test 1 marks	**Test 2 marks**		**Test 1 marks**	**Test 2 marks**	
Remember	5	5	10	7.5	7.5	15
Understand	20	20	40	12.5	12.5	25
Apply				5	5	10
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern:

There will be two parts; Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts -

Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions:

Course Outcome CO1: *To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.*

1.Explain relevance of Civil engineering in the overall infrastructural development of the country.

Course outcome 2 (CO2) (One question from each module and not more than two)

Explain different types of buildings, building components, building materials and building construction

1. Discuss the difference between plinth area and carpet area.

Course outcome 3 (CO3) (One question from each module and not more than two)

Describe the importance, objectives and principles of surveying.

1. Explain the importance of surveying in Civil Engineering

Course outcome 4 (CO4) (One question from each module and not more than two)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps

1. Explain the civil engineering aspects of elevators, escalators and ramps in buildings

Course outcome 5 (CO5) (One question from each module and not more than two)

Discuss the Materials, energy systems, water management and environment for green buildings.

1. Discuss the relevance of Green building in society

Section II *Answer any 1 full question from each module. Each full question carries 10 marks*

Course Outcome 1 (CO1) (Two full question from each module and each question can have maximum 2 sub-divisions)

To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering

CO Questions

1. a List out the types of building as per occupancy. Explain any two, each in about five sentences.
   b. Discuss the components of a building with a neat figure.

2. a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework.

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country.

Course Outcome 2 (CO2) & Course Outcome 3 (CO3) (Two full question from each module and each question can have maximum 2 sub-divisions)

Explain different types of buildings, building components, building materials and building construction & Describe the importance, objectives and principles of surveying.

CO Questions

1. **a.** What are the different kinds of cement available and what is their use.
   b. List the properties of good building bricks. Explain any five.
2. a. List and explain any five modern construction materials used for construction.
   b. Explain the objectives and principles of surveying

Course outcome 4 (CO4) & Course outcome 5 (CO5) (Two full question from each module and each question can have maximum 2 sub-divisions)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps & Discuss the Materials, energy systems, water management and environment for green buildings.

CO Questions

1. **a**. Draw the elevation and plan of one brick thick wall with English bond
   b. Explain the energy systems and water management in Green buildings

2. **a.** Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing.

   b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building

Course Outcome 6 (CO6):

1. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35°C, 0.1 MPa. The maximum temperature of the cycle is 1100°C. Find
   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii) Cycle efficiency
   Take Cp = 1.005 kJ/kgK and Cv=0.718 kJ/kgK
2. A Carnot cycle works with adiabatic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of isothermal expansion is 0.3 m^3. If the maximum temperature and pressure is limited to 550K and 21 bar, determine the minimum temperature in the cycle and efficiency of the cycle.
3. In an ideal diesel cycle, the temperature at the beginning and end of compression is 65°C and 620°C respectively. The temperature at the beginning and end of the expansion is 1850°C and 850 °C. Determine the ideal efficiency of the cycle.

4. Explain the concepts of CRDI and MPFI in IC Engines.

Course Outcome 7 (CO7)

1. With the help of a neat sketch explain the working of a 4 stroke SI engine
2. Compare the working of 2 stroke and 4 stroke IC engines
3. Explain the classification of IC Engines.

Course Outcome 8(CO8):

1. Explain the working of vapour compression refrigeration system.
2. With the help of suitable sketch explain the working of a split air conditioner.
3. Define: COP, specific humidity, relative humidity and dew point temperature.

Course Outcome 9 (CO9):

1. Explain the working of a single stage centrifugal pump with sketches.
2. With the help of a neat sketch, explain the working of a reciprocating pump.
3. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.

Course Outcome 10 (CO10):

1. Explain the working of belt drive and gear drive with the help of neat sketches
2. Explain a single plate clutch.
3. Sketch different types of gear trains and explain.

Course Outcome 11 (CO11):

1. Describe the operations which can be performed using drilling machine.
2. Explain the functions of runners and risers used in casting.
3. With a neat sketch, explain the working and parts of a lathe.

Model Question Paper

QP CODE: **EST120** page:3

Reg No:___________________

Name:_____________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 120

Course Name: BASICS OF CIVIL AND MECHANICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

PART I: BASIC CIVIL ENGINEERING

PART A

(Answer all questions. Each question carries 4 marks)

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.
2. Discuss the difference between plinth area and carpet area.
3. Explain different types of steel with their properties.
4. What are the different kinds of cement available and what is their use?
5. Define bearing capacity of soil.

(5 x 4 = 20)

Part B

Answer one full question from each module.

MODULE I

6a. List out the types of building as per occupancy. Explain any two, each in about five sentences. (5)

b. Discuss the components of a building with a neat figure. (5)

OR

7a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework. (5)

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country. (5)

MODULE II

8a. What are the different kinds of cement available and what is their use. (5)

b. List the properties of good building bricks. Explain any five. (5)

OR

9a. List and explain any five modern construction materials used for construction. (5)

b. Explain the objectives and principles of surveying (5)

MODULE III

10a. Draw the elevation and plan of one brick thick wall with English bond (5)

b. Explain the energy systems and water management in Green buildings (5)

OR

11a. Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing. (5)

b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building (5)

[10 x 3 = 30]

PART II: BASIC MECHANICAL ENGINEERING

PART A

Answer all questions. Each question carries 4 marks

1. Sketch the P-v and T-s diagram of a Carnot cycle and List the processes.
2. Illustrate the working of an epicyclic gear train.
3. Explain cooling and dehumidification processes.
4. Differentiate between soldering and brazing.
5. Explain the principle of Additive manufacturing.

4 x 5 = 20 marks

Part B

Answer one full question from each module.

MODULE I

6. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35°C, 0.1MPa. The maximum temperature of the cycle is 1100°C. Find
   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii)Cycle efficiency

   Take C_p = 1.005 kJ/kgK and C_v=0.718 kJ/kgK — 10 marks

OR

7. a) Explain the working of a 4 stroke SI engine with neat sketches. — 7 marks
   b) Explain the fuel system of a petrol engine. — 3 marks

MODULE II

8. a) Explain the working of a vapour compression system with help of a block diagram. — 7 marks
   b) Define: Specific humidity, relative humidity and dew point temperature. — 3 marks

OR

9. With the help of a neat sketch, explain the working of a centrifugal pump. — 10 marks

MODULE III

10. Explain the two high, three high, four high and cluster rolling mills with neat sketches. — 10 marks

OR

11. a) Describe the arc welding process with a neat sketch. — 6 marks
    b) Differentiate between up-milling and down-milling operations. — 4 marks

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SYLLABUS

Module 1

General Introduction to Civil Engineering: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.

Introduction to buildings: Types of buildings, selection of site for buildings, components of a residential building and their functions.

Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion only).

Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

Module 2

Surveying: Importance, objectives and principles.

Construction materials, Conventional construction materials**:** types, properties and uses of building materials: bricks, stones, cement, sand and timber

Cement concrete: Constituent materials, properties and types.

Steel: Steel sections and steel reinforcements, types and uses.

Modern construction materials:- Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

Module 3

Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only).

Brick masonry: - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

Roofs and floors: - Functions, types; flooring materials (brief discussion only).

Basic infrastructure services: MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

Green buildings:- Materials, energy systems, water management and environment for green buildings. (brief discussion only).

Module 4

Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines(Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.

Module 5

Refrigeration: Unit of refrigeration, reversed Carnot cycle,COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.
Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)
Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

Module 6

Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.
Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications
Basic Machining operations: Turning, Drilling, Milling and Grinding.
Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Mckay, W.B. and Mckay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services

References Books:

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
3. Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
4. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
5. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters &Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
11. Benjamin,J.,Basic Mechanical Engineering,Pentex Books,9th Edition,2018
12. Balachandran, P.Basic Mechanical Engineering,Owl Books

Course Contents and Lecture Schedule:

No	Topic	Course outcomes addressed	No. of Lectures
1	**Module I**		**Total: 7**
1.1	*General Introduction to Civil Engineering*: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment.	CO1	1
1.2	Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.	CO1	2
1.3	*Introduction to buildings:* Types of buildings, selection of site for buildings, components of a residential building and their functions.	CO2	2
1.4	*Building rules and regulations:* Relevance of NBC, KBR & CRZ norms (brief discussion only)	CO2	1
1.5	*Building area:* Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.	CO2	1
2	**Module 2**		**Total: 7**
2.1	*Surveying:* Importance, objectives and principles.	CO3	1
2.2	Bricks: - Classification, properties of good bricks, and tests on bricks	CO2	1
2.3	Stones: - *Qualities* of good stones, types of stones and their uses. Cement: - Good qualities of cement, types of cement and their uses.	CO2	1
2.4	Sand: - Classification, qualities of good sand and sieve analysis (basics only). Timber: - Characteristics, properties and uses.	CO2	1
2.5	Cement concrete: - Constituent materials, properties and types, Steel: - Steel sections and steel reinforcements, types and uses.	CO2	1

2.6	Modern construction materials: - Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials, modern uses of gypsum, pre-fabricated building components (brief discussion only)	CO2	2
3	**Module 3**		**Total: 7**
3.1	Foundations: - Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Brick masonry: - Header and stretcher bond, English bond & Flemish bond– elevation and plan (one & one and a half brick wall only). Random rubble masonry.	CO2	2
3.2	Roofs: Functions, types; roofing materials (brief discussion only) Floors: Functions, types; flooring materials (brief discussion only)	CO2	2
3.3	*Basic infrastructure services:* MEP, HVAC, Elevators, escalators and ramps (Civil Engineering aspects only) fire safety for buildings	CO4	2
3.4	*Green buildings:*- Materials, energy systems, water management and environment for green buildings. (brief discussion only)	CO5	1
4	**MODULE 4**		
4.1	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle-Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency	4	
4.2	IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies of IC Engines(Description only)	2	
4.3	Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines	2	
5	**MODULE 5**		
5.1	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems)	1	
5.2	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.	1	

5.3	Description about working with sketches : Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)	4
5.4	Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches	3
6	**MODULE 6**	
6.1	Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.	2
6.2	Metal Joining Processes :List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications	1
6.3	Basic Machining operations: Turning, Drilling, Milling and Grinding Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine	3
6.4	Principle of CAD/CAM, Rapid and Additive manufacturing	1

EST 130	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:
This course aims to (1) equip the students with an understanding of the fundamental principles of electrical engineering(2) provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and circuits (3) provide an overview of evolution of communication systems, and introduce the basic concepts in radio communication.

Prerequisite: Physics and Mathematics (Pre-university level)

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO 2	Develop and solve models of magnetic circuits
CO 3	Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
CO 4	Describe working of a voltage amplifier
CO 5	Outline the principle of an electronic instrumentation system
CO 6	Explain the principle of radio and cellular communication

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	1	-	-	-	-	-	-	-	-	-	2
CO 4	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	2
CO 6	2	-	-	-	-	-	-	-	-	-	-	2

Assessment Pattern

Bloom's Category	Basic Electrical Engineering			Basic Electronics Engineering		
	Continuous Assessment Tests		End Semester Examination (Marks)	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)		Test 1 (Marks)	Test 2 (Marks)	
Remember	0	0	10	10	10	20
Understand	12.5	12.5	20	15	15	30
Apply	12.5	12.5	20			
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part I – Basic Electrical Engineering and Part II – Basic Electronics Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts - Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Solve problems based on current division rule.

2. Solve problems with Mesh/node analysis.

3. Solve problems on Wye-Delta Transformation.

Course Outcome 2 (CO2):

1. Problems on series magnetic circuits

2. Problems on parallel magnetic circuits

3. Problems on composite magnetic ciruits

4. **Course Outcome 3 (CO3):**

1. problems on self inductance, mutual inductance and coefficient of coupling

2. problems on rms and average values of periodic waveforms

3. problems on series ac circuits

4. Compare star and Delta connected 3 phase AC systems.

Course Outcome 4 (CO4): Describe working of a voltage amplifier

1.What is the need of voltage divider biasing in an RC coupled amplifier?

2. Define operating point in the context of a BJT amplifier.

3. Why is it required to have a voltage amplifier in a public address system?

Course Outcome 5 (CO5): Outline the principle of an electronic instrumentation system

1. Draw the block diagram of an electronic instrumentation system.

2. What is a transducer?

3. Explain the working principle of operation of digital multimeter.

Course Outcome 6 (CO6): Explain the principle of radio and cellular communication

1. What is the working principle of an antenna when used in a radio transmitter?

2. What is the need of two separate sections RF section and IF section in a super heterodyne receiver?

3. What is meant by a cell in a cellular communication?

Model Question Paper

QP CODE: Pages: 3

Reg No.:________________

Name:__________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 130

Course Name: BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

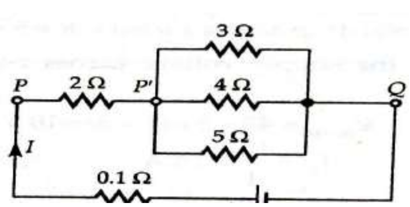
PART I

BASIC ELECTRICAL ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Calculate the current through the $4\,\Omega$ resistor in the circuit shown, applying current division rule:



2. Calculate the RMS and average values of a purely sinusoidal current having peak value 15A.

3. An alternating voltage of (80+j60)V is applied to an RX circuit and the current flowing through the circuit is (-4+j10)A. Calculate the impedance of the circuit in rectangular and polar forms. Also determine if X is inductive or capacitive.

4. Derive the relation between line and phase values of voltage in a three phase star connected system.

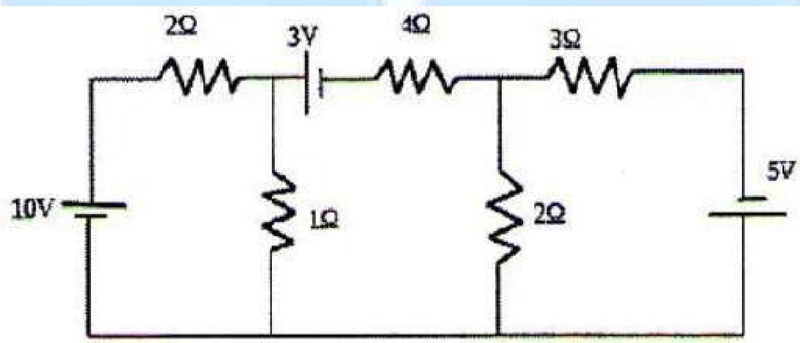
5. Compare electric and magnetic circuits. *(5x4=20)*

PART B

Answer one question from each module; each question carries 10 marks.

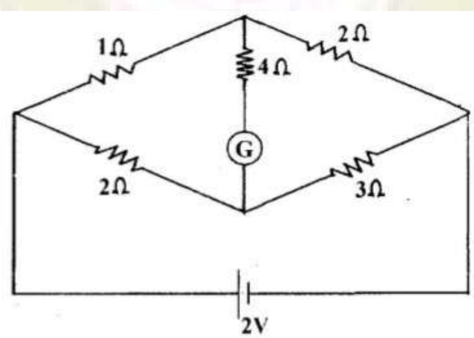
Module 1

6. . Calculate the node voltages in the circuit shown, applying node analysis:



7. (a) State and explain Kirchhoff's laws. (4 marks)

(b) Calculate the current through the galvanometer (G) in the circuit shown:



(6 marks)

Module 2

8. (a) State and explain Faraday's laws of electromagnetic induction with examples. (4 marks)

(b) Differentiate between statically and dynamically induced emf. A conductor of length 0.5m moves in a uniform magnetic field of flux density 1.1T at a velocity of 30m/s. Calculate the emf induced in the conductor if the direction of motion of the conductor is inclined at 60^0 to the direction of field. (6 marks)

9. (a) Derive the amplitude factor and form factor of a purely sinusoidal waveform. (5 marks)

(b) A current wave is made up of two components-a 5A dc component and a 50Hz ac component, which is a sinusoidal wave with a peak value of 5A. Sketch the resultant waveform and determine its RMS and average values. (5 marks)

Module 3

10. Draw the power triangle and define active, reactive and apparent powers in ac circuits. Two coils A and B are connected in series across a 240V, 50Hz supply. The resistance of A is 5Ω and the inductance of B is 0.015H. If the input from the supply is 3kW and 2kVAR, find the inductance of A and the resistance of B. Also calculate the voltage across each coil.

11. A balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the loads are connected in (i) star (ii) delta.

(3x10=30)

PART II

BASIC ELECTRONICS ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Give the specifications of a resistor. The colour bands marked on a resistor are Blue, Grey, Yellow and Gold. What are the minimum and maximum resistance values expected from that resistance?
2. What is meant by avalanche breakdown?
3. Explain the working of a full-wave bridge rectifier.
4. Discuss the role of coupling and bypass capacitors in a single stage RC coupled amplifier.
5. Differentiate AM and FM communication systems.

(5x4=20)

PART B

Answer one question from each module; each question carries 10 marks.

Module 4

6. a) Explain with diagram the principle of operation of an NPN transistor. (5)
   b) Sketch and explain the typical input-output characteristics of a BJT when connected in common emitter configuration. (5)

OR

7. a) Explain the formation of a potential barrier in a P-N junction diode. (5)
   b) What do you understand by Avalanche breakdown? Draw and explain the V-I characteristics of a P-N junction and Zener diode. (5)

Module 5

8. a) With a neat circuit diagram, explain the working of an RC coupled amplifier. (6)
   b) Draw the frequency response characteristics of an RC coupled amplifier and state the reasons for the reduction of gain at lower and higher frequencies. (4)

OR

9. a) With the help of block diagram, explain how an electronic instrumentation system. (6)
   b) Explain the principle of an antenna. (4)

Module 6

10. a) With the help of a block diagram, explain the working of Super hetrodyne receiver. (6)
    b) Explain the importance of antenna in a communication system. (4)

OR

11. a) With neat sketches explain a cellular communication system. (5)
    b) Explain GSM communication with the help of a block diagram. (5)

(3x10=30)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SYLLABUS

MODULE 1: Elementary Concepts of Electric Circuits

Elementary concepts of DC electric circuits: Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.

Analysis of DC electric circuits: Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.

MODULE 2: Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals

Magnetic Circuits: Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.

Electromagnetic Induction: Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling

Alternating Current fundamentals: Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.

MODULE 3: AC Circuits

AC Circuits: Phasor representation of sinusoidal quantities. Trignometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.

Three phase AC systems: Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems

MODULE 4

Introduction to Semiconductor devices: Evolution of electronics – Vacuum tubes to nano electronics. Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, color coding. PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration.

MODULE 5

Basic electronic circuits and instrumentation: Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

MODULE 6

Introduction to Communication Systems: Evolution of communication systems – Telegraphy to 5G. Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.

Text Books

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. ChinmoySaha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
4. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
5. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010.

Reference Books

1. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
3. Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill
4. Hughes, "Electrical and Electronic Technology", Pearson Education.
5. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering," Second Edition, McGraw Hill.
6. Parker and Smith, "Problems in Electrical Engineering", CBS Publishers and Distributors.
7. S. B. Lal Seksena and Kaustuv Dasgupta, "Fundamentals of Electrical Engineering", Cambridge University Press.
8. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
9. Bernard Grob, Ba sic Electronics, McGraw Hill.
10. A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lectures
1	***Elementary Concepts of Electric Circuits***	
1.1	**Elementary concepts of DC electric circuits:** Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.	1 2 1
1.2	**Analysis of DC electric circuits:** Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.	1 1 2
2	**Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals**	
2.1	**Magnetic Circuits:** Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.	1 2
2.2	**Electromagnetic Induction:** Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling	1 2
2.3	**Alternating Current fundamentals:** Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.	2
3	**AC Circuits**	

3.1	**AC Circuits:** Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power, Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.	1 2 1 2
3.2	**Three phase AC systems:** Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems.	2
4	**Introduction to Semiconductor devices**	
4.1	Evolution of electronics – Vacuum tubes to nano electronics (In evolutional perspective only)	1
4.2	Resistors, Capacitors and Inductors: types, specifications. Standard values, color coding (No constructional features)	2
4.3	**PN Junction diode**: Principle of operation, V-I characteristics, principle of avalanche breakdown	2
4.4	**Bipolar Junction Transistors:** PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration	3
5	**Basic electronic circuits and instrumentation**	
5.1	**Rectifiers and power supplies:** Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator	3
5.2	**Amplifiers:** Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing	4
5.3	**Electronic Instrumentation:** Block diagram of an electronic instrumentation system	2
6	**Introduction to Communication Systems**	
6.1	Evolution of communication systems – Telegraphy to 5G	1

6.2	**Radio communication:** principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge	4
6.3	**Mobile communication:** basic principles of cellular communications, principle and block diagram of GSM.	2

Suggested Simulation Assignments for Basic Electronics Engineering

1. Plot V-I characteristics of Si and Ge diodes on a simulator
2. Plot Input and Output characteristics of BJT on a simulator
3. Implementation of half wave and full wave rectifiers
4. Simulation of RC coupled amplifier with the design supplied
5. Generation of AM signal

Note: The simulations can be done on open tools such as QUCS, KiCad, GNURadio or similar software to augment the understanding.

HUN 101	LIFE SKILLS	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		MNC	2	0	2	---	**2019**

Preamble: Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underly personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to

CO 1	Define and Identify different life skills required in personal and professional life
CO 2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.
CO 3	Explain the basic mechanics of effective communication and demonstrate these through presentations.
CO 4	Take part in group discussions
CO 5	Use appropriate thinking and problem solving techniques to solve new problems
CO 6	Understand the basics of teamwork and leadership

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2		1	2	2	1	3
CO 2									3			2
CO 3						1			1	3		
CO 4										3		1
CO 5		3	2	1								
CO 6						1			3			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation
Total Marks: 50

Attendance	: 10 marks
Regular assessment	: 15 marks
Series test (one test only, should include first three modules)	: 25 marks

Regular assessment

- Group Discussion (Marks: 9)
  Create groups of about 6 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation are as follows:
  - Communication Skills : 3 marks
  - Subject Clarity : 2 marks
  - Group Dynamics : 2 marks
  - Behaviours & Mannerisms : 2 marks

- Presentation Skills (Marks: 6)
  Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation are as follows:
  - Communication Skills : 2 marks
  - Platform Skills : 2 marks
  - Subject Clarity/Knowledge : 2 marks

End Semester Examination
Total Marks: 50 **Time: 2 hrs.**

Part A: Short answer question (25 marks)
There will be one question from each MODULE (five questions in total, five marks each). Each question should be written in about maximum of 400 words. Parameters to be used for evaluation are as follows:
(i) Content Clarity/Subject Knowledge
(ii) Presentation style
(iii) Organization of content

Part B: Case Study (25 marks)
The students will be given a case study with questions at the end. The students have to analyze the case and answer the question at the end. Parameters to be used for evaluation are as follows:
(i) Analyze the case situation
(ii) Key players/characters of the case
(iii) Identification of the problem (both major & minor if exists)
(iv) Bring out alternatives
(v) Analyze each alternative against the problem
(vi) Choose the best alternative
(vii) Implement as solution
(viii) Conclusion

(ix) Answer the question at the end of the case

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List 'life skills' as identified by WHO
2. What do you mean by effective communication?
3. What are the essential life skills required by a professional?

Course Outcome 2 (CO2)

1. Identify an effective means to deal with workplace stress.
2. How can a student apply journaling to stress management?
3. What is the PATH method? Describe a situation where this method can be used effectively.

Course Outcome 3(CO3):

1. Identify the communication network structure that can be observed in the given situations. Describe them.

   (a) A group discussion on development.

   (b) An address from the Principal regarding punctuality.

   (c) A reporter interviewing a movie star.

   (d) Discussing the answers of a test with a group of friends.

2. Elucidate the importance of non-verbal communication in making a presentation
3. Differentiate between kinesics, proxemics, and chronemics with examples.

Course Outcome 4 (CO4):

1. How can a participant conclude a group discussion effectively?
2. 'Listening skills are essential for effectively participating in a group discussion.' Do you agree? Substantiate your answer.

Course Outcome 5 (CO5):

1. Illustrate the creative thinking process with the help of a suitable example
2. Translate the following problem from verbal to graphic form and find the solution : *In a quiz, Ananth has 50 points more than Bimal, Chinmay has 60 points less than Ananth, and Dharini is 20 points ahead of Chinmay. What is the difference in points between Bimal and Dharini?*

3. List at least five ways in which the problem "How to increase profit?" can be redefined

Course Outcome 6 (CO6):

1. A group of engineers decided to brainstorm a design issue on a new product. Since no one wanted to disagree with the senior members, new ideas were not flowing freely. What group dynamics technique would you suggest to avoid this 'groupthink'? Explain the procedure.

2. "A group focuses on individual contribution, while a team must focus on synergy." Explain.

3. Identify the type of group formed / constituted in each of the given situations

    a) A Police Inspector with subordinates reporting to him

    b) An enquiry committee constituted to investigate a specific incident

    c) The Accounts Department of a company

    d) A group of book lovers who meet to talk about reading

Syllabus

Module 1

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ

Module 2

Self-awareness: definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback.

Stress Management: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance-oriented, resilience, Gratitude Training,

Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques.

Morals, Values and Ethics: Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Co operation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.

Module 3

21st century skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in problem solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

Module 4

Group and Team Dynamics: Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

Module 5

Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

Lab Activities

Verbal

Effective communication and Presentation skills.
Different kinds of communication; Flow of communication; Communication networks, Types of barriers; Miscommunication
Introduction to presentations and group discussions.
Learning styles: visual, aural, verbal, kinaesthetic, logical, social, solitary; Previewing, KWL table, active listening, REAP method
Note-taking skills: outlining, non-linear note-taking methods, Cornell notes, three column note taking.
Memory techniques: mnemonics, association, flashcards, keywords, outlines, spider diagrams and mind maps, spaced repetition.
Time management: auditing, identifying time wasters, managing distractions, calendars and checklists; Prioritizing - Goal setting, SMART goals; Productivity tools and apps, Pomodoro technique.

Non Verbal:

Non-verbal Communication and Body Language: Forms of non-verbal communication; Interpreting body-language cues; Kinesics; Proxemics; Chronemics; Effective use of body language, Communication in a multi cultural environment.

Reference Books

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra, "Personality Development & Soft Skills", Oxford Publishers, Third impression, 2017.
3. ICT Academy of Kerala, "Life Skills for Engineers", McGraw Hill Education (India) Private Ltd., 2016.
4. Caruso, D. R. and Salovey P, "The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership", John Wiley & Sons, 2004.
5. Kalyana, "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd, 2015.
6. Larry James, "The First Book of Life Skills"; First Edition, Embassy Books, 2016.
7. Shalini Verma, "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company, 2014.
8. Daniel Goleman, "Emotional Intelligence"; Bantam, 2006.
9. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016.
10. Butterfield Jeff, "Soft Skills for Everyone", Cengage Learning India Pvt Ltd; 1 edition, 2011.
11. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6 edition, 2015.
12. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.

PHL 120	ENGINEERING PHYSICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	0	0	2	1	2019

Preamble: The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to develop practical applications of engineering materials and use the principle in the right way to implement the modern technology.

Prerequisite: Higher secondary level Physics

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories
CO 2	Understand the need for precise measurement practices for data recording
CO 3	Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations
CO 4	Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				3			1	2			1
CO 2	3				3			1	2			1
CO 3	3				3			1	2			1
CO 4	3				3			1	2			1
CO 5	3				3			1	2			1

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SYLLABUS

LIST OF EXPERIMENTS

(Minimum 8 experiments should be completed)

1. CRO-Measurement of frequency and amplitude of wave forms
2. Measurement of strain using strain gauge and wheatstone bridge
3. LCR Circuit – Forced and damped harmonic oscillations
4. Melde's string apparatus- Measurement of frequency in the transverse and longitudinal mode
5. Wave length measurement of a monochromatic source of light using Newton's Rings method.
6. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
7. To measure the wavelength using a millimeter scale as a grating.
8. Measurement of wavelength of a source of light using grating.
9. Determination of dispersive power and resolving power of a plane transmission grating
10. Determination of the particle size of lycopodium powder
11. Determination of the wavelength of He-Ne laser or any standard laser using diffraction grating
12. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
13. I-V characteristics of solar cell.
14. LED Characteristics.
15. Ultrasonic Diffractometer- Wavelength and velocity measurement of ultrasonic waves in a liquid
16. Deflection magnetometer-Moment of a magnet- Tan A position.

Reference books

1. S.L.Gupta and Dr.V.Kumar, "Practical physics with viva voice", Pragati PrakashanPublishers, Revised Edition, 2009
2. M.N.Avadhanulu, A.A.Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand&Co,2008
3. S. K. Gupta, "Engineering physics practicals", Krishna Prakashan Pvt. Ltd., 2014
4. P. R. Sasikumar "Practical Physics", PHI Ltd., 2011.

CYL 120	ENGINEERING CHEMISTRY LAB	CATEGORY	L	T	P	CREDIT
		BSC	0	0	2	1

Preamble: To impart scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters

Prerequisite: Experiments in chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Understand and practice different techniques of quantitative chemical analysis to generate experimental skills and apply these skills to various analyses
CO 2	Develop skills relevant to synthesize organic polymers and acquire the practical skill to use TLC for the identification of drugs
CO 3	Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds
CO 4	Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO 5	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
CO 6	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				2							3
CO 2	3				3							3
CO 3	3				3							3
CO 4	3				3							3
CO 5	3				1							3
CO 6	3				1							3

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance : 20 marks
Class work/ Assessment /Viva-voce : 50 marks
End semester examination (Internally by college) : 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

LIST OF EXPERIMENTS (MINIMUM 8 MANDATORY)

1. Estimation of total hardness of water-EDTA method
2. Potentiometric titration
3. Determination of cell constant and conductance of solutions.
4. Calibration of pH meter and determination of pH of a solution
5. Estimation of chloride in water
6. Identification of drugs using TLC
7. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
8. Determination of molar absorptivity of a compound ($KMnO_4$ or any water soluble food colorant)
9. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
10. Estimation of iron in iron ore
11. Estimation of copper in brass
12. Estimation of dissolved oxygen by Winkler's method
13. (a) Analysis of IR spectra (minimum 3 spectra) (b) Analysis of ^1H NMR spectra (minimum 3 spectra)
14. Flame photometric estimation of Na^+ to find out the salinity in sand
15. Determination of acid value of a vegetable oil
16. Determination of saponification of a vegetable oil

Reference Books

1. G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.
3. Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers, 2019.
4. Ahad J., "Engineering Chemistry Lab manual", Jai Publications, 2019.
5. Roy K Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers, 2019.
6. Soney C George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd, New Delhi, 2019.

ESL 120	CIVIL & MECHANICAL WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
			0	0	2	1	2019

Preamble: The course is designed to train the students to identify and manage the tools, materials and methods required to execute an engineering project. Students will be introduced to a team working environment where they develop the necessary skills for planning, preparing and executing an engineering project.

To enable the student to familiarize various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to:

Course Outcome	Course Outcome Description
CO 1	Name different devices and tools used for civil engineering measurements
CO 2	Explain the use of various tools and devices for various field measurements
CO 3	Demonstrate the steps involved in basic civil engineering activities like plot measurement, setting out operation, evaluating the natural profile of land, plumbing and undertaking simple construction work.
CO 4	Choose materials and methods required for basic civil engineering activities like field measurements, masonry work and plumbing.
CO 5	Compare different techniques and devices used in civil engineering measurements
CO 6	Identify Basic Mechanical workshop operations in accordance with the material and objects
CO 7	Apply appropriate Tools and Instruments with respect to the mechanical workshop trades
CO 8	Apply appropriate safety measures with respect to the mechanical workshop trades

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	-	-	-	1	1	-	-	2	2	-	-
CO 2	1	-	-	-	1	1	-	-	2	2	-	-
CO 3	1	-	-	-	1	1	-	2	2	2	1	-
CO 4	1	-	-	-	1	1	-	2	2	2	1	1
CO 5	1	-	-	-	1	1	-	-	2	2		1
CO 6	2											

CO 7	2											
CO 8	2											

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

Assessment Procedure: Total marks allotted for the course is 100 marks. CIE shall be conducted for 70 marks and ESE for 30 marks. CIE should be done for the work done by the student and also viva voce based on the work done on each practical session. ESE shall be evaluated by written examination of one hour duration conducted internally by the institute.

Continuous Internal Evaluation Pattern:

Attendance : 20 marks
Class work/ Assessment /Viva-voce : 50 marks
End semester examination (Internally by college) : 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

PART 1

CIVIL WORKSHOP

Exercise 1. Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices

Exercise 2. (a) Use screw gauge and vernier calliper to measure the diameter of a steel rod and thickness of a flat bar

(b) Transfer the level from one point to another using a water level

(c) Set out a one room building with a given plan and measuring tape

Exercise 3. Find the level difference between any two points using dumpy level

Exercise 4. (a) Construct a $1\frac{1}{2}$ thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls.

(b) Estimate the number of different types of building blocks to construct this wall.

Exercise 5. (a) Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves ,fixtures and sanitary fittings.

(b) Install a small rainwater harvesting installation in the campus

Reference Books:

1. Khanna P.N, “Indian Practical Civil Engineering Handbook”, Engineers Publishers.
2. Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House
3. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications
4. S. C. Rangwala, “Engineering Materials,” Charotar Publishing House.

PART II

MECHANICAL WORKSHOP

LIST OF EXERCISES

(Minimum EIGHT units mandatory and FIVE models from Units 2 to 8 mandatory)

UNIT 1:- General : Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge.

Study of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc.

UNIT 2:- Carpentry : Understanding of carpentry tools

Minimum any one model

1. T –Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joints

UNIT 3:- Foundry : Understanding of foundry tools

Minimum any one model

1.Bench Molding 2. Floor Molding 3. Core making 4. Pattern making

UNIT 4: - Sheet Metal : Understanding of sheet metal working tools

Minimum any one model

1. Cylindrical shape
2. Conical shape
3. Prismatic shaped job from sheet metal

UNIT 5: - Fitting : Understanding of tools used for fitting

Minimum any one model

1. Square Joint
2. V- Joint
3. Male and female fitting

UNIT 6: - Plumbing : Understanding of plumbing tools, pipe joints

Any one exercise on joining of pipes making use of minimum three types of pipe joints

UNIT 7: - Smithy: Understanding of tools used for smithy.

Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in cold and hot states.

Observing the qualitative difference in the hardness of these materials

Minimum any one exercise on smithy

1. Square prism
2. Hexagonal headed bolt
3. Hexagonal prism
4. Octagonal prism

UNIT 8: -Welding: Understanding of welding equipments

Minimum any one welding practice

Making Joints using electric arc welding. bead formation in horizontal, vertical and over head positions

UNIT 9: - Assembly: Demonstration only

Dissembling and assembling of

1. Cylinder and piston assembly
2. Tail stock assembly
3. Bicycle
4. Pump or any other machine

UNIT 10: - Machines: Demonstration and applications of the following machines

Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; Drilling Machine.

UNIT 11: - Modern manufacturing methods: Power tools, CNC machine tools, 3D printing, Glass cutting.

Course Contents and Lecture Schedule:

No	Topic	No of Sessions
1	**INTRODUCTION**	
1.1	Workshop practice, shop floor precautions, ethics and First Aid knowledge. Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc	1
2	**CARPENTRY**	
2.1	Understanding of carpentry tools and making minimum one model	2

3	**FOUNDRY**	
3.1	Understanding of foundry tools and making minimum one model	2
4	**SHEET METAL**	
4.1	Understanding of sheet metal working tools and making minimum one model	2
5	**FITTING**	
5.1	Understanding of fitting tools and making minimum one model	2
6	**PLUMBING**	
6.1	Understanding of pipe joints and plumbing tools and making minimum one model	2
7	**SMITHY**	
7.1	Understanding of smithy tools and making minimum one model	2
8	**WELDING**	
8.1	Understanding of welding equipments and making minimum one model	2
9	**ASSEMBLY**	
9.1	Demonstration of assembly and dissembling of multiple parts components	1
10	**MACHINES**	
10.1	Demonstration of various machines	1
11	**MODERN MANUFACTURING METHODS**	
11.1	Demonstrations of: power tools, CNC Machine tools, 3D printing, Glass cutting	1

ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	0	0	2	1	2019

Preamble: Electrical Workshop is intended to impart skills to plan and carry out simple electrical wiring. It is essential for the practicing engineers to identify the basic practices and safety measures in electrical wiring.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Demonstrate safety measures against electric shocks.
CO 2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols
CO 3	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings
CO 4	Identify and test various electronic components
CO 5	Draw circuit schematics with EDA tools
CO 6	Assemble and test electronic circuits on boards
CO 7	Work in a team with good interpersonal skills

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	3	-	-	-	-	-	1
CO 2	2	-	-	-	-	-	-	-	-	1	-	-
CO 3	2	-	-	1	-	1	-	1	2	2	-	2
CO 4	3	-	-	-	-	-	-	-	-	-	-	2
CO 5	3	-	-	-	2	-	-	-	-	-	-	2
CO 6	3	-	-	-	2	-	-	-	-	-	-	1
CO 7	-	-	-	-	-	-	-	-	3	2	-	2

Mark distribution

Total Marks	CIE	ESE	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

Syllabus

PART 1

ELECTRICAL

List of Exercises / Experiments

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.

   b)Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.
2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3. Wiring of light/fan circuit using Two way switches . (Staircase wiring)
4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6. a)Identify different types of batteries with their specifications.

   b)Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

PART II

ELECTRONICS

List of Exercises / Experiments (Minimum of 7 mandatory)

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)

2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Dia or XCircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.

3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station etc.]

4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]

5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]

6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
8. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (**Any Two circuits).**

    1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
    2. Square wave generation using IC 555 timer in IC base.
    3. Sine wave generation using IC 741 OP-AMP in IC base.
    4. RC coupled amplifier with transistor BC107.

SEMESTER II

MAT 102	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: This course introduces the concepts and applications of differentiation and integration of vector valued functions, differential equations, Laplace and Fourier Transforms. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include the Calculus of vector valued functions, ordinary differential equations and basic transforms such as Laplace and Fourier Transforms which are invaluable for any engineer's mathematical tool box. The topics treated in this course have applications in all branches of engineering.

Prerequisite: Calculus of single and multi variable functions.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the derivatives and line integrals of vector functions and learn their applications
CO 2	Evaluate surface and volume integrals and learn their inter-relations and applications.
CO 3	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients
CO 4	Compute Laplace transform and apply them to solve ODEs arising in engineering
CO 5	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	3	3	3	2	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			

Create			

Mark distribution

Total Marks	**CIE** (Marks)	**ESE** (Marks)	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

Assignments: Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): Compute the derivatives and line integrals of vector functions and learn their applications

1. How would you calculate the speed, velocity and acceleration at any instant of a particle moving in space whose position vector at time $t$is $\boldsymbol{r}(t)$?
2. Find the work done by the force field $F = (e^x - y^3)\boldsymbol{i} + (\cos y + x^3)$on a particle that travels once around the unit circle centred at origin having radius 1.
3. When do you say that a vector field is conservative? What are the implications if a vector field is conservative?

Course Outcome 2 (CO2): Evaluate surface and volume integrals and learn their inter-relations and applications

1. Write any one application each of line integral, double integral and surface integral.
2. Use the divergence theorem to find the outward flux of the vector field $F(x, y\,, z) = z\boldsymbol{k}$across the

$$x^2 + y^2 + z^2 = a^2$$

3. State Greens theorem. Use Green's theorem to express the area of a plane region bounded by a curve as a line integral.

Course Outcome 3 (CO3): Solve homogeneous and non-homogeneous linear differential equation with constant coefficients

1. If $y_1(x)$ and $y_2(x)$ are solutions of $y'' + py' + qy = 0$, where p, q are constants, show that

   $y_1(x) + y_2(x)$ is also a solution.

2. Solve the differential equation $y'' + y = 0.001x^2$ using method of undetermined coefficient.

3. Solve the differential equation of $y''' - 3y'' + 3y' - y = e^x - x - 1$.

Course Outcome 4 (CO4): Compute Laplace transform and apply them to solve ODEs arising in engineering

1. What is the inverse Laplace Transformof $(s) = \frac{3s-137}{s^2+2s+4}$?

2. Find Laplace Transform of Unit step function.

3. Solve the differential equation of $y'' + 9y = \delta\left(t - \frac{\pi}{2}\right)$? Given $y(0) = 2,\ y'(0) = 0$

Course Outcome 5(CO5): Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

1. Find the Fourier integral representation of function defined by $f(x) = e^{-x}$ for $x > 0$ and $f(x) = 0$ for $x < 0$.

2. What are the conditions for the existence of Fourier Transform of a function $f(x)$?

3. Find the Fourier transform of $f(x) = 1$ for $|x| < 1$ and $f(x) = 0$ otherwise.

Model Question paper

QP CODE: PAGES:3

Reg No:______________

Name :______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MAT 102

Max. Marks: 100 **Duration: 3 Hours**

VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS

(2019-Scheme)

(Common to all branches)

PART A

(Answer all questions. Each question carries 3 marks)

1. Is the vector $\boldsymbol{r}$ **where** $\boldsymbol{r} = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$ conservative. Justify your answer.
2. State Greens theorem including all the required hypotheses
3. What is the outward flux of $\boldsymbol{F}(\boldsymbol{x}, \boldsymbol{y}, \boldsymbol{z}) = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$ across any unit cube**.**
4. What is the relationship between Green's theorem and Stokes theorem?
5. Solve $y'' + 4y' + 2.5y = 0$
6. Does the function $y = C_1 \cos x + C_2\, sinx$form a solution of$y'' + y = 0$?. Is it the general solution? Justify your answer.
7. Find the Laplace transform of $e^{-t} \sinh 4t$
8. Find the Laplace inverse transform of $\frac{1}{s\,(s^2+\omega^2)}$.
9. Given the Fourier transform $\frac{1}{\sqrt{2}} e^{-\frac{\omega^2}{4}}$ of $f(x) = e^{-x^2}$, find the Fourier transform of xe^{-x^2}
10. State the convolution theorem for Fourier transform

PART B

(Answer one full question from each module. Each full question carries 14 marks)

MODULE 1

11a) Prove that the force field $\boldsymbol{F} = e^y \boldsymbol{i} + xe^y \boldsymbol{j}$is conservative in the entire xy-plane

b**)** Use Greens theorem to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

12 a) Find the divergence of the vector field$\boldsymbol{F} = \frac{c}{(\boldsymbol{x^2+y^2+z^2})^{3/2}} (x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k})$

b) Find the work done by the force field$\boldsymbol{F}(x, y, z) = xy\boldsymbol{i} + yz\boldsymbol{j} + xz\boldsymbol{k}$along C where

C is the curve$\boldsymbol{r}(t) = t\boldsymbol{i} + t^2\boldsymbol{j} + t^3\boldsymbol{k}$

MODULE II

13 a) Use divergence theorem to find the outward flux of the vector field

$\boldsymbol{F} = 2x\boldsymbol{i} + 3y\boldsymbol{j} + z^3\boldsymbol{k}$acrossthe unit cube bounded by or $x = 0$, $y = 0$,$z = 0$,$x = 1$,$y = 1$,$z = 1$

b) Find the circulation of $\boldsymbol{F} = (x - z)\boldsymbol{i} + (y - x)\boldsymbol{j} + (\boldsymbol{z} - \boldsymbol{xy})\boldsymbol{k}$ using Stokes theorem around the triangle with vertices $A(1,0,0)$, $B(0,2,0)$and $C(0,0,1)$

14 a**)** Use divergence theorem to find the volume of the cylindrical solid bounded by $x^2 + 4x + y^2 = 7$, $z = -1$, $z = 4$, given the vector field $\boldsymbol{F} = \boldsymbol{x}i + \boldsymbol{y}j + \boldsymbol{z}k$ across surfaceof the cylinder

b) Use Stokes theorem to evaluate$\int_C \boldsymbol{F}.\boldsymbol{dr}$where$\boldsymbol{F} = x^2\boldsymbol{i} + 3x\boldsymbol{j} - y^3\boldsymbol{k}$where Cis the circle $x^2 + y^2 = 1$ in the xy- plane with counterclockwise orientation looking down the positive z-axis

MODULE III

15 a) Solve $y'' + 4y' + 4y = x^2 + e^{-x}\cos x$

b) Solve $y''' - 3y'' + 3y' - y = e^x - x - 1$

16 a) Solve $\boldsymbol{y}''' + \mathbf{3}y'' + 3y' + y = 30e^{-x}$ given $y(0) = 3, y'(0) = -3$, $y''(0) = -47$

b) Using method of variation of parameters, solve $y'' + y = sec\, x$

MODULE IV

17 a) Find the inverse Laplace transform of $F(s) = \frac{2(e^{-s} - e^{-3s})}{s^2 - 4}$

b) Solve the differential equation $y'' + 16y = 4\delta(t - 3\pi)$; $y(0) = 2, y'(0) = 0$ using Laplace transform

18 a) Solve $y'' + 3y' + 2y = f(t)$ where $f(t) = 1$ for $0 < t < 1$ and $f(t) = 1$ for $t > 1$ using Laplace transform

b) Apply convolution theorem to find the Laplace inverse transform of $\frac{1}{s^2(s^2+\omega^2)}$

MODULE V

19 a) Find the Fourier cosine integral representation for $f(x) = e^{-kx}$ for $x > 0$ and $k > 0$ and hence evaluate $\int_0^\infty \frac{\cos wx}{k^2 + w^2}$ the function

b) Does the Fourier sine transform $f(x) = x^{-1}\sin x$ for $0 < x < \infty$ exist? Justify your answer

20 a) Find the Fourier transform of $f(x) = |x|$ for $|x| < 1$ and $f(x) = 0$ otherwise

b) Find the Fourier cosine transform of $f(x) = e^{-ax}$ for a> 0

Syllabus

Module 1 (Calculus of vector functions)

(Text 1: Relevant topics from sections 12.1, 12.2, 12.6, 13.6, 15.1, 15.2, 15.3)

Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields , Gradient and its properties, directional derivative , divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields , independence of path and potential function(results without proof).

Module 2 (Vector integral theorems)

(Text 1: Relevant topics from sections 15.4, 15.5, 15.6, 15.7, 15.8)

Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z) , Flux integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z), divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.

Module- 3 (Ordinary differential equations)

(Text 2: Relevant topics from sections 2.1, 2.2, 2.5, 2.6, 2.7, 2.10, 3.1, 3.2, 3.3)

Homogenous linear differential equation of second order, superposition principle,general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only).Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right hand side of the form x^n,e^{kx},$sinax$,$cosax$,$e^{kx}sinaxe^{kx}cosax$and their linear combinations), methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficient using method of undetermined coefficient.

Module- 4 (Laplace transforms)

(Text 2: Relevant topics from sections 6.1,6.2,6.3,6.4,6.5)

Laplace Transform and its inverse ,Existence theorem (without proof) , linearity,Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Solution of ordinary differential equation involving unit step function and Dirac delta functions. Convolution theorem(without proof)and its application to finding inverse Laplace transform of products of functions.

Module-5 (Fourier Tranforms)

(Text 2: Relevant topics from sections 11.7,11.8, 11.9)

Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transform of derivatives. Convolution theorem (without proof)

Text Books

1. H. Anton, I. Biven S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10th edition, 2015.

Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson,Reprint, 2002.
3. Peter O Neil, Advanced Engineering Mathematics, 7th Edition, Thomson, 2007.
4. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6th edition, 2003.
5. VeerarajanT."Engineering Mathematics for first year", Tata McGraw - Hill, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th edition , 2010.
7. Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 2015.
8. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw – Hill International Editions, 2000.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Calculus of vector functions (9 hours)**	
1.1	Vector valued function of a scalar variable - derivative of vector valued function of scalar variable t-geometrical meaning	2
1.2	Motion along a curve-speed , velocity, acceleration	1
1.3	Gradient and its properties, directional derivative , divergent and curl	3
1.4	Line integrals with respect to arc length, line integrals of vector fields. Work done as line integral	2
1.5	Conservative vector field, independence of path, potential function	1

2	**Vector integral theorems(9 hours)**	
2.1	Green’s theorem and it’s applications	2
2.2	Surface integrals , flux integral and their evaluation	3
2.3	Divergence theorem and applications	2
2.4	Stokes theorem and applications	2
3	**Ordinary Differential Equations (9 hours)**	
3.1	Homogenous linear equation of second order, Superposition principle, general solution	1
3.2	Homogenous linear ODEs of second order with constant coefficients	2
3.3	Second order Euler-Cauchy equation	1
3.4	Non homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients, variation of parameters.	3
3.5	Higher order equations with constant coefficients	2
4	**Laplace Transform (10 hours)**	
4.1	Laplace Transform , inverse Transform, Linearity, First shifting theorem, transform of basic functions	2
4.2	Transform of derivatives and integrals	1
4.3	Solution of Differential equations, Initial value problems by Laplace transform method.	2
4.4	Unit step function --- Second shifting theorem	2
4.5	Dirac Delta function and solution of ODE involving Dirac delta function	2
4.6	Convolution and related problems.	1
5	**Fourier Transform (8 hours)**	
5.1	Fourier integral representation	1
5.2	Fourier Cosine and Sine integrals and transforms	2
5.3	Complex Fourier integral representation, Fourier transform and its inverse transforms, basic properties	3
5.4	Fourier transform of derivatives, Convolution theorem	2

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY
KTU
2014

PHT 100	ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Classify the properties of magnetic materials and apply vector calculus to static magnetic fields and use Maxwell's equations to diverse engineering problems
CO 5	Analyze the principles behind various superconducting applications, explain the working of solid state lighting devices and fibre optic communication system

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3	1						1	2			1
CO 5	3	1						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.

   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.

   (b) A liquid of refractive index μ is introduced between the lens and glass plate.

What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function ?
2. What are excitons ?
3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.

   (b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Compare displacement current and conduction current.
2. Mention any four properties of ferro magnetic materials.
3. (a) Starting from Maxwell's equations, derive the free space electromagnetic wave equation and show that velocity of electromagnetic wave is $1/(\mu_o \varepsilon_o)^{1/2}$

   (b) An electromagnetic wave is described by $E = 100 \exp 8\pi i [10^{14} t - (10^{6} z / 3)]$ V/m. Find the direction of propagation of the wave,speed of the wave and magnetic flux density in the wave.

Course Outcome 5 (CO5):

1. Explain the working of a solar cell.
2. Distinguish between Type I and Type II super conductors.
3. (a) Define numerical aperture and derive an expression for it.

   (b) Explain the working of intensity modulated fibre optic sensor.

Model Question paper

QP CODE: PAGES:3

Reg No:______________

Name :______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 100

Course Name: Engineering Physics A

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators

2. Distinguish between longitudinal and transverse waves

3. Write a short note on antireflection coating.

4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.

5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.

6. Explain surface to volume ratio of nanomaterials.

7. State Faraday's laws of electromagnetic induction.

8. Compare displacement current and conduction current

9. List four important applications of superconductors.

10. Give the working principle of LED. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution.Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is $7\times10^{4.}$ Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value.(4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t)m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv)Velocity of the wave. (4)

Module 2

13.(a)Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid. (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given β = 0.0555 cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15.(a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16.(a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17.(a) State Poynting's Theorem. Calculate the value of Poynting vector at the surface of the sun if the power radiated by the sun is 3.8 x 10^{26} W and its radius is 7 X 10^{8} m. (5)

(b) Distinguish between paramagnetic, diamagnetic and ferromagnetic materials. (9)

18.(a) Starting from Maxwell's Equations, derive electromagnetic wave equations in free space. (10)

(b) If the magnitude of **H** in a plane wave is 1 A/m, find the magnitude of **E** in free space. (4)

Module 5

19.(a) Show that superconductors are perfect diamagnets. Distinguish between Type I and Type II superconductors with suitable examples. (10)

(b) Write a short note on high temperature superconductors. (4)

20.(a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33. (4)

(14x5=70)

Syllabus

ENGINEERING PHYSICS A
(FOR CIRCUIT BRANCHES)

Module 1
Oscillations and Waves
Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2
Wave Optics
Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3
Quantum Mechanics & Nanotechnology
Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4
Magnetism & Electro Magnetic Theory
Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux, Magnetic permeability and susceptibility, Classification of magnetic materials-para, dia and ferromagnetic materials

Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem, Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)

Module 5

Superconductivity & Photonics

Superconducting phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II, BCS Theory (Qualitative), High temperature superconductors-Applications of super conductivity

Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics, Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors.

Text Books

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition 2019

2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition 2017

Reference Books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. Halliday, Resnick, Walker, "Fundamentals of Physics'', John Wiley & Sons.Inc, 2001
8. David J Griffiths, "Introduction to Electrodynamics'', Addison-Wesley publishing, 3rd Edition, 1999
9. Premlet B., "Advanced Engineering Physics", Phasor Books,10^{th} edition,2017
10. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves. Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hr
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Magnetism & Electro Magnetic Theory (9 hours)**	
4.1	Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux	2 hrs

	density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux	
4.2	Explanation for Magnetic permeability and susceptibility Classification of magnetic materials- para, dia and ferromagnetic materials	1 hr
4.3	Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem	2 hrs
4.4	Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)	4 hrs
5	**Superconductivity &Photonics (9hours)**	
5.1	Super conducting Phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II	2 hrs
5.2	BCS Theory (Qualitative), High temperature superconductors, Applications of super conductivity	2 hrs
5.3	Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics	2 hrs
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

PHT 110	ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)	Category	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Apply the knowledge of ultrasonics in non-destructive testing and use the principles of acoustics to explain the nature and characterization of acoustic design and to provide a safe and healthy environment
CO 5	Apply the comprehended knowledge about laser and fibre optic communication systems in various engineering applications

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3							1	2			1
CO 5	3	2						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50

Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE MARKS	ESE MARKS	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.
   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.
   (b) A liquid of refractive index μ is introduced between the lens and glass plate. What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function?

2. What are excitons ?
3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.
   (b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Explain reverberation and reverberation time.
2. How ultrasonic waves are used in non-destructive testing.
3. (a) With a neat diagram explain how ultrasonic waves are produced by a piezoelectric oscillator.
   (b) Calculate frequency of ultrasonic waves that can be produced by a nickel rod of length 4 cm. (Young's Modulus = 207 G Pa, Density = 8900 Kg /m^3)

Course Outcome 5 (CO 5):

1. Distinguish between spontaneous emission and stimulated emission.
2. Explain optical resonators.
3. (a) Explain the construction and working of Ruby Laser.
   (b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33.

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Model Question paper

QP CODE: PAGES:3

Reg No:_______________

Name :_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 110

Course Name: Engineering Physics B

Max.Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators.

2. Distinguish between longitudinal and transverse waves.

3. Write a short note on antireflection coating.

4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.

5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.

6. Explain surface to volume ratio of nanomaterials.

7. Define sound intensity level. Give the values of threshold of hearing and threshold of pain.

8. Describe the method of non-destructive testing using ultra sonic waves

9. Explain the condition of population inversion

10. Distinguish between step index and graded index fibre. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution. Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is 7×10^{4}. Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value. (4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t) m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of the wave. (4)

Module 2

13. (a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid? (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given β = 0.0555 cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15. (a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16. (a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17. (a) Explain reverberation and reverberation time? What is the significance of Reverberation time. Explain the factors affecting the acoustics of a building and their corrective measures? (10)

(b) The volume of a hall is 3000 m^3. It has a total absorption of 100m^2 sabine. If the hall is filled with audience who add another 80 m^2sabine, then find the difference in reverberation time. (4)

18. (a) With a neat diagram explain how ultrasonic waves are produced by piezoelectric oscillator. Also discuss the piezoelectric method of detection of ultrasonic waves. (10)

(b) An ultrasonic source of 0.09 MHz sends down a pulse towards the sea bed which returns after 0.55 sec. The velocity of sound in sea water is 1800 m/s. Calculate the depth of the sea and the wavelength of the pulse. (4)

Module 5

19. (a) Outline the construction and working of Ruby laser. (8)

(b) What is the principle of holography? How is a hologram recorded? (6)

20. (a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) An optical fibre made with core of refractive index 1.5 and cladding with a fractional index difference of 0.0006. Find refractive index of cladding and numerical aperture. (4)

(14x5=70)

SYLLABUS

ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)

Module 1

Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2

Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3

Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening Mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4

Acoustics & Ultrasonics

Acoustics, Classification of sound-Musical sound-Noise, Characteristics of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation), Factors affecting architectural acoustics and their remedies

Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator –Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods, Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid , Applications of ultrasonic waves -SONAR,NDT and Medical

Module 5

Laser and Fibre optics

Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle, Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) ,Applications of laser, Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications

Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors

Text Books

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition, 2019.

2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition, 2017.

Reference Books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. B. B. Laud, "Lasers and Non linear optics", New age International Publishers, 2nd Edition ,2005
8. Premlet B., "Advanced Engineering Physics", Phasor Books,10^{th} edition ,2017
9. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hrs
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Acoustics & Ultrasonics (9hrs)**	
4.1	Acoustics, Classification of sound-Musical sound-Noise, Characteristics	3 hrs

	of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine’s formula (no derivation)	
4.2	Factors affecting architectural acoustics and their remedies	1 hr
4.3	Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods	3hrs
4.4	Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid ,Applications of ultrasonic waves -SONAR,NDT and Medical.	2 hr
5	**Laser and Fibre optics (9hours)**	
5.1	Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein’s coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle	2 hrs
5.2	Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) Applications of laser	3 hrs
5.3	Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications	1 hr
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

CYT 100	ENGINEERING CHEMISTRY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like spectroscopy, electrochemistry, instrumental methods etc. Also familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, SEM, stereochemistry, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

Prerequisite: Concepts of chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Apply the basic concepts of electrochemistry and corrosion to explore its possible applications in various engineering fields.
CO 2	Understand various spectroscopic techniques like UV-Visible, IR, NMR and its applications.
CO 3	Apply the knowledge of analytical method for characterizing a chemical mixture or a compound. Understand the basic concept of SEM for surface characterisation of nanomaterials.
CO 4	Learn about the basics of stereochemistry and its application. Apply the knowledge of conducting polymers and advanced polymers in engineering.
CO 5	Study various types of water treatment methods to develop skills for treating wastewater.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1									
CO 2	1	1		1	2							
CO 3	1	1		1	2							
CO 4	2	1										
CO 5	1			1			3					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

End Semester Examination Pattern: There will be two parts- **Part A** and **Part B. Part A** contains **10** questions (**2** questions from each module), having **3** marks for each question. Students should answer **all** questions. **Part B** contains **2** questions from each module, of which student should answer any one. Each question can have maximum **2** subdivisions and carries **14** marks.

Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is calomel electrode? Give the reduction reaction (3 Marks)

2. List three important advantages of potentiometric titration (3 Marks)

3. (a) Explain how electroless plating copper and nickel are carried out (10 Marks)

(b) Calculate the emf of the following cell at 30°C, Z n / Zn^{2+} (0.1M) // Ag^{+} (0.01M) // Ag.

Given E^0 Zn^{2+}/Zn = -0.76 V, E^0 Ag^{+}/Ag = 0.8 V. (4 Marks)

Course Outcome 2 (CO 2)

1. State Beer Lambert's law (3 Marks)

2. List the important applications of IR spectroscopy (3 Marks)

3. (a) What is Chemical shift? What are factors affecting Chemical shift? How ^{1}H NMR spectrum of CH_3COCH_2Cl interpreted using the concept of chemical shift. (10 Marks)

(b) Calculate the force constant of HF molecule, if it shows IR absorption at 4138 cm^{-1}. Given that atomic masses of hydrogen and fluorine are 1u and 19u respectively. (4 Marks)

Course Outcome 3 (CO 3):

1. Distinguish between TGA and DTA (3 Marks)

2. Give two differences between GSC and GLC (3 Marks)

3. (a) Explain the principle, instrumentation and procedure of HPLC (10 Marks)

(b) Interpret TGA of $CaC_2O_4 . H_2O$ (4 Marks)

Course Outcome 4 (CO 4):

1. Explain the geometrical isomerism in double bonds (3 Marks)

2. What are the rules of assigning R-S notation? (3 Marks)

3. (a) What are conducting polymers? How it is classified? Give the preparation of polyaniline (10 Marks)

(b) Draw the stereoisomers possible for CH_3-$(CHOH)_2$-COOH (4 Marks)

Course Outcome 5 (CO 5):

1. What is degree of hardness? (3 Marks)

2. Define BOD and COD (3 Marks)

3. (a) Explain the EDTA estimation of hardness (10 Marks)

(b) Standard hard water contains 20 g of CaCO3 per liter,50 mL of this required 30mL of EDTA solution, 50mL of sample water required 20mL of EDTA solution. 50mL sample water after boiling required 14 mL EDTA solution. Calculate the temporary hardness of the given sample of water, in terms of ppm. (4 Marks)

MODEL QUESTION PAPER

Total Pages:

Reg No.:________________ Name:____________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER B.TECH DEGREE EXAMINATION

Course Code: CYT100,

Course Name: ENGINEERING CHEMISTRY

Max. Marks: 100 Duration: 3 Hours

PART A

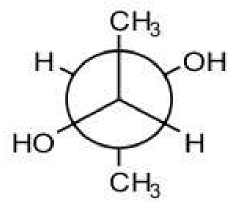
Answer all questions, each carries 3 marks Marks

1	What is potentiometric titration? How the end point is determined graphically?	(3)
2	What is Galvanic series? How is it different from electrochemical series?	(3)
3	Which of the following molecules can give IR absorption? Give reason? (a) O_2 (b) H_2O (c) N_2 (d) HCl	(3)
4	Which of the following molecules show UV-Visible absorption? Give reason. (a) Ethane (b) Butadiene (c) Benzene	(3)

5 What are the visualization techniques used in TLC? (3)

6 Write the three important applications of nanomaterials. (3)

7 Draw the Fischer projection formula and find R-S notation of (3)



8 Write the structure of a) Polypyrroleb) Kevlar. (3

9 What is break point chlorination? (3)

10 What is reverse osmosis? (3)

PART B

Answer any one full question from each module, each question carries 14 marks

Module 1

11 a) Give the construction of Li-ion cell. Give the reactions that take place at the electrodes during charging and discharging. What happens to anodic material when the cell is 100% charged. (10)

b) Calculate the standard electrode potential of Cu, if its electrode potential at 25 °C is 0.296 V and the concentration of Cu^{2+} is 0.015 M. (4)

OR

12 a) Explain the mechanism of electrochemical corrosion of iron in oxygen rich and oxygen deficient acidic and basic environments. (10)

b) Given below are reduction potentials of some species (4)

$MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O$; $E^0 = +1.51$ V

$Cl_2 + 2e \rightarrow 2Cl^-$; $E^0 = +1.36$ V

$S_2O_8^{2-} + 2e \rightarrow 2SO_4^{2-}$; $E^0 = +1.98$ V

Use the above data to examine whether the acids, dil. HCl and dil. H_2SO_4 , can be used to provide acid medium in redox titrations involving $KMnO_4$.

Module 2

13 a) What is spin-spin splitting? Draw the NMR spectrum of (i) CH_3 CH_2CH_2 Br (ii) $CH_3CH(Br)CH_3$ Explain how NMR spectrum can be used to identify the two isomers. (10)

b) A dye solution of concentration 0.08M shows absorbance of 0.012 at 600 nm; while a test solution of same dye shows absorbance of 0.084 under same conditions. Find the concentration of the test solution. (4)

OR

14 a) Explain the basic principle of UV-Visible spectroscopy. What are the possible electronic transitions? Explain with examples. (10)

b) Sketch the vibrational modes of CO_2 and H_2O. Which of them are IR active? (4)

Module 3

15 a) Explain the principle, instrumentation and procedure involved in gas chromatography. (10)

b) Explain the DTA of $CaC_2O_4.H_2O$ with a neat sketch. (4)

OR

16 a) Explain the various chemical methods used for the synthesis of nanomaterial (10)

b) How TGA is used to analyse the thermal stability of polymers? (4)

Module 4

17 a) What are conformers? Draw the*cis* and *trans*isomers of 1, 3-dimethylcylohexane. Which conformer (chair form) is more stable in each case? (10)

b) What is ABS? Give properties and applications. (4)

OR

18 a) Explain the various structural isomers with suitable example. (10)

b) What is OLED? Draw a labelled diagram. (4)

Module 5

19 a) What are ion exchange resins? Explain ion exchange process for removal of hardness of water? How exhausted resins are regenerated? (10)

b) 50 mL sewage water is diluted to 2000 mL with dilution water; the initial dissolved oxygen was 7.7 ppm. The dissolved oxygen level after 5 days of incubation was 2.4 ppm. Find the BOD of the sewage. (4)

OR

20 a) What are the different steps in sewage treatment? Give the flow diagram. Explain the working of trickling filter. (10)

b) Calculate the temporary and permanent hardness of a water sample which contains $[Ca^{2+}]$ = 160 mg/L, $[Mg^{2+}]$ = 192 mg/L and $[HCO_3^-]$ = 122 mg/L. (4)

Syllabus

Module 1

Electrochemistry and Corrosion

Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes - SHE - Calomel electrode - Glass Electrode - Construction and Working. Single electrode potential - definition - Helmholtz electrical double layer -Determination of E^0 using calomel electrode.Determination of pH using glass electrode.Electrochemical series and its applications. Free energy and EMF - Nernst Equation - Derivation - single electrode and cell (Numericals) -Application - Variation of emf with temperature. Potentiometric titration - Introduction -Redox titration only.Lithiumion cell - construction and working.Conductivity- Measurement of conductivity of a solution (Numericals).

Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.

Module 2

Spectroscopic Techniques and Applications

Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications. ^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).

Module 3

Instrumental Methods and Nanomaterials

Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$. Chromatographic methods - Basic principles and applications of column and TLC-Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.

Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).

Module 4

Stereochemistry and Polymer Chemistry

Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.

Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications.Kevlar-preparation, properties and applications.Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.

Module 5

Water Chemistry and Sewage Water Treatment

Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.

Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.

Text Books

1. B. L. Tembe, Kamaluddin, M. S. Krishnan, "Engineering Chemistry (NPTEL Web-book)", 2018.

2. P. W. Atkins, "Physical Chemistry", Oxford University Press, 10th edn., 2014.

Reference Books

1. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 4thedn., 1995.
2. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
3. B. R. Puri, L. R. Sharma, M. S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 47th Edition, 2017.
4. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7th Edition, 2005.
5. Ernest L. Eliel, Samuel H. Wilen, "Stereo-chemistry of Organic Compounds", WILEY, 2008.
6. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc; 4th Revised Edition, 1996.
7. MuhammedArif, Annette Fernandez, Kavitha P. Nair "Engineering Chemistry", Owl Books, 2019.
8. Ahad J., "Engineering Chemistry", Jai Publication, 2019.
9. Roy K. Varghese, "Engineering Chemistry", Crownplus Publishers, 2019.
10. Soney C. George,RinoLaly Jose, "Text Book of Engineering Chemistry", S. Chand & Company Pvt Ltd, 2019.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures (hrs)
1	**Electrochemistry and Corrosion**	**9**
1.1	Introduction - Differences between electrolytic and electrochemical cells- Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes- SHE - Calomel electrode - Glass Electrode - Construction and Working.	**2**
1.2	Single electrode potential – definition - Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF - Nernst Equation – Derivation - single electrode and cell (Numericals) -Application -Variation of emf with temperature.	**3**
1.3	Potentiometric titration - Introduction -Redox titration only. Lithiumion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals).	**2**
1.4	Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	**2**
2	**Spectroscopic Techniques and Applications**	**9**
2.1	Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals).	**2**
2.2	UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.	**2**
2.3	IR-Spectroscopy – Principle - Number of vibrational modes -Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications.	**2**
2.4	^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).	**3**
3	**Instrumental Methods and Nanomaterials**	**9**
3.1	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$.	**2**

3.2	Chromatographic methods - Basic principles and applications of column and TLC-Retention factor.	**2**
3.3	GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.	**2**
3.4	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).	**3**
4	**Stereochemistry and Polymer Chemistry**	**9**
4.1	Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations).	**2**
4.2	R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.	**1**
4.3	Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.	**2**
4.4	Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	**4**
5	**Water Chemistry and Sewage Water Treatment**	**9**
5.1	Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	**3**
5.2	Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.	**2**
5.3	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals).	**2**
5.4	Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process.	**2**

EST 100	ENGINEERING MECHANICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	1	0	3	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to:

CO 1	Recall principles and theorems related to rigid body mechanics
CO 2	Identify and describe the components of system of forces acting on the rigid body
CO 3	Apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	Choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	Solve problems involving rigid bodies, applying the properties of distributed areas and masses

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	15
Understand	10	10	15
Apply	30	30	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

<u>End Semester Examination Pattern:</u> There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

<u>Course Level Assessment Questions:</u>

Part A

Course Outcome 1 (CO1): (One question from each module to meet the course objective 1: *To recall principles and theorems related to rigid body mechanics***)**

1. Explain D'Alembert's principle

2. Distinguish static and dynamic friction

3. State and explain perpendicular axis theorem

Course Outcome 2 (CO2) (One question from each module to meet the course objective 2: *To identify and describe the components of system of forces acting on the rigid body***)**

1. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

2. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

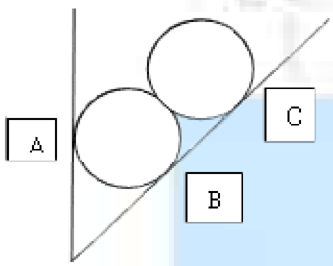
3. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

Part B

All the questions under this section shall assess the learning levels corresponding to the course outcomes listed below.

CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses

1. Two rollers each of weight 100 N are supported by an inclined plane and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth.

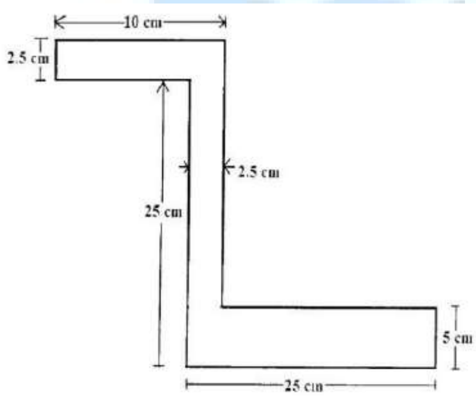


Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent equilibrium state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

2. A cylindrical disc, 50 cm diameter and cm thickness, is in contact with a horizontal conveyor belts running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s. Also compute the moment acting about the axis of the disc in both cases.

Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

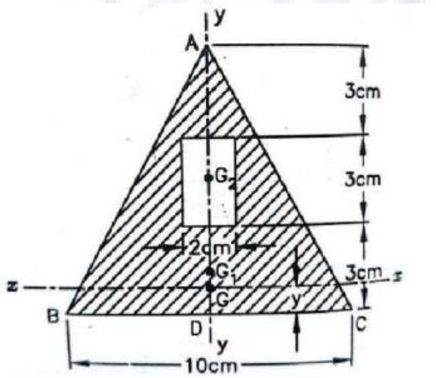
3. Determine the centroid of the given section



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of centroid for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed	Applying (Solve the problem based on the descriptions	6

	areas and masses	given in CO3 and CO4)	
Total			14

4. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC.



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of moment of inertia for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

Model Question Paper

QP CODE:

Reg No.:_______________

Name:__________________________ ___

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 100

ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 hours

Part A

(Answer all questions; each question carries 3 marks)

1. Explain D'Alembert's principle

2. Distinguish static and dynamic frictioni.

3. State and explain perpendicular axis theorem.

4. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

5. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

6. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

7. Compare damped and undamped free vibrations.

8. State the equation of motion of a rotating rigid body, rotating about its fixed axis.

9. Illustrate the significance of instantaneous centre in the analysis of rigid body undergoing rotational motion.

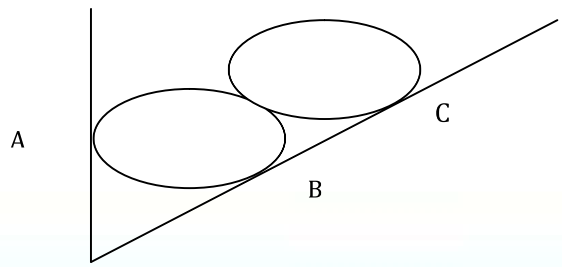
10. Highlight the principles of mechanics applied in the evaluation of elastic collusion of rigid bodies.

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module -I

11. Two identical rollers each of weight 100 N are supported by an inclined plane, making an angle of 30^{o} with the vertical, and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth. (14 marks)

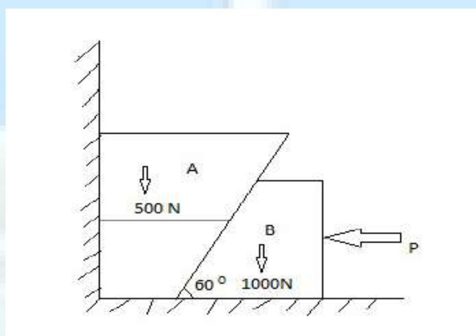


12. A string tied to a wall is made to pass over a pulley placed 2m away from it. A weight P is attached to the string such that the string stretches by 2m from the support on the wall to the location of attachment of weight. Determine the force P required to maintain 200 kg body in position for $\theta = 30^o$, The diameter of pulley B is negligible. (14 marks)

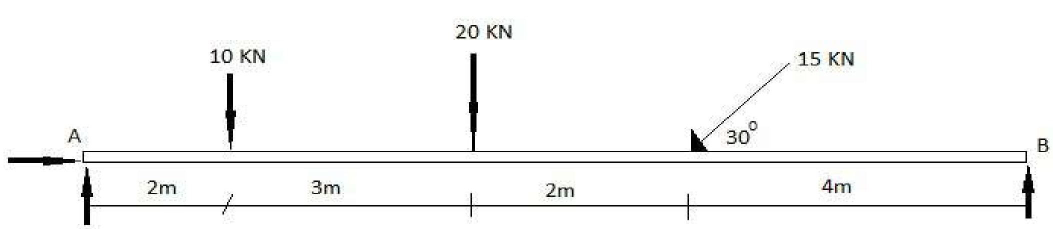
Module – 2

13. Two blocks A & B are resting against a wall and the floor as shown in figure below. Find the value of horizontal force P applied to the lower block that will hold the system in equilibrium. Coefficient of friction are : 0.25 at the floor, 0.3 at the wall and 0.2 between the blocks.

(14 marks)

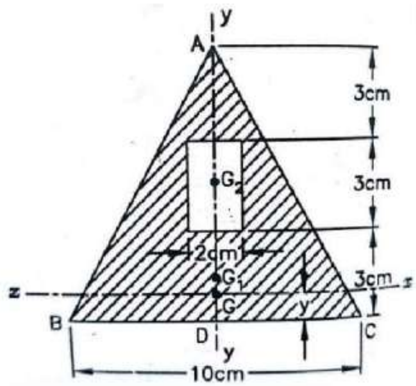


14. A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below.
Find the reactions at A & B. (14 marks)

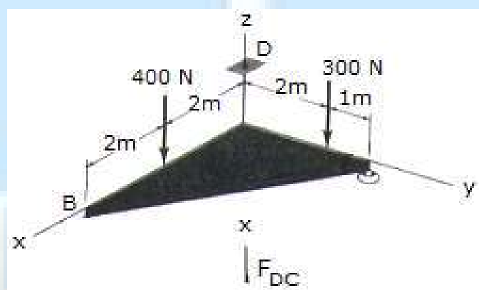


Module – 3

15. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC. (14 marks)



16. Support A has ball and socket connection. Roller support at B prevents motion in the —z direction. Corner *C* is tied to *D* by a rope. The triangle is weightless. Determine the unknown force components acting at *A*, *B*, and *C*. (14 marks)



Module - 4

17. A cricket ball is thrown by a fielder from a height of 2m at an angle of 30^0 to the horizontal with an initial velocity of 20 m/s , hits the wickets at a height of 0.5 m from the ground. How far was the fielder from the wicket? (14 marks)

18. An engine of weight 500 kN pull a train weighing 1500 kN up an incline of 1 in 100. The train starts from rest and moves with constant acceleration against a resistance of 5 N/kN. It attains a maximum speed of 36 kmph in 1 km distance. Determine the tension in the coupling between train and engine and the traction force developed by the engine. (14marks)

Module – 5

19. A cylindrical disc, 50 cm diameter and 10 cm thickness having mass of 10 kg, is in contact with a horizontal conveyor belt running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s in 10 seconds. Also compute the moment acting about the axis of the disc in both cases. (14 marks)

20. A wheel rotating about fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find the (i) angular velocity at the end of this interval and (ii) time required for the velocity to reach 100 revolutions per minute. (14 marks)

SYLLABUS

Module 1

Introduction to Engineering Mechanics-statics-basic principles of statics-Parallelogram law, equilibrium law, principles of superposition and transmissibility, law of action and reaction(review) free body diagrams.

Concurrent coplanar forces-composition and resolution of forces-resultant and equilibrium equations – methods of projections – methods of moments – Varignon's Theorem of moments.

Module 2

Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –wedges, ladder-analysis of connected bodies .

Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads. General coplanar force system - resultant and equilibrium equations.

Module 3

Centroid of composite areas- – moment of inertia-parallel axis and perpendicular axis theorems. Polar moment of inertia,radius of gyration,mass moment of inertia-ring,cylinder and disc.

Theorem of Pappus Guldinus(demonstration only)

Forces in space - vectorial representation of forces, moments and couples –resultant and equilibrium equations – concurrent forces in space (simple problems only)

Module 4

Dynamics – rectilinear translation - equations of kinematics(review)

kinetics – equation of motion – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies. Impulse momentum equation and work energy equation (concepts only).

Curvilinear translation - equations of kinematics –projectile motion(review), kinetics – equation of motion. Moment of momentum and work energy equation (concepts only).

Module 5

Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – rotation under a constant moment.

Plane motion of rigid body – instantaneous centre of rotation (concept only).

Simple harmonic motion – free vibration –degree of freedom- undamped free vibration of spring mass system-effect of damping(concept only)

Text Books

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.

References

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications
3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers
4. F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill
5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.

Course Contents and Lecture Schedule:

Module	Topic	Course outcomes addressed	No. of Hours
1	**Module 1**		**Total: 7**
1.1	Introduction to engineering mechanics – introduction on statics and dynamics - Basic principles of statics – Parellogram law, equilibrium law – Superposition and transmissibility, law of action and reaction (review the topics)	CO1 and CO2	1
1.2	Free body diagrams. Degree of freedom-types of supports and nature of reactions - exercises for free body diagram preparation – composition and resolution of forces, resultant and equilibrium equations (review the topics) - numerical exercises for illustration.	CO1 and CO2	1
1.3	Concurrent coplanar forces - analysis of concurrent forces -methods of projections – illustrative numerical exercise – teacher assisted problem solving.	CO1 and CO2	1
1.4	Analysis of concurrent forces -methods of moment-Varignon's Theorem of Moments - illustrative numerical exercise– teacher assisted problem solving.	CO1 and CO2	1
1.5	Analysis of concurrent force systems – extended problem solving - Session I.	CO3,CO4 and CO5	1
1.6	Analysis of concurrent force systems – extended problem solving - Session II – learning review quiz.	CO3,CO4 and CO5	1
1.7	Analysis of concurrent force systems – extended problem solving - Session III.	CO3,CO4 and CO5	1
2	**Module 2**		**Total: 7**
2.1	Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –illustrative examples on wedges and ladder-teacher	CO1 and CO2	1

	assisted problem solving tutorials using problems from wedges and ladder.		
2.2	Problems on friction - analysis of connected bodies. illustrative numerical exercise– teacher assisted problem solving.	CO3, CO4 and CO5	1
2.3	Problems on friction-extended problem solving	CO3,C04 and CO5	1
2.4	Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads.	CO1 and CO2	1
2.5	General coplanar force system - resultant and equilibrium equations - illustrative examples- teacher assisted problem solving.	CO1 and CO2	1
2.6	General coplanar force system-resultant and equilibrium equations - illustrative examples	CO3, CO4 and CO5	1
2.7	General coplanar force system - Extended problem solving - Quiz to evaluate learning level.	CO3, CO4 and CO5	1
3	**Module 3**		**Total: 7**
3.1	Centroid of simple and regular geometrical shapes – centroid of figures in combination - composite areas- examples for illustration – problems for practice to be done by self.	CO1 and CO2	1
3.2	Moment of inertia- parallel axis theorem –examples for illustration - problems for practice to be done by self.	CO1 and CO2	1
3.3	Moment of inertia - perpendicular axis theorem - example for illustration to be given as hand out and discussion on the solved example.	CO1 and CO2	1
3.4	Solutions to practice problems – problems related to centroid and moment of inertia - problems for practice to be done by self.	CO3, CO4 and CO5	1
3.5	Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, cylinder and uniform disc. Theorem of Pappus Guldinus - Demonstration	CO1 and CO2	1
3.6	Introduction to forces in space – vectorial representation of forces, moments and couples – simple problems to illustrate vector representations of forces, moments and couples to be done in class.	CO1,and CO2	1
3.7	Solution to practice problems - resultant and equilibrium equations for concurrent forces in space – concurrent forces in space - 2 simple problems to illustrate the application of resultant and equilibrium equations for concurrent forces in space.	CO3,CO4 and CO5	1
4	**Module 4**		**Total: 7**

4.1	Introduction to dynamics – review of rectilinear translation - equations of kinematics – problems to review the concepts – additional problems involving extended application as exercises .	CO1 and CO2	1
4.2	Solutions to exercises with necessary explanation given as hand out – introduction to kinetics – equation of motion – D'Alembert's principle – illustration of the concepts using one numerical exercise from motion on horizontal and inclined surfaces.	CO1 and CO2	1
4.3	Motion of connected bodies - example for illustration to be given as hand out and discussion on the solved example – problems for practice to be done by self.	CO3, CO4 and CO5	1
4.4	Motion of connected bodies-extended problem solving.	CO3, CO4 & CO5	1
4.5	Curvilinear translation - Review of kinematics –projectile motion – simple problems to review the concepts – introduction to kinetics – equation of motion – illustration of the concepts using numerical exercises.	CO3, CO4 & CO5	1
4.6	Extended problem solving – rectilinear and curvilinear translation.	CO3, CO4 & CO5	1
4.7	Concepts on Impulse momentum equation and work energy equation (rectilinear translation – discussions to bring out difference between elastic and inelastic collusions). Concepts on Moment of momentum and work energy equation (curvilinear translation).	CO1 and CO2	1
5	**Module 5**		**Total: 7**
5.1	Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	CO1 and CO2	1
5.2	Rotation under a constant moment – teacher assisted problem solving.	CO3,CO4 and CO5	1
5.3	Rotation under a constant moment - extended problem solving.	CO3, CO4 and CO5	1
5.4	Plane motion of rigid body- instantaneous centre of rotation (concept only).	CO1 and CO2	1
5.5	Introduction to harmonic oscillation –free vibrations - simple harmonic motion – differential equation and solution. Degree of freedom – examples of single degree of freedom (SDOF) systems – Idealisation of mechanical systems as spring-mass systems (concept only).	CO1 and CO2	1

5.6	SDOF spring mass system –equation of motion – undamped free vibration response - concept of natural frequency. Free vibration response due to initial conditions. Simple problems on determination of natural frequency and free vibration response to test the understanding level.	CO1 and CO2	1
5.7	Free vibration analysis of SDOF spring-mass systems – Problem solving Effect of damping on free vibration response (concept only).	CO1and CO2	1

EST 110	ENGINEERING GRAPHICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	0	2	3	2019

Preamble: To enable the student to effectively perform technical communication through graphical representation as per global standards.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Draw the projection of points and lines located in different quadrants
CO 2	Prepare multiview orthographic projections of objects by visualizing them in different positions
CO 3	Draw sectional views and develop surfaces of a given object
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.
CO 5	Convert 3D views to orthographic views
CO 6	Obtain multiview projections and solid models of objects using CAD tools

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3											
CO 3	3	1										
CO 4	3									1		
CO 5	3									2		
CO 6	3				3					3		

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (100 Marks)
	Test 1 (15 Marks)	Test 2 (15 Marks)	
Remember			
Understand	5		20
Apply	10	10	80
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
CIA for section A carries 25 marks (15 marks for 1 test and Class work 10 marks)
CIA for section B carries 15 marks (10 marks for 1 test and Class work 5 marks)

End Semester Examination Pattern:

ESE will be of 3 hour duration on A4 size answer booklet and will be for 100 marks. The question paper shall contain two questions from each module of Section A only. Student has to answer any one question from each module. Each question carries 20 marks.

Course Level Assessment Questions

(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes .
3. Find True length, Inclinations and Traces of lines.

Course Outcome 2 (CO2)

1. Draw orthographic views of solids and combination solids
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.

Course Outcome 3 (CO3):

1. Draw views of solids sectioned by a cutting plane
2. Find location and inclination of cutting plane given true shape of the section
3. Draw development of lateral surface of solids and also its sectioned views

Course Outcome 4 (CO4):

1. Draw Isometric views/projections of soilds
2. Draw Isometric views/projections of combination of soilds
3. Draw Perspective views of Soilds

Course Outcome 5 (CO5):

1. Draw Orthographic views of solids from given three dimensional view

Course Outcome 6 (CO6):

1. Draw the given figure including dimensions using 2D software
2. Create 3D model using modelling software from the given orthographic views or 3D figure or from real 3D objects

Model Question paper

QP CODE: PAGES:3

Reg No:______________

Name :______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 110

ENGINEERING GRAPHICS

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

Instructions: Retain necessary Construction lines
Show necessary dimensions
Answer any ONE question from each module
Each question carries 20 marks

MODULE I

1. The end point A of a line is 20mm above HP and 10mm in front of VP. The other end of the line is 50mm above HP and 15mm behind VP. The distance between the end projectors is 70mm. Draw the projections of the line. Find the true length and true inclinations of the line with the principal planes. Also locate the traces of the line.
2. One end of a line is 20mm from both the principal planes of projection. The other end of the line is 50mm above HP and 40mm in front of VP. The true length of the line is 70mm. Draw the projections of the line. Find its apparent inclinations, elevation length and plan length. Also locate its traces.

MODULE II

3. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30^{o} to VP. Draw the projections of the solid.

4. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30^o to HP and 45^o to VP. Draw the projections of the solid.

MODULE III

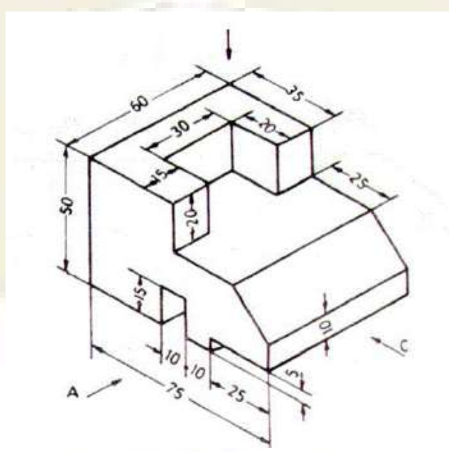
5. A triangular prism of base side 40mm and height 70mm is resting with its base on the ground and having an edge of the base perpendicular to VP. Section the solid such that the true shape of the section is a trapezium of parallel sides 30mm and 10mm. Draw the projections showing the true shape. Find the inclination of the cutting plane with the ground plane.
6. Draw the development of a pentagonal pyramid of base side 30mm and height 50mm. A string is wound from a corner of the base round the pyramid and back to the same point through the shortest distance. Show the position of the string in the elevation and plan.

MODULE IV

7. The frustum of a cone has base diameter 50mm and top diameter 40mm has a height of 60mm. It is paced centrally on top of a rectangular slab of size 80x60mm and of thickness 20mm. Draw the isometric view of the combination.
8. A hexagonal prism has base side 35mm and height 60mm. A sphere of diameter 40mm is placed centrally on top of it. Draw the isometric projection of the combination.

MODULE V

9. Draw the perspective view of a pentagonal prism, 20mm side and 45mm long lying on one of its rectangular faces on the ground and having its axis perpendicular to picture plane. One of its pentagonal faces touches the picture plane and the station point is 50mm in front of PP, 25mm above the ground plane and lies in a central plane, which is 70mm to the left of the center of the prism.
10. Draw three orthographic views with dimensions of the object shown in figure below.



(20X5=100)

Time : 3 hours **EST110 ENGINEERING GRAPHICS** **Max. Marks: 100**

SCHEME OF VALUATION

1. Locating the points and drawing the projections of the line – 4 marks
   Finding true length by any one method – 6 marks
   Finding true inclination with VP – 2 marks
   Finding true inclination with HP – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks
2. Locating the points and drawing true length of the line – 4 marks
   Finding projections by any method – 6 marks
   Finding length of elevation and plan – 2 marks
   Finding apparent inclinations – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks
3. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used.
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

4. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

5. Drawing initial position plan and elevation – 4 marks
   Locating section plane as per given condition – 5 marks
   Drawing true shape -5 marks
   Finding inclination of cutting plane – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks
6. Drawing initial position plan and elevation – 4 marks
   Development of the pyramid – 6 marks

Locating string in development -2 marks
Locating string in elevation – 3 marks
Locating string in plan – 3 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

7. Drawing initial positions – 4 marks
   Isometric View of Slab -6 marks
   Isometric View of Frustum – 10 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Initial position is optional, hence redistribute if needed.
   Reduce 4 marks if Isometric scale is taken)

8. Drawing initial positions – 4 marks
   Isometric scale – 4 marks
   Isometric projection of prism -5 marks
   Isometric projection of sphere – 5 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Initial position is optional, hence redistribute if needed.

9. Drawing the planes and locating the station point – 4 marks
   Locating elevation points – 2 marks
   Locating plan points – 2 marks
   Drawing the perspective view – 10 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

10. Drawing the elevation – 8marks
    Drawing the plan – 4 marks
    Drawing the side view – 4 marks
    Marking invisible edges – 2 marks
    Dimensioning and neatness – 2 marks

    Total = 20 marks

SYLLABUS

General Instructions:

- First angle projection to be followed
- Section A practice problems to be performed on A4 size sheets
- Section B classes to be conducted on CAD lab

SECTION A

Module 1

Introduction : Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.

Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

Module 2

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

Module 3

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given.

Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

Module 4

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

Module 5

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane.

Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

SECTION B

(To be conducted in CAD Lab)

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory)

Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.

Reference Books

1. Anilkumar, K.N., Engineering Graphics, Adhyuth narayan Publishers
2. Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill Publishers.
3. Benjamin, J., Engineering Graphics, Pentex Publishers- 3rd Edition, 2017
4. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.
5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., Engineering Graphics with AutoCAD, PHI.
6. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.
7. Varghese, P.I., Engineering Graphics, V I P Publishers
8. Venugopal, K., Engineering Drawing and Graphics, New Age International Publishers.

Course Contents and Lecture Schedule

No	**SECTION A**	No. of Hours
1	**MODULE I**	
1.1	Introduction to graphics, types of lines, Dimensioning	1
1.2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	2
1.3	Projection of lines, inclined to one plane. Lines inclined to both planes, trapezoid method of solving problems on lines.	2
1.4	Problems on lines using trapezoid method	2
1.5	Line rotation method of solving, problems on line rotation method	2
2	**MODULE II**	
2.1	Introduction of different solids, Simple position plan and elevation of solids	2
2.2	Problems on views of solids inclined to one plane	2
2.3	Problems on views of solids inclined to both planes	2
2.4	Practice problems on solids inclined to both planes	2

3	**MODULE III**	
3.1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	2
3.2	Problems on sections of different solids	2
3.3	Problems when the true shape is given	2
3.4	Principle of development of solids, sectioned solids	2
4	**MODULE IV**	
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	2
4.3	Problems on combination of different solids	2
5	**MODULE V**	
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
5.2	Perspective problems on prisms	2
5.3	Practice on conversion of pictorial views into orthographic views	2
	SECTION B *(To be conducted in CAD lab)*	
1	Introduction to CAD and software. Familiarising features of 2D software. Practice on making 2D drawings	2
2	Practice session on 2D drafting	2
3	Introduction to solid modelling and software	2
4	Practice session on 3D modelling	2

EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

To introduce the students to the basic principles of mechanical engineering

Prerequisite: NIL

Course Outcomes: After completion of the course, the student will be able to

CO 1	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
CO 2	Explain different types of buildings, building components, building materials and building construction
CO 3	Describe the importance, objectives and principles of surveying.
CO 4	Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps
CO 5	Discuss the Materials, energy systems, water management and environment for green buildings.
CO 6	Analyse thermodynamic cycles and calculate its efficiency
CO 7	Illustrate the working and features of IC Engines
CO 8	Explain the basic principles of Refrigeration and Air Conditioning
CO 9	Describe the working of hydraulic machines
CO 10	Explain the working of power transmission elements
CO 11	Describe the basic manufacturing, metal joining and machining processes

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	3	2	2	-	-	-	-
CO2	3	2	-	1	3	-	-	3	-	-	-	-
CO3	3	2	-	-	3	-	-	-	2	-	-	-

CO4	3	2	-	-	3	-	-	-	2	-	-	-
CO5	3	2	-	-	3	2	3	-	2	-	-	-
CO6	3	2										
CO7	3	1										
CO8	3	1										
CO9	3	2										
CO10	3	1										
CO11	3											

Assessment Pattern

	Basic Civil Engineering			**Basic Mechanical Engineering**		
Bloom's Category	**Continuous Assessment**		**End Semester Examination (marks)**	**Continuous Assessment**		**End Semester Examination (marks)**
	Test 1 marks	**Test 2 marks**		**Test 1 marks**	**Test 2 marks**	
Remember	5	5	10	7.5	7.5	15
Understand	20	20	40	12.5	12.5	25
Apply				5	5	10
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	**CIE (Marks)**	**ESE (Marks)**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern:

There will be two parts; Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts -

Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions:

Course Outcome CO1: *To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.*

1.Explain relevance of Civil engineering in the overall infrastructural development of the country.

Course outcome 2 (CO2) (One question from each module and not more than two)

Explain different types of buildings, building components, building materials and building construction

1. Discuss the difference between plinth area and carpet area.

Course outcome 3 (CO3) (One question from each module and not more than two)

Describe the importance, objectives and principles of surveying.

1. Explain the importance of surveying in Civil Engineering

Course outcome 4 (CO4) (One question from each module and not more than two)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps

1. Explain the civil engineering aspects of elevators, escalators and ramps in buildings

Course outcome 5 (CO5) (One question from each module and not more than two)

Discuss the Materials, energy systems, water management and environment for green buildings.

1. Discuss the relevance of Green building in society

Section II *Answer any 1 full question from each module. Each full question carries 10 marks*

Course Outcome 1 (CO1) (Two full question from each module and each question can have maximum 2 sub-divisions)

To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering

CO Questions

1. a List out the types of building as per occupancy. Explain any two, each in about five sentences.
b. Discuss the components of a building with a neat figure.

2. a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework.

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country.

Course Outcome 2 (CO2) & Course Outcome 3 (CO3) (Two full question from each module and each question can have maximum 2 sub-divisions)

Explain different types of buildings, building components, building materials and building construction & Describe the importance, objectives and principles of surveying.

CO Questions

1. **a.** What are the different kinds of cement available and what is their use.
   b. List the properties of good building bricks. Explain any five.
2. a. List and explain any five modern construction materials used for construction.
   b. Explain the objectives and principles of surveying

Course outcome 4 (CO4) & Course outcome 5 (CO5) (Two full question from each module and each question can have maximum 2 sub-divisions)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps & Discuss the Materials, energy systems, water management and environment for green buildings.

CO Questions

1. **a**. Draw the elevation and plan of one brick thick wall with English bond
   b. Explain the energy systems and water management in Green buildings

2. **a.** Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing.

   b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building

Course Outcome 6 (CO6):

1. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35°C, 0.1 MPa. The maximum temperature of the cycle is 1100°C. Find
   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii) Cycle efficiency
   Take Cp = 1.005 kJ/kgK and Cv=0.718 kJ/kgK
2. A Carnot cycle works with adiabatic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of isothermal expansion is 0.3 m^3. If the maximum temperature and pressure is limited to 550K and 21 bar, determine the minimum temperature in the cycle and efficiency of the cycle.
3. In an ideal diesel cycle, the temperature at the beginning and end of compression is 65°C and 620°C respectively. The temperature at the beginning and end of the expansion is 1850°C and 850 °C. Determine the ideal efficiency of the cycle.

4. Explain the concepts of CRDI and MPFI in IC Engines.

Course Outcome 7 (CO7)

1. With the help of a neat sketch explain the working of a 4 stroke SI engine
2. Compare the working of 2 stroke and 4 stroke IC engines
3. Explain the classification of IC Engines.

Course Outcome 8(CO8):

1. Explain the working of vapour compression refrigeration system.
2. With the help of suitable sketch explain the working of a split air conditioner.
3. Define: COP, specific humidity, relative humidity and dew point temperature.

Course Outcome 9 (CO9):

1. Explain the working of a single stage centrifugal pump with sketches.
2. With the help of a neat sketch, explain the working of a reciprocating pump.
3. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.

Course Outcome 10 (CO10):

1. Explain the working of belt drive and gear drive with the help of neat sketches
2. Explain a single plate clutch.
3. Sketch different types of gear trains and explain.

Course Outcome 11 (CO11):

1. Describe the operations which can be performed using drilling machine.
2. Explain the functions of runners and risers used in casting.
3. With a neat sketch, explain the working and parts of a lathe.

Model Question Paper

QP CODE: **EST120** page:3

Reg No:___________________

Name:_____________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 120

Course Name: BASICS OF CIVIL AND MECHANICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

PART I: BASIC CIVIL ENGINEERING

PART A

(Answer all questions. Each question carries 4 marks)

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.
2. Discuss the difference between plinth area and carpet area.
3. Explain different types of steel with their properties.
4. What are the different kinds of cement available and what is their use?
5. Define bearing capacity of soil.

(5 x 4 = 20)

Part B

Answer one full question from each module.

MODULE I

6a. List out the types of building as per occupancy. Explain any two, each in about five sentences. (5)

b. Discuss the components of a building with a neat figure. (5)

OR

7a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework. (5)

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country. (5)

MODULE II

8a. What are the different kinds of cement available and what is their use. (5)

b. List the properties of good building bricks. Explain any five. (5)

OR

9a. List and explain any five modern construction materials used for construction. (5)

b. Explain the objectives and principles of surveying (5)

MODULE III

10a. Draw the elevation and plan of one brick thick wall with English bond (5)

b. Explain the energy systems and water management in Green buildings (5)

OR

11a. Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing. (5)

b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building (5)

[10 x 3 = 30]

PART II: BASIC MECHANICAL ENGINEERING

PART A

Answer all questions. Each question carries 4 marks

1. Sketch the P-v and T-s diagram of a Carnot cycle and List the processes.
2. Illustrate the working of an epicyclic gear train.
3. Explain cooling and dehumidification processes.
4. Differentiate between soldering and brazing.
5. Explain the principle of Additive manufacturing.

4 x 5 = 20 marks

Part B

Answer one full question from each module.

MODULE I

6. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35^{o}C, 0.1MPa. The maximum temperature of the cycle is 1100^{o}C. Find

   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii)Cycle efficiency

   Take C_p = 1.005 kJ/kgK and C_v=0.718 kJ/kgK — 10 marks

OR

7. a) Explain the working of a 4 stroke SI engine with neat sketches. — 7 marks
   b) Explain the fuel system of a petrol engine. — 3 marks

MODULE II

8. a) Explain the working of a vapour compression system with help of a block diagram. — 7 marks
   b) Define: Specific humidity, relative humidity and dew point temperature. — 3 marks

OR

9. With the help of a neat sketch, explain the working of a centrifugal pump. — 10 marks

MODULE III

10. Explain the two high, three high, four high and cluster rolling mills with neat sketches. — 10 marks

OR

11. a) Describe the arc welding process with a neat sketch. — 6 marks
    b) Differentiate between up-milling and down-milling operations. — 4 marks

SYLLABUS

Module 1

General Introduction to Civil Engineering: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.

Introduction to buildings: Types of buildings, selection of site for buildings, components of a residential building and their functions.

Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion only).

Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

Module 2

Surveying: Importance, objectives and principles.

Construction materials, Conventional construction materials**:** types, properties and uses of building materials: bricks, stones, cement, sand and timber

Cement concrete: Constituent materials, properties and types.

Steel: Steel sections and steel reinforcements, types and uses.

Modern construction materials:- Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

Module 3

Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only).

Brick masonry: - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

Roofs and floors: - Functions, types; flooring materials (brief discussion only).

Basic infrastructure services: MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

Green buildings:- Materials, energy systems, water management and environment for green buildings. (brief discussion only).

Module 4

Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines(Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.

Module 5

Refrigeration: Unit of refrigeration, reversed Carnot cycle,COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.
Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)
Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

Module 6

Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.
Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications
Basic Machining operations: Turning, Drilling, Milling and Grinding.
Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Mckay, W.B. and Mckay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services

References Books:

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
3. Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
4. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
5. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters &Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
11. Benjamin,J.,Basic Mechanical Engineering,Pentex Books,9th Edition,2018
12. Balachandran, P.Basic Mechanical Engineering,Owl Books

Course Contents and Lecture Schedule:

No	Topic	Course outcomes addressed	No. of Lectures
1	**Module I**		**Total: 7**
1.1	*General Introduction to Civil Engineering*: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment.	CO1	1
1.2	Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.	CO1	2
1.3	*Introduction to buildings:* Types of buildings, selection of site for buildings, components of a residential building and their functions.	CO2	2
1.4	*Building rules and regulations:* Relevance of NBC, KBR & CRZ norms (brief discussion only)	CO2	1
1.5	*Building area:* Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.	CO2	1
2	**Module 2**		**Total: 7**
2.1	*Surveying:* Importance, objectives and principles.	CO3	1
2.2	Bricks: - Classification, properties of good bricks, and tests on bricks	CO2	1
2.3	Stones: - *Qualities* of good stones, types of stones and their uses. Cement: - Good qualities of cement, types of cement and their uses.	CO2	1
2.4	Sand: - Classification, qualities of good sand and sieve analysis (basics only). Timber: - Characteristics, properties and uses.	CO2	1
2.5	Cement concrete: - Constituent materials, properties and types, Steel: - Steel sections and steel reinforcements, types and uses.	CO2	1

2.6	Modern construction materials: - Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials, modern uses of gypsum, pre-fabricated building components (brief discussion only)	CO2	2
3	**Module 3**		**Total: 7**
3.1	Foundations: - Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Brick masonry: - Header and stretcher bond, English bond & Flemish bond– elevation and plan (one & one and a half brick wall only). Random rubble masonry.	CO2	2
3.2	Roofs: Functions, types; roofing materials (brief discussion only) Floors: Functions, types; flooring materials (brief discussion only)	CO2	2
3.3	*Basic infrastructure services:* MEP, HVAC, Elevators, escalators and ramps (Civil Engineering aspects only) fire safety for buildings	CO4	2
3.4	*Green buildings:*- Materials, energy systems, water management and environment for green buildings. (brief discussion only)	CO5	1
4	**MODULE 4**		
4.1	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle-Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency	4	
4.2	IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies of IC Engines(Description only)	2	
4.3	Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines	2	
5	**MODULE 5**		
5.1	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems)	1	
5.2	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.	1	

5.3	Description about working with sketches : Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)	4
5.4	Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches	3
6	**MODULE 6**	
6.1	Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.	2
6.2	Metal Joining Processes :List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications	1
6.3	Basic Machining operations: Turning, Drilling, Milling and Grinding Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine	3
6.4	Principle of CAD/CAM, Rapid and Additive manufacturing	1

EST 130	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

This course aims to (1) equip the students with an understanding of the fundamental principles of electrical engineering(2) provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and circuits (3) provide an overview of evolution of communication systems, and introduce the basic concepts in radio communication.

Prerequisite: Physics and Mathematics (Pre-university level)

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO 2	Develop and solve models of magnetic circuits
CO 3	Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
CO 4	Describe working of a voltage amplifier
CO 5	Outline the principle of an electronic instrumentation system
CO 6	Explain the principle of radio and cellular communication

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	1	-	-	-	-	-	-	-	-	-	2
CO 4	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	2
CO 6	2	-	-	-	-	-	-	-	-	-	-	2

Assessment Pattern

Bloom's Category	**Basic Electrical Engineering**			**Basic Electronics Engineering**		
	Continuous Assessment Tests		**End Semester Examination (Marks)**	**Continuous Assessment Tests**		**End Semester Examination (Marks)**
	Test 1 (Marks)	**Test 2 (Marks)**		**Test 1 (Marks)**	**Test 2 (Marks)**	
Remember	0	0	10	10	10	20
Understand	12.5	12.5	20	15	15	30
Apply	12.5	12.5	20			
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part I – Basic Electrical Engineering and Part II – Basic Electronics Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts - Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Solve problems based on current division rule.

2. Solve problems with Mesh/node analysis.

3. Solve problems on Wye-Delta Transformation.

Course Outcome 2 (CO2):

1. Problems on series magnetic circuits

2. Problems on parallel magnetic circuits

3. Problems on composite magnetic ciruits

4. **Course Outcome 3 (CO3):**

1. problems on self inductance, mutual inductance and coefficient of coupling

2. problems on rms and average values of periodic waveforms

3. problems on series ac circuits

4. Compare star and Delta connected 3 phase AC systems.

Course Outcome 4 (CO4): Describe working of a voltage amplifier

1.What is the need of voltage divider biasing in an RC coupled amplifier?

2. Define operating point in the context of a BJT amplifier.

3. Why is it required to have a voltage amplifier in a public address system?

Course Outcome 5 (CO5): Outline the principle of an electronic instrumentation system

1. Draw the block diagram of an electronic instrumentation system.

2. What is a transducer?

3. Explain the working principle of operation of digital multimeter.

Course Outcome 6 (CO6): Explain the principle of radio and cellular communication

1. What is the working principle of an antenna when used in a radio transmitter?

2. What is the need of two separate sections RF section and IF section in a super heterodyne receiver?

3. What is meant by a cell in a cellular communication?

Model Question Paper

QP CODE: Pages: 3

Reg No.:________________

Name:__________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 130

Course Name: BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

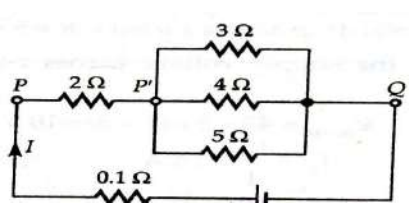
PART I

BASIC ELECTRICAL ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Calculate the current through the 4Ω resistor in the circuit shown, applying current division rule:



2. Calculate the RMS and average values of a purely sinusoidal current having peak value 15A.

3. An alternating voltage of (80+j60)V is applied to an RX circuit and the current flowing through the circuit is (-4+j10)A. Calculate the impedance of the circuit in rectangular and polar forms. Also determine if X is inductive or capacitive.

4. Derive the relation between line and phase values of voltage in a three phase star connected system.

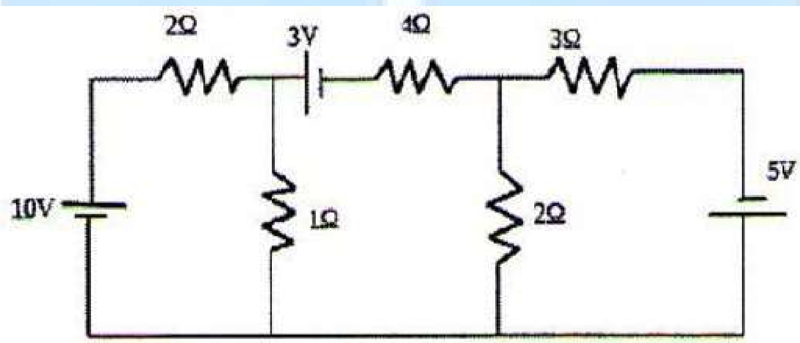
5. Compare electric and magnetic circuits. *(5x4=20)*

PART B

Answer one question from each module; each question carries 10 marks.

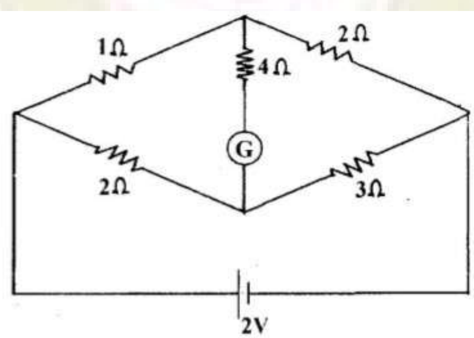
Module 1

6. . Calculate the node voltages in the circuit shown, applying node analysis:



7. (a) State and explain Kirchhoff's laws. (4 marks)

(b) Calculate the current through the galvanometer (G) in the circuit shown:



(6 marks)

Module 2

8. (a) State and explain Faraday's laws of electromagnetic induction with examples. (4 marks)

(b) Differentiate between statically and dynamically induced emf. A conductor of length 0.5m moves in a uniform magnetic field of flux density 1.1T at a velocity of 30m/s. Calculate the emf induced in the conductor if the direction of motion of the conductor is inclined at 60^0 to the direction of field. (6 marks)

9. (a) Derive the amplitude factor and form factor of a purely sinusoidal waveform. (5 marks)

(b) A current wave is made up of two components-a 5A dc component and a 50Hz ac component, which is a sinusoidal wave with a peak value of 5A. Sketch the resultant waveform and determine its RMS and average values. (5 marks)

Module 3

10. Draw the power triangle and define active, reactive and apparent powers in ac circuits. Two coils A and B are connected in series across a 240V, 50Hz supply. The resistance of A is $5\,\Omega$ and the inductance of B is 0.015H. If the input from the supply is 3kW and 2kVAR, find the inductance of A and the resistance of B. Also calculate the voltage across each coil.

11. A balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the loads are connected in (i) star (ii) delta.

(3x10=30)

PART II

BASIC ELECTRONICS ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Give the specifications of a resistor. The colour bands marked on a resistor are Blue, Grey, Yellow and Gold. What are the minimum and maximum resistance values expected from that resistance?
2. What is meant by avalanche breakdown?
3. Explain the working of a full-wave bridge rectifier.
4. Discuss the role of coupling and bypass capacitors in a single stage RC coupled amplifier.
5. Differentiate AM and FM communication systems.

(5x4=20)

PART B

Answer one question from each module; each question carries 10 marks.

Module 4

6. a) Explain with diagram the principle of operation of an NPN transistor. (5)

   b) Sketch and explain the typical input-output characteristics of a BJT when connected in common emitter configuration. (5)

OR

7. a) Explain the formation of a potential barrier in a P-N junction diode. (5)

   b) What do you understand by Avalanche breakdown? Draw and explain the V-I characteristics of a P-N junction and Zener diode. (5)

Module 5

8. a) With a neat circuit diagram, explain the working of an RC coupled amplifier. (6)

   b) Draw the frequency response characteristics of an RC coupled amplifier and state the reasons for the reduction of gain at lower and higher frequencies. (4)

OR

9. a) With the help of block diagram, explain how an electronic instrumentation system. (6)

   b) Explain the principle of an antenna. (4)

Module 6

10. a) With the help of a block diagram, explain the working of Super hetrodyne receiver. (6)

    b) Explain the importance of antenna in a communication system. (4)

OR

11. a) With neat sketches explain a cellular communication system. (5)

    b) Explain GSM communication with the help of a block diagram. (5)

(3x10=30)

SYLLABUS

MODULE 1: Elementary Concepts of Electric Circuits

Elementary concepts of DC electric circuits: Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.

Analysis of DC electric circuits: Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.

MODULE 2: Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals

Magnetic Circuits: Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.

Electromagnetic Induction: Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling

Alternating Current fundamentals: Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.

MODULE 3: AC Circuits

AC Circuits: Phasor representation of sinusoidal quantities. Trignometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.

Three phase AC systems: Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems

MODULE 4

Introduction to Semiconductor devices: Evolution of electronics – Vacuum tubes to nano electronics. Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, color coding. PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration.

MODULE 5

Basic electronic circuits and instrumentation: Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

MODULE 6

Introduction to Communication Systems: Evolution of communication systems – Telegraphy to 5G. Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.

Text Books

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. ChinmoySaha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
4. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
5. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010.

Reference Books

1. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
3. Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill
4. Hughes, "Electrical and Electronic Technology", Pearson Education.
5. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering," Second Edition, McGraw Hill.
6. Parker and Smith, "Problems in Electrical Engineering", CBS Publishers and Distributors.
7. S. B. Lal Seksena and Kaustuv Dasgupta, "Fundamentals of Electrical Engineering", Cambridge University Press.
8. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
9. Bernard Grob, Ba sic Electronics, McGraw Hill.
10. A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lectures
1	***Elementary Concepts of Electric Circuits***	
1.1	**Elementary concepts of DC electric circuits:** Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.	1 2 1
1.2	**Analysis of DC electric circuits:** Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.	1 1 2
2	**Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals**	
2.1	**Magnetic Circuits:** Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.	1 2
2.2	**Electromagnetic Induction:** Faraday's laws, problems, Lenz's law-statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling	1 2
2.3	**Alternating Current fundamentals:** Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.	2
3	**AC Circuits**	

3.1	**AC Circuits:** Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power, Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.	1 2 1 2
3.2	**Three phase AC systems:** Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems.	2
4	**Introduction to Semiconductor devices**	
4.1	Evolution of electronics – Vacuum tubes to nano electronics (In evolutional perspective only)	1
4.2	Resistors, Capacitors and Inductors: types, specifications. Standard values, color coding (No constructional features)	2
4.3	**PN Junction diode**: Principle of operation, V-I characteristics, principle of avalanche breakdown	2
4.4	**Bipolar Junction Transistors:** PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration	3
5	**Basic electronic circuits and instrumentation**	
5.1	**Rectifiers and power supplies:** Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator	3
5.2	**Amplifiers:** Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing	4
5.3	**Electronic Instrumentation:** Block diagram of an electronic instrumentation system	2
6	**Introduction to Communication Systems**	
6.1	Evolution of communication systems – Telegraphy to 5G	1

6.2	**Radio communication:** principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge	4
6.3	**Mobile communication:** basic principles of cellular communications, principle and block diagram of GSM.	2

Suggested Simulation Assignments for Basic Electronics Engineering

1. Plot V-I characteristics of Si and Ge diodes on a simulator
2. Plot Input and Output characteristics of BJT on a simulator
3. Implementation of half wave and full wave rectifiers
4. Simulation of RC coupled amplifier with the design supplied
5. Generation of AM signal

Note: The simulations can be done on open tools such as QUCS, KiCad, GNURadio or similar software to augment the understanding.

HUN 102	PROFESSIONAL COMMUNICATION	CATEGORY	L	T	P	CREDIT
		MNC	2	0	2	--

Preamble: Clear, precise, and effective communication has become a *sine qua non* in today's information-driven world given its interdependencies and seamless connectivity. Any aspiring professional cannot but master the key elements of such communication. The objective of this course is to equip students with the necessary skills to listen, read, write, and speak so as to comprehend and successfully convey any idea, technical or otherwise, as well as give them the necessary polish to become persuasive communicators.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop vocabulary and language skills relevant to engineering as a profession
CO 2	Analyze, interpret and effectively summarize a variety of textual content
CO 3	Create effective technical presentations
CO 4	Discuss a given technical/non-technical topic in a group setting and arrive at generalizations/consensus
CO 5	Identify drawbacks in listening patterns and apply listening techniques for specific needs
CO 6	Create professional and technical documents that are clear and adhering to all the necessary conventions

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1										3		2
CO 2										1		3
CO 3						1			1	3		
CO 4										3		1
CO 5		1							2	3		
CO 6	1					1			1	3		

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation

Total Marks: 50

Attendance	: 10 marks
Regular assessment	: 25 marks
Series test (one test only, should include verbal aptitude for placement and higher studies, this test will be conducted for 50 marks and reduced to 15)	: 15 marks

Regular assessment

Project report presentation and Technical presentation through PPT	: 7.5 marks
Listening Test	: 5 marks
Group discussion/mock job interview	: 7.5 marks
Resume submission	: 5 marks

End Semester Examination

Total Marks: 50, Time: 2 hrs.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List down the ways in which gestures affect verbal communication.
2. Match the words and meanings

Ambiguous	promotion
Bona fide	referring to whole
Holistic	not clear
Exaltation	genuine

3. Expand the following Compound Nouns - a. Water supply. b. Object recognition. c. Steam turbine

Course Outcome 2 (CO2)

1. Read the passage below and prepare notes:

Mathematics, rightly viewed, possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. The true spirit of delight, the exaltation, the sense of being more than man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry. What is best in mathematics deserves not merely to be learnt as a task, but to be assimilated as a part of daily thought, and brought again and again before the mind with ever-renewed encouragement. Real life is, to most men, a long second-best, a perpetual compromise between the ideal and the possible; but the world of pure reason knows no compromise, no practical limitations, no barrier to the creative activity embodying in splendid edifices the passionate aspiration after the perfect from which all great work springs. Remote from human passions, remote even from the pitiful facts of nature, the generations have gradually created an ordered cosmos, where pure thought can dwell as in its natural home, and where one, at least, of our nobler impulses can escape from the dreary exile of the actual world.

So little, however, have mathematicians aimed at beauty, that hardly anything in their work has had this conscious purpose. Much, owing to irrepressible instincts, which were better than avowed *beliefs, has been moulded by an unconscious taste; but much also has been spoilt by false notions of what was fitting. The characteristic excellence of mathematics is only to be found where the reasoning is rigidly logical: the rules of logic are to mathematics what those of structure are to architecture. In the most beautiful work, a chain of argument is presented in which every link is important on its own account, in which there is an air of ease and lucidity throughout, and the premises achieve more than would have been thought possible, by means which appear natural and inevitable. Literature embodies what is general in particular circumstances whose universal significance shines through their individual dress; but mathematics endeavours to present whatever is most general in its purity, without any irrelevant trappings.*

How should the teaching of mathematics be conducted so as to communicate to the learner as much as possible of this high ideal? Here experience must, in a great measure, be our guide; but some maxims may result from our consideration of the ultimate purpose to be achieved.

- From "On the teaching of mathematics" – Bertrand Russell

2. Enumerate the advantages and disadvantages of speed reading. Discuss how it can impact comprehension.

Course Outcome 3(CO3):

1. What are the key elements of a successful presentation?
2. Elucidate the importance of non-verbal communication in making a presentation
3. List out the key components in a technical presentation.

Course Outcome 4 (CO4):

1. Discuss: 'In today's world, being a good listener is more important than being a good Speaker.'
2. Listen to a video/live group discussion on a particular topic, and prepare a brief summary of the proceedings.
3. List the do's and don'ts in a group discussion.

Course Outcome 5 (CO5):

1. Watch a movie clip and write the subtitles for the dialogue.
2. What do you mean by barriers to effective listening? List ways to overcome each of these.
3. What are the different types of interviews? How are listening skills particularly important in Skype/telephonic interviews?

Course Outcome 6 (CO6):

1. Explain the basic structure of a technical report.
2. You have been offered an internship in a much sought-after aerospace company and are very excited about it. However, the dates clash with your series tests. Write a letter to the Manager – University Relations of the company asking them if they can change the dates to coincide with your vacation.
3. You work in a well-reputed aerospace company as Manager – University Relations. You are in charge of offering internships. A student has sent you a letter requesting you to change the dates allotted to him since he has series exams at that time. But there are no vacancies available during the period he has requested for. Compose an e-mail informing him of this and suggest that he try to arrange the matter with his college.

Syllabus

Module 1

Use of language in communication: Significance of technical communication Vocabulary Development: technical vocabulary, vocabulary used in formal letters/emails and reports, sequence words, misspelled words, compound words, finding suitable synonyms, paraphrasing, verbal analogies. Language Development: subject-verb agreement, personal passive voice, numerical adjectives, embedded sentences, clauses, conditionals, reported speech, active/passive voice.

Technology-based communication: Effective email messages, slide presentations, editing skills using software. Modern day research and study skills: search engines, repositories, forums such as Git Hub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora; Plagiarism

Module 2

Reading, Comprehension, and Summarizing: Reading styles, speed, valuation, critical reading, reading and comprehending shorter and longer technical articles from journals, newspapers, identifying the various transitions in a text, SQ3R method, PQRST method, speed reading. Comprehension: techniques, understanding textbooks, marking and underlining, Note-taking: recognizing non-verbal cues.

Module 3

Oral Presentation: Voice modulation, tone, describing a process, Presentation Skills: Oral presentation and public speaking skills, business presentations, Preparation: organizing the material, self-Introduction, introducing the topic, answering questions, individual presentation practice, presenting visuals effectively.

Debate and Group Discussions: introduction to Group Discussion (GD), differences between GD and debate; participating GD, understanding GD, brainstorming the topic, questioning and clarifying, GD strategies, activities to improve GD skills

Module 4

Listening and Interview Skills Listening: Active and Passive listening, listening: for general content, to fill up information, intensive listening, for specific information, to answer, and to understand. Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks.

Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews

Module 5

Formal writing: Technical Writing: differences between technical and literary style. Letter Writing (formal, informal and semi formal), Job applications, Minute preparation, CV preparation (differences between Bio-Data, CV and Resume), and Reports. Elements of style, Common Errors in Writing: describing a process, use of sequence words, Statements of Purpose, Instructions, Checklists.

Analytical and issue-based Essays and Report Writing: basics of report writing; Referencing Style (IEEE Format), structure of a report; types of reports, references, bibliography.

Lab Activities

Written: Letter writing, CV writing, Attending a meeting and Minute Preparation, Vocabulary Building
Spoken: Phonetics, MMFS (Multimedia Feedback System), Mirroring, Elevator Pitch, telephone etiquette, qualities of a good presentation with emphasis on body language and use of visual aids.
Listening: Exercises based on audio materials like radio and podcasts. Listening to Song. practice and exercises.
Reading: Speed Reading, Reading with the help of Audio Visual Aids, Reading Comprehension Skills
Mock interview and Debate/Group Discussion: concepts, types, Do's and don'ts- intensive practice

Reference Books

1. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan 2010.
2. Meenakshi Raman and Sangeetha Sharma,"Technical Communication: Principles and Practice", 2nd Edition, Oxford University Press, 2011
3. Stephen E. Lucas, "The Art of Public Speaking", 10th Edition; McGraw Hill Education, 2012.
4. Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw Hill Education, 2017.
5. William Strunk Jr. & E.B. White, "The Elements of Style", 4th Edition, Pearson, 1999.
6. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
7. Goodheart-Willcox, "Professional Communication", First Edition , 2017.
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 edition, 2015.
9. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.
10. Anand Ganguly, "Success in Interview", RPH, 5th Edition, 2016.
11. Raman Sharma, "Technical Communications", Oxford Publication, London, 2004.

<table>
<tr><td rowspan="2">EST
102</td><td rowspan="2">PROGRAMING IN C</td><td>CATEGORY</td><td>L</td><td>T</td><td>P</td><td>CREDIT</td><td>YEAR OF INTRODUCTION</td></tr>
<tr><td>ESC</td><td>2</td><td>1</td><td>2</td><td>4</td><td>2019</td></tr>
</table>

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of writing readable C programs to solve computational problems that they may have to solve in their professional life. The course content is decided to cover the essential programming fundamentals which can be taught within the given slots in the curriculum. This course has got 2 Hours per week for practicing programming in C. A list showing 24 mandatory programming problems are given at the end. The instructor is supposed to give homework/assignments to write the listed programs in the rough record as and when the required theory part is covered in the class. The students are expected to come prepared with the required program written in the rough record for the lab classes.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Analyze a computational problem and develop an algorithm/flowchart to find its solution
CO 2	Develop readable* C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
CO 3	Write readable C programs with arrays, structure or union for storing the data to be processed
CO 4	Divide a given computational problem into a number of modules and develop a readable multi-function C program by using recursion if required, to find the solution to the computational problem
CO 5	Write readable C programs which use pointers for array processing and parameter passing
CO 6	Develop readable C programs with files for reading input and storing output

readable* - readability of a program means the following:

1. Logic used is easy to follow
2. Standards to be followed for indentation and formatting
3. Meaningful names are given to variables
4. Concise comments are provided wherever needed

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔	✔	✔		✔				✔	✔	✔
CO2	✔	✔	✔	✔	✔					✔		✔
CO3	✔	✔	✔	✔	✔					✔		✔
CO4	✔	✔	✔	✔	✔					✔	✔	✔
CO5	✔	✔			✔					✔		✔
CO6	✔	✔			✔					✔		✔

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination Marks**
	Test 1 (Marks)	**Test 2 (Marks)**	
Remember	15	10	25
Understand	10	15	25
Apply	20	20	40
Analyse	5	5	10
Evaluate			
Create			

Mark distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test 1 (for theory, for 2 hrs)	: 20 marks
Continuous Assessment Test 2 (for lab, internal examination, for 2 hrs)	: 20 marks

Internal Examination Pattern: There will be two parts; Part A and Part B. Part A contains 5 questions with 2 questions from each module (2.5 modules x 2 = 5), having 3 marks for each question. Students should answer all questions. Part B also contains 5 questions with 2 questions from each module (2.5 modules x 2 = 5), of which a student should answer any one. The questions should not have sub-divisions and each one carries 7 marks.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1): Write an algorithm to check whether largest of 3 natural numbers is prime or not. Also, draw a flowchart for solving the same problem.

Course Outcome 2 (CO2): Write an easy to read C program to process a set of n natural numbers and to find the largest even number and smallest odd number from the given set of numbers. The program should not use division and modulus operators.

Course Outcome 3(CO3): Write an easy to read C program to process the marks obtained by n students of a class and prepare their rank list based on the sum of the marks obtained. There are 3 subjects for which examinations are conducted and the third subject is an elective where a student is allowed to take any one of the two courses offered.

Course Outcome 4 (CO4): Write an easy to read C program to find the value of a mathematical function f which is defined as follows. f(n) = n! / (sum of factors of n), if n is not prime and f(n) = n! / (sum of digits of n), if n is prime.

Course Outcome 5 (CO5): Write an easy to read C program to sort a set of n integers and to find the number of unique numbers and the number of repeated numbers in the given set of numbers. Use a function which takes an integer array of n elements, sorts the array using the Bubble Sorting Technique and returns the number of unique numbers and the number of repeated numbers in the given array.

Course Outcome 6 (CO6): Write an easy to read C program to process a text file and to print the Palindrome words into an output file.

Model Question paper

QP CODE: PAGES:3

Reg No:_______________

Name :_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: **EST 102**

Course Name: Programming in C (Common to all programs)

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Write short note on processor and memory in a computer.
2. What are the differences between compiled and interpreted languages? Give example for each.
3. Write a C program to read a Natural Number through keyboard and to display the reverse of the given number. For example, if "3214567" is given as input, the output to be shown is "7654123".
4. Is it advisable to use *goto* statements in a C program? Justify your answer.
5. Explain the different ways in which you can *declare & initialize* a single dimensional array.
6. Write a C program to read a sentence through keyboard and to display the count of white spaces in the given sentence.
7. What are the advantages of using functions in a program?
8. With a simple example program, explain *scope* and *life time* of variables in C.
9. Write a function in C which takes the address of a single dimensional array (containing a finite sequence of numbers) and the number of numbers stored in the array as arguments and stores the numbers in the same array in reverse order. Use pointers to access the elements of the array.
10. With an example, explain the different modes of opening a file. (10x3=30)

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. (a) Draw a flow chart to find the position of an element in a given sequence, using linear searching technique. With an example explain how the flowchart finds the position of a given element. **(10)**

(b) Write a pseudo code representing the flowchart for linear searching. **(4)**

OR

12. (a) With the help of a flow chart, explain the bubble sort operation. Illustrate with an example. **(10)**
    (b) Write an algorithm representing the flowchart for bubble sort. **(4)**

13. (a) Write a C program to read an English Alphabet through keyboard and display whether the given Alphabet is in upper case or lower case. **(6)**
    (b) Explain how one can use the builtin function in C, *scanf*to read values of different data types. Also explain using examples how one can use the builtin function in C, *printf*for text formatting. **(8)**

OR

14. (a) With suitable examples, explain various operators in C. (10)
    (b) Explain how characters are stored and processed in C. **(4)**

15. (a) Write a function in C which takes a 2-Dimensional array storing a matrix of numbers and the order of the matrix (number of rows and columns) as arguments and displays the sum of the elements stored in each row. **(6)**
    (b) Write a C program to check whether a given matrix is a diagonal matrix. **(8)**

OR

16. (a) Without using any builtin string processing function like *strlen*, *strcat* etc., write a program to concatenate two strings. **(8)**
    (b) Write a C program to perform bubble sort. **(6)**

17. (a) Write a function namely *myFact* in C to find the factorial of a given number. Also, write another function in C namely*nCr* which accepts two positive integer parameters *n* and *r* and returns the value of the mathematical function*C(n,r)*(n! / (r! x (n - r)!)). The function *nCr* is expected to make use of the factorial function *myFact.* *(10)*
    (b) What is recursion? Give an example. **(4)**

OR

18. (a) With a suitable example, explain the differences between a structure and a union in C. **(6)**
    (b) Declare a structure namely *Student* to store the details (*roll number, name, mark_for_C*) of a student. Then, write a program in C to find the average mark obtained by the students in a class for the subject *Programming in C* (using the field *mark_for_C*). Use array of structures to store the required data **(8)**

19. (a) With a suitable example, explain the concept of pass by reference. **(6)**
    (b) With a suitable example, explain how pointers can help in changing the content of a single dimensionally array passed as an argument to a function in C. **(8)**

OR

20. (a) Differentiate between sequential files and random access files? **(4)**

(b) Using the prototypes explain the functionality provided by the following functions. (10)

rewind()

i. fseek()

ii. ftell()

iii. fread()

iv.** fwrite()* ***(14X5=70)

SYLLABUS

Programming in C (Common to all disciplines)

Module 1

Basics of Computer Hardware and Software

Basics of Computer Architecture: processor, Memory, Input& Output devices

Application Software & System software: Compilers, interpreters, High level and low level languages

Introduction to structured approach to programming, Flow chart Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudocode*)

Module 2

Program Basics

Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types , Constants, Console IO Operations, printf and scanf

Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence

Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.(Simple programs covering control flow)

Module 3

Arrays and strings

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array

String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets) Linear search program, bubble sort program, simple programs covering arrays and strings

Module 4

Working with functions

Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Recursion, Arrays as Function Parameters structure, union, Storage Classes, Scope and life time of variables, *simple programs using functions*

Module 5

Pointers and Files

Basics of Pointer: declaring pointers, accessing data though pointers, NULL pointer,array access using pointers, pass by reference effect

File Operations: open, close, read, write, append

Sequential access and random access to files: In built file handlingfunctions (*rewind() ,fseek(), ftell(), feof(), fread(), fwrite()*), *simple programs covering pointers and files.*

Text Books

1. Schaum Series, Gottfried B.S.,Tata McGraw Hill,Programming with C
2. E. Balagurusamy, Mcgraw Hill,Programming in ANSI C
3. Asok N Kamthane, Pearson,Programming in C
4. Anita Goel, Pearson, Computer Fundamentals

Reference Books

1. Anita Goel and Ajay Mittal, Pearson, Computer fundamentals and Programming in C
2. Brian W. Kernighan and Dennis M. Ritchie, Pearson, C Programming Language
3. Rajaraman V, PHI, Computer Basics and Programming in C
4. Yashavant P, Kanetkar, BPB Publications, Let us C

Course Contents and Lecture Schedule

	Module 1: Basics of Computer Hardware and Software	**(7 hours)**
1.1	**Basics of Computer Architecture:** Processor, Memory, Input& Output devices	**2 hours**
1.2	**Application Software & System software:** Compilers, interpreters, High level and low level languages	**2 hours**
1.3	Introduction to structured approach to programming, Flow chart	**1 hours**
1.4	Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudocode*)	**2 hours**
Module 2: Program Basics		**(8 hours)**
2.1	**Basic structure of C program:** Character set, Tokens, Identifiers in C, Variables and Data Types , Constants, Console IO Operations, printf and scanf	**2 hours**
2.2	**Operators and Expressions:** Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, sizeof operator, Assignment operators and Bitwise Operators. Operators Precedence	**2 hours**

2.3	**Control Flow Statements:** If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.*(Simple programs covering control flow)*	**4 hours**
Module 3: Arrays and strings:		**(6 hours)**
3.1	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array	**2 hours**
3.2	**String processing:** In built String handling functions(*strlen, strcpy, strcat and strcmp, puts, gets*)	**2 hours**
3.3	Linear search program, bubble sort program, *simple programs covering arrays and strings*	**3 hours**
Module 4: Working with functions		**(7 hours)**
4.1	Introduction to modular programming, writing functions, formal parameters, actual parameters	**2 hours**
4.2	Pass by Value, Recursion, Arrays as Function Parameters	**2 hours**
4.3	structure, union, Storage Classes,Scope and life time of variables, *simple programs using functions*	**3 hours**
Module 5: Pointers and Files		**(7 hours)**
5.1	**Basics of Pointer**: declaring pointers, accessing data though pointers, NULL pointer,array access using pointers, pass by reference effect	**3 hours**
5.2	**File Operations**: open, close, read, write, append	1 **hours**
5.3	**Sequential access and random access to files:** In built file handlingfunctions (*rewind() ,fseek(), ftell(), feof(), fread(), fwrite()*)**,** *simple programs covering pointers and files.*	**2 hours**

C PROGRAMMING LAB (Practical part of EST 102, Programming in C)

Assessment Method: The Academic Assessment for the Programming lab should be done internally by the College. The assessment shall be made on 50 marks and the mark is divided as follows: Practical Records/Outputs - 20 marks (internal by the College), Regular Lab Viva - 5 marks (internal by the College), Final Practical Exam – 25 marks (internal by the College).

The mark obtained out of 50 will be converted into equivalent proportion out of 20 for CIE computation.

LIST OF LAB EXPERIMENTS

1. Familiarization of Hardware Components of a Computer

2. Familiarization of Linux environment – How to do Programming in C with Linux

3. Familiarization of console I/O and operators in C

i) Display "Hello World"

ii) Read two numbers, add them and display theirsum

iii) Read the radius of a circle, calculate its area and display it

iv)Evaluate the arithmetic expression ((a -b / c * d + e) * (f +g)) and display its solution.Read the values of the variables from the user through console.

4. Read 3 integer values and find the largest amoung them.

5. Read a Natural Number and check whether the number is prime or not

6. Read a Natural Number and check whether the number is Armstrong or not

7. Read n integers, store them in an array and find their sum and average

8. Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search

9. Read n integers, store them in an array and sort the elements in the array using Bubble Sort algorithm

10**.** Read a string (word), store it in an array and check whether it is a palindrome word or not.

11. Read two strings (each one ending with a $ symbol), store them in arrays and concatenate them without using library functions.

12. Read a string (ending with a $ symbol), store it in an array and count the number of vowels, consonants and spaces in it.

13. Read two input each representing the distances between two points in the Euclidean space, store these in structure variables and add the two distance values.

14. Using structure, read and print data of n employees (*Name, Employee Id and Salary*)

15. Declare a union containing 5 string variables (*Name, House Name, City Name, State and Pin code*) each with a length of C_SIZE (user defined constant). Then, read and display the address of a person using a variable of the union.

16. Find the factorial of a given Natural Number n usingrecursive and non recursive functions

17. Read a string (word), store it in an array and obtain its reverse by using a user defined function.

18. Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to (i) read a matrix, (ii) find the sum of two matrices, (iii) find the product of two matrices, (i) find the transpose of a matrix and (v) display a matrix.

19. Do the following using pointers

i) add two numbers

ii) swap two numbers using a user defined function

20. Input and Print the elements of an array using pointers

21. Compute sum of the elements stored in an array using pointers and user defined function.

22. Create a file and perform the following

iii) Write data to the file

iv) Read the data in a given file & display the file content on console

v) append new data and display on console

23. Open a text input file and count number of characters, words and lines in it; and store the results in an output file.

PHL 120	ENGINEERING PHYSICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	0	0	2	1	2019

Preamble: The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to develop practical applications of engineering materials and use the principle in the right way to implement the modern technology.

Prerequisite: Higher secondary level Physics

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories
CO 2	Understand the need for precise measurement practices for data recording
CO 3	Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations
CO 4	Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				3			1	2			1
CO 2	3				3			1	2			1
CO 3	3				3			1	2			1
CO 4	3				3			1	2			1
CO 5	3				3			1	2			1

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

LIST OF EXPERIMENTS

(Minimum 8 experiments should be completed)

1. CRO-Measurement of frequency and amplitude of wave forms
2. Measurement of strain using strain gauge and wheatstone bridge
3. LCR Circuit – Forced and damped harmonic oscillations
4. Melde's string apparatus- Measurement of frequency in the transverse and longitudinal mode
5. Wave length measurement of a monochromatic source of light using Newton's Rings method.
6. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
7. To measure the wavelength using a millimeter scale as a grating.
8. Measurement of wavelength of a source of light using grating.
9. Determination of dispersive power and resolving power of a plane transmission grating
10. Determination of the particle size of lycopodium powder
11. Determination of the wavelength of He-Ne laser or any standard laser using diffraction grating
12. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
13. I-V characteristics of solar cell.
14. LED Characteristics.
15. Ultrasonic Diffractometer- Wavelength and velocity measurement of ultrasonic waves in a liquid
16. Deflection magnetometer-Moment of a magnet- Tan A position.

Reference books

1. S.L.Gupta and Dr.V.Kumar, "Practical physics with viva voice", Pragati PrakashanPublishers, Revised Edition, 2009

2. M.N.Avadhanulu, A.A.Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand&Co,2008

3. S. K. Gupta, "Engineering physics practicals", Krishna Prakashan Pvt. Ltd., 2014

4. P. R. Sasikumar "Practical Physics", PHI Ltd., 2011.

CYL 120	ENGINEERING CHEMISTRY LAB	CATEGORY	L	T	P	CREDIT
		BSC	0	0	2	1

Preamble: To impart scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters

Prerequisite: Experiments in chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Understand and practice different techniques of quantitative chemical analysis to generate experimental skills and apply these skills to various analyses
CO 2	Develop skills relevant to synthesize organic polymers and acquire the practical skill to use TLC for the identification of drugs
CO 3	Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds
CO 4	Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO 5	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
CO 6	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				2							3
CO 2	3				3							3
CO 3	3				3							3
CO 4	3				3							3
CO 5	3				1							3
CO 6	3				1							3

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

LIST OF EXPERIMENTS (MINIMUM 8 MANDATORY)

1. Estimation of total hardness of water-EDTA method
2. Potentiometric titration
3. Determination of cell constant and conductance of solutions.
4. Calibration of pH meter and determination of pH of a solution
5. Estimation of chloride in water
6. Identification of drugs using TLC
7. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
8. Determination of molar absorptivity of a compound ($KMnO_4$ or any water soluble food colorant)
9. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
10. Estimation of iron in iron ore
11. Estimation of copper in brass
12. Estimation of dissolved oxygen by Winkler's method
13. (a) Analysis of IR spectra (minimum 3 spectra) (b) Analysis of ^1H NMR spectra (minimum 3 spectra)
14. Flame photometric estimation of Na^+ to find out the salinity in sand
15. Determination of acid value of a vegetable oil
16. Determination of saponification of a vegetable oil

Reference Books

1. G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.
3. Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers, 2019.
4. Ahad J., "Engineering Chemistry Lab manual", Jai Publications, 2019.
5. Roy K Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers, 2019.
6. Soney C George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd, New Delhi, 2019.

ESL 120	CIVIL & MECHANICAL WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
			0	0	2	1	2019

Preamble: The course is designed to train the students to identify and manage the tools, materials and methods required to execute an engineering project. Students will be introduced to a team working environment where they develop the necessary skills for planning, preparing and executing an engineering project.

To enable the student to familiarize various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to:

Course Outcome	Course Outcome Description
CO 1	Name different devices and tools used for civil engineering measurements
CO 2	Explain the use of various tools and devices for various field measurements
CO 3	Demonstrate the steps involved in basic civil engineering activities like plot measurement, setting out operation, evaluating the natural profile of land, plumbing and undertaking simple construction work.
CO 4	Choose materials and methods required for basic civil engineering activities like field measurements, masonry work and plumbing.
CO 5	Compare different techniques and devices used in civil engineering measurements
CO 6	Identify Basic Mechanical workshop operations in accordance with the material and objects
CO 7	Apply appropriate Tools and Instruments with respect to the mechanical workshop trades
CO 8	Apply appropriate safety measures with respect to the mechanical workshop trades

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	-	-	-	1	1	-	-	2	2	-	-
CO 2	1	-	-	-	1	1	-	-	2	2	-	-
CO 3	1	-	-	-	1	1	-	2	2	2	1	-
CO 4	1	-	-	-	1	1	-	2	2	2	1	1
CO 5	1	-	-	-	1	1	-	-	2	2		1
CO 6	2											

CO 7	2											
CO 8	2											

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

Assessment Procedure: Total marks allotted for the course is 100 marks. CIE shall be conducted for 70 marks and ESE for 30 marks. CIE should be done for the work done by the student and also viva voce based on the work done on each practical session. ESE shall be evaluated by written examination of one hour duration conducted internally by the institute.

Continuous Internal Evaluation Pattern:

Attendance : 20 marks
Class work/ Assessment /Viva-voce : 50 marks
End semester examination (Internally by college) : 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

PART 1

CIVIL WORKSHOP

Exercise 1. Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices

Exercise 2. (a) Use screw gauge and vernier calliper to measure the diameter of a steel rod and thickness of a flat bar

(b) Transfer the level from one point to another using a water level

(c) Set out a one room building with a given plan and measuring tape

Exercise 3. Find the level difference between any two points using dumpy level

Exercise 4. (a) Construct a $1\frac{1}{2}$ thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls.

(b) Estimate the number of different types of building blocks to construct this wall.

Exercise 5. (a) Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves ,fixtures and sanitary fittings.

(b) Install a small rainwater harvesting installation in the campus

Reference Books:

1. Khanna P.N, “Indian Practical Civil Engineering Handbook”, Engineers Publishers.
2. Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House
3. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications
4. S. C. Rangwala, “Engineering Materials,” Charotar Publishing House.

PART II

MECHANICAL WORKSHOP

LIST OF EXERCISES

(Minimum EIGHT units mandatory and FIVE models from Units 2 to 8 mandatory)

UNIT 1:- General : Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge.

Study of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc.

UNIT 2:- Carpentry : Understanding of carpentry tools

Minimum any one model

1. T –Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joints

UNIT 3:- Foundry : Understanding of foundry tools

Minimum any one model

1.Bench Molding 2. Floor Molding 3. Core making 4. Pattern making

UNIT 4: - Sheet Metal : Understanding of sheet metal working tools

Minimum any one model

1. Cylindrical shape
2. Conical shape
3. Prismatic shaped job from sheet metal

UNIT 5: - Fitting : Understanding of tools used for fitting

Minimum any one model

1. Square Joint
2. V- Joint
3. Male and female fitting

UNIT 6: - Plumbing : Understanding of plumbing tools, pipe joints

Any one exercise on joining of pipes making use of minimum three types of pipe joints

UNIT 7: - Smithy: Understanding of tools used for smithy.

Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in cold and hot states.

Observing the qualitative difference in the hardness of these materials

Minimum any one exercise on smithy

1. Square prism
2. Hexagonal headed bolt
3. Hexagonal prism
4. Octagonal prism

UNIT 8: -Welding: Understanding of welding equipments

Minimum any one welding practice

Making Joints using electric arc welding. bead formation in horizontal, vertical and over head positions

UNIT 9: - Assembly: Demonstration only

Dissembling and assembling of

1. Cylinder and piston assembly
2. Tail stock assembly
3. Bicycle
4. Pump or any other machine

UNIT 10: - Machines: Demonstration and applications of the following machines

Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; Drilling Machine.

UNIT 11: - Modern manufacturing methods: Power tools, CNC machine tools, 3D printing, Glass cutting.

Course Contents and Lecture Schedule:

No	Topic	No of Sessions
1	**INTRODUCTION**	
1.1	Workshop practice, shop floor precautions, ethics and First Aid knowledge. Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc	1
2	**CARPENTRY**	
2.1	Understanding of carpentry tools and making minimum one model	2

3	**FOUNDRY**	
3.1	Understanding of foundry tools and making minimum one model	2
4	**SHEET METAL**	
4.1	Understanding of sheet metal working tools and making minimum one model	2
5	**FITTING**	
5.1	Understanding of fitting tools and making minimum one model	2
6	**PLUMBING**	
6.1	Understanding of pipe joints and plumbing tools and making minimum one model	2
7	**SMITHY**	
7.1	Understanding of smithy tools and making minimum one model	2
8	**WELDING**	
8.1	Understanding of welding equipments and making minimum one model	2
9	**ASSEMBLY**	
9.1	Demonstration of assembly and dissembling of multiple parts components	1
10	**MACHINES**	
10.1	Demonstration of various machines	1
11	**MODERN MANUFACTURING METHODS**	
11.1	Demonstrations of: power tools, CNC Machine tools, 3D printing, Glass cutting	1

ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	0	0	2	1	2019

Preamble: Electrical Workshop is intended to impart skills to plan and carry out simple electrical wiring. It is essential for the practicing engineers to identify the basic practices and safety measures in electrical wiring.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Demonstrate safety measures against electric shocks.
CO 2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols
CO 3	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings
CO 4	Identify and test various electronic components
CO 5	Draw circuit schematics with EDA tools
CO 6	Assemble and test electronic circuits on boards
CO 7	Work in a team with good interpersonal skills

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	3	-	-	-	-	-	1
CO 2	2	-	-	-	-	-	-	-	-	1	-	-
CO 3	2	-	-	1	-	1	-	1	2	2	-	2
CO 4	3	-	-	-	-	-	-	-	-	-	-	2
CO 5	3	-	-	-	2	-	-	-	-	-	-	2
CO 6	3	-	-	-	2	-	-	-	-	-	-	1
CO 7	-	-	-	-	-	-	-	-	3	2	-	2

Mark distribution

Total Marks	CIE	ESE	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

Syllabus

PART 1

ELECTRICAL

List of Exercises / Experiments

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.

   b)Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.
2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3. Wiring of light/fan circuit using Two way switches . (Staircase wiring)
4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6. a)Identify different types of batteries with their specifications.

   b)Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

PART II

ELECTRONICS

List of Exercises / Experiments (Minimum of 7 mandatory)

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)

2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Dia or XCircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.

3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station etc.]

4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]

5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]

6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
8. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (**Any Two circuits).**

    1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
    2. Square wave generation using IC 555 timer in IC base.
    3. Sine wave generation using IC 741 OP-AMP in IC base.
    4. RC coupled amplifier with transistor BC107.

SEMESTER -3

FTT 201	PRINCIPLES OF CHEMICAL ENGINEERING	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the basic area of directive principle of chemical engineering and its application in food technology.

Prerequisite: Nil.

Course Outcomes: After the completion of the course the student will be able to

CO 1	To apply the fundamental concepts of stochiometry in food industries.
CO 2	To study the material and energy balance in unit operation and unit processes.
CO 3	To develop basic ideas of fluid flow characteristics.
CO 4	To understand the various flow measuring devices .

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1										
CO 2	2		1									
CO 3	2											1
CO 4		2										

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	30
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

Differentiate unit operations and processes

Method to solve material balance problems without reactions

Course Outcome 2 (CO2)

Method to solve material balance problems with reactions

Calculate the heat capacities of solids

Course Outcome 3(CO3):

Basics of fluid and fluid properties

Definition of hydrostatic equilibrium

Different types of manometers

Course Outcome 4 (CO4):

Applications pf Bernaulli's Equation

Effect of friction in the flowing fluids

Course Outcome 5 (CO5):

Different Methods of transportation of fluids

Different types flow measuring equipment

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 201

Course Name: Principles of chemical Engineering

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all ten full questions, each carries 3 marks. (3×10=30 marks)

1) Define the terms recycling, bypassing, and purging

2) The rate of heat loss from the walls of a cylindrical pipe to the ambient is given by Q= 0.5 $T^{1.25}/D^{.25}$ Q is in the rate of heat loss in Btu/ft^2 h, T in o F and D in inches. convert into SI units

3) Estimate the vapor pressure of a pure substance at a specified temperature or the boiling point at a specified pressure using (a) The Antoine equation, (b) The Coxchart, (c) The Clausius-Clapeyron equation

4) Chlorinated diphenyl is heated from 313 K to 533 K in an in directly fired heater at rate of 4000kg / h Calculate the heat to be supplied to the fluid in the heater. The capacity of the fluid in this temperature range Is given by equation given below : C = 0.7511 + 1.4465 X 10^{-3} T,kJ/kg.K , Where T is in K

5) Differentiate Newtonian fluids and non-Newtonian fluids

6) Discuss the analogy between viscosity coefficient μ and thermal conductivity k

7) Explain the terms priming, NPSH,cavitation in a pump

8) With neat figures explain the working of a single acting and double acting reciprocating pumps.

9) What is fluidization?

10) Explain the characteristic curves of a centrifugal pump.

PART B

Answer any five full questions, each carries 14 marks. (5×14=70 marks)

1) A combustion chamber is fed with 50 kmol/h of butane and 2000 kmol/h of air . Calculate the % excess air used and composition of the gases leaving combustion reactor Assuming complete combustion of butane

OR

2) A Waste acid from nitrating process contains 23 % HNO_3 , 57 % H_2SO_4 and 20% by weight. This is to be concentrated to contain 27 % HNO_3 , 60 % H_2SO_4 by the addition of concentrated H_2SO_4 containing 93 % H_2SO_4 and concentrated nitric acid containing 90 % HNO_3. Calculate the weights of waste and concentrated acid that must be combined to obtain 1000 kg desired mixture.

3) The combustion of n-heptane is C7H16 + 11O2 ----------- 7CO2 + 8H2O .Ten (10) kg of n-heptane is reacted with an excess amount of O2, and 14.4 kg of CO2 is formed.Calculate the conversion percentage of n-heptane

OR

4) Explain (i) Adiabatic air saturation (ii) Dew point (iii) relative humidity (iv) find the humid volume of air at 60 % RH and at a temp 50^{O} c.

5) Determine heat of reaction for the oxidation of SO^2 at 527^o c.using the data (cp=Kcal/Kmole K ,T in K) Cp,SO_2 = 6.147 + 13.844 X 10^{-3} - 91.03 X 10 $^{-7}$ T2 Cp,O_2 = 6.732 + 1.505 X 1O $^{-3}$ T - 1.791 X 10 $^{-7}$ T 2 Cp, SO_3 = 6.077 + 23.533 X 10 $^{-3}$ x T – 96.87 X 10 $^{-7}$ T 2 Heat of formation at 298 k are,SO_2 = - 70944 cal/k mole (15) SO_3 = - 94500 k cal/kmole

OR

6) Explain the stress shear Distribution of a fluid flowing through pipe

7) What is meant by fluidization? Explain the types of fluidization

OR

8) With neat figure explain the working of a centrifugal pump. Discuss its advantages and disadvantages.

9) Water at a is to be pumped from ground level, which is open to atmosphere to a cooling tower. The difference b/w the level of water in the tank and discharge point is 15 meters. The velocity of water through 40 mm internal diameter discharge point is 3m/s .In the pipe line there is a valve which is equivalent to 200 diameters. Calculate the power requirement of pump if efficiency is 60 % Density = 1000kg/m^3 Viscocity of water = .0008pa/s Friction factor ,f =.004

OR

10) With the help of a neat diagram explain the working of a venturimeter and derive the equation for volumetric flow rate

Syllabus

Module 1

Introduction: Fundamental concepts –units and dimensions-basic and derived quantities-conversion of units – conversion of empirical equations – mole concept –method of expressing composition – mole fraction – weight fraction – volume fraction – concentration of liquid solutions – molarity, molality, normality, ppm – ideal gas and gas mixtures – Material balance – unit operation and unit process – material balance in unit operation - evaporation ,crystallization, mixing, leaching ,extraction, absorption anddrying.

Module 2

Material balance with chemical reaction – oxidation of sulphur compounds, carbon dioxide from limestone - definition of terms limiting reactant, excess reactant, conversion, yield, selectivity . Energy balance-heat capacity- mean heat capacity – Kopps rule —enthalpy change of phase changes – heat of mixing – heat effects accompanying chemical reactions - standard heat of formation ,standard heat of combustion and standard heat of reaction – Hess's law of heat summation.

Module 3

Fluid Mechanics : definition of fluid- properties of fluids – density, specific gravity, compressibility, surface tension and viscosity –absolute and kinematic viscosity variation of properties with temperature and pressure – rheology of fluids- Newtonian and non-Newtonian fluids –fluid static-Pascal's law – hydrostatic equilibrium in gravity and centrifugal field –barometric equation – principle of manometer- principle of continuous gravity and centrifugal decanter –Introduction to fluid kinematics - Reynolds experiment – classification of flow.

Module 4

Fluid dynamics : Basic equation of fluid flow- continuity, Bernoulli's and momentum equations – kinetic energy correction factor- correction for fluid friction - flow of incompressible fluids in pipe – shear stress and velocity distribution in circular channel- Hagen Poissellius equation – flow through non circular cross section –hydraulic radius, equivalent diameter – friction factor - friction from changes in velocity or direction – sudden expansion ,sudden contraction –fittings and valves

Module 5

Transportation and metering of fluids : pumps- positive displacement pump-reciprocating–piston ,plunger diaphrum- rotary ,gear pump. Lobe pump,screw pump centrifugal pump- theory of centrifugal pump- characteristic curve –cavitation NPSH, water hammer, priming – flowmeters – classification –venturimeter ,orificemeter ,rotameter –open channel meters- weirs and notches – valves.

Text Books

1.K.V.Narayanan and B.Lakshmikutty , Stochiometry and Process Calculation, Prentice Hall, Second Editon,2016

2.Mc Cabe and Smith , Unit Operations in Chemical Engineering , Mc Graw Hill, Seventh Edition

3.Streeter.V.L ,Fluid Mechanics, Mc Graw Hill

Reference Books

1.Bhutt and Vora ,Stochiometry, Tata Mc Graw Hill

2.Manish Kumar Goyal ,Fluid Mechanics and Hydraulic Machines ,Prentice Hall

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Process calculation**	**9**
1.1	Units and dimensions	3
1.2	Methods of expressing compositions	3
1.3	Material balance in unit operation	3
2	**Material balance and energy balance**	**9**
2.1	Material balance in unit process	3
2.2	Energy balance	3
2.3	Energy balance with chemical reaction	3
3	**Fluid mechanics**	**9**
3.1	Properties and classification	3
3.2	Fluid statics	3
3.3	Application	3
4	**Fluid dynamics**	**9**
4.1	Basic equations in fluid dynamics	3
4.2	Flow through pipes	3
4.3	Friction factor	3
5	**Transportation and metering of fluids**	**9**
5.1	Classification of pumps	3
5.2	Centrifugal pump	3
5.3	Flow meters	3

FTT 203	FOOD MICROBIOLOGY	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the basic area of Food Microbiology. This is essential for the better understanding of history of microbiology, pioneers involved and various microbiological technologies involved in preservation as well as processing. This course will enable students to understand the various factors influencing in spoilage of food, microorganisms involved and detection or analysis of biological contaminants.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Learn the history of food microbiology, basics of Microscopy, major microorganisms in food; their isolation, growth, quantification and culture.
CO 2	Identify the factors and microbes involved in food spoilage; food borne pathogens, food poisoning and microbial toxins.
CO 3	Learn the qualitative and quantitative methods to detect microbes and microbial toxins in food
CO 4	Understand the Microbial quality assurance systems in food industry which include GMP and HACCP
CO 5	To identify beneficial organisms in the food processing industry with emphasis on various fermented foods

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	2		3						1
CO 2	3	3	2	2		1						1
CO 3	2	3	2	3	1	1						2
CO 4	2	2	3	3		1		1	3			2
CO 5	3	2	2			3						2

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	50
Analyse	5	5	10
Evaluate	5	5	10
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List out the contributions of Louis Pasteur to the field of microbiology.
2. What are the different kinds of microscopy?
3. Illustrate Growth curve and explain each phase in details
4. Write a note on intrinsic and extrinsic factors affecting food spoilage.
5. List out major Gram positive and facultative anaerobes spoiling food products

Course Outcome 2 (CO2)

1. Differentiate between food borne intoxication and food borne diseases with examples
2. List out the major microorganisms affecting sea food and products.
3. Discuss on Botulism and its characteristic features.
4. What are aflatoxins and the major microorganisms involved.

Course Outcome 3(CO3):

1. What are biosensors and major components involved?
2. Explain the principle behind the ELISA method
3. Describe the methods to enumerate bacteria in food sample using standard plate count method.
4. What is polymerase chain reaction and discuss on its role in food microbiology
5. Explain the major thing to be noticed during sampling for microbiological analysis

Course Outcome 4 (CO4):

1. List out the main personal hygiene practices to be followed as part of GMP
2. Discuss on why GMP need to be implemented in a food production / handling area

3. List out and explain the 7 principle of HACCP.

4. Write a note on functions and objectives of FSSAI

Course Outcome 5 (CO5):

1. Write about the role of microorganisms in food preservation

2. How are microorganisms positively associated with food industry?

3. Discuss about any five enzymes important in food industry

4. What are probiotics and what are its specific characteristics.

5. What are the various steps involved in alcoholic fermentation

Model Question paper

QP CODE:

Reg No.:_______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT 203

FOOD MICROBIOLOGY

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Discuss on 'Golden age of Microbiology'.
2. List out the various methods of preservation of pure culture
3. List out different fungal genera normally associated with food
4. Write in detail on various extrinsic factors influencing the food spoilage.
5. Comment on precautions needed during sampling for microbial analysis
6. Discuss the principle involved in PCR for microbial analysis.
7. Write a note on functions and objectives of FSSAI
8. What is GMP and discuss on why it need to be implemented
9. Discuss on production of culture for food fermentation with a suitable example
10. What are probiotics and what are its specific characteristics

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Explain the different phases of growth curve with the help of a neat and labelled diagram.

Or

12. Differentiate Gram Positive and Gram negative bacteria based on cell wall compositions with the help of a diagram.

13. Write about the characteristic features of Botulism and significance of its causative organism in food industry.

Or

14. Explain the characteristic features of food borne disease and how it will be different from food borne intoxication.

Or

15. Explain the concept of immunological methods for detection of microorganisms with anyone example.

Or

16. What are biosensors? Write about its working principle and applications with supporting figures.
17. List out the 7 principles of HACCP and explain in detail with the help of product flowchart

Or

18. Discuss the main concerns about establishment Design and layout as part of GMP.
19. Explain briefly on various microbial enzymes in Food Processing.

Or

20. Explain the preparation of Fermented beverages-Beer and Vinegar.

Syllabus

Module 1

History of microbiology of Food; Food microbiology and its Scope. Basics of Microscope; different types of Microscopy (Bright –Field Microscopy, Dark-Field Microscopy, Fluorescence Microscopy, Phase-Contrast Microscopy, TEM, SEM). Isolation, preservation and maintenance of pure cultures. Growth curve, Types of microorganisms associated with food: bacteria, fungi, & virus. Factors affecting spoilage of foods.

Module 2

Micro flora associated with various food groups, their spoilage potential, control and microbiological spoilage problems associated with typical food products (Seafood, milk and milk products, meat, cereals, fruits and vegetables) . Food poisonings - due to pathogens, important features. Microbial toxins. Bacterial agents of food borne illness-A brief account of various organisms related with food poisoning.

Module 3

Enumeration of microorganisms: Quantitative and Qualitative methods for microbial enumeration in foods, Physical (Impedance, Microcalorimetry, Flow cytometry) , Chemical

(LAL, ATPase, Radiometry) and immunological methods (ELISA, RIA, Immunomagnetic), Biosensors, Test for bacterial toxins in foods, Rapid methods and automation (FACS, PCR).

Module 4

Microbial quality assurance systems in food industry, Codes of Good Manufacturing Practices, HACCP food standards, Quality control using microbiological criteria

Module 5

Introduction to biotics and probiotics, Microbial enzymes in Food Processing. Fermented milk and milk products, fermented fruits and vegetables, Fermented fish, Fermented meats, Cereal based fermented foods, Fermented beverages-Beer, Vinegar and Wine.

Text Books

1. James M.J. (2000) Modern Food Microbiology,5th Edition, CBS Publishers
2. Barnart,G .J. (1997) Basic Food Microbiology, CBS Publishers

Reference Books

1. William Carroll Frazier and Dennis C Westoff (2017) Food Microbiology, 5th Edition
2. Bibek Ray (1996) Fundamental Food Microbiology, CRC Press
3. M. R. Adams, M. O. Moss. 2008 Food Microbiology, 2nd Edition

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**History, Introduction to Microbiology and Food microbiology**	**8**
1.1	Introduction and History of Food Microbiology, various microscopy	3
1.2	Types of microorganisms, Isolation maintenance and preservation	3
1.3	Growth curve	2
2	**Various food and microorganisms associated:**	**10**
2.1	Factors affecting food spoilage	3
2.2	Major food products and microorganisms involved	4
2.3	Food poisonings, food borne illness and toxins	3
3	**Microbiological analysis:**	**9**
3.1	Sampling and Enumeration of microorganisms	3
3.2	Physical, Quantitative and Qualitative methods	3
3.3	Rapid methods and automation	3
4	**Quality control in food industry**	**9**
4.1	Microbiological quality assurance systems in food industry	3
4.2	GMP and HACCP	4
4.3	Various standards in microbiological criteria	2

5	**Beneficial microorganisms in Food industry**	**9**
5.1	Probiotics.	2
5.2	Microbial enzymes in Food Processing.	3
5.3	Fermented food and products	4

CODE FTT 205	COURSE NAME FOOD CHEMISTRY	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble:

This course will deal with the chemistry of the principal components of food, their properties and interactions with food. This course gives understanding of different nutrients present in food and its biological significance. Relationships between the chemical composition of foods and its functional, nutritional, and sensory properties are emphasized.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the fundamentals of bio molecules and describe the food sources
CO 2	Explain the principal components of food, their chemical and nutritional properties
CO 3	Analyze the relationship between the composition of the individual food components and their chemical and physical properties
CO 4	Recognize real examples underlying physicochemical mechanisms responsible for food functionality and be able to use their knowledge of food chemistry
CO 5	Analyze the quality changes in food components during processing and preservation
CO 6	Apply basic knowledge food components for producing various food products for different age groups

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3											
CO 2	3											2
CO 3	2	2										2
CO 4	2	2	2	3								
CO 5	2	2	2	2								2
CO 6	3	2			2	1	1					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Differentiate micro and macro nutrients with examples?

2. Explain the structure of conjugated fat

3. Describe the functions of different chemical components of food

Course Outcome 2 (CO2)

1. Explain the term optical rotation?

2. Differentiate essential and non essential amino acid with examples?

3. Discuss the chemical reactions of carbohydrates?

Course Outcome 3(CO3):

1. How will you modify starch using chemical methods ?

2. Illustrate the process of auto oxidation of fat

3. Describe the dipole moment of water.

Course Outcome 4 (CO4):

1. Demonstrate the process of gelatinization of starch.

2. Explain the process of auto oxidation of fat.

3. Demonstrate the process of computing nutritional value for new product development

Course Outcome 5 (CO5):

1. Explain different types of rancidity?

2. Role of fat replacers in food processing?

3. Explain the factors causing protein denaturation?

Course Outcome 6 (CO6):

1. Define glycemic index of food and its significance?

2 Explain the significance of BMR in regulating body homeostasis

3 Recall the biological role of fiber?

MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER BTECH DEGREE EXAMINATION

Course Code: FTT 205

Course Name: Food Chemistry

Max marks: 100 Time: 3 hrs

Part A

Answer all questions each question carries 3 marks (Marks = 10x 3 = 30 marks)

1. Give an account of different food groups.
2. Define water activity and give the equation for water activity.
3. What is a disaccharide? Give an example.
4. Write down the changes involved in gelatinization of starch.

5. Differentiate essential and non essential amino acids with example.
6. List out the biological role of protein.
7. Define rancidity and its effects?
8. Structure of Phospholipids?
9. Define the term glycemic index of food?
10. List out the six factors affecting BMR?

PART B

Answer anyone full question from each module, each question carries 14 marks

11. a) Explain the different forms of water found in food? List the characteristics of bound water (7)
    b) Describe methods for determining water activity of food sample? (7)

OR

12. a) Elucidate the structure of water? (6)
    b) Give a detailed account on water quality in food processing? (8)
    Module 2
13. a) Illustrate the process of Maillard reaction in food. Mention any three ways to minimize Maillard browning in foods (9)
    b) What are sugar alcohols? Explain its food applications with example (5)

OR

14. a) Classify polysaccharides in detail with example? (7)
    b) How will you modify starch by chemical methods (7)
15. Classify food proteins based on structure with examples? (14)

OR

16. a) Explain the methods of protein quality evaluation (7)
    b) Mention the application of enzymes in food processing with example (7)
17. a) Give an account of structure and composition of fat? (7)
    b) Differentiate plasticity and isomerization of fat? (7)

OR

18. a) Explain 2 ways in which fats are deteriorated and become rancid? (7)
    b) Describe fat replacers with example? (7)
19. a)Describe the functions of various fat soluble vitamins with its food sources (7)
    b) Give an account of functions of iron and iodine and its effects of deficiency? (7)

OR

20 a) Explain the principle and working of Bomb Calorimeter with the help of a neat diagram? (10)
b) Compute the calorie value of food which contains 10 g of fat, 3.5 g of protein, 0.5 g of dietary fibre and 35 of carbohydrate (4)

Syllabus

Module 1 Introduction to food chemistry

Introduction to Food chemistry: Importance of food, Scope of food chemistry - different food groups: their classification and importance -Water -Structure of water molecule, properties of water, water activity and its importance, determination, water quality for food processing

Module 2 Carbohydrate

Chemistry of carbohydrates – composition and structure-Definition, classification, properties, Browning reactions- Caramelization, Maillard reaction, Dextrose Equivalent, Sugar alcohols; Starch- properties, thickening & gelatinization, modified starches, resistant starch, Dextrins and dextrans, Starch hydrolysis, Pectins, gums & seaweeds- Food sources, functional role in foods.

Module 3 Protein

Proteins- structure and functions, Classification -according to composition, structure, and functions – Role of proteins and requirements –Amino acids-Definition, classification, Physical and chemical properties of proteins, Important protein sources–Milk, Meat, Fish, Egg and Cereal proteins – Texturized proteins; Food Enzymes- Food sources, functional role and uses in foods.

Module 4 Lipid

Lipids- Structure, classification & nomenclature of fats. Properties of fats & oils: crystal formation, polymorphism, melting points, plasticity, isomerisation; Modification of fats: hydrogenation- cis and trans isomers, inter-esterification, Rancidity and its types; Shortening power of fats, tenderization, emulsification; Fat replacements; Food sources, functional role and uses in foods.

Module 5 Food and Nutrition

Vitamins- Definition, Classification, general sources, functions and dietary requirements – deficiency symptoms of vitamins- Role of minerals –Role of soluble and insoluble fiber – Basal metabolic rate- Calorific value of food -balanced diet- Computing caloric requirements- Glycemic Index- Biological value of protein- Protein Malnutrition- Obesity.

Text Books

1. Sivasankar, B, "Food processing and preservation" Prentice – Hall of India Pvt. Ltd. New Delhi 2002.
2. Srinivasan Damodaran, Kirk L. Parkin, and O.R. Fennema, E, "Food Chemistry" 4th Edition, CRC Press, New York 2007.
3. Chopra, H.K. and P.S. Panesar. "Food Chemistry". Narosa, 2010
4. Food Chemistry, H.-D. Belitz , W. Grosch , P. Schieberle 3rd ed. 2004, Publisher: Springer

Reference Books

1. Charley, H, "Food Science" John Wiley and Sons Inc., New York, 1982.
2. Birch, G.G., Brennan, J. G. and Parker, K. J, "The Sensory Properties of Foods" Applied Science Publication, London, 1977.
3. Robinson, D. S, "Food – Biochemistry and Nutritional Value" Longman Scientific and
4. Technical, London, 1987.
5. Handbook of Food Chemistry, Peter Chi Keung Cheung, Bhavbhuti M. Mehta, 1st ed. 2015, Springer Berlin Heidelberg
6. Principles of Food Chemistry (Food Science Text Series), John M. deMan, John W. Finley, W. Jeffrey Hurst, Chang Yong Lee, 4th ed. 2018 Edition, Springer

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Introduction to food chemistry**	**9**
1.1	Importance of food, Scope of food chemistry	2
1.2	different food groups - classification and importance	2
1.3	Water -Structure of water molecule, properties of water	2
1.4	Functions of water in food processing	1
1.5	Water activity – definition, significance, measurement	2
2	**Module 2 Carbohydrate**	**9**
2.1	Carbohydrates – definition, functions, food sources	1
2.2	Chemistry of carbohydrates – composition , structure and classification	3
2.3	Reactions of carbohydrates – significance and food applications	3
2.4	Modified and resistant starch, pectin ,gums	2
3	**Module 3 Proteins**	**9**
3.1	Proteins- functions, food sources, classification	2
3.2	Structure of protein – amino acids, types of amino acids ,examples	3
3.3	Physical and Chemical properties of protein	2

3.4	Texturized proteins, enzymes and its applications	2
4	**Module 4 – Lipids**	**9**
4.1	Lipids- Structure, classification & nomenclature of fats.	2
4.2	Properties of fats & oils – physical properties	1
4.3	Chemical reactions of fat – Significance in food processing	3
4.4	Rancidity of fat	1
4.5	Modification of fat, shortening ,fat replacers	2
5	**Module 5 – Food and nutrition**	**9**
5.1	Vitamins- Definition, Classification, general sources, functions and dietary requirements, deficiency	3
5.2	Minerals – common minerals, types, general sources, functions and dietary requirements, deficiency	2
5.3	Fiber content in food – Biological functions in body	1
5.4	Basal metabolic rate- Calorific value of food – Bomb calorimeter	1
5.5	Balanced diet- - Over nutrition and under nutrition	1
5.6	Computing caloric requirements and nutritive value of food	1

Code.	Course Name	L-T-P - Credits	Year of Introduction
FTL201	Food Microbiology Lab – I	0-0-3-2	2020

Preamble: Goal of this course is to develop the knowledge of students in the basic area of Food Microbiology. This is essential for the better understanding of various basic microbiological technologies and acquires knowledge about different types microorganism related to food and techniques of microbial analysis.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Demonstrate safety practices inside a microbiology laboratory
CO 2	Identify, explain function and preparation of common culture media in microbiology lab and sterilization
CO 3	Demonstrate proficiency in aseptic transfer of living microbes using different techniques; staining techniques, proper culture handling and enumeration of microorganisms
CO 4	Demonstrate proper usage, identify the parts/functions of the microscopes and viewing microorganisms using with/ without staining techniques
CO 5	Understand and explain bacterial growth and environmental/physical/ chemical factors that influence microbial growth

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1			3	2				1				3
CO 2	2		2	2								3
CO 3	2		2	3								3
CO 4	2		1	3								3
CO 5	2		1	3								3

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	: 15 Marks
(b) Implementing the work/Conducting the experiment	: 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting)	: 25 Marks
(d) Viva voce	: 20 marks
(e) Record	: 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What are the safety precautions need to be taken before starting work in microbiology lab?
2. What are the precautions need to be taken to avoid cross contamination in microbiology lab?
3. How sterilization and culturing of microorganism possible inside a microbiology lab?

Course Outcome 2 (CO2)

1. What is the difference in agar culture media and broth culture media?
2. Prepare the media suitable for culturing fungus from the given sample
3. Prepare the media suitable for culturing bacteria from the given sample

Course Outcome 3(CO3):

1. Perform serial dilution and perform spread plate culture from given water sample
2. Perform streak plate culturing for isolation of microorganism
3. Enumerate the number of microorganism in the given sample

Course Outcome 4 (CO4):

1. Identify and explain the different parts of the compound microscope
2. Perform Gram staining and identify the organism is Gram positive or Gram negative
3. Perform the Microscopic examination of living microorganisms

Course Outcome 5 (CO5):

1. Draw the growth curve for the given microorganism
2. Demonstrate and explain the influence of pH on the growth of given microorganism
3. Discuss the efficiency of given antibiotic against test organism

List of Exercises/Experiments: (Minimum 12 are mandatory)

1. Introduction to microbiology & Laboratory instructions
2. Sterilization techniques and Disinfection
3. Culture media
4. Preparation of nutrient broth
5. Preparation of nutrient agar plates and nutrient agar slants
6. Subculturing in slants
7. Enumeration of heterotrophic bacterial population-Serial dilution and pour plate technique
8. Demonstration of technique for pure culture of microorganisms-Spread plate and Streak plate method
9. Simple staining
10. Negative staining of bacteria
11. Grams Staining method for differentiation of bacteria
12. Fungal staining
13. Acid-fast staining of *Mycobacterium*
14. Spore staining-Schaeffer Fulton staining
15. Microscopic examination of living microorganisms using hanging drop preparation
16. Microscopic enumeration of microorganisms
17. Antibiotic sensitivity of pathogens
18. Bacterial Growth curve-observation and growth characteristics of bacteria

Text Book:

1. Microbiology: A Laboratory Manual, 10th edition. James Cappuccino, Natalie Sherman. Pearson Higher education
2. Practical Microbiology, R C Dubey, D K Maheshwary

Code.	Course Name	L-T-P - Credits	Year of Introduction
FTL 203	**Food Chemistry Lab**	**0-0-3-2**	**2020**

Preamble: Objective of this course is to develop the knowledge of students in the area of Food Chemistry. This course is designed to demonstrate the major chemical and physical properties of foods and also shows the effects of processing and preservation methods on nutritional and sensory quality of food. Students will evaluate different food products using various chemical analysis techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain various chemical methods for the detection and estimation of chemical constituents in food
CO 2	Analyze different chemical compounds in food sample
CO 3	Demonstrate various chemical methods to find the chemical properties of foods
CO 4	Design, carry out, record and analyze the results of chemical experiments precisely
CO 5	Function as a member of a team, communicate effectively and engage in further learning
CO 6	Apply this as a base for facing an issue in Food Processing Industry or in a Food Research Institute

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2											
CO 2		2										
CO 3		2										
CO 4		1										
CO 5	2											
CO 6			1									

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	: 15 Marks
(b) Implementing the work/Conducting the experiment	: 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting)	: 25 Marks
(d) Viva voce	: 20 marks
(e) Record	: 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Estimation of reducing sugar by Fehlings procedure
2. Perform Molisch's Test
3. Determination of alkalinity/ hardness of water

Course Outcome 2 (CO2)

1. Checking the brix by using hand refractometer
2. Determination of acidity of given food sample
3. Estimation of proteins by Biuret method

Course Outcome 3(CO3):

1. What is paper chromatography? How does it work?
2. Estimation of vitamin C
3. Perform Ninhydrin reaction

Course Outcome 4 (CO4):

1. Estimation of salt content in brine solution
2. Perform two methods to detect the adulteration in milk
3. Estimation of salt content in butter

Course Outcome 5 (CO5):

1. How to analyze the presence of starch in milk
2. Estimate presence of reducing aldehyde or ketone groups by Benedict's test
3. Estimation of Lactose by Benedict's Quantitative Regent

Course Outcome 6 (CO6):

1. How to analyze the presence of salt in butter
2. Estimate presence of reducing sugar in milk
3. Estimate TSS in given food sample

List of Exercises/Experiments: (Minimum 12 are mandatory)

1. Analysis of water for potable and food purposes
2. Moisture content in foods in relation to their stability
3. Qualitative tests for carbohydrates-
   a) Distinguishing reducing from non- reducing sugars
   b) Keto sugar from aldo sugars
4. Determination of rate/ extent of hydrolysis of sucrose/starch
5. Gelling properties of starch
6. Acid hydrolysis and action of salivary amylase on starch
7. Qualitative tests for proteins
8. Quantitative determination of protein
9. Coagulation of protein
10. Effect of heat and p H on proteins
11. Study of some functional properties of proteins
12. Determination of free fatty acid content in fats and oils
13. Detection and estimation of oxidative rancidity in fats/oils
14. Non-enzymatic browning reactions and its determinations
15. Determination of heat stability of vitamin C
16. Detection / Estimation of some additives in foods
17. Detection/Estimation of adulterants in some foods
18. Preparation and measurement of pH of standard buffers
19. Determination of gluten content in wheat flour

Text Book:

1. Morris B. Jacobs , *The chemical analysis of foods and food products,* III Edition, CBS Publishers and distributors New Delhi.
2. *ISI hand book of food analysis*
3. Ranganna S , *Hand book of analysis and quality control for fruit and vegetable products,* II Ed., Tata McGraw Hill Publishing Co. New Delhi.
4. *Official Method of analysis of AOAC*
5. Rui M. S. Cruz, Igor Khmelinskii, Margarida Vieira, Methods in Food Analysis1st Edition, 2014 CRC Publishers

SEMESTER -3

MINOR

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT 281	Principles of Food Technology	VAC	3	1	0	4

Preamble:

This course will deal with the basic principles and concepts of food preservation and processing. This course introduces the basic processes in food technology, significance of regulatory bodies and principles of food safety.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply the knowledge of food properties in handling and processing operations
CO 2	Study the compositional and nutritional aspects of various food groups
CO 3	Demonstrate and apply the principles of food preservation in extending the shelf life of food products
CO 4	Study and analyze the principles and processing methods of various value added food products
CO 5	Evaluate the role of government regulatory bodies in promoting the food processing sector in India
CO 6	Ensure safe and wholesome food to the public by applying the principles of food safety and packaging techniques

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	2									
CO 2	2	2	3	1								
CO 3	2	3	2									
CO 4	2	1	3									
CO 5		1	3	2								
CO 6	2	3	3									

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What are the various constituents of food?

2. Explain the applications of various properties of food.

3. Elucidate the physical properties of food

Course Outcome 2 (CO2)

1. Explain the nutritional composition of milk.

2. Explain the nutritional composition of meat.

3. Elucidate the compositional and nutritional aspects of cereals and pulses.

Course Outcome 3 (CO3):

1. With examples explain perishable, semi perishable and non-perishable foods.
2. Explain the principle of food preservation using high temperature.
3. What are the factors affecting microbial growth in foods?

Course Outcome 4 (CO4):

1. With examples explain primary, secondary and tertiary processing of food.
2. Explain the processing of any two fermented food products.
3. Write a short note on extruded products.

Course Outcome 5 (CO5):

1. Describe the significance of FSSAI in Indian food processing sector.
2. Write a short note on CAC and its functions.
3. Explain the role of APEDA and MPEDA in export of processed food products.

Course Outcome 6 (CO6):

1. List out the seven principles of HACCP.

2 Illustrate the functions of food packaging.

3. Distinguish between SOP and SSOP.

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER BTECH DEGREE EXAMINATION

Course Code: FTT 281 Course name : Principles of Food Technology

Max marks : 100 Time : 3 hrs

Part A

Answer all questions each question carries 3 marks (Marks = 10x 3 = 30 marks)

1. List out the functions of food. (3)
2. What are the major food groups? (3)
3. Write down the principle of food irradiation. (3)

4. What do you mean by class I and class II preservatives? (3)
5. With examples state the significance of minimally processed products? (3)
6. List out the processed products from fruits. (3)
7. What are the major functions of AGMARK? (3)
8. Write down the significance of horizontal committee of CAC. (3)
9. What are the major qualities attributes of food? (3)
10. Write down the significance of ISO 22000. (3)

PART B

11. Write a brief note on vitamins and minerals. (14)

OR

12. Explain in detail about properties of food. (14)
13. What are the factors affecting microbial growth? (14)

OR

14. Elucidate the principle of preservation by low and high temperature. (14)
15. Write a brief note on dairy based processed products. (14)

OR

16. Exemplify the types and manufacturing of confectionery products. (14)
17. Describe the significance of Mega food parks and packaging centers. (14)

OR

18. Explain the following- (14)
    i) KINFRA
    ii) BIS
19. Write a detailed note on food industry waste management. (14)

OR

20. Explain the packaging methods adopted in food processing industry. (14)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY Estd. 2014

Syllabus

Module 1

Food basics

Food definition, Food constituents- Moisture, Carbohydrates, Proteins, Lipids, Vitamins and minerals, Food and its functions, Food groups, Major properties of food, Compositional and nutritional aspects- fruits and vegetables, dairy, cereals, pulses, oilseeds, fisheries, meat and poultry, consumer foods etc.

Module 2

Food spoilage and preservation

Perishable, semi perishable and non-perishable foods, Food deterioration- types and causes, Major microbes causing food spoilage, Factors affecting microbial growth, Principles and methods of food preservation- preservation by low temperature, high temperature, preservatives, dehydration and food irradiation

Module 3

Food Processing

Need of Food processing, Primary, Secondary and tertiary processing, Processed food products types and method of preparation- cereals and pulses, extruded products, fruits and vegetables, minimally processed products, dairy, flesh foods, confectionary and fermented products

Module 4

Food processing regulation bodies

Status of food processing sector in India- fruits and vegetables, dairy, cereals, pulses, fisheries, meat and poultry, consumer foods, Major challenges and growth potential. The role of Codex alimentarius commission, FSSAI, MOFPI, KINFRA, BIS, APEDA, MPEDA and AGMARK, Mega food parks and packaging Centers, Role of food technologist in society.

Module 5

Food safety and packaging

Introduction to food safety and food quality importance, Quality attributes of food, factors affecting quality, Principles of HACCP, ISO 22000, TQM, GHP, GMP, SOP and SSOP, Food packaging- functions of packaging, packaging materials, types of packaging systems, environmental aspects, Waste management in food industry

Text Books

1. Annual Report by Ministry of Food Processing, India
2. P. Fellows. 2000. Food Processing Technology: Principles and Practice, 2nd Ed. CRC Press, Boca Raton, FL, USA
3. William C. Frazier and & Dennis C. Westfoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi.

Reference Books

1. Food processing Handbook Ed. James G Brennan 2006 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
2. Zeki Berk ,Food process engineering and technology, 2013, ELSEVIER

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Food basics**	**9**
1.1	Food definition, Food constituents- Moisture, Carbohydrates, Proteins, Lipids, Vitamins and minerals	3
1.2	Food and its functions, Food groups	1
1.3	Major properties of food	2
1.4	Compositional and nutritional aspects- fruits and vegetables, dairy, cereals, pulses, oilseeds, fisheries, meat and poultry, consumer foods etc.	3
2	**Module 2- Food spoilage and preservation**	**9**
2.1	Perishable, semi perishable and non-perishable foods, Food deterioration- types and causes	1
2.2	Major microbes causing food spoilage	1
2.3	Factors affecting microbial growth	1
2.4	Principles and methods of food preservation	1
2.5	Preservation by low temperature	1
2.6	High temperature	1
2.7	Preservatives	1
2.8	Dehydration	1
2.9	Food irradiation	1

3	**Module 3- Food Processing**	**9**
3.1	Need of Food processing, Primary, Secondary and tertiary processing	1
3.2	Processed food products types and method of preparation- cereals and pulses	1
3.3	Extruded products	1
3.4	Fruits and vegetables,	1
3.5	Minimally processed products	1
3.6	Dairy	1
3.7	Flesh foods	1
3.8	Confectionary	1
3.9	Fermented products	1
4	**Module 4- Food processing regulation bodies**	**9**
4.1	Status of food processing sector in India- fruits and vegetables, dairy, cereals, pulses, fisheries, meat and poultry, consumer foods, Major challenges and growth potential.	3
4.2	The role of Codex alimentarius commission	1
4.3	FSSAI	1
4.4	MOFPI, KINFRA	1
4.5	BIS, APEDA, MPEDA	1
4.6	AGMARK, Mega food parks and packaging Centers, Role of food technologist in society	2
5	**Module 5-Food safety and packaging**	**9**
5.1	Introduction to food safety and food quality importance, Quality attributes of food, factors affecting quality	2
5.2	Principles of HACCP, ISO 22000	1
5.3	TQM, GHP, GMP	2
5.4	SOP and SSOP	1
5.5	Food packaging- functions of packaging, packaging materials, types of packaging systems, environmental aspects	2
5.6	Waste management in food industry	1

FTT 283	FOOD SCIENCE & TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the basic area of Food Science and technologies involved. This is essential for the better understanding of history of Food Science, Chemical & Biological properties of food, technology involved in various processing as well as preservation of foods, elements of packaging and food safety.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the history of food science and scope of food processing sector
CO 2	Understand biological and chemical properties of food.
CO 3	Identify the factors and microbes involved in food spoilage and methods of preventing spoilage of food
CO 4	Apply the different food preservation methods for increasing shelf life of food
CO 5	Understand food packaging technology and food safety regulations

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3				1						
CO 2	3											
CO 3	2	1					1					
CO 4	3	2	1	1								2
CO 5	3	1	1				1	1				2

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	50
Analyse	5	5	10
Evaluate	5	5	10
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What are the different classifications of food?
2. Discuss on sensory attributes of food
3. Define the role and scope of food science and Technology

Course Outcome 2 (CO2)

1. List out the carbohydrates present in food and its significance.
2. Discuss the Physiological and biochemical functions of food.
3. Define balanced diet with an example.

Course Outcome 3(CO3):

1. Comment on various factors affecting spoilage of foods
2. Differentiate between food borne disease and food poisoning with examples
3. How microorganisms act beneficial to food industry?

Course Outcome 4 (CO4):

1. Discuss on various factors influencing food supply and processing
2. Differentiate Thermal and Non thermal processing of food
3. Compare various packaging materials in the aspect of Environmental Issues

Course Outcome 5 (CO5):

1. List out and explain the 7 principle of HACCP.
2. What are the Good manufacturing practices to be followed in any food handling area?
3. Write on any of the food safety regulatory body in India

Model Question paper

QP CODE: **Reg No.:______________**
Name: ______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT 283
FOOD SCIENCE & TECHNOLOGY

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Define the role and scope of food science and Technology.
2. What are the important nutrient composition in food
3. Define balanced diet with an example
4. Comment on the role of minerals and fibres in the food.
5. What are microbial toxins and explain with the help of an example
6. What are probiotics and what are its specific characteristics.
7. Discuss on the precautions taken during Post Harvest Handling
8. What are the characteristic features of a packing material
9. Write on the activities of any of the food safety regulatory body in India
10. Comment on significance of personal hygiene on food safety

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Write in detail about the different classifications of food?

Or

12. Discuss on sensory attributes of food and how the sensory analysis is done
13. Discuss the Physiological and biochemical functions of food.

Or

14. Comment on the different classification of carbohydrates and its role in the food.

Or

15. Write about the characteristic features of Botulism and significance in food industry.

Or

16. Comment on various factors including intrinsic and extrinsic factors affecting spoilage of foods.
17. Differentiate Thermal and Non thermal processing of food

Or

18. Compare various packaging materials with respect to its Environmental Issues.
19. Explain briefly on various microbial enzymes in Food Processing.

Or

20. List out the 7 principles of HACCP and explain in detail with the help of flowchart.

Syllabus

Module 1

History, Introduction to food science technology

History and Classification: Food definition; Importance of food; Introduction to different food groups: classification, importance and properties of food - nutrient composition; Sensory attributes of food and sensory analysis: Appearance, Texture and flavour, Food Processing sector – scope and significance

Module 2

Food and nutrients

Composition of food – Carbohydrates, protein, lipids, vitamins, minerals and fibres; Physiological and biochemical factors: their functions, daily requirements; Biological value, energy value, Balanced diet

Module 3

Food Microbiology

Food as a substrate for microorganism: Microorganisms normally associated with food - bacteria, yeast & mold; Factors affecting spoilage of foods; Food poisoning, food borne diseases and microbial toxins; Beneficial microorganisms: Fermentation, Probiotics.

Module 4

Food Processing and Preservation

Raw material properties - physical, functional; Post Harvest Handling and storage: Aseptic processing, Canning, Extrusion, Minimal Processing, Microwave Processing Ozone Technology, High Pressure Processing, Pulsed Electric Field, Food Packaging , Environmental Issues in Packaging, Food Labelling

Module 5

Food Safety

Food safety concept and its importance; Food hygiene and safety regulations - Food Safety Programs: - GMP, HACCP; Food Safety management systems, Regulatory Bodies.

Text Books

1. Sivasankar, B, "Food processing and preservation" Prentice – Hall of India Pvt. Ltd. New Delhi 2002.
2. P G Smith, Introduction to Food Process Engineering, 2011, Springer International Publishing.

Reference Books

1. William Carroll Frazier and Dennis C Westoff (2017) Food Microbiology, 5th Edition
2. Charley, H, *"Food Science" John Wiley and Sons Inc., New York 1982*
3. Robinson, D. S, "Food – Biochemistry and Nutritional Value" Longman Scientific and Technical, London 1987M.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**History, Introduction to food science technology**	**9**
1.1	History and Classification: Food definition; Importance of food ,food processing	4
1.2	Different food groups: classification, importance and properties	3
1.3	Sensory attributes of food and sensory analysis	2
2	**Food and Nutrients**	**10**
2.1	Composition of food – Food groups	2
2.2	Nutrients - functions, food sources	3
2.3	Physiological and biochemical factors	3
2.4	Biological value, energy value, Balanced diet	2
3	**Food Microbiology**	**8**
3.1	Microorganisms associated with food	3
3.2	Factors affecting spoilage of foods	3
3.3	Beneficial microorganisms in food industry	2
4	**Food processing, preservation and packaging**	**10**
4.1	Principles of food processing technology	4
4.2	Principles of food preservation technology	3
4.3	Food Packaging and Labelling	3
5	**Food safety and regulation**	**8**
5.1	Food Safety and importance	2
5.2	Food Safety Programs	4
5.3	Food Safety management systems and Regulatory Bodies	2

FTT 285	Introductory Food Technology	CATEGORY	L	T	P	CREDIT
		VAC	4	0	0	4

Preamble: Goal of this course is to develop the knowledge of students in the basic area of food science and technology. This course is very essential for learning the nutrients composition and categories of food, preservation methods, unit operations and packaging of food products.

Prerequisite:

Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand and summarizes the nutrients composition and functions of food and their sources.
CO 2	Able to apply the knowledge on production principles of value added products and understand the production, export-import statistics of agricultural products.
CO 3	Compare and apply the different food preservation methods for increasing shelf life of processed products.
CO 4	Apply the principles of different unit operations of food processing in developing various processed food products.
CO 5	Understand and apply various packaging materials and recent trends in the food packaging

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2	3										
CO 2	3	2										
CO 3	3	1	1	2								2
CO 4	3	2										2
CO 5	3	1	1									

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define food and explain the functions of food.
2. Describe the classification of carbohydrate and their role in the biological system.
3. Discuss the role of water as nutrient in food.

Course Outcome 2 (CO2)

1. Illustrate the nutritional composition of cereals
2. Describe the status of grain segment in India

4. Describe the status of food processing sector in India.

Course Outcome 3(CO3):

1. Illustrate the extrinsic and intrinsic factors affecting the microbial growth in food products
2. Differentiate between freezing and freeze drying.
3. Demonstrate the equipment used in the drying of liquid and slurry products.

Course Outcome 4 (CO4):

1. Describe the filtration and explain the cake filtration in detail.
2. Explain the different equipment used in the mixing of dough in food processing sector.
3. Define evaporation and describe the single and multistage evaporator

Course Outcome 5 (CO5):

1. Explain the functions of packaging
2. Describe the manufacturing of glass.
3. Differentiate between active and smart packaging

Model Question paper

			Total Pages:
Reg No.:________________			Name:____________________________
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY			
Course Code: FTT 285			
Course Name: INTRODUCTORY FOOD TECHNOLOGY			
Max. Marks: 100			Duration: 3 Hours
PART A			

		Answer all questions, each question carries 3 marks.	Marks
1	a)	Define food and the functions of food	(3)
2	a)	Illustrate the classification of lipids	(3)

3	a)	Identify the following:- a) gluten b) zein c) casein	(3)
4	a)	Relate fish and meat segment in India and express your thoughts about it	(3)
5	a)	Compare the primary, secondary and tertiary processing infood processing with an example	(3)
6	a)	Describe HTST pasteurization of milk	(3)
7	a)	List out the various size reduction methods	(3)
8	a)	Explain the processing of twin screw extruder	(3)
9	a)	Discuss the functions of packaging	(3)
10	a)	Explain intelligent packaging	(3)
		PART B	
		Answer any one question from each or question, each carries 14 marks	
11	a)	Classify protein and explain their role in the biological system	(10)
	b)	Vitamin C is lost during cooking. Validate the statement	(4)
		OR	
12	a)	Classify carbohydrates and give examples for each category	(9)
	b)	Discuss various food groups	(5)
13	a)	Describe the status of food processing sector in India	(14)
		OR	
14	a)	Describe the nutritional composition of cereals and pulses	(14)
15	a)	Discuss the causes of food deterioration	(10)
	b)	List out 4 bacteria involved in the food spoilage	(4)

		OR	
16	a)	Describe the various chemical additives used in the preservation of food	(7)
	b)	Identify the principle behind fluidized bed dryer? Explain the working of a fluidized bed dryer	(7)
17	a)	Describe the principle behind membrane separation process	(7)
	b)	Explain cryogenic grinding	(7)
		OR	
18	a)	Explain the following unit operations :- a) Cleaning b) expelling c)coagulation d) grading	(14)
19	a)	Describe the functions and various forms of food packaging	(14)
		OR	
20	a)	Explain the labelling requirement of a food package	(6)
	b)	Identify the packaging methodology used in the packaging of "Lays". Explain the process.	(8)
		****	

Syllabus

Module 1

Introduction to food and nutrients

Definition of food, functions of food, food groups, Nutrients in food– Carbohydrate, proteins, lipids, vitamins and minerals, their classification, functions and sources. Role of water as nutrient and its dietary sources

Module 2

Categories of food

Composition and nutritive value of cereals, pulses, fruits, vegetables, oil seeds, diary, meat, fish and poultry. Production, consumption, export, import statistics of grains, fruits and vegetables, diary, meat and fishery segments in India. Status of food processing sector in India.

Module 3

Food Processing and preservation

Need of food processing, Food spoilage, causes of deterioration, major microbes causing food deterioration, intrinsic and extrinsic factors affecting the microbial growth. Primary, secondary and tertiary processing in food processing.

Food preservation- pasteurization, ultra high temperature, canning, drying – tray, tunnel, fluidized bed, spray, drum, foam, vacuum drying, irradiation and microwave drying. Low temperature drying – refrigeration and freezing. Preservation by chemical additives

Module 4

Unit operations of food processing

Grading, cleaning, washing, sorting, size reduction, cryogenic grinding, crystallization, evaporation, distillation, mixing, coagulation, mechanical separation processes, filtration, pressing, expelling, leaching, extraction and extrusion.

Module V

Packaging of food products

Functions of food packaging. Different types of Packaging materials and their properties. Recent trends in packaging, aseptic, active packaging, smart packaging, intelligent packaging, modified atmosphere, vacuum and gas packaging. Labelling requirements of a package.

References

1. Y. H. HUI, HANDBOOK OF FOOD SCIENCE, TECHNOLOGY, AND ENGINEERING, volume 1,Taylor and Francis group, 2006.
2. Annual Report by Ministry of Food Processing, India
3. Zeki Berk, Food Process Engineering and technology, 2013, Elsevier
4. Food processing Handbook Ed. James G Brennan 2006 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.

Text books

1.Vickie A. VaclavikElizabeth W. Christian, Essentials of Food Science, 4th Edition, Springler, 2014
2. B. Srilakshmi,Food Science, seventh edition, New age international pvt ltd,2018
3. P J Fellows, Food Processing Technology Principles and practices, Fourth edition, Woodhead Publishing Limited, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to food and nutrients (9)**	
1.1	Definition of food, functions of food, food groups	2
1.2	Nutrients in food – Carbohydrate, proteins, lipids, vitamins and minerals, their classification, functions and sources.	5
1.3	Role of water as nutrient and its dietary sources	2
2	**Categories of food (9)**	
2.1	Composition and nutritive value of cereals, pulses, fruits, vegetables, oil seeds, diary, meat, fish and poultry.	4
2.2	Production, consumption, export, import statistics of grains, fruits and vegetables, diary, meat and fishery segments in India.	3
2.3	Status of food processing sector in India.	2
3	**Food processing and preservation**	**(10)**
3.1	Need of food processing, Food spoilage, causes of deterioration, major microbes causing food deterioration, intrinsic and extrinsic factors affecting the microbial growth.	3
3.2	Primary, secondary and tertiary processing in food processing.	1
3.3	Food preservation - pasteurization	1
3.4	Ultra high temperature, canning, drying – tray, tunnel	1
3.5	Fluidized bed, spray, drum, foam, vacuum drying, irradiation and microwave drying.	2
3.6	Low temperature drying – refrigeration and freezing.	1
3.7	Preservation by chemical additives.	1
4	**Unit operations of food processing (9)**	
4.1	Grading, cleaning, washing, sorting, size reduction,	2

4.2	cryogenic grinding, crystallization, evaporation,	2
4.3	distillation, mixing, coagulation,	2
4.4	mechanical separation processes, filtration, pressing, expelling, leaching, extraction and extrusion.	3
5	**Packaging of food products**	**(8)**
5.1	Functions of food packaging. Different types of Packaging materials and their properties	3
5.2	Recent trends in packaging, aseptic, active packaging, smart packaging, intelligent packaging, modified atmosphere, vacuum and gas packaging.	4
5.3	Labelling requirements of a package.	1

SEMESTER -4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT 202	FUNDAMENTALS OF HEAT AND MASS TRANSFER	PCC	3	1	0	4

Preamble:

To understand basic principles of heat and mass transfer in food processing and equipment used

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply basic principles and mechanism of heat transfer in the design of heat transfer equipment.
CO 2	Recognize problems and develop solutions for steady state conduction in simple geometrics.
CO 3	Apply mass transfer through molecular diffusion, gas- liquid and vapor-liquid operations.
CO 4	Analyze unit operations and type of equipments used in food allied industries
CO5	Understand the application of absorbers in food industry

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1				3							
CO 2	3	2										
CO 3	3	2										
CO 4	3	2										
CO5	3											

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State the basic laws and modes of heat transfer.

2. List the applications of heat exchanger equipment.

3. Analyse the heat transfer in the design of equipment

Course Outcome 2 (CO2)

1. Apply the heat conduction equations in various geometrics

2. List out the significance of dimensionless numbers .

3. Recognize problems and develop solutions for steady state conduction

Course Outcome 3(CO3):

1. State the basic law of mass transfer

2. Give example for diffusion and its types

3. Mention the types of distillation

Course Outcome 4 (CO4):

1. List out the unit operations in food allied industries

2. Give examples and types of absorption tower

3. Describe the constructional features of distillation tower

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD SEMESTER B.TECH DEGREE MODEL EXAMINATION, DECEMBER 2020			
Course Code: FTT202			
Course Name: FUNDAMENTALS OF HEAT AND MASS TRANSFER			
Max. Marks: 100			Duration: 3 Hours
PART A			
		Answer full questions, each carries three marks.	Marks
1		What are the three modes of heat transfer?	(3)
2		Define thermal conductivity. Give its unit.	(3)
3		What is forced convection and free convection? Give example for each	(3)
4		What s overall heat transfer coefficient and individual heat transfer coefficients?	(3)
5		What is LMTD?	(3)
6		State Stefan-Boltzmann law of radiation	(3)
7		How heat transfer differs from mass transfer?	(3)
8		State Ficks law.	(3)
9		What are the types of tower packings?	(3)
10		Define reflux ratio.	(3)
PART B			
Answer ONE question from each, each carries 14 marks.			
11		Derive the heat conduction equation for cylinder and composite wall.	(14)
		OR	
12		Derive the one dimensional steady state equation.	(14)

13		Explain the regimes of heat transfer.	(14)
		OR	
14		Derive the dimensionless numbers used in forced convection.	(14)
15		A counter flow heat exchanger with a heat transfer area of 17.5 m^2 is to be used to cool oil (C_p of oil is 1.9kJ/kg.K)at 473 K .The oil flow rate is 2.77kg/s. Water at 293 K is available as a cooling medium . It flows at a rate of 0.83 kg/s. Calculate the exit temperatures of oil and water if the overall heat transfer coefficient is 300W/m^2K	(14)
		OR	
16		Derive the LMTD expression for parallel flow heat exchanger	(14)
17		Explain in detail about the mass transfer theories in fluid flow.	(14)
		OR	
18		Derive the steady state diffusion of gas and liquids.	(14)
19		Explain in brief McCabe-Thiele method used for obtaining theoretical plates required for given degree of separation.	(14)
		OR	
20		How will you design a packed tower absorber.	(14)
		****	

Syllabus

Module 1

Mechanisms and modes of heat transfer-conduction and Fourier law - Thermal conductivity of solid liquid and gases, General Heat conduction Equation, Heat conduction in Plane wall, cylinder, sphere for single and composite resistances , Concept of Individual and Overall heat transfer Coefficient-Critical Thickness of Insulation – wall, cylinder and sphere, Introduction to Lumped Capacity Systems and its derivation-problems related to heat conduction.

Module 2

Basics and concepts ,Types of Convection – Free convection – Forced Convection , heat transfer coefficient and overall heat transfer coefficient ,factors affecting heat transfer coefficients, Dimensional Analysis by Buckingham Theorem for forced convection– Types of Boiling and Condensation ,importance of boilers and condensers, dimensionless numbers used in heat transfer.

Module 3

Radiation heat transfer- Basic Concepts, Laws of Radiation – Stefan Boltzmann Law, Kirchoffs law Weins displacement law, Black Body Radiation, Heat Exchanger equipment – classification and constructional details-Heat Exchanger Analysis – LMTD Method and NTU method - Effectiveness – Overall Heat Transfer Coefficient – Fouling Factors

Module 4

Molecular diffusion, Fick's Law, concentration , mass flux, Steady State molecular diffusion of A through stagnant gas B and equimolar counter diffusion in liquids , Application; Mass Transfer coefficients: Types of mass Transfer Coefficient ,Dimensionless Groups in Mass Transfer ,types of diffusion, Theories of Mass Transfer , Analogies in Transport Phenomenon, Raoult's Law and Henry's Law .

Module 5

Gas absorption- Packed tower and plate tower- types and properties of packing , choice of solvent ,solubility of gas in liquid, Design principles of absorbers; Industrial absorbers; Distillation- relative volatility , types of distillation, principles of rectification, V-L Equilibria; Simple, Steam and Flash Distillation; McCABE-THIELE method for number of plates ,reflux ratio and its importance-constructional features and process of Industrial distillation equipment, HETP, HTU and NTU concepts.

Text Books

1. Geankoplis C.J. Transport Processes and Unit Operations, 3rd edition Prentice Hall of India, 2002

2. Coulson and Richardsons, Chemical Engineering ,Vol I& II, Asiali Books Pvt ltd,1998

Reference Books

1. Treybal R. E.: "Mass Transfer Operations" 3rd edition. McGraw Hill, 1981

2. Binay K Dutta "Principles of Mass Transfer and Separation Processes" PHI Learning Private Ltd

3.Yunus A Cengel, Heat and Mass Transfer: A practical Approach, 3rd edition McGraw Hill, 2006

4. J P Holman , "Heat transfer" edition, McGraw Hill

Course Contents and Lecture Schedule

No	Topics	No. of Lectures
1	CONDUCTION	9
1.1	Mechanisms and modes of heat transfer-conduction and Fourier law	3
1.2	Heat conduction in Plane wall, cylinder, sphere for single and composite resistances , Concept of Individual and Overall heat transfer Coefficient	3
1.3	Introduction to Lumped Capacity Systems and problems related to heat conduction	3
2	CONVECTION	9
2.1	Basics and concepts ,Types of Convection – Free convection – Forced Convection , heat transfer coefficient and overall heat transfer coefficient	3
2.2	factors affecting heat transfer coefficients, Dimensional Analysis by Buckingham Theorem for forced convection	3
2.3	Types of Boiling and Condensation ,importance of boilers and condensers, dimensionless numbers used in heat transfer	3
3	RADIATION	9
3.1	Radiation heat transfer- Basic Concepts, Laws of Radiation – Stefan Boltzmann Law, Kirchoffs law ,Weins displacement law, Black Body Radiation	3
3.2	Heat Exchanger equipment – classification and constructional details- Heat Exchanger Analysis	3
3.3	LMTD Method and NTU method - Effectiveness – Overall Heat Transfer Coefficient – Fouling Factors	3
4	MOLECULAR DIFFUSION IN FLUIDS AND SOLIDS	9
4.1	Molecular diffusion, Fick's Law, concentration ,mass flux, Steady State molecular diffusion of A through stagnant gas B and equimolar counter diffusion in liquids	3
4.2	Application; Mass Transfer coefficients: Types of mass Transfer Coefficient ,Dimensionless Groups in Mass transfer	3
4.3	Types of diffusion, Theories of Mass Transfer , Analogies in Transport Phenomenon, Raoult's Law and Henry's Law .	3
5	ABSORPTION AND DISTILLATION OPERATIONS	9
5.1	Gas absorption- Packed tower and plate tower- types and properties of	3

	packing , choice of solvent ,solubility of gas in liquid, Design principles of absorbers; Industrial absorbers	
5.2	Distillation- relative volatility , types of distillation, principles of rectification, V-L Equilibria; Simple, Steam and Flash Distillation; McCABE-THIELE method for number of plates ,reflux ratio and its importance	3
5.3	Constructional features and process of Industrial distillation equipment, HETP, HTU and NTU concepts.	3

FTT 204	Engineering Properties of Food Materials	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the basic area of engineering properties of food. This course is very essential for learning the effect of properties of food in the storage, processing and handling of food material.

Prerequisite:

Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the physical, aero and hydrodynamic properties of food materials and their methods of measurement.
CO 2	Apply the theoretical knowledge of frictional properties of food materials in calculating pressure distribution in storage structures.
CO 3	Recognize thermal, electrical and electromagnetic properties food and their measurement techniques.
CO 4	Apply the knowledge of rheological properties to improve the qualitative and quantitative attributes of food.
CO 5	Understand methods for the measurement of texture of food material.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2										1
CO 2	3	2	2									1
CO 3	2	2	3									1
CO 4	2	2										1
CO 5	2	3										1

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10

Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State the definitions of following properties: -
   a. various physical properties such as volume, density, porosity and surface area.
   b. surface properties Helmholtz free energy, excess interfacial energy, work of cohesion and work of adhesion.
   c. Aero and hydrodynamic properties such as terminal velocity and drag force.
2. Describe the methods of measurement of size, shape, volume, apparent density, material density, bulk density, true density, surface area, porosity.
3. Derive the equation for terminal velocity for spherical and non spherical bodies and Gibbs adsorption theorem.

Course Outcome 2 (CO2)

1. State the definition of law of friction, kinetic friction, static friction, coefficient of friction, rolling resistance, angle of repose, angle of internal friction and angle of wall friction.
2. Describe the effect of various load and properties of contacting bodies, sliding velocity and contact surface temperature, water film and surface roughness on friction.
3. Describe the methods of measurement of angle of repose and the factors
4. Derive the various equation for calculating the lateral pressure in the designing of storage bins.

Course Outcome 3(CO3):

1. State the various basic definitions related to thermal, electrical and electromagnetic properties.
2. Describe the methods of measurement of thermal properties.
3. Describe the effect of surrounding conditions on boiling and freezing points of food.

Course Outcome 4 (CO4):

1. State the various basic concepts and definitions of rheology
2. Describe the classification of rheology, physical state of matter and classical ideal materials
3. Illustrate the various force deformation behaviour like uniaxial compression, tension, shear, bending

Course Outcome 5 (CO5):

1. Discuss the importance of texture in the food analysis
2. Describe the subjective and objective measurement of texture
3. Illustrate the texture profile method, dynamic test for evaluation of food texture
4. Describe the firmness and hardness of food material and the factors affecting them

Model Question paper

			Total Pages:
Reg No.:_______________		Name:___________________________	

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MAY2020

Course Code: FTT 204

Course Name: ENGINEERING PROPERTIES OF FOOD MATERIALS (FT)

Max. Marks: 100	Duration: 3 Hours

PART A

		Answer all questions, each question carries 3 marks.	Marks
1		Describe the roundness and sphericity	3
2		Detail the equation of terminal velocity	3
3		What is rolling resistance	3
4		Elucidate law of friction	3
5		List out food processing methods using dielectric properties of food	3
6		What is boiling point elevation and freezing point depression?	3
7		Explain viscoelasticity	3
8		What is Newtonian fluid?	3
9		Explain the factors affecting hardness	3
10		Elucidate the working of texture profile analysis	3

PART B

Answer any one question from each or question, each carries 14 marks

11	a)	What is porosity? Describe the density methods of measurement of porosity	(7)
	b)	With neat diagram, explain the gas pycnometer methods of density	(7)

		measurement	
		OR	
12	a)	What is terminal velocity? Derive the equation of terminal velocity for spherical bodies	(7)
	b)	Derive Gibbs adsorption theorem.	(7)
13	a)	What is angle of repose? Explain the method of measurement of the angle of repose	(7)
	b)	What is law of friction? Explain the effect of load and properties of contacting bodies on the frictional force between two contact surfaces	(7)
		OR	
14	a)	Derive the equation for pressure distribution in a bin	(10)
	b)	Differentiate between angle of internal friction and angle of wall friction.	(4)
15	a)	Describe thermal conductivity and methods of measurement of it.	(11)
	b)	Define the following:- 1. Enthalpy 2. Thermal diffusivity 3. Freezing point	(3)
		OR	
16	a)	What are the L*a*b colour system?	(7)
	b)	How are specific heat of food determined?	(7)

17		How is rheology classified? Explain the classification of flow in food products	(14)
		OR	
18		Describe the force deformation behaviour of the food products	(14)
19	a)	What is the importance of texture in the quality analysis of food materials?	(5)
	b)	Explain the subjective measurement of texture analysis	(9)
		OR	
20	a)	Define hardness and firmness	(4)
	b)	With neat diagram, explain the texture profile analysis	(10)
		****	

Syllabus

Module 1

Physical, Aero and hydrodynamic properties
Shape and size – criteria for describing shape and size Volume and methods of measurement of volume, Density, Types, Method of measurement of apparent density, material density, particle density, bulk density, true density Porosity, types, methods of measurement of porosity Surface area measurement for fruits and vegetables, egg surface area, pore surface area

Drag coefficient, terminal velocity – for spherical and non- spherical bodies. Surface properties – Gibb's Adsorption equation.

Module II

Frictional properties:

Laws of friction, effect of load and properties of contacting bodies. Effect of sliding velocity and contact surface temperature, effect of water film and surface roughness. Rolling resistance, angle of repose, angle of internal friction, pressure distribution in storage structures and compression chambers.

Module III

Thermal, electrical, and electromagnetic properties:

Thermal conductivity, measurement of thermal conductivity, Specific heat, measurement of specific heat, enthalpy, thermal diffusivity boiling point, freezing point colour, measuring equipments, L*a*b system, dielectric properties

Module IV

Rheological properties:

Basic concepts and definitions –classification - physical states of matter – classical Ideal materials – viscoelasticity. Force deformation behaviour – stress strain behaviour – uniaxial compression, tension, shear, bending. Elastic plastic behaviour

Module V

Texture of food materials:

Subjective measurements – physiological aspects, psychological aspects, mechanical aspects. Imitative measurements- equipments used, texture profile analysis, dynamic test for evaluation of food texture, mechanical test applicable to food materials – firmness and hardness, mechanics of hardness, dynamic hardness, effect of age, water content and temperature on texture of foods.

Text Books

1.Mohensenin N N, *Physical properties of plants animal materials, Gordon and Breach publishers, New York, 1980*
2. Rao M A , Rizvi S S H,Azim K Datta and Jasim Ahmed, *Engineering properties of foods* 4th Ed., CRC Press, 2014
3. K M Sahay and K K Singh, *Unit operations of Agricultural Processing*, Second edition, Vikas Publishing India Pvt Ltd, 2004
4. Ignacio Arana, Physical Properties of Foods Novel Measurement Techniques and Applications, 1st edition, CRC Press, 2016

Reference Books

1. Singhal,O.P. and Samuel,D.V.K, *“Engineering Properties of Biological Materials”.* Saroj Prakasan, Allahabad 2003.
2. Peleg, M.and BagelayE.B., *“Physical properties of foods”.* AVI publishing Co. USA 1983.

Course Contents and Lecture Schedule

No	**Topic**	**No. of Lectures**
1	**Physical, aero and hydrodynamic properties**	10
1.1	Shape and size – criteria for describing shape and size Volume and methods of measurement of volume,	2
1.2	Density, Types, Method of measurement of apparent density, material density, particle density, bulk density, true density	2
1.3	Porosity, types, methods of measurement of porosity Surface area measurement for fruits and vegetables, egg surface area, pore surface area	2
1.4	Drag coefficient, terminal velocity – for spherical and non-spherical bodies.	2
1.5	Surface properties – Gibb's Absorption equation.	2
2	**Frictional Properties**	**9**
2.1	Laws of friction	2
2.2	effect of load and properties of contacting bodies. Effect of sliding velocity and contact surface temperature, effect of water film and surface roughness.	3
2.3	Rolling resistance, angle of repose, angle of internal friction	2
2.4	pressure distribution in storage structures and compression chambers.	2
3	**Thermal, electrical, and electromagnetic properties**	**9**
3.1	Thermal conductivity, measurement of thermal conductivity	2
3.2	Specific heat, measurement of specific heat	2
3.3	enthalpy, thermal diffusivity, boiling point, freezing point , moisture content, water activity	3
3.4	colour, measuring equipments, L*a*b system, dielectric properties	2
4	**Rheological properties:**	**8**
4.1	Basic concepts and definitions and classification of rheology	2
4.2	physical states of matter – classical Ideal materials – viscoelasticity	2
4.3	Force deformation behaviour – stress strain behaviour – uniaxial compression, tension, shear, bending.	4
4.4	Elastic plastic behaviour	1
5	**Texture of food materials:**	**9**
5.1	Subjective measurements – physiological aspects, psychological aspects, mechanical aspects	2
5.2	Imitative measurements – equipments used	1

5.3	Texture profile method, dynamic test for evaluation of food texture	2
5.4	Mechanical test applicable to food materials	1
5.5	Firmness and hardness , mechanics of hardness, dynamic hardness	2
5.6	Effect of age, water content and temperature on texture of foods	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

FTT 206	FOOD ENGINEERING THERMODYNAMICS AND REACTION KINETICS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the basic area of Engineering Thermodynamics and reaction Kinetics. This is essential for the better understanding the relationships of thermodynamics properties with the characteristic reactions in food industry and correlate their kinetics. This course will give students a clear vision about the complexities of real food technology problems which are industrial oriented. On completion of the course, learner will be able to apply various laws of thermodynamics to various processes and real systems and the concept of Entropy, Calculate heat, work and other important thermodynamic properties for various ideal gas processes.

Prerequisite: Basic mathematical knowledge in integration, differentiation and basic principles of applied chemistry.

Course Outcomes: After the completion of the course the student will be able to

CO 1	**Identify** the unique vocabulary associated with thermodynamics and the basic concepts of thermodynamics .
CO 2	**State and prove** the equivalence of two statements of second law of thermodynamics and evaluate the limitations of first law of thermodynamics**.**
CO 3	**Explain** the thermodynamic properties of pure fluids.
CO 4	**Understand** the concept of reaction rates how to express the rate of reactions.
CO 5	**Explain** the use integrated first-order,second-order rate laws and the concept of activation energy .
CO 6	**Understand** the application of reactors and Explain how enzymes act as biological catalysts and how they interact with specific substrate molecules

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	1									
CO 2	1	2	3									
CO 3	3						1					
CO 4	3											1
CO 5	3											
CO 6	2			3								1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	30
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the terms closed and open systems.

2. Describe the P-V-T behaviour of pure fluids.

3. Explain the applications of Vander Waals equation

Course Outcome 2 (CO2)

1. Derive the equation for calculating the efficiency of a Carnot's engine

2. Explain the Equivalence of Clausius and Kelvin planks statement for second law of thermodynamics.

3. State and explain third law of Thermodynamics

Course Outcome 3(CO3):

1. Explain the importance of Maxwell's equation in explaining the thermodynamic properties of pure fluids.

2. Explain the effect of Pressure and temperature heat capacities of fluids.

3. Elaborate different types of thermodynamic diagrams.

Course Outcome 4 (CO4):

1. Explain the factors affecting the rate of reactions.

2. Explain the effect of concentration of reactants in determining the rate of reaction.

3. Explain collision and transition state theory in terms of temperature dependency in rate of reactions

Course Outcome 5 (CO5):

1. Explain Integral and Differential methods in rate analysis.
2. Derive the second order rate equation using integral method of analysis
3. Differentiate integral and differential methods of rate analysis.

Course Outcome 6 (CO6):

1. Explain the working of reactors.
2. Derive the Monod equation for describing the cell growth Kinetics.
3. Differentiate space time and space.

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Model Question paper

Model Question paper

QP CODE: **PAGES: 2**

Reg No: ______________

Name: ______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 206

Course Name: FOOD ENGINEERING THERMODYNAMICS AND REACTION KINETICS

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions.

Each question carries 3 Marks

1. What is meant by closed and open systems?
2. Explain Zeroth law of thermodynamics.
3. Explain the limitations of first law of thermodynamics
4. State second law of thermodynamics.
5. Describe the significance of Helmoltz free energy and Gibbs free energy
6. Explain the significance fundamental thermodynamic property relations
7. What are the different forms of expressing the rate of reaction?
8. Explain the role of intermediate complexes in the mechanism of non-elementary reactions
9. Write short notes on variable volume batch reactors
10. Discuss different methods of analysis of performance equation of reactors

PART B

Answer any one Question from each module.

Each Question carries 14 Marks

11. With neat representation explain

a) The P-V-T behaviour of pure fluids. (6)

b) The phase behaviour of water (8)

OR

12. Prove that for reversible non-flow process dH=dQ at constant pressure and dU=dQ at constant volume? (14)

13. The efficiency of Carnot engine $\eta = (T_1-T_2)/T_1$, Where T_1 is high temperature reservoir and T_2 is low Temperature reservoir (14)

OR

14. (a) Discuss the equivalence of kelvin Planck's and Clausius statement of second law of Thermodynamics. (9)

(b) Show that Ideal gas temperature and Absolute thermodynamic scale are identical (5)

15. (a) Discuss the effect of temperature, pressure and volume on internal energy,enthalpy,and entropy based on thermodynamic relations (14)

OR

16. (a) What is meant by fugacity of pure fluids? Discuss the effect of pressure and temperature on fugacity (9)

(b) Explain the significance fundamental thermodynamic property relations (5)

17. (a) Differentiate molecularity and order of a reaction. (6)

(b) Explain the characteristics of the integral rate equation of reaction of the form A→Products (8)

OR

18. (a) What are different methods of determination of performance equations of reactors and explain any two in detail (8)

(b) Derive the integrated rate equation for an autocatalytic reaction A + R------->R + R (6)

19. (a). Explain Michaelis Menten kinetics in explaining the fundamentals of enzymatic reactions. (9)

(b) Discuss the Monod Equation in study of cell growth kinetics. (5)

OR

20.(a)With neat sketches explain the working of any two bioreactors (9)

(b) Discuss different methods of analysis of performance equation of reactors (5)

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KTU
Estd.
2014

Syllabus

Module 1

Introduction: Fundamental concepts and definitions - closed, open and isolated system - intensive and extensive properties - path and state functions - reversible and irreversible process temperature - Zeroth law of thermodynamics - First law of thermodynamics - internal energy- enthalpy - heat capacity - first law for cyclic, non-flow and flow processes - applications -P-V-T behaviour of pure fluids - ideal gases and ideal gas processes - equations of state -Vander Waals equation

Module 2

Thermodynamics: Second law of thermodynamics - limitations of first law - general statements of second law - concept of entropy - calculation of entropy changes - Carnot's principle -absolute scale of temperature - Clausius inequality - entropy and irreversibility – statistical explanation of entropy - Third law of thermodynamics

Module 3

Thermodynamic Properties: Thermodynamic properties of pure fluids - Gibbs free energy, work function - Maxwell's equations - Clapeyron equation-entropy-heat capacity relationships - equations for entropy, internal energy and enthalpy in terms of measurable quantities - effect of temperature and pressure on U, H and S - relationship between CP and CV - effect of pressure and volume on heat capacities - Joule-Thomson coefficient - Gibbs - Helmholtz equation- Thermodynamic diagrams - fugacity and activity of pure fluids - selection of standard state - determination of fugacity of pure gases and liquids - effect of temperature and pressure on fugacity and activity.

Module 4

Overview of chemical reaction engineering. Classification of chemical reactions. Variables affecting the rate of reaction. Definition of reaction rate. Kinetics of homogeneous reaction. Concentration dependent term of rate equation. Temperature dependent term of rate equation. Temperature dependency from Arrhenius law, Collision theory and transition state theory. Reaction Kinetics: Analysis of rate equations –Interpretation of batch reactor data: integral and differential method of rate analysis. Integral method; irreversible first order, second order and third order type reactions, zero order reactions.

Module 5

Evaluation of laboratory reactors, Integral (fixed bed) reactor, stirred batch reactor, stirred contained solid reactor (SCSR), Differential reactors: Continuous stirred tank reactor (CSTR), Laminar flow, plug flow reactors.
Ideal reactors: concept of ideality, Design equations for batch, tubular and stirred tank reactors. Space time and space velocity, steady state mixed flow.

Enzymatic reaction fundamentals, Michaelis - Menten kinetics, Batch reactor calculations for enzymatic reactions. Bioreactors cell growth kinetics- Monod equation.

Text Books

1. Smith J. M. & Van Ness H.V., Introduction to Chemical Engineering Thermodynamics, McGraw Hill ,7th Edition
2. Narayanan K. V., A Textbook of Chemical Engineering Thermodynamics, Prentice-Hall of India
3. Levenspiel O., Chemical Reaction Engineering, John Wiley ,3rd Edition ,1998

Reference Books

1. Y.V.C. Rao, Chemical Engineering Thermodynamics, Universities Press,1997.
2. Fogler H.S., Elements of Chemical Reaction Engineering, Prentice Hall of India,4th 1998
3. Smith J.M., Chemical Engineering Kinetics, McGraw Hill.3rd Edition.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to thermodynamics**	**9**
1.1	Fundamental concepts and definitions - closed, open and isolated system - intensive and extensive properties - path and state functions - reversible and irreversible process temperature.	2
1.2	Zeroth law of thermodynamics - First law of thermodynamics - internal energy- enthalpy - heat capacity - first law for cyclic, non-flow and flow processes - applications.	3
1.3	P-V-T behaviour of pure fluids - ideal gases and ideal gas processes - equations of state -Vander Waals equation	4
2	**Thermodynamics**	**8**
2.1	Second law of thermodynamics - limitations of first law - general statements of second law - concept of entropy - calculation of entropy changes.	3
2.2	Carnot's principle -absolute scale of temperature - Clausius inequality - entropy and irreversibility – statistical explanation of entropy.	4
2.3	Third law of thermodynamics	1
3	**Thermodynamic Properties**	**10**
3.1	Thermodynamic properties of pure fluids - Gibbs free energy, work function - Maxwell's equations-Clapeyron equation-entropy-heat capacity relationships.	3
3.2	Equations for entropy, internal energy and enthalpy in terms of measurable quantities - effect of temperature and pressure on U, H and S - relationship between CP and CV - effect of pressure and volume on heat capacities.	3
3.3	Joule-Thomson coefficient - Gibbs - Helmholtz equation.	1
3.4	Thermodynamic diagrams - fugacity and activity of pure fluids - selection of standard state - determination of fugacity of pure gases and liquids - effect of temperature and pressure on fugacity and activity.	3
4	**Overview of chemical reaction engineering.**	**8**
4.1	Classification of chemical reactions. Variables affecting the rate of reaction. Definition of reaction rate. Kinetics of homogeneous reaction. Concentration dependent term of rate equation. Temperature dependent term of rate equation.	3
4.2	Temperature dependency from Arrhenius law, Collision theory and transition state theory.	1
4.3	Reaction Kinetics: Analysis of rate equations –Interpretation of batch reactor data: integral and differential method of rate	4

	analysis. Integral method; irreversible first order, second order and third order type reactions, zero order reactions	
5	**Evaluation of laboratory reactors**	**10**
5.1	Integral (fixed bed) reactor, stirred batch reactor, stirred contained solid reactor (SCSR), Differential reactors: Continuous stirred tank reactor (CSTR), Laminar flow, plug flow reactors.	3
5.2	**Ideal reactors:** concept of ideality, Design equations for batch, tubular and stirred tank reactors. Space time and space velocity, steady state mixed flow.	4
5.3	Enzymatic reaction fundamentals, Michaelis-Menten kinetics, Batch reactor calculations for enzymatic reactions. Bioreactors cell growth kinetics- Monod equation	3

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

Course No.	Course Name	L-T-P - Credits	Year of Introduction
FTL202	**Food Microbiology Lab – II**	**0-0-3-2**	**2020**

Preamble: Goal of this course is to develop the knowledge of students in the core area of Food Microbiology. This is essential for the better understanding of various techniques for qualitative or quantitative microbiological evaluation of food as well as food products and identification of microorganisms.

Prerequisite: Food Microbiology Lab – I

Course Outcomes: After the completion of the course the student will be able to

CO 1	Evaluate the total microbial load in the food or in the environment
CO 2	Identify suitable methods for qualitative evaluation of food
CO 3	Identify suitable methods for quantitative evaluation of food
CO 4	Demonstrate the procedure for identification of specific microorganism in food
CO 5	Demonstrate the usage of beneficial microorganism for production of food

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1		3	2								2
CO 2	2		3	2								2
CO 3	2		3	2								3
CO 4	2		3	3								3
CO 5	2		3	3								3

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	: 15 Marks
(b) Implementing the work/Conducting the experiment	: 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting)	: 25 Marks
(d) Viva voce	: 20 marks
(e) Record	: 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Evaluation of microbiological quality of potable water
2. Perform microbial examination of Fruit/ vegetable sample by surface washing and internal tissue
3. Estimation the microbial count inside microbiology sample by testing air sample

Course Outcome 2 (CO2)

1. Demonstrate the microbiological quality of milk using MBRT
2. Perform presumptive test for Coliforms for identification of the presence
3. Detection of bacteria in spoiled tinned foods

Course Outcome 3(CO3):

1. Enumerate the number of microorganism using Standard plate count (SPC) method
2. Perform MPN test for analysing microbial quality of milk/water
3. Isolation and enumerate microbial load from ready to eat street foods

Course Outcome 4 (CO4):

1. Perform the methods for identification of *Escherichia coli*/ *Staphylococcus aureus*
2. Demonstrate the method for detection of bacteria in spoiled tinned foods
3. Isolation and enumerate *Staphylococci* from ready to eat street foods

Course Outcome 5 (CO5):

1. Demonstrate microbial production of fermented dairy product
2. Demonstrate microbial production of fermented beverage

List of Exercises/Experiments : (Minimum 12 are mandatory)

1. Evaluation of microbiological quality of milk (MBRT)
2. Quantitative analysis of milk by Standard plate count (SPC) method.
3. Presumptive test for Coliforms in milk
4. Evaluation of microbiological quality of potable water
5. Sample preparation to detect microbial contamination in food samples
6. Evaluation of microbiological quality of food products
7. Microbial Examination of Fruit sample-surface washing and internal tissue
8. Microbial Examination of Vegetable sample-surface washing and internal tissue
9. Demonstration of microbial production of curd
10. Demonstration of microbial production of wine
11. Counting for yeasts and moulds
12. Methods for identification of *Escherichia coli*
13. Methods for identification of *Staphylococcus aureus*
14. Methods for identification of *Bacillus cereus*
15. Methods for identification of *Vibrio cholerae*
16. Detection of bacteria in spoiled tinned foods
17. Enumeration & Isolation of Staphylococci from ready to eat street foods
18. Estimation of microbial count of air.

Text Book:

1. James Cappuccino, Microbiology: A Laboratory Manual, 10th edition., Natalie Sherman. Pearson Higher education
2. R C Dubey and D K Maheshwary, Practical Microbiology, S. Chand & Co. Ltd., 2006
3. Prescott's Microbiology w/ Harley Lab Manual 8th Ed. Joanne Wiley. McGraw Hill education
4. Bibek Ray, Fundamental Food Microbiology, CRC press

FTL 204	ENGINEERING PROPERTIES OF FOOD MATERIALS LAB	CATEGORY	L	T	P	CREDIT
		PCC	0	0	3	2

Preamble: The course is designed to demonstrate and illustrate the physical, thermal, aerodynamic frictional and rheological properties of food. Goal of this course is to develop the practical knowledge of students in identifying various engineering properties of food.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand and practice different techniques for determining the physical properties of food such as density, volume, porosity, surface area, shape and size
CO 2	Understand and practice different techniques for determining the thermal properties of food such as thermal conductivity, specific heat etc
CO 3	Understand and practice different techniques for determining the frictional properties of food such as coefficient of friction, angle of repose etc
CO 4	Understand, explain and use equipments for size reduction, conveying and separation of food materials
CO 5	Understand, explain and use equipments for bursting strength, terminal velocity and ohmic heating
CO 6	Learn to design and carry out scientific experiments as well as accurately record and analyse the results of such experiments

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				2							1
CO 2	3				2							1
CO 3	3				2							1
CO 4	3				2							1
CO 5	3				1							1
CO 6	3				1							1

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Assessment	:	30 marks
Internal Test (Immediately before the second series test)	:	30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work : 15 Marks
(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting) : 25 Marks
(d) Viva voce : 20 marks
(e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

LIST OF EXPERIMENTS **(12 Experiments Mandatory)**

1. Determination of firmness of fruits and vegetables.
2. Determination of size and shape of various food products.
3. Determination of volume, true density and bulk density of various food products.
4. Study on particle size distribution of various food grains using sieve analysis.
5. Determination of thermal conductivity of foods.
6. Estimation of surface area of fruits and vegetables.
7. Experiment on size reduction of solid foods using milling equipments.
8. Determination of specific heat of solid foods.
9. Determination of viscosity of foods by rotational viscometer.
10. Determination of porosity of foods using air pycnometer.
11. Determination of the efficiency of drum dryer.
12. Study on bucket elevator and determination of optimum capacity.
13. Study on experiment on ohmic heating.
14. Determination of bursting strength of various packaging materials.
15. Determination of terminal velocity of the given material.
16. Determination of efficiency of separation of various food products using inclined belt separator.
17. Determination of efficiency of separation of various food products using spiral separator.
18. Determination of mixing index of different grains.

Reference Books

1. 1. Rao M.A. and Rizvi, S.S.H. *"Engineering Properties of Foods", Marcel Dekker, New York, 1986.*

2.Sergio O Serna Saldivar, Cereal grains laboratory references and procedure manual, Taylor and Francis group, 2012

3.Nuri N Mohsenin, Physical properties of plant and animal materials, second edition, Gordon and research science publishers, 1986

SEMESTER -4

MINOR

FTT 282	FOOD PROCESS ENGINEERING	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble:

Objective of this course is to make students understand fundamental theories behind general process involved in commercial processing of food and major equipment types used for each process. The operation starts from the collection stage of raw material at producer level to its transformation into final consumption form till it reaches the consumer.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will

CO 1	Describe the mechanism of transportation, storage, cleaning, peeling and size reduction of food materials
CO 2	Understand and comprehend the principles of high temperature application in pasteurizers, sterilizers and evaporators.
CO 3	Apply preservation methods that make use of refrigerated processing and drying in processing equipment types.
CO 4	Illustrate the construction and operation principles of filtration, sedimentation, centrifugation, agitation and extrusion in food processing.
CO 5	Gain knowledge in process and machinery involved in conveying, filling and packing of food products and cleaning methods in food industries.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	-	-	1	-	-	-	-	-	-
CO 3	3	2	2	-	-	1	-	-	-	-	-	1
CO 4	3	2	2	-	-	-	-	-	-	-	-	-
CO 5	3	1	2	-	-	-	-	-	-	1	-	-

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	30	30	50
Apply	10	10	15
Analyse			5
Evaluate			5
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

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Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain different methods of precooling of raw food.
2. Describe wet cleaning methods of raw food material.
3. How will you sort food material by size and shape mechanically?

Course Outcome 2 (CO2)

1. Explain construction of an LTLT pasteurizer
2. What are direct and indirect type heating systems used for UHT treatment?
3. How are evaporators classified?

Course Outcome 3(CO3):

1. What are the main components of a VC refrigeration system?
2. Explain freezing kinetics?
3. Explain about drying rate curves.

Course Outcome 4 (CO4):

1. Derive filtration rate equations at constant rate and pressure drop.
2. How settling velocity is calculated in sedimentation
3. Explain working of a twin screw extruder

Course Outcome 5 (CO5):

1. Describe working and features of a bucket elevator.
2. What are common materials used for food packaging
3. Distinguish between COP and CIP in cleaning process.

Model Question paper

QP CODE: **PAGES: 2**

Reg No:______________

Name :______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,

MONTH & YEAR

Course Code: FTT 282

Course Name: Food Process Engineering

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Distinguish between perishable, semi-perishable and non-perishable foods with examples.
2. How flash steam peeling of food is done?
3. Analyze material balance in a single effect evaporator
4. How is UHT treatment of food done?
5. What is meant by IQF?
6. Explain the importance of EMC in drying process.
7. Justify centrifugal separation is better than gravitational separation.
8. Analyse how baffles are important in agitators.
9. Why do we need proper packaging of processed foods?
10. Describe extrusion process.

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. (a) How refrigerated transportation of food materials are done by road (8)

(b) Explain dry cleaning methods adopted in food processing industries. (6)

OR

12. a) How energy requirement for size reduction are calculated using Kick's, Bond's and Rittinger's law.
(9)

b) Explain working of a colour sorter.
(5)

13. Schematically represent working of an LTLT pasteurizer and an HTST pasteurizer (14)

OR

14. Explain working of batch sterilization and continuous sterilization retorts. (14)

15. (a) Explain the construction and working of Spray dryer for food with neat sketch. (9)

b) Illustrate components of a VC refrigeration system.
(5)

OR

16. Explain working of indirect and direct contact systems of freezers.
(14)

17. Explain the working of pressure type and vacuum type filters.
(14)

OR

18. Describe the working of agitation equipment types used for mixing of solid foods and liquid foods.
(14)

19. Describe structure and working of conveyors used for conveying unpackaged food material in industries. (14)

OR

20. Explain working of solid food and liquid food fillers.
(14)

21.

Syllabus

Module 1

Collection, storage and primary processing of food raw materials

Perishable, semi perishable and non-perishable foods; Non refrigerated, refrigerated transportation Precooling – room cooling, forced air cooling, package icing, hydro cooling, vacuum cooling, evaporative cooling; Storage in bins, silos, bag storage, warehouses,

Cleaning of raw materials – Dry cleaning and wet cleaning; Pre-treatment – blanching, sulphur dioxide dipping; Sorting and grading according to size, shape, weight, colour
Peeling - Flash steam peeling, knife peeling, abrasion peeling, caustic peeling, flame peeling
Size reduction - Energy consumption laws- Rittinger's law, Kick's law, Bond's law; Size reduction equipments for solids – Impact mills, pressure mills, attrition mills, cutters, choppers, shredders, pulpers; Size reduction liquid foods - Homogenization, homogenizers

Module 2

Thermal Processing and concentration process:

Pasteurization - Pasteurization of packed foods- water bath, continuous steam, tunnel pasteurization
Pasteurization of non-packed foods- Low Temperature Long Time (LTLT) pasteurization, LTLT pasteurizer; High Temperature Short Time (HTST) pasteurization, HTST pasteurizer
Sterilization –Unpacked foods- Ultra High Temperature treatment- direct and indirect heating types; Packaged food sterilization - Batch sterilization, continuous sterilization retorts - hydrolock sterilizer, hydrostatic cooker
Aseptic processing and packaging- Tetrapak, Vertical and Horizontal Form Fill Seal machines.
Evaporation, types of evaporators- short tube, falling film, natural and forced circulation, rising film, Material and energy balance in single effect evaporator.

Module 3

Refrigeration and Drying process:

Recommended storage temperatures of foods; Refrigerated storage; Components of a vapour compression refrigeration system
Chilling, Freezing- Freezing systems- indirect contact systems, direct contact systems - Still air freezer, air blast freezer, tunnel freezer, belt freezer, spiral belt freezer, fluidized bed freezer, plate freezer, liquid immersion freezer, cryogenic freezers, liquid food freezers, Individual Quick Freezing.
Freezing kinetics of food and water, nucleation, super cooling, crystal growth
Drying process- drying rate curves, bound moisture, unbound moisture, free moisture, Equilibrium Moisture Content (EMC), sorption isotherm
Dryers – cabinet dryer, tunnel dryer, belt dryer, spray dryer, drum dryer, rotary dryer, freeze dryer

Module 4

Supplementary process:

Filtration- process, cake formation, constant rate and constant pressure drop filtration equations; Filters - frame press filters, rotary vacuum filter
Sedimentation, sedimentation velocity; Centrifugation, separation velocity, centrifugal separators
Mixing process, mixing index agitation equipment, role of baffles; Equipment types for solid mixing, liquid mixing, kneading
Extrusion process, single screw extruder components, regions, twin screw extruder – structure, working

Module 5

Handling and Packing of food. Cleaning of processing plant:

Food handling equipment considerations; Structure and working of industrial food conveyors- Bucket elevator, Belt conveyor, Chain conveyor, Screw conveyor, Pneumatic conveyor
Packaging functions; Packaging types- rigid packages, flexible packages; Packaging materials- paper, plastics, metals, bottle, wood, textiles; Labelling
Solid fillers- count wise, weight wise; Liquid fillers- gravimetric fillers, volumetric fillers; Bottling, Cartoning, Shrink wrapping
Clean Out Place, Clean in Place systems; General CIP programme steps

Text Books

1. Rao, D., Fundamentals of Food Engineering. New Delhi: PHI Learning Private Ltd.
2. Berk, Zeki., Food Process Engineering and Technology : London : Academic Press.
3. Fellows, P. J., Food Processing Technology: Principles and Practice: Elsevier: Woodhead publishing.
4. Brennan, J. G., Grandison A. S., Food Processing Handbook : Wiley-VCH Verlag & Co.

Reference Books

1. R. Paul Singh, Dennis R Heldman. Introduction to Food Engineering: Elsevier/Academic Press.
2. P G Smith. Introduction to Food Process Engineering: Springer-Verlag New York.
3. Gordon L Robertson. Food Packaging – Principles and Practice: CRC Press Taylor and Francis Group
4. Romeo T Toledo. Fundamentals of Food Process Engineering: Springer.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1**	
1.1	Perishable, semi perishable and non-perishable foods; Non refrigerated, refrigerated transportation Precooling – room cooling, forced air cooling, package icing, hydro cooling, vacuum cooling, evaporative cooling	2
1.2	Storage in bins, silos, bag storage, warehouses,	1
1.3	Cleaning of raw materials – Dry cleaning and wet cleaning; Pre-treatment – blanching, sulphur dioxide dipping	1
	Sorting and grading according to size, shape, weight, colour	1
	Peeling - Flash steam peeling, knife peeling, abrasion peeling, caustic peeling, flame peeling	1
	Size reduction - Energy consumption laws- Rittinger's law, Kick's law, Bond's law; Size reduction equipments for solids – Impact mills, pressure mills, attrition mills, cutters, choppers, shredders,	3

	pulpers Size reduction liquid foods - Homogenization, homogenizers	
2	**Module 2**	
2.1	Pasteurization - Pasteurization of packed foods- water bath, continuous steam, tunnel pasteurization Pasteurization of non-packed foods- Low Temperature Long Time (LTLT) pasteurization, LTLT pasteurizer; High Temperature Short Time (HTST) pasteurization, HTST pasteurizer	3
2.2	Sterilization –Non packed foods- Ultra High Temperature treatment – direct heating, indirect heating types; Packed food sterilization - Batch sterilization, continuous sterilization retorts - hydrolock sterilizer, hydrostatic cooker	3
2.3	Aseptic processing and packaging- Tetrapak, Vertical and Horizontal Form Fill Seal machines.	1
	Evaporation, types of evaporators- short tube, falling film, natural and forced circulation, rising film, Material and energy balance in single effect evaporator	2
3	**Module 3**	
3.1	Recommended storage temperatures of foods; Refrigerated storage; Components of a vapour compression refrigeration system	1
	Chilling, Freezing- Freezing systems- indirect contact systems, direct contact systems - Still air freezer, air blast freezer, tunnel freezer, belt freezer, spiral belt freezer, fluidized bed freezer, plate freezer, liquid immersion freezer, cryogenic freezers, liquid food freezers, Individual Quick Freezing (IQF).	3
3.2	Freezing kinetics of food and water, nucleation, super cooling, crystal growth	1
3.3	Drying process- drying rate curves, bound moisture, unbound moisture, free moisture, Equilibrium Moisture Content (EMC), sorption isotherm	2
	Dryers – cabinet dryer, tunnel dryer, belt dryer, puff dryer, spray dryer, drum dryer, rotary dryer, freeze dryer	2
4	**Module 4**	
4.1	Filtration- process, cake formation, constant rate and constant pressure drop filtration equations; Filters - frame press filters, rotary vacuum filter	2
4.2	Sedimentation, sedimentation velocity; Centrifugation, separation velocity, centrifugal separators	2
4.3	Mixing process, mixing index agitation equipment, role of baffles; Equipment types for solid mixing, liquid mixing, kneading	3
	Extrusion process, single screw extruder components, regions,	2

	twin screw extruder – structure , working	
5	**Module 5**	
5.1	Food handling equipment considerations; Structure and working of industrial food conveyors- Bucket elevator, Belt conveyor, Chain conveyor, Screw conveyor, Pneumatic conveyor	3
	Packaging functions; Packaging types- rigid packages, flexible packages; Packaging materials- paper, plastics, metals, bottle, wood, textiles; Labelling	3
	Solid fillers- count wise ,weight wise; Liquid fillers- gravimetric fillers, volumetric fillers; Bottling, Cartoning, Shrink wrapping	2
5.2	Clean Out Place, Clean in Place systems; General CIP programme steps	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT284	UNIT OPERATIONS IN FOOD PROCESSING	VAC	4	0	0	4

Preamble:

This course will deal with the different unit operations involved food processing. This course gives understanding of how these unit operations affects the quality of food and improves the process efficiency.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the different unit operations in food processing
CO 2	Understand the principles and mechanisms of different unit operations
CO 3	Analyze the effects of different unit operations on food quality
CO 4	Apply the knowledge of unit operations for the process optimization.
CO 5	Apply the knowledge of unit operations to improve the product quality

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1		1								
CO 2	1	2		1								
CO 3		3										
CO 4	2	1	2	1								
CO 5	2	1	2	1								

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Identify the different unit operations.
2. Explain the importance of these unit operations in food processing
3. State the functions of unit operations.

Course Outcome 2 (CO2)

1. Explain the principles of unit operations
2. Explain the mechanism of unit operations
3. Differentiate leaching and other extraction techniques.

Course Outcome 3(CO3):

1. Explain how freezing improves the quality of food
2. Express how the evaporation process increases the shelf life of product
3. Narrate the effects of filtration in liquid food processing

Course Outcome 4 (CO4):

1. Describe the mixing index

2. Calculate the filtration rate

3. Calculate the evaporator efficiency.

Course Outcome 5 (CO5):

1. Calculate the freezing time and identify the factors affecting freezing time.

2. Explain the changes in food texture and properties during freezing

3. Explain the changes in food quality during milling.

Model Question paper

Reg No.:______________ Name:________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION MAY 2020

Course Code: FTT284

Course Name: UNIT OPERATIONS IN FOOD PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

		Marks
1	Define evaporation	(3)
2	Explain the mechanism behind natural circulated evaportor	(3)
3	Describe the working principle of immersion freezing	(3)
4	List out the factors affecting freezing time	(3)
5	Define filtration rate	(3)
6	List out any 3 applications of filtration in food processing	(3)
7	Define Rittinger's law	(3)
8	Define Mixing index	(3)
9	Explain leaching	(3)
10	Define extraction	(3)

PART B

Answer any five questions, each carries 14 marks.

11		Explain working of frame and press filter with a neat diagram	(14)
12	a	Compare the time required for constant rate and constant pressure filtration	(10)

b What is the function of filter aid (4)

13 Explain all freezing methods (14)

14 a Describe the factors affects freezing time (10)

b 5cm potato cubes are individually quick frozen (IQF) in a blast freezer operating at 40ºC and with a surface heat transfer coefficient of $30 Wm^{-2}K^{-1}$. If the freezing point of the potato is measured as 1.0ºC and the density is $1180 kgm^{-3}$ calculate the expected freezing time for each cube. If the cubes are then packed into a cardboard carton measuring 20 cm x 10 cm x10 cm. Calculate the freezing time. (the thickness of the card is 1.5 mm, the thermal conductivity of the card is $0.07 W m^{-1}K^{-1}$, the thermal conductivity of potato is $2.5 Wm^{-1}K^{-1}$ and the latent heat of crystallization $2.74 \times 10^5 J kg^{-1}$ (4)

15 Classify multiple effect evaporator according to the feed supply (14)

16 Explain the working of vapour recompression evaporator with a neat diagram (14)

17 Explain all energy requirement laws in milling (14)

18 Explain the working of hammer mill and ball mill (14)

19 Explain the extractors mixer settler and perforated tray tower (14)

20 Demonstrate the different types of extractors (14)

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Syllabus

Module 1

Evaporation: Principles of evaporation, factors affecting rate of evaporation, mass and energy balance, types of evaporators, natural, forced, thin film evaporators etc. single effect, multiple effect evaporators, Short tube, long tube, plate, agitated thin film, centrifugal evaporators ,evaporator efficiency, vapour recompression, multiple effect evaporation sizing

Module 2

Food freezing: Introduction, freezing point curve for food and water, freezing points of common food materials, Principles of food freezing, Freezing time calculation by using Plank's equation; Freezing systems; Direct contact systems(air blast, immersion) & indirect contact systems ; Changes in foods; Frozen food properties; freezing time, factors influencing freezing time, freezing/thawing time.

Module 3

Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids

Module 4

Size reduction in solid foods & liquid foods: Principles, types of equipments, energy laws, effect on foods. **Mixing**: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids

Module 5

Expression and Extraction: solid-liquid extraction processes, types of equipment and design for liquid-liquid extraction, continuous multistage counter current extraction; Leaching: process, preparation of solids, rate of leaching, types of equipment, equilibrium relation

Text Books

1. Earle R L Unit Operations in Food Processing. Web Edition. Pergamon Press, UK2004
2. Fellows P J, Food Processing Technology Principles and Practice, CRC Press, 2000.
3. Geankoplis C J, Transport Process and Unit Operations, Prentice Hall Intl Edition, 1993

Reference Books

1. Albert Ibarz and Gustavo V. Barbosa-Cánovas, Unit Operations in Food Engineering, CRC Press,2003
2. Coulson, J.M. and etal. "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol. I & II, Butterworth – Heinman / Elsevier, 2004.
3. Foust, A.S. etal., " Principles of Unit Operations", 2nd Edition, John Wiley & Sons, 1999.
4. R. Paul Singh and Dennis R. Heldman, Introduction to Food Engineering, 5th Ed. Elsevier ,2014

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Evaporation**	**9**
1.1	Principle of evaporation ;factors affecting evaporation	1
1.2	Mass and energy balance theory	1
1.3	Natural, forced circulation & falling thin film evaporator- Working principle , mechanism	3
1.4	Single effect and multiple effect evaporator- agitated thin film long tube evaportaors - mechanism and applications	3
1.5	Calculation of Evaporator efficiency, Vapor recompression	1
2	**Freezing**	**9**
2.1	Principle of freezing; freezing point curve for food and water, freezing points of common food materials	2
2.2	Freezing time calculation, factors influencing freezing time, freezing/thawing time.	2
2.3	Direct freezing systems- methods, mechanism and application	2
2.4	Indirect freezing systems- methods, mechanism and application	2
2.5	Frozen food properties	1
3	**Filtration**	**9**
3.1	Theory of Filtration, importance of filtration	1
3.2	Calculation and equation derivation- rate of filtration, pressure drop during filtration, applications,	2
3.3	Calculation and equation derivation -constant-rate filtration and constant-pressure filtration	2
3.4	Filtration equipment: Plate and frame filter press mechanism and diagram	2
3.5	Rotary filters and centrifugal filters -mechanism and diagram	1
3.6	Filter aids: types , importance and applications	1
4	**Size reduction and mixing**	**9**
4.1	Principles of size reduction, Energy laws	1
4.2	Equipment of size reduction in solid food – hammer mill, ball mill, attrition mill – mechanism and working principle	2
4.3	Equipment of size reduction in liquid food- colloidal mill & homogenizer mechanism and working principle	1
4.4	**Mixing**: theory of solids mixing, criteria of mixer effectiveness and mixing indices	1
4.5	Theory of liquid mixing, power requirement for liquids mixing	1
4.6	Mixing equipments: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers),	2

4.7	Mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids	1
5	**Expression and Extraction**	**9**
5.1	Theory solid-liquid extraction processes, Types of equipment-mechanism and working principle	2
5.2	Design for liquid-liquid extraction, continuous multistage counter current extraction	2
5.3	Leaching: process, preparation of solids rate of leaching	2
5.4	Types of leaching equipment and equilibrium relationship	3

FTT 286	Food Preservation and Processing Technology	Category	L	T	P	Credit
		VAC	3	1	0	4

Preamble: This course deals with the principles of food preservation and processing technology. The students will be able to accord an understanding on various booming innovative food processing techniques for the felicitous processing and preservation of foods. It also helps the students to gain knowledge in the processing efficiency by tangible means of reducing food loss and increasing the food supply.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the concepts and principles of food preservation
CO 2	Choose appropriate preservation methods for various food processing industry
CO 3	Understand the principle and application of novel food preservation techniques
CO 4	Apply the basic knowledge of food preservation to evaluate current challenges in food safety and spoilage
CO 5	Select appropriate packaging/ storage techniques for processed foods and analyze quality changes in processed food

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1									
CO 2	1	1		1	2							
CO 3	1	1		1	2							1
CO 4	2	1										
CO 5	1			1								1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Differentiate food processing and food preservation.
2. Elucidate on Food contamination and List out the various factors of food contamination.
3. Explain the principles of food preservation.

Course Outcome 2 (CO2):

1. Mention the various methods of food preservation.
2. What are the different preservation techniques using high and low temperatures?
3. List out and explain the different types of dryers used for food preservation.
3. Define Hurdle Technology with examples

Course Outcome 3(CO3):

1. Explain about the non-thermal processing of food.
2. Exemplify on minimal processing of foods.
3. Describe the quality parameters of foods that underwent high pressure processing and pulsed electric field treatment.

Course Outcome 4 (CO4):

1. What are processed foods? Explain its different types and method of preparation.
2. Explain the process of extrusion and the processing of any two extruded products.
3. Write a brief note on fermented food products.

Course Outcome 5 (CO5):

1. How will you evaluate Controlled and Modified atmospheric storage?
2. Exemplify the different types and classification of food storage.
3. Explain the importance of packaging in food preservation.

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 286

Course Name: Food Preservation and Processing Technology

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all ten full questions, each carries 3 marks. (3×10=30 marks)

1) Enumerate on the methods of food preservation.

2) Describe the principles of food preservation.

3) What are physical contaminants? Give some examples.

4) Exemplify the microbiological profile of cereal grains and cereal products.

5) What are the factors affecting heat resistance of cells or spores?

6) Evaluate on the temperatures employed in low-temperature storage.

7) Write a short note on fermentation. List out the examples of fermented products.

8) Describe the factors affecting the growth of microorganisms in Wine.

9) List out the preservatives recognized as safe (GRAS) for the storage of food products.

10) Explain the principles of food storage.

PART B

Answer any five full questions, each carries 14 marks. (5×14=70 marks)

1) Exemplify the three major categories of food contaminants.

or

2) Explain the need for food preservation and scope for food processing in India.

3) . What are the different preservation techniques using high and low temperatures?

or

4) List out and explain the different types of dryers used for food preservation.

5) Define Hurdle Technology with examples. Explain any two non-thermal methods for food preservation.

or

6) Write a detailed note on minimal processing of foods and explain the following technologies of food processing:

(a) High Pressure Processing

(b) Pulsed Electric Field

7) Explain the term extrusion and the processing of any two extruded products.

or

8) What are processed foods? Explain its different types and method of preparation.

9) How will you evaluate Controlled and Modified atmospheric storage?

or

10) Describe about the packaging material used for varied food products and also write a brief on storage structures.

Syllabus

Module 1

Food and its classification, Food contamination/ Spoilage-Physical, Chemical and Biological Spoilage, Food processing- Food preservation-Definition, significance and scope in India, Basic principles of food preservation.

Module 2

Food preservation methods- Principles- Importance, Preservation by high and low temperature-Types, Preservation by food Additives- Natural-Chemical preservatives, Preservation by drying-Types

Module 3

Preservation by Radiation-Types, Non thermal process-Types, Membrane processing-Types, Minimal processing- Types, Emerging preservation technologies-High Pressure Processing, Pulsed Electric Field, Ultrasound processing, Hurdle Technology -Advantages, Disadvantages.

Module 4

Processing and method of preparation- Cereals and Pulses, Fruits and Vegetables, Dairy, Meat and poultry, Extruded products, Bakery and Confectionary, Fermented products.

Module 5

Storage-Storage types, Classification, Principles of Storage, Controlled and Modified atmospheric storage- Packaging and its importance- Quality evaluation of processed foods.

Text Books

1. *Unit operations of Agricultural Processing by K.M Sahay and K.K Singh,2007.*
2. *Principles and Practices of Agricultural Structures and Environmental Control ,P.H Pandey, 2014.*
3. *Fruit and Vegetable Preservation: Principles and Practice, Srivastava R P , Second Edition.*
4. *Handbook of Post-Harvest Technology, Chakraverty A, 2001.*

5. *Food Processing And Preservation, B. Sivasankar, Prentice-Hall of India Pvt.Ltd; 1 edition (August 30, 2004)*
6. *Food Processing: Principles and Applications, J. Scott Smith, Y.H. Hui, Wiley India Pvt Ltd (28 October 2013)*

References

1. *Food Microbiology, William C Frazier, Fourth Edition*
2. *Food Processing Technology, P J Fellows,1995*
3. *Food Process Engineering and Technology, Akash Pare*
4. *Principles of Food Preservation. Microbial Control and Food Preservation, Mukhopadhyay, S, 2017, 17–39.*
5. *A review on mechanisms and commercial aspects of food preservation and processing, Sadat Kamal Amit*

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Introduction to Food preservation**	**9**
1.1	Introduction , Food and its classification,	2
1.2	Food contamination/ Spoilage-Physical, Chemical and Biological Spoilage,	3
1.3	Food processing- Food preservation-Definition, significance and scope in India,	2
1.4	Basic principles of food preservation.	2
2	**Module 2- Conventional preservation Techniques**	**9**
2.1	Food preservation methods	1
2.2	Preservation by high and low temperature-Types,	4
2.3	Preservation by food Additives- Natural-Chemical preservatives,	2
2.4	Preservation by drying-Types	2
3	**Module 3- Novel Preservation Techniques**	**9**
3.1	Preservation by Radiation-Types, Non thermal process-Types,	3
3.2	Membrane processing-Types, Minimal processing- Types,	2
3.3	Emerging preservation technologies-High Pressure Processing, Pulsed Electric Field, Ultrasound processing, Hurdle Technology - Advantages, Disadvantages.	4
4	**Module 4- Processing of Food Commodities**	**9**
4.1	Processed food products types and method of preparation	2

4.2	Cereals and pulses, extruded products	2
4.3	Fruits and vegetables,	2
4.4	Dairy, flesh foods	1
4.5	Confectionary and fermented products	2
5	**Module 5- Storage and quality evaluation**	**9**
5.1	Storage-Storage types, Classification	2
5.2	Principles of Storage	2
5.3	Controlled and Modified atmospheric storage	2
5.4	Packaging and its importance	1
5.5	Quality evaluation of processed foods	2

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEMESTER -4 HONOURS

FTT292	ADVANCED FOOD MICROBIOLOGY	CATEGORY	L	T	P	CREDIT
		VAC	4	0	0	4

Preamble: This course is designed to give students an understanding of the role of microorganisms in food processing and preservation; relation of microorganisms to food spoilage, foodborne illness and intoxication, general food quality, and role of microorganisms in health promotion.

Prerequisite: Food Microbiology

Course Outcomes: After the completion of the course the student will be able to

CO 1	To build a comprehensive understanding about industrially important microorganisms regarding their isolation, screening, strain improvement and preservation of strains
CO 2	To be aware of microbial fermentation technology and technical information on fermenter design, operation and growth kinetics of microbes involved in the fermentation processes
CO 3	Recognize the principles behind advanced techniques and develop the basic skills to apply these techniques to solve food industry problems as well as research questions.
CO 4	Identify the causes of foodborne diseases and their etiology and evaluate the measures required to control undesired microorganisms in food;
CO 5	Appreciate the role of microorganisms in food processing, preservation and safety, and the possible health benefits from the consumption of health promoting microorganisms or products derived from their fermentation.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3										
CO 2	3	2	2		3							
CO 3	2	3										
CO 4	1	1	3									
CO 5	2	2										
CO 6	1	3				2						2

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. **Elaborate the methods used for isolation of industrially important microorganism.**
2. **Explain different methods of strain improvement**
3. **Differentiate between primary and secondary screening of industrially important microorganism.**
4. **How is preservation of strains performed?**

Course Outcome 2 (CO2):

1. **What are the differences between primary and secondary metabolites?**
2. **Give a detailed description on different types of fermentations**
3. **Write about the major steps involved in the formulation of fermentation media**
4. **With the help of a neat and labelled diagram, mention different parts of a fermenter**

Course Outcome 3(CO3):

1. **What are the physical and chemical methods of food preservation?**
2. **How is biopreservation done? Explain with examples.**
3. **Give a short note on Modified environment for storage of food.**
4. **How do Bacterial Stress Response Factors act as a Hurdle for Food Preservation?**

Course Outcome 4 (CO4):

1. **What are the novel methods for controlling spoilage of food?**
2. **How Predictive modelling is performed for food spoilage?**
3. **What are antibiotic resistant bacteria? What is their relevance in food microbiology?**
4. **What does Food security mean to you? How will you ensure food security in the world you live in?**

Course Outcome 5 (CO5):

1. **Elaborate on the different kinds of pathogen detection methods.**
2. **How is molecular detection of pathogens performed?**
3. **What is Whole Genome Sequencing? Give an insight into its applications.**
4. **What are the different bacterial identification methods?**
5. **Give an account on emerging food borne pathogens with relevant examples.**

MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH HONOURS DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT 292

ADVANCED FOOD MICROBIOLOGY

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. How is isolation of industrially important microorganisms performed?.
2. Name 3 emerging food borne illness and causative organisms.
3. How is RT-PCR performed?
4. What is strain improvement?
5. Mention 3 physical methods of food preservation.
6. What are bio-preservatives?
7. Why are food safety laws required?
8. Differentiate between GMP and GHP.
9. What is the need for maintaining food security?
10. What is the relevance of antiobiotic resistant bacteria in food safety?

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Detail on batch, continuous and fed batch fermentation.

(OR)

12. How will you investigate a foodborne illnesses outbreak?

13. Elaborate on the different pathogen detection methods.

(OR)

14. How is molecular detection of pathogens performed?

15. Give a short note on Modified environment for storage of food.

(OR)

16. How do Bacterial Stress Response Factors act as a Hurdle for Food Preservation?

17. What are the basic principles of hygiene and sanitation to be followed in food service establishments?

(OR)

18. How will you conduct microbiological risk assessment of food?

19. What are the novel methods for controlling spoilage of food?

(OR)

20. How is Predictive modelling performed for food spoilage?

Syllabus

Module 1

Introduction to Industrial Microbiology: Introduction to microbes in industrial processes. Isolation and screening of industrially useful microorganisms, Primary and secondary screening, Strain improvement in industrial microbiology; improvement of characters other than product yield. Preservation of strains

Module 2

Microorganisms in Fermentation technology: Introduction to microbial fermentation technology - Fermentation process: Primary and secondary Metabolites. Design of a fermentor and Types of fermentors. Types of fermentations: Batch, Continuous, Fed Batch, Submerged and Solid State. Fermentation media formulation and modification, Fermentation process: Inoculum preparation, Scaling up of fermentation.

Module 3

Microorganisms in food preservation and nutritional enhancement : Principles of food preservation and significance, Preservation of food by physical and chemical methods, Food bio-preservatives of microbial origin, Food ingredients and enzymes of microbial origin- Microbial Proteins and Food Additives, Modified environment for storage of food.

Module 4

Microorganisms and Food safety: Introduction to food spoilage, Indicators of food microbial quality and safety, Newer methods for controlling spoilage of food, Predictive modelling for food spoilage, Antibiotic resistance bacteria, Solutions: Intervention, vaccines, probiotics, genomics, Food Security

Module 5

Microorganism detection and analysis: Emerging Foodborne Pathogens, Investigation of food borne illnesses outbreaks, Pathogen Detection Methods - Molecular detection: PCR, QPCR, RT-PCR, Molecular typing: MLST, PFGE, microarray, Bacterial Identification Methods, Whole Genome Sequencing (WGS)

Text Books

1. Fundamental Food Microbiology, Third Edition. B. Ray. CRC Press 2005.

2. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition. New Age International (P) Limited Publishers, New Delhi, India.

Reference Books

1. Food Microbiology. Fundamentals and Frontiers. M.P. Doyle, L.R. Beuchat and T.J. Montville, eds., ASM Press, Washington, DC. 1997 (or 2001).

2. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.

3. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.

4. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	***Introduction to Industrial Microbiology***	
1.1	Introduction to microbes in industrial processes. Isolation and screening of industrially useful microorganisms and Primary and secondary screening	4
1.2	Strain improvement in industrial microbiology; improvement of characters other than product yield	3
1.3	Preservation of strains	2
2	***Microorganisms in Fermentation technology***.	
2.1	Introduction to microbial fermentation technology - Fermentation process: Primary and secondary Metabolites and Design of a fermentor and Types of fermentors.	4
2.2	Types of fermentations: Batch, Continuous, Fed Batch, Submerged and Solid State	3
2.3	Fermentation media formulation and modification, Fermentation process: Inoculum preparation, Scaling up of fermentation.	2
3	***Microorganisms in food preservation and nutritional enhancement***	
3.1	Principles of food preservation and significance Preservation of food by physical and chemical methods,	3
3.2	Bio preservation of food, Modified environment for storage of food	3
3.3	Food ingredients and enzymes of microbial origin- Microbial	3

	Proteins and Food Additives	
4	***Microorganisms and Food safety***	
4.1	Introduction to food spoilage, Indicators of food microbial quality and safety Newer methods for controlling spoilage of food, Predictive modelling for food spoilage	4
4.2	Antibiotic resistance bacteria, Solutions: Intervention, vaccines, probiotics, genomics	3
4.3	Food Security	2
5	***Microorganism detection and analysis***	
5.1	Emerging Foodborne Pathogens Investigation of foodborne illnesses outbreaks,	4
5.2	Pathogen Detection Methods Molecular detection: PCR, QPCR, RT-PCR, Molecular typing: MLST, PFGE, microarray	3
5.3	Bacterial Identification Methods, Whole Genome Sequencing (WGS)	2

FTT294	ADVANCED SEPARATION PROCESSES IN FOOD PROCESSING	CATEGORY	L	T	P	CREDIT
		VAC	4	0	0	4

Preamble: Goal of this course is to develop the knowledge of students in the area of advanced separation processes in food processing. This course is very essential for learning the fundamentals, design criteria and applications of separation processes in food industry

Prerequisite: Knowledge of mass transfer operations and unit operations

Course Outcomes: After the completion of the course the student will be able to

CO 1	differentiate conventional and novel separation techniques
CO 2	analyze and design novel membranes for food industry application
CO 3	paraphrase different chromatographic separation techniques
CO 4	analyze adsorption and ion exchange based separation processes
CO 5	describe pervaporation, freeze crystallisation and other separation processes
CO 6	apply novel separation techniques in various applications

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2			3									
CO 3	3											
CO 4		3										
CO 5	3											
CO 6	3											

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain equilibrium and rate governed separation process.

2. List different type's of separation process.

3. Describe separation factor

Course Outcome 2 (CO2)

1. Explain different membrane configurations

2. List out the design considerations for membranes

3. Describe reverse osmosis

Course Outcome 3(CO3):

1. List out the different chromatographic techniques

2. Explain Advantages and disadvantages of chromatographic separations

3. Elaborate on Liquid-solid chromatography

Course Outcome 4 (CO4):

1. List out the applications of Ion Exchange separation in the Food Industry

2. Give example for Ion exchange resins.

3. Compare dielectrophoresis and zonal electrophoresis

Course Outcome 5 (CO5):

1. Describe pervaporation

2. Explain freeze crystallisation

3. Elaborate on Zone melting

Course Outcome 6 (CO6):

1. List the applications of Foam Separation in food industry

2. Explain the relevance of Supercritical fluid extraction

3. What are the applications of membrane separation process?

Model Question paper

MODEL QUESTION PAPER

Total Pages:

Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT294
Course Name: ADVANCED SEPARATION PROCESSES IN FOOD PROCESSING
Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carry 3 marks **Marks**

1. Define separation factor. What is its significance? (3)
2. Explain Equilibrium and rate governed separation (3)
3. Which are the different types of membranes used in separation process? (3)
4. Compare ultrafiltration and Microfiltration (3)
5. Explain the types of chromatographic techniques (3)
6. Describe liquid chromatography. (3)
7. Explain adsorption isotherms (3)
8. Describe the applications of Ion Exchange separation in the Food Industry (3)
9. What are the advantages and limitations of super critical fluid extraction? (3)
10. Explain zone melting process (3)

PART B

Answer any one full question from each module, each question carries 14 marks

Module-I

11. a) Explain theory of cascades and its application in single and multistage operation for binary and multi component separations (7)
    b) Write short note on distillation (7)

or

12. a) Elaborate on the conventional methods of separation (12)
    b) List out the limitations of conventional methods (2)

Module-II

13. Elaborate on the principle, working, advantages and applications of reverse osmosis (14)

or

14. a) What is electro dialysis? Explain the process with the help a neat diagram. (10)
    b) Explain Concentration Polarization (4)

Module-III

15. Explain the principle, method and applications of immunochromatography in Food Processing (14)

or

16. Elaborate on Ion Exchange chromatography (14)

Module-IV

17. a) Explain Ion exchange resins and its properties (7)
    b) What is Zonal electrophoresis? Write its applications. (7)

or

18. a) Explain different types of adsorption (10)
    b) List out the types of adsorbents used (4)

Module-V

19. a) Explain the process of freeze crystallization (10)
    b) What is Osmotic Distillation? (4)

or

20. Define prevaporation. Elaborate on prevaporation techniques and its application. (14)

Syllabus

Module 1

Introduction

Separation factor and its dependence on process variable, Equilibrium and rate governed process , classification of separation process, conventional methods like sedimentation, centrifugal separation, distillation, absorption, adsorption etc. Limitations of conventional methods, Theory of cascades and its application in single and multistage operation for binary and multi component separations, thermodynamic analysis of separation systems.

Module 2

Membrane Separation

Membrane configurations – Plate and Frame, Tubular, Spiral wound and Hollow fibre systems. Types of membranes, Materials for membrane, design considerations, performance of membrane, electro dialysis ,reverse osmosis, Nanofiltration, ultrafiltration, Microfiltration and Donnan dialysis, Fouling of membrane, Concentration Polarization, External field induced membrane separation processes, Applications in food processing.

Module 3

Chromatographic Separations

Theory of chromatographic separation, Selectivity or separation factor, Efficiency of chromatographic system, Types of chromatography, Liquid chromatography, Liquid-solid chromatography, Advantages and disadvantages of chromatographic separations, Affinity chromatography, Immunochromatography, Ion exchange chromatography ,principle, method and applications in Food Processing

Module 4

Adsorption and Ionic Separations

Types and choice of adsorbents, Adsorptive Membranes, adsorption techniques ,batch adsorption, stage-type and continuous adsorption; fixed-bed adsorption, adsorption isotherms, Ion exchange resins, properties, Binary ion exchange, Ion movement theory, Controlling factors, electrophoresis, Di-electrophoresis, Zonal electrophoresis, , Applications of Ion Exchange separation in the Food Industry

Module 5

Other Techniques

Freeze crystallization, Prevaporation and permeation techniques for solids, liquids and gases. Osmotic distillation, Zone melting: Equilibrium diagrams, Controlling factors ,Apparatus and applications, Addluctive crystallization, Supercritical fluid extraction, Foam Separation: Surface adsorption, Nature of foams, Apparatus, Applications in food processing, and Controlling factors

Text Books

1. Sivasankar, “Bioseparations–Principles and Techniques”, Prentice Hall of India Pvt.Ltd, New Delhi, 2005.
2. Zeki Berk ,Food Process Engineering and Technology, Academic Press, 2006

Reference Books

1. *Seader J.D., Ernet J. Henlay, and Keith, D., Separation Process Principles,Wiley (2010).*
2. Kaushik Nath, “Membrane Separation processes”, Prentice Hall of India Pvt.Ltd, 2008.
3. Marcel Mulder, “Basic Principles of Membrane Technology”,2 Ed., Springer Publications, 2007
4. Geankoplis, Transport Processes, And Separation Process principles, Prentice-Hall of India Private Ltd, New Delhi, 4th Edition 2006
5. Nunes. S.P, Peinemann, K.V, “Membrane Technology in thechemical industry”, 2nd Edition, Wiley-VCH, 2006
6. Gunter Jagschies Gail Sofer and Lars Hagel, “Handbook of process chromatography”, Academic Press, 2007

7. Serban C. Moldoveanu and Victor David, "Essentials in Modern HPLC Separations", Elsevier,2012
8. Dickson Ozokwelu, Suojiang Zhang, Obiefuna Okafor, Weiguo Cheng and Nicholas Litombe, Novel Catalytic and Separation Processes Based on Ionic Liquids, Elsevier, 2017
9. S. Sridhar and Siddhartha Moulik, "Membrane Processes: Pervaporation, Vapor Permeation and Membrane Distillation for Industrial Scale Separations", Wiley-Scrivener, 1st edition , 2018
10. Jean Garcia, "Pervaporation: Process, Materials and Applications", Nova Science Publishers, 2018

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**8**
1.1	Separation factor and its dependence on process variable	1
1.2	Equilibrium and rate governed process , classification of separation process	2
1.3	conventional methods like sedimentation, centrifugal separation, distillation, absorption, adsorption etc.	3
1.4	Limitations of conventional methods	1
1.5	Theory of cascades and its application in single and multistage operation for binary and multi component separations, thermodynamic analysis of separation systems.	1
2	**Membrane Separation**	**9**
2.1	Membrane configurations – Plate and Frame, Tubular, Spiral wound and Hollow fibre systems.	2
2.2	Types of membranes, Materials for membrane, design considerations, performance of membrane	2
2.3	electro dialysis ,reverse osmosis	1
2.4	Nanofiltration, ultrafiltration, Microfiltration	1
2.5	Donnan dialysis	1
2.6	Fouling of membrane, Concentration Polarization	1
2.7	External field induced membrane separation processes, Applications	1
3	**Chromatographic Separations**	**8**
3.1	Theory of chromatographic separation, Selectivity or separation factor, Efficiency of chromatographic system, Types of chromatography	1
3.2	Liquid chromatography, Liquid-solid chromatography, Advantages and disadvantages of chromatographic separations	2
3.3	Affinity chromatography, Immunochromatography	3

3.4	Ion exchange chromatography ,principle, method and applications in Food Processing	2
4	**Adsorption and Ionic Separations**	**10**
4.1	Types and choice of adsorbents, Adsorptive Membranes, adsorption techniques	1
4.2	batch adsorption, stage-type and continuous adsorption; fixed-bed adsorption,	2
4.3	adsorption isotherms	1
4.4	Ion exchange resins, properties, Binary ion exchange, Ion movement theory, Controlling factors,	1
4.5	electrophoresis, Di-electrophoresis, Zonal electrophoresis	3
4.6	Applications of Ion Exchange separation in the Food Industry	2
5	**Other Techniques:**	**10**
5.1	Freeze crystallization	1
5.2	Prevaporation and permeation techniques for solids, liquids and gases. Osmotic distillation	3
5.3	Zone melting: Equilibrium diagrams, Controlling factors ,Apparatus and applications	2
5.4	Addluctive crystallization	1
5.5	Supercritical fluid extraction	1
5.6	Foam Separation: Surface adsorption, Nature of foams, Apparatus, Applications, and Controlling factors	2

FTT 296	NOVEL FOOD PROCESSING TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble:

The syllabus is prepared with the view of making the Engineering Graduates capable of carrying out processing of food in industry, by applying novel techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Carry out the high pressure processing in food industry.
CO 2	Explain in detail about all membrane technology so that it can be applied in processing industry.
CO 3	Process the food items through novel heating methods.
CO 4	Carry out extrusion for producing food items with novel characteristic features.
CO 5	Apply nanotechnology to food processing to produce novel foods.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	1	-	-	-	-	-	-	-
CO 2	3	3	2	-	1	-	-	-	-	-	-	-
CO 3	3	2	2	-	2	-	-	-	-	-	-	-
CO 4	3	2	3	-	1	-	-	-	-	-	-	-
CO 5	3	2	3	-	2	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the basic principle behind HPP?
2. Explain the applications of HPP in food industry.

Course Outcome 2 (CO2)

1. Explain the principle behind microfiltration technique
2. What are the industrial applications of nanofiltration
3. Explain the process of pulsed electric field processing.

Course Outcome 3(CO3):

1. Explain the basic principle behind radiofrequency processing
2. What are the applications of pulsed X rays in food processing
3. Explain the basic process of ohmic heating

Course Outcome 4 (CO4):

1. Differentiate single and twin screw extruders

2. What are the different ways in which we can apply extrusion techniques in food sector.

3. Explain the manufacturing process of any one extruded food item from corn.

Course Outcome 5 (CO5):

1. Explain the application of hurdle technology in food processing

2. How can nanotechnology improve the quality of foods.

Model Question paper

QP CODE: **PAGES: 2**

Reg No:______________

Name :______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,

MONTH & YEAR

Course Code: FTT 296

Course Name: Novel Food Processing Technology

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. **Each question carries 3 Marks**

1. Classify HPP system

2. How microbial inactivation can be effected by HPP

3. What are the characteristic features a membrane should have to be used in reverse osmosis process

4. Explain the equation for calculating pulse frequency in PEF

5. Compare microwave heating and electrical resistance heating

6. What are the advantages of radiofrequency heating over conventional heating methods

7. What is coextrusion?

8. What is throttling factor?

9. Give examples for physicochemical hurdles in food processing

10. What are nanofoods?

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. (a) How can you apply HPP in food processing sector? (6)

(b) Explain the process of HPP in processing (8)

(OR)

12. (a) Explain the scope and importance of processing in current food sector (14)

13. (a) Explain the principle of nanofiltration (7)

(b) With the help of schematic representation explain the process of ultrafiltration (7)

(OR)

14. (a) Explain the principle and application of PEF in food processing (14)

15. (a) What are the important properties of ultrasound which makes it useful in food processing (7)

(b) How radiofrequency processing support food processing (7)

(OR)

16. (a) Explain the process and applications of IR heating in food processing (14)

17. (a) With the help of neat schematic representation explain the working and principle of an extruder (14)

(OR)

18. (a) Explain the effect of extrusion in food (7)

(b) Explain the production of any two extruded cereal products (7)

19. (a) Explain the important hurdles that play a part in food preservation (7)

(b) Explain the process of combination preservation in detail. (7)

(OR)

20. (a) Explain the applications of nanotechnology in food processing and preservation (14)

Syllabus

Module 1: Introduction and HPP

Introduction to food process engineering- Scope and importance. High Pressure processing – principle, equipment and process of HPP treatment, Application of HPP in food processing.

Module 2: Membrane Technologies and PEF

Membrane technologies in food processing – Overview of Membrane technology. Micro-filtration, Ultra filtration (UF), Nano filtration(NF) and Reverse Osmosis (RO) and their industrial applications.

Pulsed electric field processing - Principle , process and application in food processing sector

Module 3: Processing of food using novel techniques

Ultrasonic processing: Properties and application of ultrasonic processing techniques. Microwave and

radio frequency processing.

Ohmic heating, IR heating, dielectric heating and pulsed X-rays in food processing and preservation.

Module 4 : Extrusion Technology

Food extrusion technology – theory, Equipment and its functioning, Types of extruders, Effect of extrusion on foods. Application of extrusion cooking in food industry. Examples of extruded food.

Module 5: Hurdle technology and Nanotechnology

Hurdle technology - Concept of hurdle technology and its application.

Nanotechnology its Principles and applications in foods

Text Books

1. James G Brennan, Alistair S Grandison (Ed.), Food processing Handbook, Wiley – VCH, 2011

2. P G Smith, Introduction to Food Process Engineering, Springer, 2011

3. Zeki Berk, Food process engineering and technology, Elsevier, 2013

Reference Books

1. Geankoplis, C.J. "Transport Processes and Separation Process Principles", 4th Edition, Prentice Hall, 2003.

2. McCabe W.L., Smith J.C. "Unit Operations in Chemical Engineering", 7th Edition, McGraw – Hill Int., 2001

3. Richardson, J.E. et al., "Coulson & Richardson's Chemical Engineering" Vol.2 (Particle Technology & Separation Processes") 5th Edition, Butterworth – Heinemann / Elsevier, 2003.

Course Contents and Lecture Schedule

No	**Topic**	**No. of Lectures**
1	**Introduction and HPP**	
1.1	Introduction to food process engineering	3
1.2	Principle ,equipment and process of HPP	3
1.3	Applications of HPP	1
2	**Membrane Technologies and PEF**	
2.1	Principle and process of different membrane filtration techniques	5
2.2	Industrial applications of membrane separation techniques	3
2.3	Process and applications of PEF	2
3	**Processing of food using novel techniques**	
3.1	Processing and applications of food using ultrasound, microwave and radiofrequency waves	4
3.2	Novel heating methods in food processing	5
3.3	Application of pulsed X rays in food processing	1
4	**Extrusion Technology**	
4.1	Principle behind the extrusion process	3
4.2	Application of extrusion in food industry	2
4.3	Example of extruded foods	5
5	**Hurdle technology and Nanotechnology**	
5.1	Hurdle technology and its applications	5
5.2	Principle of nanotechnology and its effects in food processing	3

COMMON COURSES S3 & S4

SEMESTER -3

CODE MCN201	SUSTAINABLE ENGINEERING	CATEGORY	L	T	P	CREDIT
			2	0	0	NIL

Preamble: Objective of this course is to inculcate in students an awareness of environmental issues and the global initiatives towards attaining sustainability. The student should realize the potential of technology in bringing in sustainable practices.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the relevance and the concept of sustainability and the global initiatives in this direction
CO 2	Explain the different types of environmental pollution problems and their sustainable solutions
CO 3	Discuss the environmental regulations and standards
CO 4	Outline the concepts related to conventional and non-conventional energy
CO 5	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	3					2
CO 2						2	3					2
CO 3						2	3					2
CO 4						2	3					2
CO 5						2	3					2

Assessment Pattern

Mark distribution

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyse			
Evaluate			
Create			

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand the relevance and the concept of sustainability and the global initiatives in this direction

1. Explain with an example a technology that has contributed positively to sustainable development.
2. Write a note on Millennium Development Goals.

Course Outcome 2 (CO2): Explain the different types of environmental pollution problems and their sustainable solutions

1. Explain the 3R concept in solid waste management?
2. Write a note on any one environmental pollution problem and suggest a sustainable solution.
3. In the absence of green house effect the surface temperature of earth would not have been suitable for survival of life on earth. Comment on this statement.

Course Outcome 3(CO3): Discuss the environmental regulations and standards

1. Illustrate Life Cycle Analysis with an example of your choice.
2. "Nature is the most successful designer and the most brilliant engineer that has ever evolved". Discuss.

Course Outcome 4 (CO4): Outline the concepts related to conventional and non-conventional energy

1. Suggest a sustainable system to generate hot water in a residential building in tropical climate.
2. Enumerate the impacts of biomass energy on the environment.

Course Outcome 5 (CO5): Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

1. Suggest suitable measures to make the conveyance facilities used by your institution sustainable.

Model Question paper

Part A

(Answer all questions. Each question carries 3 marks each)

1. Define sustainable development.
2. Write a short note on Millennium Development Goals.
3. Describe carbon credit.
4. Give an account of climate change and its effect on environment.
5. Describe biomimicry? Give two examples.
6. Explain the basic concept of Life Cycle Assessment.
7. Name three renewable energy sources.

8. Mention some of the disadvantages of wind energy.

9. Enlist some of the features of sustainable habitat.

10. Explain green engineering.

Part B

(Answer one question from each module. Each question carries 14 marks)

11. Discuss the evolution of the concept of sustainability. Comment on its relevance in the modern world.

OR

12. Explain Clean Development Mechanism.

13. Explain the common sources of water pollution and its harmful effects.

OR

14. Give an account of solid waste management in cities.

15. Explain the different steps involved in the conduct of Environmental Impact Assessment.

OR

16. Suggest some methods to create public awareness on environmental issues.

17. Comment on the statement, “Almost all energy that man uses comes from the Sun”.

OR

18. Write notes on:

    a. Land degradation due to water logging.

    b. Over exploitation of water.

19. Discuss the elements related to sustainable urbanisation.

OR

20. Discuss any three methods by which you can increase energy efficiency in buildings.

Syllabus

Sustainability- need and concept, technology and sustainable development-Natural resources and their pollution, Carbon credits, Zero waste concept. Life Cycle Analysis, Environmental Impact Assessment studies, Sustainable habitat, Green buildings, green materials, Energy, Conventional and renewable sources, Sustainable urbanization, Industrial Ecology.

Module 1

Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

Module 2

Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.

Module 3

Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.

Module 4

Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.

Module 5

Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.

Reference Books

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
8. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Sustainability	
1.1	Introduction, concept, evolution of the concept	1
1.2	Social, environmental and economic sustainability concepts	1
1.3	Sustainable development, Nexus between Technology and Sustainable development	1
1.4	Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)	1
1.5	Clean Development Mechanism (CDM)	1
2	Environmental Pollution	
2.1	Air Pollution and its effects	1
2.2	Water pollution and its sources	1
2.3	Zero waste concept and 3 R concepts in solid waste management	1
2.4	Greenhouse effect, Global warming, Climate change, Ozone layer depletion	1
2.5	Carbon credits, carbon trading and carbon foot print.	1
2.6	Legal provisions for environmental protection.	1
3	Environmental management standards	
3.1	Environmental management standards	1
3.2	ISO 14001:2015 frame work and benefits	1
3.3	Scope and Goal of Life Cycle Analysis (LCA)	1
3.4	Circular economy, Bio-mimicking	1
3.5	Environment Impact Assessment (EIA)	1
3.6	Industrial Ecology, Industrial Symbiosis	1
4	Resources and its utilisation	
4.1	Basic concepts of Conventional and non-conventional energy	1
4.2	General idea about solar energy, Fuel cells	1
4.3	Wind energy, Small hydro plants, bio-fuels	1
4.4	Energy derived from oceans and Geothermal energy	1
5	Sustainability Practices	
5.1	Basic concept of sustainable habitat	1
5.2	Methods for increasing energy efficiency of buildings	1
5.3	Green Engineering	1
5.4	Sustainable Urbanisation, Sustainable cities, Sustainable transport	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
			2	0	0	2
EST 200	**DESIGN AND ENGINEERING**					

Preamble:

The purpose of this course is to

i) introduce the undergraduate engineering studentsthe fundamental principles of design engineering,

ii) make them understand the steps involved in the design process and

iii) familiarize them with the basic tools used and approaches in design.

Students are expected to apply design thinking in learning as well as while practicing engineering, which is very important and relevant for today. Case studies from various practical situations will help the students realize that design is not only concerned about the function but also many other factors like customer requirements, economics, reliability, etc. along with a variety of life cycle issues.

The course will help students to consider aesthetics, ergonomics and sustainability factors in designs and also to practice professional ethics while designing.

Prerequisite:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

Course Outcomes:

After the completion of the course the student will be able to

CO 1	Explain the different concepts and principles involved in design engineering.
CO 2	Apply design thinking while learning and practicing engineering.
CO 3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1					1			1		
CO 2		2				1		1				2
CO 3			2			1	1		2	2		1

Assessment Pattern

Continuous Internal Evaluation (CIE) Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B.

Part A	: 30 marks
part B	: 70 marks

Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.

Part B contains 2 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	10	10	20
Apply	35	35	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1): Appreciate the different concepts and principles involved in design engineering.

1. State how engineering design is different from other kinds of design

2. List the different stages in a design process.

3. Describedesign thinking.

4. State the function of prototyping and proofing in engineering design.

5. Write notes on the following concepts in connection with design engineering 1) Modular Design, 2) Life Cycle Design , 3) Value Engineering, 4) Concurrent Engineering, and 5) Reverse Engineering

6. State design rights.

Course Outcome 2 (CO2) Apply design thinking while learning and practicing engineering.

1. Construct the iterative process for design thinking in developing simple products like a pen, umbrella, bag, etc.

2. Show with an example how divergent-convergent thinking helps in generating alternative designs and then how to narrow down to the best design.

3. Describe how a problem-based learning helps in creating better design engineering solutions.

4. Discuss as an engineer, how ethics play a decisive role in your designs

Course Outcome 3(CO3): Develop innovative, reliable, sustainable and economically viable designs incorporating different segments of knowledge in engineering.

1. Illustratethe development of any simple product by passing through the different stages of design process

2. Show thegraphical design communication with the help of detailed 2D or 3D drawings for any simple product.

3. Describe how to develop new designs for simple products through bio-mimicry.

Model Question paper

Reg No.:_______________Name:___________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: EST 200

Course Name: DESIGN AND ENGINEERING

Max. Marks: 100Duration: 3 Hours

PART A

Answer all questions, each question carries 3 marks
Use only hand sketches

(1) Write aboutthe basic design process.

(2) Describe how to finalize the design objectives.

(3) State the role of divergent-convergent questioning in design thinking.

(4) Discuss how to perform design thinking in a team managing the conflicts.

(5) Show how engineering sketches and drawings convey designs.

(6) Explain the role of mathematics and physics in design engineering process.

(7) Distinguish between project-based learning and problem-based learning in design engineering.

(8) Describe how concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?

(9) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?

(10) Explain how economics influence the engineering designs?

(10x3 marks =30 marks)

Part B

Answer any ONE question from each module. Each question carry 14 marks

Module 1

(11) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.

or

(12) Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

(13) Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

or

(14) Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

(15) Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

or

(16) Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

(17) Show the development of a nature inspired design for a solar poweredbus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

or

(18) Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

(19) Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

or

(20) Describe the how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) anelectrical or electronic system or device and v) a car.

Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

(5x14 marks =70 marks)

Syllabus

Module 1

Design Process:- Introduction to Design and Engineering Design, Defining a Design Process-:Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Module 2

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

Module 3

Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

Module 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design.Modular Design and Life Cycle Design Approaches. Application of Bio-mimicry,Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Module 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Text Books

1) YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,

2) Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference Books

1.Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.

2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5

3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361

4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1: Design Process**	
1.1	Introduction to Design and Engineering Design. *What does it mean to design something? How Is engineering design different from other kinds of design? Where and when do engineers design? What are the basic vocabularyin engineering design? How to learn and do engineering design.*	1
1.2	*Defining a Design Process*-: Detailing Customer Requirements. *How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?*	1
1.3	*Defining a Design Process*-: Setting Design Objectives, Identifying Constraints, Establishing Functions. *How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?*	1
1.4	*Defining a Design Process*-: Generating Design Alternatives and Choosing a Design. *How to generate or create feasible design alternatives? How to identify the "best possible design"?*	1
1.5	Case Studies:- Stages of Design Process. *Conduct exercises for designing simple products going through the different stages of design process.*	1
2	**Module 2: Design Thinking Approach**	
2.1	Introduction to Design Thinking *How does the design thinking approach help engineers in creating innovative and efficient designs?*	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. *How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?*	1
2.3	Design Thinking as Divergent-Convergent Questioning. *Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'.*	1
2.4	Design Thinking in a Team Environment. *How to perform design thinking as a team managing the conflicts ?*	1
2.5	Case Studies: Design Thinking Approach. *Conduct exercises using the design thinking approach for*	1

	designing any simple products within a limited time and budget	
3	**Module 3: Design Communication (Languages of Engineering Design)**	
3.1	Communicating Designs Graphically. *How do engineering sketches and drawings convey designs?*	1
3.2	Communicating Designs Orally and in Writing. *How can a design be communicated through oral presentation or technical reports efficiently?*	1
	First Series Examination	
3.3	Mathematical Modelling in Design. *How do mathematics and physics become a part of the design process?*	1
3.4	Prototyping and Proofing the Design. *How to predict whether the design will function well or not?*	1
3.5	Case Studies: Communicating Designs Graphically. *Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.*	1
4	**Module 4: Design Engineering Concepts**	
4.1	Project-based Learning and Problem-based Learning in Design. *How engineering students can learn design engineering through projects?* *How students can take up problems to learn design engineering?*	1
4.2	Modular Design and Life Cycle Design Approaches. *What is modular approach in design engineering? How it helps?* *How the life cycle design approach influences design decisions?*	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. *How do aesthetics and ergonomics change engineering designs?* *How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?*	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. *How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?*	1
4.5	Case Studies: Bio-mimicry based Designs. *Conduct exercises to develop new designs for simple*	1

	products using bio-mimicry and train students to bring out new nature inspired designs.	
5	**Module 5: Expediency, Economics and Environment in Design Engineering**	
5.1	Design for Production, Use, and Sustainability. *How designs are finalized based on the aspects of production methods, life span, reliability and environment?*	1
5.2	Engineering Economics in Design. *How to estimate the cost of a particular design and how will economics influence the engineering designs?*	1
5.3	Design Rights. *What are design rights and how can an engineer put it into practice?*	1
5.4	Ethics in Design. *How do ethics play a decisive role in engineering design?*	1
5.5	Case Studies: Design for Production, Use, and Sustainability. *Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors.*	1
	Second Series Examination	

Code.	Course Name	L	T	P	Hrs	Credit
HUT 200	Professional Ethics	2	0	0	2	2

Preamble: To enable students to create awareness on ethics and human values.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the core values that shape the ethical behaviour of a professional.
CO 2	Adopt a good character and follow an ethical life.
CO 3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.
CO 5	Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1								2			2	
CO 2								2			2	
CO 3								3			2	
CO 4								3			2	
CO 5								3			2	

Assessment Pattern

Bloom's category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understood	20	20	40
Apply	15	15	30

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	:	10 marks
Continuous Assessment Tests (2 Nos)	:	25 marks
Assignments/Quiz	:	15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):
1. Define integrity and point out ethical values.
2. Describe the qualities required to live a peaceful life.
3. Explain the role of engineers in modern society.

Course Outcome 2 (CO2)
1. Derive the codes of ethics.
2. Differentiate consensus and controversy.
3. Discuss in detail about character and confidence.

Course Outcome 3(CO3):
1. Explain the role of professional's ethics in technological development.
2. Distinguish between self interest and conflicts of interest.
3. Review on industrial standards and legal ethics.

Course Outcome 4 (CO4):
1. Illustrate the role of engineers as experimenters.
2. Interpret the terms safety and risk.
3. Show how the occupational crimes are resolved by keeping the rights of employees.

Course Outcome 5 (CO5):
1. Exemplify the engineers as managers.
2. Investigate the causes and effects of acid rain with a case study.
3. Explorate the need of environmental ethics in technological development.

Model Question paper

QP CODE: **Reg No:______________**

PAGES:3 **Name :______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 200
Course Name: PROFESSIONAL ETHICS

Max. Marks: 100 **Duration: 3 Hours**

(2019-Scheme)

PART A

(Answer all questions, each question carries 3 marks)

1. Define empathy and honesty.

2. Briefly explain about morals, values and ethics.

3. Interpret the two forms of self-respect.

4. List out the models of professional roles.

5. Indicate the advantages of using standards.

6. Point out the conditions required to define a valid consent?

7. Identify the conflicts of interests with an example?

8. Recall confidentiality.

9. Conclude the features of biometric ethics.

10. Name any three professional societies and their role relevant to engineers.

(10x3 = 30 marks)

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Classify the relationship between ethical values and law?

b) Compare between caring and sharing. (10+4 = 14 marks)

Or

12. a) Exemplify a comprehensive review about integrity and respect for others.

b) Discuss about co-operation and commitment. (8+6 = 14 marks)

MODULE II

13.a) Explain the three main levels of moral developments, deviced by Kohlberg.

b) Differentiate moral codes and optimal codes. (10+4 = 14 marks)

Or

14. a) Extrapolate the duty ethics and right ethics.

b) Discuss in detail the three types of inquiries in engineering ethics (8+6 = 14 marks)

MODULE III

Summarize the following features of morally responsible engineers.

(i) Moral autonomy **(ii)** Accountability

b)Explain the rights of employees (8+6 = 14 marks)

Or

16. a) Explain the reasons for Chernobyl mishap ?

b) Describe the methods to improve collegiality and loyalty. (8+6 = 14 marks)

MODULE IV

17.a) Execute collegiality with respect to commitment, respect and connectedness.

b) Identify conflicts of interests with an example. (8+6 = 14 marks)

Or

18. a) Explain in detail about professional rights and employee rights.

b) Exemplify engineers as managers.

MODULE V

19.a) Evaluate the technology transfer and appropriate technology.

b) Explain about computer and internet ethics. (8+6 = 14 marks)

Or

20. a) Investigate the causes and effects of acid rain with a case study.

b) Conclude the features of ecocentric and biocentric ethics. (8+6 = 14 marks)

Syllabus

Module 1 – Human Values.

Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue-Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment-Empathy-Self Confidence -Social Expectations.

Module 2 - Engineering Ethics & Professionalism.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.

Module 3- Engineering as social Experimentation.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism-A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Module 4- Responsibilities and Rights.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality-Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights-Employee right- IPR Discrimination.

Module 5- Global Ethical Issues.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.

Text Book

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Reference Books

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

Course Contents and Lecture Schedule

SL.No	Topic	No. of Lectures 25
1	**Module 1 – Human Values.**	
1.1	Morals, values and Ethics, Integrity, Academic Integrity,Work Ethics	1
1.2	Service Learning, Civic Virtue, Respect for others, Living peacefully	1
1.3	Caring and Sharing, Honesty, Courage, Co-operation commitment	2
1.4	Empathy, Self Confidence, Social Expectations	1
2	**Module 2- Engineering Ethics & Professionalism.**	
2.1	Senses of Engineering Ethics, Variety of moral issues, Types of inquiry	1
2.2	Moral dilemmas, Moral Autonomy, Kohlberg's theory	1
2.3	Gilligan's theory, Consensus and Controversy,Profession& Professionalism, Models of professional roles, Theories about right action	2
2.4	Self interest-Customs and Religion, Uses of Ethical Theories	1
3	**Module 3- Engineering as social Experimentation.**	
3.1	Engineering as Experimentation, Engineers as responsible Experimenters	1
3.2	Codes of Ethics,Plagiarism, A balanced outlook on law	2
3.3	Challenger case study, Bhopal gas tragedy	2
4	**Module 4- Responsibilities and Rights.**	
4.1	Collegiality and loyalty, Managing conflict, Respect for authority	1
4.2	Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest	2
4.3	Occupational crime, Professional rights, Employee right, IPR Discrimination	2
5	**Module 5- Global Ethical Issues.**	
5.1	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics	2
5.2	Role in Technological Development, Moral leadership	1
5.3	Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	2

SEMESTER -4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCN202	CONSTITUTION OF INDIA		2	0	0	NIL

Preamble:

The study of their own country constitution and studying the importance environment as well as understanding their own human rights help the students to concentrate on their day to day discipline. It also gives the knowledge and strength to face the society and people.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the background of the present constitution of India and features.
CO 2	Utilize the fundamental rights and duties.
CO 3	Understand the working of the union executive, parliament and judiciary.
CO 4	Understand the working of the state executive, legislature and judiciary.
CO 5	Utilize the special provisions and statutory institutions.
CO 6	Show national and patriotic spirit as responsible citizens of the country

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	2	2		2		
CO 2						3	3	3		3		
CO 3						3	2	3		3		
CO 4						3	2	3		3		
CO 5						3	2	3		3		
CO 6						3	3	3		2		

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyse			

Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1 Discuss the historical background of the Indian constitution.

2 Explain the salient features of the Indian constitution.

3 Discuss the importance of preamble in the implementation of constitution.

Course Outcome 2 (CO2)

1 What are fundamental rights ? Examine each of them.

2 Examine the scope of freedom of speech and expression underlying the constitution.

3 The thumb impression of an accused is taken by the police against his will. He contends that this is a violation of his rights under Art 20(3) of the constitution. Decide.

Course Outcome 3(CO3):

1 Explain the powers of the President to suspend the fundamental rights during emergency.

2 Explain the salient features of appeal by special leave.

3. List the constitutional powers of President.

Course Outcome 4 (CO4):

1 Discuss the constitutional powers of Governor.

2 Examine the writ jurisdiction of High court.

3 Discuss the qualification and disqualification of membership of state legislature.

Course Outcome 5 (CO5):

1 Discuss the duties and powers of comptroller of auditor general.

2 Discuss the proclamation of emergency.

3 A state levies tax on motor vehicles used in the state, for the purpose of maintaining roads in the state. X challenges the levy of the tax on the ground that it violates the freedom of interstate commerce guaranteed under Art 301. Decide.

Course Outcome 6 (CO6):

1 Explain the advantages of citizenship.

2 List the important principles contained in the directive principles of state policy.

3 Discuss the various aspects contained in the preamble of the constitution

Model Question paper

PART A

(Answer all questions. Each question carries 3 marks)

1 Define and explain the term constitution.

2 Explain the need and importance of Preamble.

3 What is directive principle of state policy?

4 Define the State.

5 List the functions of Attorney general of India.

6 Explain the review power of Supreme court.

7 List the qualifications of Governor.

8 Explain the term and removal of Judges in High court.

9 Explain the powers of public service commission.

10 List three types of emergency under Indian constitution.

(10X3=30marks)

PART B

(Answer on question from each module. Each question carries 14 marks)

Module 1

11 Discuss the various methods of acquiring Indian citizenship.

12 Examine the salient features of the Indian constitution.

Module 2

13 A high court passes a judgement against X. X desires to file a writ petition in the supreme court under Art32, on the ground that the judgement violates his fundamental rights. Advise him whether he can do so.

14 What is meant by directive principles of State policy? List the directives.

Module3

15 Describe the procedure of election and removal of the President of India.

16 Supreme court may in its discretion grant special leave to appeal. Examine the situation.

Module 4

17 Discuss the powers of Governor.

18 X filed a writ petition under Art 226 which was dismissed. Subsequently, he filed a writ petition under Art 32 of the constitution, seeking the same remedy. The Government argued that the writ petition should be dismissed, on the ground of res judicata. Decide.

Module 5

19 Examine the scope of the financial relations between the union and the states.

20 Discuss the effects of proclamation of emergency.

(14X5=70marks)

Syllabus

Module 1 Definition, historical back ground, features, preamble, territory, citizenship.

Module 2 State, fundamental rights, directive principles, duties.

Module 3 The machinery of the union government.

Module 4 Government machinery in the states

Module 5 The federal system, Statutory Institutions, miscellaneous provisions.

Text Books

1 D D Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi, 24e, 2019

2 PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

Reference Books

1 Ministry of law and justice, The constitution of India, Govt of India, New Delhi, 2019.

2 JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019

3 MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1**	
1.1	Definition of constitution, historical back ground, salient features of the constitution.	1
1.2	Preamble of the constitution, union and its territory.	1
1.3	Meaning of citizenship, types, termination of citizenship.	2
2	**Module 2**	
2.1	Definition of state, fundamental rights, general nature, classification, right to equality ,right to freedom , right against exploitation	2

2.2	Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences.	2
2.3	Directive principles of state policy, classification of directives, fundamental duties.	2
3	**Module 3**	
3.1	The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions.	2
3.2	The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament.	2
3.3	Union judiciary, the supreme court, jurisdiction, appeal by special leave.	1
4	**Module 4**	
4.1	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories.	2
4.2	The State Legislature, composition, qualification and disqualification of membership, functions.	2
4.3	The state judiciary, the high court, jurisdiction, writs jurisdiction.	1
5	**Module 5**	
5.1	Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission.	1
5.2	Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals.	2
5.3	Official language, elections, special provisions relating to certain classes, amendment of the Constitution.	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
			2	0	0	2
EST 200	DESIGN AND ENGINEERING					

Preamble:

The purpose of this course is to

i) introduce the undergraduate engineering studentsthe fundamental principles of design engineering,

ii) make them understand the steps involved in the design process and

iii) familiarize them with the basic tools used and approaches in design.

Students are expected to apply design thinking in learning as well as while practicing engineering, which is very important and relevant for today. Case studies from various practical situations will help the students realize that design is not only concerned about the function but also many other factors like customer requirements, economics, reliability, etc. along with a variety of life cycle issues.

The course will help students to consider aesthetics, ergonomics and sustainability factors in designs and also to practice professional ethics while designing.

Prerequisite:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

Course Outcomes:

After the completion of the course the student will be able to

CO 1	Explain the different concepts and principles involved in design engineering.
CO 2	Apply design thinking while learning and practicing engineering.
CO 3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1					1			1		
CO 2		2				1		1				2
CO 3			2			1	1		2	2		1

Assessment Pattern

Continuous Internal Evaluation (CIE) Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B.

Part A	: 30 marks
part B	: 70 marks

Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.

Part B contains 2 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	10	10	20
Apply	35	35	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1): Appreciate the different concepts and principles involved in design engineering.

1. State how engineering design is different from other kinds of design

2. List the different stages in a design process.

3. Describedesign thinking.

4. State the function of prototyping and proofing in engineering design.

5. Write notes on the following concepts in connection with design engineering 1) Modular Design, 2) Life Cycle Design , 3) Value Engineering, 4) Concurrent Engineering, and 5) Reverse Engineering

6. State design rights.

Course Outcome 2 (CO2) Apply design thinking while learning and practicing engineering.

1. Construct the iterative process for design thinking in developing simple products like a pen, umbrella, bag, etc.

2. Show with an example how divergent-convergent thinking helps in generating alternative designs and then how to narrow down to the best design.

3. Describe how a problem-based learning helps in creating better design engineering solutions.

4. Discuss as an engineer, how ethics play a decisive role in your designs

Course Outcome 3(CO3): Develop innovative, reliable, sustainable and economically viable designs incorporating different segments of knowledge in engineering.

1. Illustratethe development of any simple product by passing through the different stages of design process

2. Show thegraphical design communication with the help of detailed 2D or 3D drawings for any simple product.

3. Describe how to develop new designs for simple products through bio-mimicry.

Model Question paper

Reg No.:_______________Name:___________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: EST 200

Course Name: DESIGN AND ENGINEERING

Max. Marks: 100Duration: 3 Hours

PART A

Answer all questions, each question carries 3 marks
Use only hand sketches

(1) Write aboutthe basic design process.

(2) Describe how to finalize the design objectives.

(3) State the role of divergent-convergent questioning in design thinking.

(4) Discuss how to perform design thinking in a team managing the conflicts.

(5) Show how engineering sketches and drawings convey designs.

(6) Explain the role of mathematics and physics in design engineering process.

(7) Distinguish between project-based learning and problem-based learning in design engineering.

(8) Describe how concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?

(9) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?

(10) Explain how economics influence the engineering designs?

(10x3 marks =30 marks)

Part B

Answer any ONE question from each module. Each question carry 14 marks

Module 1

(11) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.

or

(12) Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

(13) Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

or

(14) Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

(15) Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

or

(16) Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

(17) Show the development of a nature inspired design for a solar poweredbus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

or

(18) Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

(19) Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

or

(20) Describe the how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) anelectrical or electronic system or device and v) a car.

Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

(5x14 marks =70 marks)

Syllabus

Module 1

Design Process:- Introduction to Design and Engineering Design, Defining a Design Process-:Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Module 2

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

Module 3

Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

Module 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design.Modular Design and Life Cycle Design Approaches. Application of Bio-mimicry,Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Module 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Text Books

1) YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,

2) Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference Books

1.Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.

2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5

3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361

4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1: Design Process**	
1.1	Introduction to Design and Engineering Design. *What does it mean to design something? How Is engineering design different from other kinds of design? Where and when do engineers design? What are the basic vocabularyin engineering design? How to learn and do engineering design.*	1
1.2	*Defining a Design Process*-: Detailing Customer Requirements. *How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?*	1
1.3	*Defining a Design Process*-: Setting Design Objectives, Identifying Constraints, Establishing Functions. *How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?*	1
1.4	*Defining a Design Process*-: Generating Design Alternatives and Choosing a Design. *How to generate or create feasible design alternatives? How to identify the "best possible design"?*	1
1.5	Case Studies:- Stages of Design Process. *Conduct exercises for designing simple products going through the different stages of design process.*	1
2	**Module 2: Design Thinking Approach**	
2.1	Introduction to Design Thinking *How does the design thinking approach help engineers in creating innovative and efficient designs?*	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. *How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?*	1
2.3	Design Thinking as Divergent-Convergent Questioning. *Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'.*	1
2.4	Design Thinking in a Team Environment. *How to perform design thinking as a team managing the conflicts ?*	1
2.5	Case Studies: Design Thinking Approach. *Conduct exercises using the design thinking approach for*	1

	designing any simple products within a limited time and budget	
3	**Module 3: Design Communication (Languages of Engineering Design)**	
3.1	Communicating Designs Graphically. *How do engineering sketches and drawings convey designs?*	1
3.2	Communicating Designs Orally and in Writing. *How can a design be communicated through oral presentation or technical reports efficiently?*	1
	First Series Examination	
3.3	Mathematical Modelling in Design. *How do mathematics and physics become a part of the design process?*	1
3.4	Prototyping and Proofing the Design. *How to predict whether the design will function well or not?*	1
3.5	Case Studies: Communicating Designs Graphically. *Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.*	1
4	**Module 4: Design Engineering Concepts**	
4.1	Project-based Learning and Problem-based Learning in Design. *How engineering students can learn design engineering through projects?* *How students can take up problems to learn design engineering?*	1
4.2	Modular Design and Life Cycle Design Approaches. *What is modular approach in design engineering? How it helps?* *How the life cycle design approach influences design decisions?*	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. *How do aesthetics and ergonomics change engineering designs?* *How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?*	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. *How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?*	1
4.5	Case Studies: Bio-mimicry based Designs. *Conduct exercises to develop new designs for simple*	1

	products using bio-mimicry and train students to bring out new nature inspired designs.	
5	**Module 5: Expediency, Economics and Environment in Design Engineering**	
5.1	Design for Production, Use, and Sustainability. *How designs are finalized based on the aspects of production methods, life span, reliability and environment?*	1
5.2	Engineering Economics in Design. *How to estimate the cost of a particular design and how will economics influence the engineering designs?*	1
5.3	Design Rights. *What are design rights and how can an engineer put it into practice?*	1
5.4	Ethics in Design. *How do ethics play a decisive role in engineering design?*	1
5.5	Case Studies: Design for Production, Use, and Sustainability. *Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors.*	1
	Second Series Examination	

Code.	Course Name	L	T	P	Hrs	Credit
HUT 200	**Professional Ethics**	2	0	0	2	2

Preamble: To enable students to create awareness on ethics and human values.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the core values that shape the ethical behaviour of a professional.
CO 2	Adopt a good character and follow an ethical life.
CO 3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.
CO 5	Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1								2			2	
CO 2								2			2	
CO 3								3			2	
CO 4								3			2	
CO 5								3			2	

Assessment Pattern

Bloom's category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understood	20	20	40
Apply	15	15	30

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	:	10 marks
Continuous Assessment Tests (2 Nos)	:	25 marks
Assignments/Quiz	:	15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):
1. Define integrity and point out ethical values.
2. Describe the qualities required to live a peaceful life.
3. Explain the role of engineers in modern society.

Course Outcome 2 (CO2)
1. Derive the codes of ethics.
2. Differentiate consensus and controversy.
3. Discuss in detail about character and confidence.

Course Outcome 3(CO3):
1. Explain the role of professional's ethics in technological development.
2. Distinguish between self interest and conflicts of interest.
3. Review on industrial standards and legal ethics.

Course Outcome 4 (CO4):
1. Illustrate the role of engineers as experimenters.
2. Interpret the terms safety and risk.
3. Show how the occupational crimes are resolved by keeping the rights of employees.

Course Outcome 5 (CO5):
1. Exemplify the engineers as managers.
2. Investigate the causes and effects of acid rain with a case study.
3. Explorate the need of environmental ethics in technological development.

Model Question paper

QP CODE: **Reg No:______________**

PAGES:3 **Name :______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 200
Course Name: PROFESSIONAL ETHICS

Max. Marks: 100 **Duration: 3 Hours**

(2019-Scheme)

PART A

(Answer all questions, each question carries 3 marks)

1. Define empathy and honesty.

2. Briefly explain about morals, values and ethics.

3. Interpret the two forms of self-respect.

4. List out the models of professional roles.

5. Indicate the advantages of using standards.

6. Point out the conditions required to define a valid consent?

7. Identify the conflicts of interests with an example?

8. Recall confidentiality.

9. Conclude the features of biometric ethics.

10. Name any three professional societies and their role relevant to engineers.

(10x3 = 30 marks)

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Classify the relationship between ethical values and law?

b) Compare between caring and sharing. (10+4 = 14 marks)

Or

12. a) Exemplify a comprehensive review about integrity and respect for others.

b) Discuss about co-operation and commitment. (8+6 = 14 marks)

MODULE II

13.a) Explain the three main levels of moral developments, deviced by Kohlberg.

b) Differentiate moral codes and optimal codes. (10+4 = 14 marks)

Or

14. a) Extrapolate the duty ethics and right ethics.

b) Discuss in detail the three types of inquiries in engineering ethics (8+6 = 14 marks)

MODULE III

Summarize the following features of morally responsible engineers.

(i) Moral autonomy **(ii)** Accountability

b)Explain the rights of employees (8+6 = 14 marks)

Or

16. a) Explain the reasons for Chernobyl mishap ?

b) Describe the methods to improve collegiality and loyalty. (8+6 = 14 marks)

MODULE IV

17.a) Execute collegiality with respect to commitment, respect and connectedness.

b) Identify conflicts of interests with an example. (8+6 = 14 marks)

Or

18. a) Explain in detail about professional rights and employee rights.

b) Exemplify engineers as managers.

MODULE V

19.a) Evaluate the technology transfer and appropriate technology.

b) Explain about computer and internet ethics. (8+6 = 14 marks)

Or

20. a) Investigate the causes and effects of acid rain with a case study.

b) Conclude the features of ecocentric and biocentric ethics. (8+6 = 14 marks)

Syllabus

Module 1 – Human Values.

Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue-Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment-Empathy-Self Confidence -Social Expectations.

Module 2 - Engineering Ethics & Professionalism.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.

Module 3- Engineering as social Experimentation.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Module 4- Responsibilities and Rights.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality-Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights-Employee right- IPR Discrimination.

Module 5- Global Ethical Issues.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.

Text Book

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Reference Books

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

Course Contents and Lecture Schedule

SL.No	Topic	No. of Lectures 25
1	**Module 1 – Human Values.**	
1.1	Morals, values and Ethics, Integrity, Academic Integrity,Work Ethics	1
1.2	Service Learning, Civic Virtue, Respect for others, Living peacefully	1
1.3	Caring and Sharing, Honesty, Courage, Co-operation commitment	2
1.4	Empathy, Self Confidence, Social Expectations	1
2	**Module 2- Engineering Ethics & Professionalism.**	
2.1	Senses of Engineering Ethics, Variety of moral issues, Types of inquiry	1
2.2	Moral dilemmas, Moral Autonomy, Kohlberg's theory	1
2.3	Gilligan's theory, Consensus and Controversy,Profession& Professionalism, Models of professional roles, Theories about right action	2
2.4	Self interest-Customs and Religion, Uses of Ethical Theories	1
3	**Module 3- Engineering as social Experimentation.**	
3.1	Engineering as Experimentation, Engineers as responsible Experimenters	1
3.2	Codes of Ethics,Plagiarism, A balanced outlook on law	2
3.3	Challenger case study, Bhopal gas tragedy	2
4	**Module 4- Responsibilities and Rights.**	
4.1	Collegiality and loyalty, Managing conflict, Respect for authority	1
4.2	Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest	2
4.3	Occupational crime, Professional rights, Employee right, IPR Discrimination	2
5	**Module 5- Global Ethical Issues.**	
5.1	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics	2
5.2	Role in Technological Development, Moral leadership	1
5.3	Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	2

SEMESTER V

FTT 301	FOOD PROCESS ENGINEERING	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: The syllabus is prepared with the view of making the Engineering Graduates capable of carrying out processing of food in industry, by teaching all the major processes happening in food processing sector, from raw material collection till novel processing techniques.

Prerequisite: Nil.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Gain knowledge on preparing raw material for processing and high temperature processing
CO 2	Be familiarized with size reduction principles and equipment for solid foods
CO 3	Analyse the importance of drying, refrigeration and freezing during processing
CO 4	Gain knowledge on principle, kinetics and equipment for baking and frying process.
CO 5	Be familiarized with the concepts of extrusion and minimal processing techniques in food technology sector.

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	3	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	3	-	-	-	-	-	-	-	-
CO 3	3	3	3	2	-	-	-	-	-	-	-	-
CO 4	3	3	3	3	2	-	-	-	-	-	-	-
CO 5	3	3	3	3	2	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	30
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):
1. What are the different types of cleaning techniques followed in food industry?
2. What is pasteurization? Explain its importance
3. Explain bout the blanching process

Course Outcome 2 (CO2):
1. What are the important types of equipments used in size reduction of raw materials in food industry?
2. Explain the importance of homogenization

Course Outcome 3(CO3):
1. What are different types of driers used in food processing sector?
2. Explain various models used in prediction of freezing time

Course Outcome 4 (CO4):
1. Explain the effect of roasting in the characteristics of food.
2. What are the important ways by which heat and mass transfer happens in frying?

Course Outcome 5 (CO5):
1. Explain the role of hurdle technology in food sector
2. What are the important minimal processing techniques applied in food processing industries?
3. What is the effect of extrusion in food? Explain the process and principle

Model Question Paper

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT301
FOOD PROCESS ENGINEERING

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Explain the F, D, Z values in thermal processing of food.
2. What are the important peeling methods followed in food industry?
3. Analyze how size reduction benefits in food processing
4. Explain the importance of homogenization in food processing sector
5. What are the different ways in which food can be transported in refrigerated conditions?
6. Define COP
7. Differentiate baking and dehydration
8. Analyze how pre frying treatments affect the oil absorption
9. Discuss the effect of irradiation on microorganism
10. Differentiate single and twin screw extruder

PART B
(Answer one full question from each module, each question carries 14 marks)

11. With the help of diagrammatic representation explain the cleaning techniques in the absence of moisture used in food process engineering

OR

12. a. Schematically explain the principle of HTST pasteurization
    b. Analyze the importance of blanching and pasterization in food processing
13. Schematically expain various equipments used in size reduction with its benefits in food processing

OR

14. Explain the importance and applications of emulsions in food industry with the different equipments used for maintaining emulsions
15. Explain the importance and applications of driers in food industry with atleast two driers

OR

16. a. Explain one method for the prediction of freezing time
    b. Explain the working and importance of VC refrigeration systems
17. Analyze the effect of baking in food and microorganisms.

OR

18. a. Explain the effect of pre frying treatments affect the oil absorption
    b. Explain the ways in which heat and mass transfer happen in frying and roasting process
19. a. Explain a non-thermal technique which uses the principle of electric field intensity.
    b. What is the effect of high-pressure processing in inactivating the microorganism and increasing the shelf life?

OR

20. What are the ways in which extrusion improves the quality of food in processing?

Syllabus

Module 1

Raw material Preparation and Thermal processing

Food processing – Introduction - Raw material properties - physical, functional - Preparation and Cleaning of raw materials - wet and dry techniques - Peeling, Sorting and grading methods of raw materials - Blanching, Pasteurization - HTST, LTLT, UHT pasteurizers - Microbial inactivation and F, D, Z values.

Module 2

Size Reduction

Size reduction of solids – principle and laws of size reduction – Kicks, Bond, Rittinger's law - Equipments used in size reduction- roller mill, impact mill, attrition mill, tumbling mills, crushers and pulveriser - Importance and principle of Homogenization and emulsification.

Module 3

Drying and Refrigeration:

Water activity and drying rate curve and Drying time prediction - Driers - Tray, tunnel, puff, fluidized bed, spray, Rotary drier etc - Freeze drying.

VA,VC refrigeration systems- components - compressor, condenser, evaporator, refrigerant, COP - Chilling and freezing, effect of low temperature on food spoilage, prediction of freezing time - Plank's, Pham's method, Thawing - Frozen food storage.

Module 4

Baking, Roasting and Frying process

Baking Process-Principle, Heat and mass transfer, machinery and products.

Frying process- principle, heat and mass transfer, machinery, products, deep, shallow frying, frying oils, kinetics of oil uptake, effects on foods.

Roasting - theory, equipment, direct, indirect, batch, continuous, effect on foods texture, aroma, colour and nutritional value.

Module 5

Extrusion and Minimal processing of food

Extrusion - Theory, rheological properties, operating characteristics, single screw, twin screw extruders, application, effect on foods.

Principle, Process and applications of Ohmic heating, RF heating, Pulsed electric field heating, high pressure processing, Food irradiation and ultrasound techniques

Hurdle technology - Principle and application

Text Books

1. James G Brennan, Alistair S Grandison (Ed.), Food processing Handbook, Wiley – VCH, 2011, ISBN-13: 978-3527324682
2. P G Smith, Introduction to Food Process Engineering, Springer, 2011, ISBN-13: 978-0306473975
3. Zeki Berk, Food process engineering and technology, Elsevier, 2013, ISBN-13: 978-0128120187

Reference Books

1. Theodoros Varzakas and Constantina Tzia, Food Engineering Handbook: Food Process Engineering, CRC Press; 1 edition (2014), ISBN-13: 978-1482261660
2. Das S K, Fundamentals And Operations In Food Process Engineering, TAYLOR & FRANCIS LTD, 2019 Edition, ISBN 9781466560901
3. Saravacos G D, Food Process Engineering Operations, Taylor and Francis, 2011, ISBN: 9781420083538
4. Toledo R T, Fundamentals of Food Process Engineering, Springer, Fourth Edition (2018), ISBN: 9783319900971

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Raw material Preparation and Thermal processing:**	
1.1	Raw material preparation and processing	4
1.2	Blanching – principle and process	1
1.3	Pasteurization – principle, process and types	3
1.4	Microbial inactivation	1
2	**Size Reduction:**	
2.1	Principles and laws of size reduction	3
2.2	Major equipments used in size reduction	4
2.3	Homogenization and emulsification	3
3	**Drying and Refrigeration:**	
3.1	Importance of drying and Drying rate curve	2
3.2	Driers used in food processing industry	4
3.3	Principles for refrigeration	2
3.4	Chilling and freezing	3
4	**Baking, Roasting and Frying process**	
4.1	Principles and equipments used in baking process	2
4.2	Principles and equipments used in frying and roasting process	2
4.3	Amount of oil uptake and its influencing factors in the above mentioned processes	1
5	**Extrusion and minimal processing techniques**	

5.1	Principle, process and types of extruders.	3
5.2	Minimal processing in food process engineering	5
5.3	Hurdle Technology	2

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

FTT303	UNIT OPERATIONS IN FOOD PROCESSING	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the area of unit operations in food processing. This course is very essential for learning the fundamental principles and mechanism of unit operations in food industry

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Characterize different unit operations in food processing
CO 2	Identify and evaluate different types of evaporators
CO 3	Describe the working of filtration equipments used in food industry
CO 4	Estimate the energy requirement for the different size reduction operations
CO 5	Explain mechanism of expression and extraction operations
CO 6	Describe crystallization and distillation process and its applications

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1									
CO 2		3	1									
CO 3	1	2	1									
CO 4		3	2	1								
CO 5	1	3										
CO 6	1	2	2									

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Identify the different unit operations.

2. Explain the importance of these unit operations in food processing

3. State the functions of unit operations.

Course Outcome 2 (CO2)

1. Explain the principle of evaporation

2. List out the factors affecting rate of evaporation

3. Compare single effect and multiple effect evaporator

Course Outcome 3(CO3):

1. List out the equipments used for filtration

2. Explain rate of filtration

3. Elaborate on Plate and frame filter press

Course Outcome 4 (CO4):

1. List out the equipments for size reduction in solid food

2. Give example for equipments used for mixing for pastes

3. Explain impeller mixers

Course Outcome 5 (CO5):

1. Describe solid-liquid extraction processes

2. Explain rate of leaching

3. Elaborate on leaching equipments

Course Outcome 6 (CO6):

1. List the factors affecting crystallisation

2. Explain the working of Swenson-Walker vacuum crystallizers

3. Elaborate on continuous distillation with reflux

Model Question paper

MODEL QUESTION PAPER

Total Pages:

Reg No.:________________

Name:____________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT303

Course Name: UNIT OPERATIONS IN FOOD PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carry 3 marksMarks

1. Define evaporation . What is its significance? (3)
2. Explain falling film evaporator (3)
3. Which are the different factors affecting rate of filtration? (3)
4. Explain filter aid and its types (3)
5. What is kicks law of size reduction? (3)

6. Describe the working of colloid mill . (3)
7. Explain multistage counter current extraction (3)
8. Describe the steps to be done during the preparation of solids for leaching (3)
9. What are the factors influencing distillation? (3)
10. Explain vacuum distillation (3)

PART B

Answer any one full question from each module, each question carries 14 marks

Module-I

11. a) Compare Single effect and multiple effect evaporator (7)
    b) Write short note on Vapor recompression system (7)

or

12. Elaborate on the types of evaporator (14)

Module-II

13. Derive the expression for constant rate and constant pressure filtration (14)

or

14. Explain working of frame and press filter with a neat diagram (14)

Module-III

15. Elaborate on the equipments for size reduction in solid food (14)

or

16. Explain the working of mixers used for low- medium-viscosity liquids (14)

Module-IV

17. Elaborate on extraction equipment and its types (14)

or

18. Explain the mechanism and working of Supercritical fluid extraction (14)

Module-V

19. a) Explain the factors affecting crystal growth (4)
    b) What is Osmotic Distillation? (10)

or

20. Explain Mccabe Thiele method. (14)

Syllabus

Module 1

Evaporation

Introduction to unit operations-classification, Principle of evaporation -factors affecting evaporation, Mass and energy balance theory, Natural, forced circulation and falling thin film evaporator- Working principle –mechanism, Single effect and multiple effect evaporator- agitated thin film long tube evaporators - mechanism and applications, Calculation of Evaporator efficiency- Vapor recompression

Module 2

Filtration

Theory of Filtration, importance of filtration, Calculation of rate of filtration, pressure drop during filtration, applications, rate of constant-rate filtration and constant-pressure filtration, Filtration equipment: Plate and frame filter press mechanism and diagram, Rotary filters and centrifugal filters -mechanism and diagram- Filter aids- types -importance and applications

Module 3

Size reduction and mixing

Principles of size reduction- Energy laws; Equipment of size reduction in solid food – hammer mill, ball mill, attrition mill – mechanism and working principle; Equipment of size reduction in liquid food- colloidal mill & homogenizer mechanism and working principle; Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, Theory of liquid mixing, power requirement for liquids mixing, Mixing equipments: Mixers for low-medium-viscosity liquids -paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers- Mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids

Module 4

Expression and Extraction

Expression and Extraction ,Theory solid-liquid extraction processes, Types of equipment-mechanism and working principle, Design for liquid-liquid extraction, continuous multistage counter current extraction, Supercritical fluid extraction, Leaching: process, preparation of solids rate of leaching, Types of leaching equipment and equilibrium relationship

Module 5

Crystallization and Distillation

Crystallization, equilibrium, solubility and equilibrium diagram, rate of crystal growth, equilibrium crystallization, Crystallization equipment, classification, construction and operation, tank, agitated batch, Swenson-Walker vacuum crystallizers, Distillation, binary mixtures, flash and differential distillation, steam distillation, Continuous distillation with rectification, vacuum distillation, Batch distillation – operation and process, advantages and limitations, Distillation equipments, construction and operation, factors influencing the operation

Text Books

1. Warren McCabe, Julian Smith, Peter Harriott, Unit Operations of Chemical Engineering, McGraw Hill Education; Seventh edition (2017), **ISBN-13:** 978-9339213237
2. Das S K, Fundamentals And Operations In Food Process Engineering, TAYLOR & FRANCIS LTD, 2019 Edition, ISBN 9781466560901

Reference Books

1. Saravacos G D, Food Process Engineering Operations, Taylor and Francis, 2011,ISBN: 9781420083538
2. Fellows P J Food Processing Technology Principles And Practice, Elsevier, Fourth Edition (2020), ISBN 9789351073918
3. Zeki Berk, Food Process Engineering and Technology, Academic Press 3rd Edition(2018), **ISBN:** 9780128120187
4. Toledo R T, Fundamentals Of Food Process Engineering, Springer, Fourth Edition (2018), ISBN: 9783319900971
5. Theodoros Varzakas and Constantina Tzia, Food Engineering Handbook: Food Process Engineering, CRC Press; 1 edition (2014), ISBN: **ISBN-13:** 978-1482261660

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Evaporation**	**9**
1.1	Principle of evaporation -factors affecting evaporation	2
1.2	Mass and energy balance theory	1
1.3	Natural, forced circulation and falling thin film evaporator- Working principle -mechanism	3
1.4	Single effect and multiple effect evaporator- agitated thin film long tube evaporators - mechanism and applications	2
1.5	Calculation of Evaporator efficiency- Vapor recompression	1
2	**Filtration**	**9**

2.1	Theory of Filtration, importance of filtration	2
2.2	Calculation and equation derivation- rate of filtration, pressure drop during filtration, applications	2
2.3	Calculation and equation derivation -constant-rate filtration and constant-pressure filtration	2
2.4	Filtration equipment: Plate and frame filter press mechanism and diagram	2
2.5	Rotary filters and centrifugal filters -mechanism and diagram- Filter aids- types -importance and applications	1
3	**Size reduction and mixing**	**9**
3.1	Principles of size reduction- Energy laws	1
3.2	Equipment of size reduction in solid food – hammer mill, ball mill, attrition mill – mechanism and working principle	2
3.3	Equipment of size reduction in liquid food- colloidal mill & homogenizer mechanism and working principle	2
3.4	Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, Theory of liquid mixing, power requirement for liquids mixing	2
3.5	Mixing equipments: Mixers for low- medium-viscosity liquids -paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers- Mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids	2
4	**Expression and Extraction**	**9**
4.1	Theory solid-liquid extraction processes	1
4.2	Types of equipment- mechanism and working principle	2
4.3	Design for liquid-liquid extraction, continuous multistage counter current extraction	1
4.4	Leaching: process, preparation of solids rate of leaching	2
4.5	Types of leaching equipment and equilibrium relationship	3
5	**Crystallization and Distillation**	**9**
5.1	Crystallization, equilibrium, solubility and equilibrium diagram, rate of crystal growth, equilibrium crystallization,	1
5.2	Crystallization equipment, classification, construction and operation, tank, agitated batch, Swenson-Walker vacuum crystallizers	2
5.3	Distillation, binary mixtures, flash and differential distillation, steam distillation	2
5.4	Continuous distillation with rectification, vacuum distillation	2
5.5	Batch distillation – operation and process, advantages and limitations Distillation equipments, construction and operation, factors influencing the operation	2

FTT305	FOOD ANALYSIS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: This course is designed to introduce the basic concepts of Food Analysis, explain the principles behind Sampling and proximate analysis, review the Government regulations related to the analysis of food materials and to strengthen the knowledge about the different equipment and techniques employed in food analysis.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	To be familiar with the Government Regulations pertaining to Food Analysis
CO 2	Identify the different methodologies employed in proper Sampling of food
CO 3	Review the principles behind the analysis of various food components
CO 4	To recognise the different techniques employed for analysis of components in food
CO 5	To gain knowledge of the instrumentation and Working of equipment used for Food Analysis

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3										
CO 2	3	2	2		3							
CO 3	2	3										
CO 4	1	1	3									
CO 5	2	2										

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is meant by accreditation? What is the function of NABL in the accreditation process?
2. Why is it necessary to analyse food? What are the different types of food anaysis?
3. Define sampling and describe sampling plan?
4. Give details of role of AOAC in food analysis.

Course Outcome 2 (CO2)

1. How will you determine the fat content of a given sample by Soxhlet method?
2. What is the significance of moisture estimation in food products? Explain Karl Fischer Titration technique for moisture analysis.
3. What is proximate analysis? Explain in detail.

Course Outcome 3(CO3):

1. Explain the principles of Spectroscopy in relation to Beer-Lambert's law.
2. Illustrate the principle and working of Fluorescence Spectroscopy.

3. What do you mean by absorption spectra and emission spectra? What is it's application in spectroscopy?

Course Outcome 4 (CO4):

1. What is Chromatography? Explain briefly about any three types of Chromatography.
2. What is HPLC? Describe the principle and instrumentation.
3. How does separation takes place in Gel filtration chromatography? Explain with a neatly labelled sketch.

Course Outcome 5 (CO5):

1. What is Radioimmunoassay? Illustrate the procedure for RIA with suitable diagrams.
2. How will you carry out Polyacrylamide gel electrophoresis?
3. Explain the methods used for analysing extraneous matter present in food.

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT305
FOOD ANALYSIS

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Write a short note on the national agency that regulates food safety and standards in India.
2. Define Sampling. What is meant by the term, 'Sampling Plan'?
3. What is proximate analysis?
4. What are the applications of TGA and DSC?
5. What do you mean by electromagnetic spectrum?
6. Explain Beer's Lambert's Law.
7. What is meant by RF? How will you interpret RF value?
8. What are Supercritical fluids? Explain with an example.
9. Differentiate between AGE and PAGE.
10. What is the principle of Isoelectric focusing?

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Give an account of NABL accreditation.

(OR)

12. Explain the role of export inspection council and export inspection agencies in our country.

13. Detail on the solvent extraction methods for analysis lipids.

(OR)

14. How will you determine ash content by dry and wet ashing method?

15. Write an essay on UV-Visible spectrophotometer with neat sketch.

(OR)

16. How can you employ Atomic Absorption and Emission Spectroscopy for mineral analysis?

17. How does separation takes place in Gel filtration chromatography?

(OR)

18. Explain the principle, working and instrumentation of High performance liquid chromatography?

19. What is Polyacrylamide gel electrophoresis? How will you carry out Polyacrylamide gel electrophoresis?

(OR)

20. Detail on the methods to analyse extraneous matter in foods.

Syllabus

Module 1

Introduction to food analysis: Significance and types of analysis - Government regulations - regulations of FSSAI 2006 – CAC -AOAC - Export Inspection Council - NABL accreditation - Sampling as per FSSA 2006

Module 2

Proximate and other methods of analysis: Proximate analysis – Moisture and Total Solids - Ash, Fat, Carbohydrate, Protein Analysis, pH and Titratable Acidity, Analysis of extraneous matter - Thermal Analysis – TGA, DSC

Module 3

Spectroscopy: Spectroscopy principles - Beer Lambert's law - deviation from Beer Lambert's law - Construction of Calibration curve, UV Visible spectroscopy, Fluorescence spectroscopy, Atomic Absorption and Emission Spectroscopy

Module 4

Chromatography: Principles of Chromatography- Column chromatography - Thin layer chromatography - Gel filtration Chromatography - Gas-liquid chromatography-High-performance liquid chromatography - Supercritical fluid chromatography

Module 5

Electrophoresis: Principle of Gel electrophoresis – AGE, PAGE, SDS-PAGE, Capillary Electrophoresis - Isoelectric focusing - 1 D and 2 D electrophoresis - Radio Immunoassay - Rocket Electrophoresis

Text Books

1. Nielsen, Suzanne (Ed.), Food Analysis, 2010, Springer US, ISBN 978-1-4614-2589-2

2. Semih Otles, "Methods of Analysis of Food Components and Additives", Published October 17, 2016, by CRC Press, ISBN 9781138199149

Reference Books

1. Semih Otles, Handbook of Food Analysis Instruments, 2016, CRC Press, ISBN 9780429147340

2. Adriana S. Franca and Leo M.L. Nollet, Spectroscopic Methods in Food Analysis, 2018, CRC Press, ISBN 9781498754613 (978-1-4987-5461-3)

3. Leo M. L. Nollet, Handbook of Food Analysis Vol I and II, Second Edition, Revised and Expanded, 2004 by Marcel Dekker, Inc, ISBN: 0-8247-5036-5

4. Rui M. S. Cruz, Igor Khmelinskii, Margarida Vieira, Methods in Food Analysis, 2014, CRC Press, ISBN 9781138582477

5. Kent K. Stewart and John R. Whitaker, Modern Methods Of Food Analysis, AVI PUBLISHING COMPANY, INC, ISBN 978-94-011-7381-0

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to food analysis**	
1.1	Significance and types of analysis - Government regulations	3
1.2	Regulations of FSSAI 2006 – CAC -AOAC - Export Inspection Council - NABL accreditation	3
1.3	Sampling as per FSSA 2006	3
2	**Proximate and other methods of analysis**	
2.1	Proximate analysis – Moisture and Total Solids - Ash, Fat, Carbohydrate, Protein Analysis	3
2.2	pH and Titratable Acidity, Analysis of extraneous matter	3
2.3	Thermal Analysis – TGA, DSC	3
3	**Spectroscopy**	
3.1	Spectroscopy principles - Beer Lambert's law - deviation from Beer Lambert's law - Construction of Calibration curve,	3
3.2	UV Visible spectroscopy, Fluorescence spectroscopy,	3
3.3	Atomic Absorption and Emission Spectroscopy	3
4	**Chromatography**	
4.1	Principles of Chromatography	3
4.2	Column chromatography - Thin layer chromatography - Gel filtration Chromatography - Gas-liquid chromatography-	3
4.3	High-performance liquid chromatography - Supercritical fluid chromatography	3
5	**Electrophoresis**	
5.1	Principle of Gel electrophoresis	3
5.2	AGE, PAGE, SDS-PAGE, Capillary Electrophoresis - Isoelectric focusing - 1 D and 2 D electrophoresis	3
5.3	Radio Immunoassay - Rocket Electrophoresis	3

FTT 307	CEREAL AND LEGUME TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the various unit operations involved in the cereals and legume processing.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the processing of rice and utilization of by products.
CO 2	Understand the processing of barley and wheat
CO3	Understand the processing of corn, oat and millets
CO 4	Recognizes the value added products and their processing
CO 5	Understand the processing of various legumes and their products.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2										1
CO 2	3	2	2									1
CO 3	2	2	3									1
CO 4	2	2										1
CO 5	2	3										1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe the status of grain industry in India.
2. Describe the different methods of parboiling.
3. Illustrate the processing of rice milling
4. Describe the processing of various by products of rice industry.

Course Outcome 2 (CO2)

1. Describe the classification of wheat and their nutritional composition.
2. Describe the nutritional composition of barley
3. Illustrate the processing of wheat milling and the equipments used.
4. Illustrate the processing of commercial malt
5. Describe the types of wheat flour used in the industries

Course Outcome 3(CO3):

1. Describe the milling of corn
2. Describe the processing of oats
3. Describe the processing of millets

Course Outcome 4 (CO4):

1. Describe the processing of breakfast cereals
2. Describe the processing of protein isolate, flakes, popcorn, puffed snacks, HFCS, special dietary foods

Course Outcome 5 (CO5):

1. Describe the nutritional composition of pulses.
2. Describe the antinutritional factors present in the pulses
3. Illustrate the processing of pulses
4. Describe the various storage bins and silos.

Model Question paper

			Total Pages:
Reg No.:_________________		Name:______________________________	
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIFTH SEMESTER B.TECH DEGREE EXAMINATION			
Course Code: FTT 307			
Course Name: CEREAL AND LEGUME TECHNOLOGY			
Max. Marks: 100			Duration: 3 Hours
PART A			

		Answer all questions, each question carries 3 marks.	Marks
1		Detail the types of rice	3
2		What is the significance of parboiling in rice processing?	3
3		What is the role of break roll in wheat milling?	3
4		What is malt?	3
5		List out the major millets	3
6		Differentiate between acid and enzyme hydrolysis?	3
7		Explain puffed snacks	3

8		What are protein isolates?	3
9		Explain CAP storage	3
10		Describe the wet milling of pulses	3
PART B			
Answer any one question from each or question, each carries 14 marks			
11	a)	Describe the different methods of parboiling.	(7)
	b)	With a neat flow chart, explain the processing of refined rice bran oil	(7)
		OR	
12	a)	With neat flow chart, explain the different unit operations involved in the rice milling	(14)
13	a)	Elucidate the milling of wheat with detailed description of equipments.	(14)
		OR	
14	a)	Detail the commercial production of malt	(14)
15	a)	Describe the acid hydrolysis of corn	(7)
	b)	With neat flow chart, explain the processing of oats	(7)
		OR	
16	a)	Describe the processing of pearl and finger millets	(14)
17	a)	Explain the different methods of protein isolate production?	(7)
	b)	Explain the processing of bread	(7)
		OR	

18		Describe the processing of HFCS	(14)
19	a)	Describe the silo flow pattern in detail	(7)
	b)	Elucidate the processing of soyabean	(7)
		OR	
20	a)	What are antinutritional factors and explain any five ANFs	(10)
	b)	What is dry milling of pulses	(4)
		****	

Syllabus

Module 1

Rice processing:-

Status of grain processing industries in India – rice- varieties- nutrient composition- Parboiling – physico chemical changes during parboiling – soaking – steaming – drying – modern methods of parboiling- Rice milling – equipments involved in the rice milling processing – Cleaner – Stoner – Husker- Separator- Whitening machine – By product utilization – processing of rice bran oil

Module II

Wheat and Barley Processing

Wheat - nutrient composition – classification of wheat - Milling of wheat -equipments used in the milling – break roll – reduction roll- purifier – plan sifter – scalping - scratch system- Types of wheat flour - Barley – Nutrient composition – Commercial production of malt

Module III

Corn, oats and millet processing

Milling of corn -Dry milling and wet milling- Gluten and starch separation – enzyme hydrolysis – acid hydrolysis- Processing of oats- Millet – major millet – minor millet - Processing of pearl and finger millets

Module IV

Value added products from Cereals

Processing of break fast cereals – processing of extruded products (noodles and pasta) - bread - Processing of protein isolates, flaked products- Processing of popcorn, puffed snacks, HFCS - Processing of special dietary foods

Module V

Legumes

Types – nutrient composition – anti nutritional factors present in the pulses - Commercial milling of pulse – premilling techniques - Processing of soya bean- Storage structure- Bag storage, Cover and plinth, CAP storage (Ceiling and Plinth Storage)- Silos and large bins - Silos flow pattern.

Text Books

1. Matz, Samuel A. "The Chemistry and Technology of Cereals as Food and Feed". 2nd Edition, CBS, 2014.
2. Chakraverty, A. Post Harvest Technology of Cereals, Pulses and Oil Seeds , Third Edition, Oxford & IBH, 2008
3. N.L.Kent, "Technology of Cereals", Elsevier, 1994.

Reference Books

1. Delcour, Jan A. and R. Carl Hoseney. " Principles of Cereal Science and Technology". 3rdEdition. American Association of Cereal Chemists, 2010.
2. Karl Kulp. "handbook of Cereal Science and Technology". 2nd Rev. Edition. CRC Press, 2000.
3. Chavan, U D & J V Patil, Millets Nutritional Value And Processing Technology , 1st edition, Astrall Publications, 2016
4. Gavin ed Owens, Cereals Processing Technology, Bio-Green Elsevier (Exc); Nil edition (2015), 978-935107329
5. Joseph Awika (Editor), Vieno Piironen (Editor), Scott Bean (Editor), Advances in Cereal Science: Implications to Food Processing and Health Promotion, OUP USA (7 June 2012), 978-0841226364

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Rice Processing (9)**	
1.1	Status of grain processing industries in India – rice- varieties-nutrient composition	1
1.2	Parboiling – physico chemical changes during parboiling – soaking – steaming – drying – modern methods of parboiling	2

1.3	Rice milling – equipments involved in the rice milling processing – Cleaner – Stoner – Husker- Separator- Whitening machine	2
1.4	By product utilization – processing of rice bran oil	2
2	**Wheat and Barley processing (9)**	
2.1	Wheat - nutrient composition – classification of wheat	2
2.2	Milling of wheat -equipments used in the milling – break roll – reduction roll- purifier – plan sifter – scalping - scratch system	3
2.3	Types of wheat flour	2
2.4	Barley – Nutrient composition – Commercial production of malt	2
3	**Corn, oats and millet processing (9)**	
3.1	Milling of corn -Dry milling and wet milling	2
3.2	Gluten and starch separation – enzyme hydrolysis – acid hydrolysis	2
3.3	Processing of oats	2
3.4	Millet – major millet – minor millet	2
3.5	Processing of pearl and finger millets	1
4	**Value added products from cereals: (9)**	
4.1	Processing of break fast cereals – processing of extruded products (noodles and pasta) - bread	2
4.2	Processing of protein isolates, flaked products	2
4.3	Processing of popcorn, puffed snacks, HFCS	4
4.4	Processing of special dietary foods	2
5	**Legumes and storage structure: (9)**	
5.1	Types – nutrient composition – anti nutritional factors present in the pulses	2
5.2	Commercial milling of pulse – premilling techniques	1
5.3	Processing of soya bean	2
5.4	Storage structure- Bag storage, Cover and plinth, CAP storage (Ceiling and Plinth Storage)	1
5.5	Silos and large bins - Silos flow pattern	2

FTL331	UNIT OPERATIONS IN FOOD LAB	CATEGORY	L	T	P	CREDIT
		PCC	0	0	3	2

Preamble: The course is designed to demonstrate and illustrate the physical, thermal, aerodynamic frictional and rheological properties of food. Goal of this course is to develop the practical knowledge of students in identifying various engineering properties of food.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand and practice different techniques for determining different fluid properties
CO 2	Understand and practice different techniques for determining the thermal properties of food such as thermal conductivity, specific heat etc.
CO 3	Understand and practice different techniques for determining heat transfer properties
CO 4	Acquire the ability to understand, explain and use equipment for mass transfer operations.
CO 5	Acquire the ability to understand, explain and use equipment for unit operations like adsorption, drying etc.
CO 6	Learn to design and carry out scientific experiments as well as accurately record and analyse the results of such experiments

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				2							3
CO 2	3				2							3
CO 3	3				2							3
CO 4	3				2							3
CO 5	3				1							3
CO 6	3				1							3

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration

150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work : 15 Marks
(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting): 25 Marks
(d) Viva voce : 20 marks
(e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering the entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Determination of of power consumption evaluation of different impellers
2. Evaluate the difference in the flow measurement using different equipment.

Course Outcome 2 (CO2)

1. Determine the thermal properties and their efficiency of steam in the extraction of foods
2. Determination of the rate of heat transfer and heat transfer coefficient of Shell and tube heat exchanger

Course Outcome 3(CO3):

1. Evaluate heat transfer properties of a given shell and tube heat exchanger
2. Determine the rate of drying at natural and forced draft conditions.

Course Outcome 4 (CO4):

1. Verify the applicability of Freundlich equation for adsorption

2. Determine the recovery efficiency of the given leaching system.

Course Outcome 5 (CO5):

1. Evaluate the drying characteristics of a given food sample using the dryer.
2. Draw the adsorption isotherm of the given system.

Course Outcome 5 (CO 6)

1. Evaluate the ability to interpret the findings of the given results
2. Learn the efficiency of the student to conduct experiments and do the calculations.

LIST OF EXPERIMENTS: (Minimum 12 are mandatory)

1. Power consumption in agitated vessel impellers with and without baffles.
2. Determination of thermal and vapourization efficiencies for steam distillation of turpentine
3. Determination of coefficient of discharge of Venturimeter
4. Calibration of venturimeter
5. Determination of coefficient of discharge of Orifice meter
6. Calibration of orifice meter
7. Verification of the applicability of Freundlich equation for adsorption for the given system and determination of the values of adsorption constants 'k' and 'n' at room temperature
8. Draw the binodal solubility curve for glacial acetic acid-benzene-water system at room temperature and pressure
9. Determination of the rate of heat transfer and heat transfer coefficient of Shell and tube heat exchanger
10. Determination of rate of drying and plotting drying curve of natural circulation dryer
11. Determination of the minimum fluidization velocity and terminal settling velocity of Fluidised bed dryer
12. Determination of the rate of drying for the given food grains in Rotary dryer
13. Determination of rate of filtration for constant pressure filtration
14. Determination of the percentage of actual recovery curves for single stage leaching
15. Determination of the overall stage efficiency of a continuous cross-current leaching unit for extracting sodium carbonate from a mixture of sodium carbonate and sand by conducting a batch laboratory experiment
16. Determination of the overall stage efficiency of a continuous counter-current leaching unit by the batch simulation of a counter-current cascade
17. Verification of the material balance equation for distillation $F X_F = D *Y_D + W X_W$ and Rayleigh's equation for methanol water mixture
18. Study of Freeze dryers.
19. Experiment on "Heat transfer in double pipe heat exchanger in laminar flow .
20. Experiment for the determination of Reynolds number for the flow through the

circular pipe.

Reference Books

1. Richardson, J.E. etal.,“Coulson & Richardson’s Chemical Engineering” Vol.2 (Praticle Technology & Separation Processes”) 5th Edition, Butterworth – Heinemann / Elsevier, 2003.

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FTL333	FOOD ANALYSIS AND QUALITY EVALUATION LAB	CATEGORY	L	T	P	CREDIT
		PCC	0	0	3	2

Preamble: Objective of this course is to develop the knowledge of students in the area of Food analysis. This course is designed to demonstrate the major chemical and physical properties of foods and also shows the effects of processing and preservation methods on nutritional and sensory quality of food. Students will evaluate different food products using various chemical analysis techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	To understand the principles behind food analysis
CO 2	To gain Knowledge of basic equipments for food sample analysis
CO 3	Calculate and interpret nutrient composition of foods
CO 4	Evaluate data generated by experimental methods for quality evaluation of food sample
CO 5	Interpret the quality parameters of food sample in relation to food standards and regulation

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1												
CO 2	3	2				2	2	2	2			3
CO 3	3	2	3									3
CO 4	3	2				2	2	2	2			3
CO 5	3	2	**2**						2			3

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern:

The following guidelines should be followed regarding award of marks

(a) Preliminary work : 15 Marks
(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting): 25 Marks
(d) Viva voce : 20 marks
(e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Basic principle behind food analysis
2. Proximate analysis of foods
3. Errors in food analysis

Course Outcome 2 (CO2)

1. Checking the 0brix by using hand refractometer
2. Preparation of standard curve
3. Validation of Beer Lambert's law

Course Outcome 3(CO3):

1. Estimation of protein

2. Perform Soxhlet analysis
3. Estimation of fibre content

Course Outcome 4 (CO4):

1. Perform two methods to detect the rancidity of oil
2. Nutrient analysis in relation to shelf life of food
3. Nutrient analysis subjected to different processing conditions

Course Outcome 5 (CO5):

1. How to interpret the results of food analysis
2. FSSAI regulations of food standards and labelling
3. Differentiate unsafe and substandard foods

List of Exercises/Experiments: (Minimum 12 are mandatory)

1. Analysis of water activity
2. Moisture content in foods in relation to different unit operations
3. Determination of Ash and ash analysis
4. Determination of protein content of food
5. Determination of fat content of food
6. Determination of fiber content of food
7. Estimation of carbohydrate content of food
8. Analysis of pectin
9. Estimation of Calcium in milk
10. Estimation of iron content in food
11. Determination of antioxidant activity
12. Shelf life analysis of food
13. Quality analysis of Tea/Coffee/
14. Quality analysis of Beverages
15. Quality analysis of Sugar and Confectionery
16. Quality analysis of Fruits and Vegetable products
17. Quality analysis of milk and milk products
18. Quality analysis of fat and oil
19. Quality analysis of fish and meat
20. Quality analysis of spices

Text Book:

1. Morris B. Jacobs , *The chemical analysis of foods and food products,* III Edition, CBS Publishers and distributors New Delhi.
2. *ISI hand book of food analysis*
3. Ranganna S , *Hand book of analysis and quality control for fruit and vegetable products,*

II Ed., Tata McGraw Hill Publishing Co. New Delhi.

4. *Official Method of analysis of AOAC*
5. Rui M. S. Cruz, Igor Khmelinskii, Margarida Vieira, Methods in Food Analysis1st Edition, 2014 CRC Publishers

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEMESTER V

MINOR

KTU Estd. 2014

CODE FTT381	FOOD PACKAGING TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: This course will deal with the different packaging materials and packaging systems being used in food industry. This course gives understanding of the properties of different packaging material and its manufacturing processes.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the different uses of packaging materials its manufacturing process and properties
CO 2	Understand the principle and working set up of different packaging systems
CO 3	Evaluate the physical and barrier properties of different packaging materials
CO 4	Calculate the shelf life of packaged foods
CO 5	Identify the criteria to design packaging material based on type of foods

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1									
CO 2	3	2	1	2								
CO 3	3	2	2	1	1							
CO 4	1	1	2	3	**1**	**1**						
CO 5	3	1	3	2		**1**					1	

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

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Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Identify the different packaging materials.

2. Explain the manufacturing process of different packaging materials

3. Explain the properties of different packaging materials.

Course Outcome 2 (CO2)

1. Explain the mechanism and working of different packaging systems.

2. Identify the application of process based on food types.

3. Explain how these packaging extends the shelf life of product.

Course Outcome 3(CO3):

1. Explain the physical properties of plastic packaging materials

2. Evaluation WVTR & OTR of packaging materials

3. Evaluation of package performance

Course Outcome 4 (CO4):

1. Explain the factors affecting the shelf life of packaged food.

2. Calculate the permeability.

3. Calculate the expected shelf life of packaged food.

Course Outcome 5 (CO5):

1. Explain the biochemical changes in food

2. Explain the characteristics of different food categories

3. Explain the interaction between the package and contents.

Model Question paper

Reg No.:_________________ Name:___________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH &YEAR

Course Code: FTT381

Course Name: FOOD PACAKGING TECHNOLOGY

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks.

		Marks
1	Define packaging.	(3)
2	Why annealing is done on glass bottles?	(3)
3	Define vacuum packaging.	(3)
4	Explain aseptic packaging.	(3)
5	Write down the properties of LDPE	(3)
6	What are the roles of lacquers in metal can?	(3)
7	Define theory of permeability.	(3)
8	Explain the importance of WVTR in food packaging material.	(3)
9	What are the criteria for selecting a packaging material?	(3)
10	What are the factors need to be considered while selecting a packaging material for dairy products?	(3)

PART B

Answer any five questions, each carries 14 marks.

11	Illustrate the manufacturing process of paper	(14)
12	a) Elaborate the principle and working set up of aseptic packaging system.	(10)
	b) Write down the application of vacuum packaging in food industry	(4)
13	Explain the packaging requirements for bakery products packaging	(14)
14	a) Explain the properties and application techniques of lacquers in tin	(10)
	b) Why beer is packed in glass containers?	(4)
15	Illustrate the manufacturing techniques process of glass bottles	(14)
16	Explain the procedure for determining WVTR in packaging film	(14)
17	Illustrate the different heat-sealing techniques with neat diagrams	(14)
18	Explain the packaging requirements for dairy products packaging	(14)
19	Explain the procedure for determining OTR in packaging film.	(14)
20	Elaborate the principle and working set up of CA packaging system.	(14)

Syllabus

Module 1

Introduction: Definitions, objectives and types of packaging materials; functions of package. Cushioning materials; Paper as food packaging material, Corrugated paper board manufacturing process; Glass: Manufacturing process, properties, uses advantages & disadvantages

Module 2

Plastics as food packaging material-, properties of different types of plasicmaterials : LDPE, PP, BOPP, PET, Polyester materials, manufacturing process of plastic films & bottles ,Co-extrusion, lamination, heat sealing techniques; Metal- tin and aluminium cans, manufacturing process: three piece can and two piece cans, can lacquering.

Module 3

Packaging Systems: MAP and CAP, Vacuum packaging, aseptic packaging, retort packaging, stretch and shrink wrapping, microwave ovenable packages active and intelligent packaging

Module 4

Packaging materials used for and criteria for selection of packaging materials for the following foods; fruits and vegetable products; meat and poultry products, dairy products, bakery & confectionery products, carbonated beverage and alcoholic beverages

Module 5

Properties: Tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, methods of testing and evaluation; Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods, Evaluation of Package Performance

Text Books

1. Robertson, G.L. *Food Packaging: Principles and Practice,* 2nd Edition. Taylor & Francis, 2006.

2. S. Sacharow and R.C. Griffin*, Principles of Food Packaging,* AVI Pub. Co., 1988

Reference Books

1. *Han, Jung H. "Innovations in Food Packaging". Elsevier, 2005.*
2. *Ahvenainen, Raija. "Novel Food Packaging Techniques". Wood Head Publishing, 2003*
3. *M. Mahadeviah and R.V. Gowramma Food Packaging Materials*
4. *Paine E.A, "Fundamentals of packaging*

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**8**
1.1	Definitions, objectives and types of packaging materials; functions of package	2
1.2	Cushioning materials, types and its characteristics	1
1.3	Manufacturing process of paper	1
1.4	Properties of glass and its uses, advantages and disadvantages	2
1.5	Manufacturing process/ techniques of glass jars and bottles	2
2	**Plastics and metal as packaging material**	**8**
2.1	Properties of plastic materials -LDPE, PP, BOPP	2
2.2	Properties of plastic materials -PET, Polyester	1
2.3	Manufacturing techniques: Extrusion, blow molding, and injection molding	2
2.4	Heat sealing techniques	1
2.5	Co extrusion and lamination techniques	2

3	**Packaging systems**	**9**
3.1	CAP &MAP,vacuum packaging	2
3.2	Principles, working set up of aseptic packaging	2
3.3	Principles, working set up of retort packaging	1
3.4	Principles, working set up of active and intelligent packaging	2
3.5	Shrink wrapping, stretch wrapping and microwaveovenablepacakges	2
4	**Packaging Materials**	**10**
4.1	Packaging materials used for and criteria for selection of packaging materials for dairy products	2
4.2	Packaging materials used for and criteria for selection of packaging materials for fruits and vegetable products	2
4.3	Packaging materials used for and criteria for selection of packaging materials for meat and meat products	2
4.4	Packaging materials used for and criteria for selection of packaging materials for bakery and confectionary products	2
4.5	Packaging materials used for and criteria for selection of packaging materials for carbonated and alcoholic beverages	2
5	**Testing and evaluation**	**10**
5.1	Tensile strength, bursting strength, tearing resistance	2
5.2	Puncture resistance, impact strength and tear strength	2
5.3	Theory of permeability, factors affecting permeability	1
5.4	Permeability coefficient	1
5.5	Determination of GTR	1
5.6	Determination of WVTR	1
5.7	Prediction of shelf life of foods	1
5.8	Evaluation of package performance	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT383	FOOD PLANT LAYOUT AND DESIGN	VAC	3	1	0	4

Preamble: This course designed with the fundamental study of manufacturing process, selection of plant location, development of plant layout while focusing on the needs of food entrepreneur to understand measurements and basic design techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO 1	List out the basic concepts involved in plant design and layout with respect to safety standards and economics in food process industries.
CO 2	Identify the factors involved in plant location, apply location theory models to select a location and develop plant layout using systematic layout planning.
CO 3	Identify the design considerations in food plant including layout and ventilation and develop process flow sheet for food plant
CO 4	Design and develop plant layout and plant design for various food processing industries
CO 5	Familiarize various plant layouts and product manufacturing

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2		2	1				3				
CO 2	3	2										
CO 3	2		3	1								
CO 4		2	3									
CO 5	3											

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10

Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List out the safety standards needed for plant layout.

2. Explain the characteristics of an efficient layout.

3. Write a short note on HACCP and ISO standards on plant layout.

Course Outcome 2 (CO2)

1. Identify the factors involved in plant location, apply location theory models to select a location and develop plant layout using systematic layout planning
2. Give a detailed note on criteria required for selection of plant site
3. Explain in detail about plant location theories.
4. Describe in detail about economic plant size

Course Outcome 3(CO3):

1. List out the factors that should consider to prepare a plant layout

2. Exemplify the layout features of bakery plant

3. Elucidate the floor plan layout.

Course Outcome 4 (CO4):

1. Give a detailed note on design of a beverage plant layout.
2. Explain the steps involved in design of meat plant.
3. Write a short note on drying plant layout

Course Outcome 5 (CO5):

1. Exemplify in detail on selection of driers
2. Explain various driers and its uses.
3. Give a detailed account on water disposal.

API ABDUL KALAM TECHNOLOGICAL UNIVERSITY

MODEL QUESTION PAPER

QP CODE:
Reg No.: ________________
Name: ________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT383
FOOD PLANT LAYOUT AND DESIGN

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Write a short note on the application of HACCP on food plant design.
2. Define plant layout. What are the types of plant layout?
3. What are the plant layout objectives?
4. What are the various plant location models?
5. What are the factors to be consider for the selection of plant site?
6. Explain SLP.
7. What are the recent trends in baking plant layout?
8. Write a short note on general food plant layout
9. Draw a diary plant layout diagram
10. Describe safety arrangement in a Diary plant

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Give an account of the requirements in food plant layout and design.

(OR)

12. Explain the role of ISO and other regulatory bodies in food plant layout.

13. Detail on the classical and practical layout.

(OR)

14. Explain the characteristics of an efficient layout.

15. Write an essay on development and presentation of layout.

(OR)

16. Give an account on equipment layout with a neat sketch

17. Detail on the types of baking and frying layout with diagrams?

(OR)

18. Explain the layout of fruits and vegetables industry with a neat diagram.

19. Detail on the layout of meat and poultry industry with the help of a diagram.

(OR)

20. Explain a diary plant in a layout diagram.

Syllabus

Module 1

Introduction:
Basic concepts of plant layout and design with special reference to food process industries. Manufacturing processes-concept -types Application of HACCP concept, ISO, other regulatory bodies, requirements in food plant layout and design. Basic plant economics

Module 2

Plant Location
Plant location, location theory and models, Plant location factors-plant site selection-Economic plant size-plant layout objectives-classical and practical layout. Characteristics of an efficient layout

Module 3

Development of the Layout
SLP, Development and presentation of the layout, selection of site and Location of plant, General points of considerations for designing food plant, floor plant types of layouts Food building planning, Basic understanding of equipment layout and ventilation in food

Module 4

Baking oven and frying plant-types

Recent trends in Plant layout, general food plant layout. Layout of fruit and vegetable processing plants. Baking oven and frying plant-types, concepts and layout. Filling closing and labeling plant layout, drying plant layout, drier types, selection of driers - Sample layout.

Module 5

Dairy Plant Layout

Plant layout and design for milk and milk products. Miscellaneous aspects of plant layout and design like provision for waste disposal, safety arrangements etc.

Other plant layouts - Layout for extruded and confectionery products, meat and poultry products fat and oil processing industry and beverages.

Text Books

1. James M Moore, “Plant Layout and Design”, MacMillan & Co.,1969
2. Bhattacharjee, B.C. Chemical Equipment Design, 1990
3. Joshi, M.V and V.V. Mahajani. Process Equipment Design (3rd edition). New India Publishing Agency, New Delhi, 2004.
4. Phirke, P.S,. Processing and conveying equipment design. Jain Brothers, New Delhi, 2004.

Reference Books

1. Hall,H.S and Y.Rosen, “Milk plant layout” (F.A.O. Publication) 1976
2. J M Apple, “Plant layout and Material Handling”, John Willey & Sons,1977
3. Slade, F.H, “Food processing plant”. Leonardhill Books, London1967

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Introduction**	**10**
1.1	Basic concepts of plant layout and design with special reference to food process industries	2
1.2	Manufacturing processes-concept -types	3
1.3	Application of HACCP concept, ISO, other regulatory bodies, requirements in food plant layout and design.	2
1.4	Basic plant economics	3
2	**Module 2- Plant Location**	
2.1	Plant location, location theory and models	2
2.2	Plant location factors and plant site selection	2
2.3	Plant layout objectives- classical and practical layout.	2
2.4	Characteristics of an efficient layout	2

3	**Module 3- Development of the Layout**	**7**
3.1	Equipment required-Quality and standards	3
3.2	Regulations to be followed	2
3.3	Packaging requirement for bakery products, Bakery unit layout	2
4	**Module 4- Baking oven and frying plant-types**	**10**
4.1	Recent trends in Plant layout	2
4.2	Layout of fruit and vegetable processing plants.	2
4.3	Baking oven and frying plant-types, concepts and layout	2
4.4	Filling closing and labeling plant layout	2
4.5	Drying plant layout and drier types	2
5	**Module 5- Dairy and other plant layouts**	**10**
5.1	Plant layout and design for milk and milk products	2
5.2	Miscellaneous aspects of plant layout and design for waste disposal	2
5.3	Layout for extruded and confectionery products	2
5.4	Meat and poultry product layout	2
5.5	Fat and oil processing industry and beverages layout	2

FTT 385	FOOD PRODUCT DESIGN AND DEVELOPMENT	CATEGORY	L	T	P	CREDIT
		VAC	4	0	0	4

Preamble: Goal of this course is to develop the knowledge of students to plan and execute a food processing unit. To enable the students to a level where they will be able to give contributions for the improvement of product development process.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Students will get a knowledge on the basic concepts of product development and innovation strategy
CO 2	Students will learn to apply the concept of Product Development Process
CO 3	Students will gain understanding about knowledge base for Product Development
CO 4	Students will analyse the role of consumers in product development
CO 5	Students will learn to manage the product development process
CO 6	Students will be able to improve the product development process

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	2									
CO 2	1	3	1									
CO 3	3											
CO 4	3											
CO 5	3	1										
CO 6	2	2	3									

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe factors for success of product development

2. Describe market survey process for product development

3. Explain innovation strategies

Course Outcome 2 (CO2)

1. Explain product cycle

2. Explain product development and commercialization

3. Explain the equipment needed for product development

Course Outcome 3(CO3):

1. Explain Role of consumers in product development

2. Explain the need of avoiding and acceptance of consumers.

3. Explain the Integration of consumer needs in product development.

Course Outcome 4 (CO4):

1. Explain the principles of product development management

2. Describe people in product development management

Course Outcome 5 (CO5):

1. Explain the method of product evaluation

Model Question paper

QP CODE: **PAGES: 2**

Reg No: ______________

Name: ______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT385

Course Name: FOOD PRODUCT DESIGN AND DEVELOPMENT

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions.

Each question carries 3 Marks

1. Define factor of success
2. Describe market survey process
3. Define steps in product launch and evaluation
4. Describe the equipments used in food product development
5. Explain the role of consumers in product development
6. Describe food preferences
7. Write constraints in product development
8. Describe people involved in product development management
9. Explain the sensory attributes of a product
10. Explain how shelf life of product is determined

PART B

Answer any one Question from each module.

Each Question carries 14 Marks

11. Describe the concept of product development, success and failure in detail (14)

OR

12. Explain the innovation strategy to be considered during product development (14)

13. Explain the Stages of product development process - product life cycle (14)

OR

14. Describe different techniques used in sensory evaluation (14)

15. Explain the method of Integration of consumer needs in product development. (14)

OR

16. Describe the avoiding and acceptance nature of consumer (14)

17. Explain in detail the principles involved in product development management (14)

OR

18. Explain the steps to be followed for managing and organising the product development process (14)

19. Describe the steps for evaluation of shelf life (14)

OR

20. Describe recent trends in food product development in India (14)

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Syllabus

Module 1

Concept behind food product design and development process

Concept of product development, product success and failure, factors for success- Market survey process for product development, managing for product's success- Innovation strategy -possibilities for innovation, building up strategy, product development programme

Module 2

Knowledge base for product development

Stages of product development process - product life cycle- Product development, product commercialization, product launch and evaluation- Technology, knowledge and the food system, knowledge management, knowledge for the conversion of raw material properties, equipment needed and design.

Module 3

Role of consumers

Role of consumers in product development - consumer behaviour, Food preferences, Avoiding and acceptance of consumers, Integration of consumer needs in product development.

Module 4

Managing the product development process

Principles of product development management, People in product development management, Establishing outcomes, budgets and constraints.

Module 5

Improving the product development process

Improving the product development process - key message, evaluating product development - Product Stability evaluation of shelf life, changes in sensory attributes and effects of environmental conditions.

Text Books

1. Clarke & Wright W.,Managing New Product and Process Development. Free Press, 1999, ISBN-13: 978-0029055175
2. Earle R, Earle R & Anderson A, Food Product Development, Woodhead Publishing, 2001,ISBN 978-1-84569-722-8

3. Karl Ulrich & Steven Eppinger Product Design and Development (Irwin Marketing) 6th Edition. McGraw-Hill Education; 6 edition (April 27, 2015), ISBN-13: 978-0078029066

Reference Books

1. Earle and Earle Creating New Foods. Chadwick House Group. 2001.ISBN 1-902375-12-2 / 1-902423-41-0
2. Fuller. New Food Product Development - from Concept to Market Place. CRCPress.2004.ISBN 9781439818640
3. Brody, Aarn L. and John B. Lord "Developing new Food Products for a Changing Marketplace", 2 nd Edition, CRC / Taylor & Francis, 2008.DOIhttps://doi.org/10.1201/9781420004328
4. Howard R. Moskowitz , Jacqueline H. Beckley, Anna V. A. Resurreccion, Sensory and Consumer Research in Food Product Design and Development (Institute of Food Technologists Series) Wiley-Blackwell; 2 edition (January 24, 2012) ISBN 978-0-8138-1366-0
5. Jacqueline H. Beckley Leslie J. Herzog M. Michele Foley. Accelerating New Food Product Design and Development, Second Edition, 2017, Print ISBN:9781119149309 |Online ISBN:9781119149330 |DOI:10.1002/9781119149330

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Concept behind food product design and development process**	
1.1	Concept of product development, product success and failure, factors for success	3
1.2	Market survey process for product development, managing for product's success.	3
1.3	Innovation strategy -possibilities for innovation, building up strategy, product development programme	3
2	**Knowledge base for product development**	
2.1	Stages of product development process - product life cycle	3
2.2	Product development, product commercialization, product launch and evaluation.	4
2.3	Technology, knowledge and the food system, knowledge management,	2
2.4	Knowledge for the conversion of raw material properties and equipment needed.	3
3	**Role of consumers**	
3.1	Role of consumers in product development - consumer behaviour	3
3.2	Food preferences.	2
3.3	Avoiding and acceptance of consumers.	2

3.4	Integration of consumer needs in product development.	2
4	**Managing the product development process**	
4.1	Principles of product development management	3
4.2	People in product development management	3
4.3	Establishing outcomes, budgets and constraints	2
5	**Improving the product development process**	
5.1	Improving the product development process - key message	3
5.2	Evaluating product development - Product Stability evaluation of shelf life, changes in sensory attributes and effects of environmental conditions	4

SEMESTER V

HONOURS

FTT 393	ADVANCED FLUID MECHANICS	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: This course provides an introduction to analyse the equation and problems in compressible fluids. It helps in determining the performance of fluid machineries and gain knowledge on the hazards occured during storage and transportation of gases.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Derive and understand the equations for flow past immersed bodies.
CO 2	Understand and apply the compressible flow equations.
CO 3	Analyse the problems related to incompressible turbulent flow.
CO 4	Determine the performance aspect of fluid machinery.
CO 5	Describe function of flow metering devices and determine the performance of flow metering devices
CO 6	Understand the hazards in storage and transportation of gases.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2		1								
CO 2	3	2	1	1								
CO 3	3	2	1	1								
CO 4	3	2			1							
CO 5	3	2			1							
CO 6	3	2				3						

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Derive the equation of fluid flow in immersed bodies.

2. Explain in detail about the Motion of particles through fluids in gravity and centrifugal field.

3. What is fluidization ? Explain the types and application of fluidization?

Course Outcome 2 (CO2)

1. Write short notes on flow of compressible fluids.

2. Describe the adiabatic flow with friction in conduits.

3. Derive the Frictionless flow through ducts with heat transfer.

Course Outcome 3(CO3):

1. Explain the turbulent flow of incompressible fluids in pipes and conduits.

2. Derive the Velocity distribution equations.

3.What are the Various fittings and valves used in fluid flow?

Course Outcome 4 (CO4):

1.With neat sketch Explain fans, blowers and compressors and give the comparison between them.

2. Explain different types of vacuum pump and ejectors.

Course Outcome 5 (CO5):

1. Describe the different head type flow meters and its working.

2. Write notes on open channel meters .

3.What is Electromagnetic flow meters and mechanical meters?

Course Outcome 6 (CO6):

1. Explain the storage of gases in cylindrical and spherical vessels.

2. What are the hazards in transportation and storage of liquids and gases?

MODEL QUESTION PAPER

QP CODE:
Reg No.:________________
Name: ________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT393
ADVANCED FLUID MECHANICS

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Define skin drag and form drag.

2. Distinguish between free and hindered settling.

3. Write briefly on shock waves.

4. What is meant by sonic velocity and mach number.?

5. Write the one seventh power law.

6. Write any 3 valves used in industries.

7. What is forced and induced draft?

8. Write on different types of compressors.

9. What is the principle of pitot tube?

10. What are constant area and constant head flow meters?

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Calculate the drag force and viscosity of the liquid when a spherical body of 0.5 cm dia. weighing 0.1 gram attains a terminal settling velocity of 0.5 cm. The density of the liquid is 1g/cc. (14)

OR

12.Explain the concept of fluidization. What are the advantages and disadvantages of Fluidization? (14)

13. Starting from the basic relations ,Derive integrated expressions for temperature in terms of Mach number for a polytrophic fluid flow under adiabatic conditions. (14)

OR

14. Discuss the flow of compressible fluid through convergent divergent nozzle. (14)

15. Derive the universal velocity distribution equation with neat diagram. (14)

OR

16.Explain on friction factor chart and how it is useful in estimating the equation..(14)

17.Distinguish between fans blowers and compressors with application. (14)

OR

18. What are the safety precautions to be taken for transporting and storing hazardous liquids and gases. (14)

19.Develop equations to compute flow rates using orifice meter and triangular weir. (14)

OR

20. Explain the working of anemometer. (14)

Syllabus

Module 1

Flow past immersed bodies-drag, drag coefficient-stream lining – friction in flow through beds of solids- Ergun , Kozney Carman and Blake Plummer equations – motion of particles through fluids in gravity and centrifugal fields- terminal settling velocity in Stokes law, intermediate law and Newtons law ranges – free and hindered settling- fluidization-condition for minimum velocity, types of fluidization, application of fluidization

Module 2

Flow of compressible fluids - perfect gas relationship- speed of sound and mach number - continuity equation, total energy balance - isentropic flow- shock waves- fannolines - rayleigh lines- adiabatic flow with friction in conduits – frictionless flow through ducts with heat transfer

Module 3

Turbulent flow of incompressible fluids in pipes and conduits- universal velocity distribution equation-nikuradse and von carmann equation-Blasius equation (derivation not required)- prandtl number , one seventh power law- friction factor chart- fittings and valves

Module 4

Fans, blowers and compressors – different types-compressor efficiency-forced and natural drafts – vacuum pump and ejectors- principle different types and comparison- storage of gases- cylindrical and spherical vessels- hazards in transportation and storage of liquids and gases-safety measures.

Module 5

Flow measuring devices-head type flow meters -orifice meter, venturi meter, pitot tube, flow nozzle- open channel meters- weirs and notches-electromagnetic flowmeters- variable area meter – cone and float type rotameter-mechanical flowmeter-positive displacement meter – rotating disc and turbine meter-anemometer.

Text Books

1. Dr.R.K.Bansal, Fluid mechanics and hydraulic machines", ,4th edition,30 Dec 2005.

2. McCabe W.L and Smith.J C, Unit operations of Chemical Engineering, McGraw Hill.

3. Streeter .V.L, Fluid Mechnaics, McGraw Hill.

Reference Books

1. Fox and McDonald, Fluid mechanics, John Wiley.

2. Kunii and Levenspiel, Fluidization Engineering.

3. Geancoplis, Transport process and unit operations, PHI, 3^{RD} edn.

4. Foust and Wenzel, Principles of unit operations, Wiley, 1980.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**FLOW OF PAST IMMERSED BODIES**	
1.1	Derivation of fluid flow in immersed bodies	3
1.2	Motion of particles through fluids in gravity and centrifugal field	3
1.3	Fluidization, types, application of fluidization.	3
2	**COMPRESSIBLE FLUIDS**	
2.1	Flow of compressible fluids	3
2.2	Adiabatic flow with friction in conduits.	3
2.3	Frictionless flow through ducts with heat transfer.	3
3	**INCOMPRESSIBLE FLUIDS**	
3.1	Turbulent flow of incompressible fluids in pipes and conduits.	3
3.2	Velocity distribution equations.	3
3.3	Various fittings and valves used in fluid flow.	3
4	**FLUID MACHINERY**	
4.1	Fans, blowers and compressors comparison and working principle	3
4.2	vacuum pump and ejectors- principle different types and comparison	3
4.3	Hazards in transportation and storage of liquids and gases.	3
5	**FLOWMETERS**	
5.1	Different head type flow meters working and derivation for flow rate.	3
5.2	Different open channel meters working	3
5.3	Electromagnetic flow meters and mechanical meters.	3

FTT395	COMPUTER AIDED DESIGN OF FOOD PLANT, MACHINERY AND EQUIPMENT	CATEGORY	L	T	P	CREDIT
		VAC	4	0	0	4

Preamble: Goal of this course is to develop the knowledge of students in the area computer aided design of food plant, machinery and equipment. This course is very essential for learning the basics terms and techniques of computer aided design.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Familiarize the basic terms associated with CAD/CAM
CO 2	Compare the working of various input/output devices
CO 3	Describe basics of co-ordinate systems and transformation
CO 4	Explain the concept of Computer aided process planning
CO 5	Characterize the Computer integrated manufacturing techniques
CO 6	Familiarize Numeric Control and APT

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1									
CO 2	1	2	1									
CO 3	1	3										
CO 4		3	1									
CO 5	1	1	2									
CO 6	1	2	2									

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List out the advantages of CAM.

2. Explain the types of production

3. List out the applications of CA/CAM process

Course Outcome 2 (CO2)

1. Explain types of memory

2. List out the Video Display Devices

3. Compare system software and application software

Course Outcome 3(CO3):

1. Explain scaling

2. List out the transformations that can be done using CAD

3. Compare reflection and rotation

Course Outcome 4 (CO4):

1. List out the difficulties in traditional process planning

2. Explain Material resource planning

3. Compare retrieval and generative type CAM technique

Course Outcome 5 (CO5):

1. List out the benefits of FMS

2. Explain Computer integrated manufacturing technique

3. Explain the components of FMS Equipment

Course Outcome 6 (CO6):

1. List the components of NC system

2. Explain the working of Swenson-Walker vacuum crystallizers

3. Elaborate on continuous distillation with reflux

Model Question paper

MODEL QUESTION PAPER

Total Pages:

Reg No.:_______________

Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT395

Course Name: COMPUTER AIDED DESIGN OF FOOD PLANT, MACHINERY AND EQUIPMENT

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions.

Each question carry 3 marks **Marks**

1. What is CAM the advantages of CAM? (3)
2. Explain product cycle (3)
3. Define translation (3)
4. Explain coordinate system and its types (3)
5. What are the difficulties in traditional process planning (3)
6. Describe Material resource planning. (3)
7. Explain the benefits of Computer integrated manufacturing (3)
8. Describe machine vision system (3)
9. What is NC technology? (3)
10. Explain the elements of APT language (3)

PART B

Answer any one full question from each module, each question carries 14 marks

Module-I

11. Explain the hardware components of Computer aided design (14)

or

12. Elaborate on Graphic Terminals of CAD system (14)

Module-II

13. Explain the transformations that can be done in CAD Modelling (14)

or

14. Explain geometric modelling techniques (14)

Module-III

15. Elaborate on Computer aided process planning (14)

or

16. Explain Computer aided manufacturing resource planning (14)

Module-IV

17. Elaborate on Computer integrated manufacturing (14)

or

18. Explain Flexible manufacturing system (14)

Module-V

19. Elaborate on PLC (14)

or

20. Explain NC technology (14)

Syllabus

Module 1

Introduction

Overview of CAD/CAM, Automation, product cycle, benefits; types of memory, definition of system software and application software ,design process, application of computers for design, Video Display Devices, Input/Output Devices, Hard-Copy Devices, data presentation, data and file structures, data base design, design work station- Graphics terminals

Module 2

Computer Graphics and Modelling

Computer graphics – co-ordinate systems- Basic Terminologies of Modelling- Geometric Modeling Techniques -wireframe, surface and solid modelling- transformations-Translation, Rotation, Scaling, Reflection-Homogeneous Coordinates- Projections- Orthographic, Axonometric, Oblique, Perspective-Curve representation

Module 3

Computer aided process planning

Computer aided process planning- difficulties in traditional process planning, computer aided process planning- retrieval and generative type- machinability data systems. Computer aided manufacturing resource planning- Material resource planning- benefits of MRP,Enterprise resource planning-integration with CAM/CAD

Module 4

Computer integrated manufacturing

Computer integrated manufacturing: CIM systems, benefits of CIM, Flexible manufacturing system: FMS Equipment, FMS layouts, Analysis methods of FMS, Benefits of FMS, Computer aided quality control: Automated inspection offline online. Contact and noncontact co-ordinate measuring machines, machine vision

Module 5

Numeric Control

CAM -Introduction to Numerical Control (NC) technology-components of NC system-applications in food processing- NC procedure, current status of NC, advantages and disadvantages of NC-PLC- Computer aided NC programming in APT language, elements of APT language

Text Books

1. Srinivasa Prakash Regalla , Computer Aided Analysis and Design, I K International Publishing House Pvt. Ltd (2010), **ISBN-13:** 978-9380026459
2. P Rao, N Tewari and T.K. Kundra , Computer Aided Manufacturing, McGraw Hill , 2017, **ISBN-13:** 978-0074631034

Reference Books

1. Mikell P. Groover**, Automation, Production Systems and Computer-Integrated Manufacturing,** Pearson Education; Fourth edition (2016), **ISBN-13:** 978-9332572492
2. Groover , Automation, Production Systems and Computer-Integrated Manufacturing, Pearson Education India; Fourth edition (2016), **ISBN-13:** 978-9332573826
3. Groover , CAD/CAM Computer Aided Design and Manufacturing, Pearson Education India, 1 edition (2003), **ISBN-13:** 978-8177584165
4. Zeid, CAD/CAM Theory & Practice 2E, Tata McGraw-Hill Education, 2009, ISBN: 0070151342, 9780070151345
5. Vikram Sharma, Fundamentals of CAD/CAM, S. K. Kataria & Sons, 2009, ISBN: 8189757946, 9788189757946

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**9**
1.1	OVERVIEW OF CAD/CAM, Automation, product cycle	2
1.2	Automation- types of memory-definition of system software and application software	3
1.3	Video Display Devices -Input/Output Devices- Hard-Copy Devices	2
1.4	data presentation- data and file structures- data base design-design work station-Graphics terminals	2
2	**Computer Graphics and Modelling**	**9**
2.1	Computer graphics – co-ordinate systems	3
2.2	Basic Terminologies of Modelling- Geometric Modelling Techniques -wireframe, surface and solid modelling	3
2.3	transformations-Translation, Rotation, Scaling, Reflection- Homogeneous Coordinates- Projections- Orthographic, Axonometric, Oblique, Perspective-Curve representation	3
3	**Computer aided process planning**	**9**
3.1	Computer aided process planning- difficulties in traditional process planning	2
3.2	computer aided process planning- retrieval and generative type-	3

	machinability data systems.	
3.3	Computer aided manufacturing resource planning- Material resource planning- benefits of MRP	2
3.4	Enterprise resource planning-integration with CAM/CAD	2
4	**Computer integrated manufacturing**	**9**
4.1	Computer integrated manufacturing: CIM systems, benefits of CIM	3
4.2	Flexible manufacturing system: FMS Equipment, FMS layouts, Analysis methods of FMS, Benefits of FMS.	3
4.3	Computer aided quality control: Automated inspection offline online. Contact and noncontact co-ordinate measuring machines, machine vision	3
5	**Numeric Control**	**9**
5.1	CAM -Introduction to Numerical Control (NC) technology-components of NC system- applications in food processing	3
5.2	NC procedure, current status of NC, advantages and disadvantages of NC-PLC	3
5.3	Computer aided NC programming in APT language, elements of APT language	3

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT397	ADVANCES IN FOOD PACKAGING	VAC	3	1	0	4

Preamble: This course will deal with various concepts and principles involved in food packaging and explain the objectives and need of food packaging in the food processing sector.The course will help the students to understand the role of packaging in maintaining the quality and shelf life of the product and also familiarize the students about modern packaging techniques.

Prerequisite: Nil

Course Outcomes:

CO 1	Explain the importance of packaging system to produce safe and convenient foods to the consumer
CO 2	Apply the knowledge of food packaging in various food processing sectors
CO 2	Enable the students to develop modern packaging technologies
CO 3	Students can understand the advantages and limitations of various packaging materials
CO 4	Develop skills in the area of food packaging required in various food processing industries
CO 5	Choose new type of packaging material to improve the shelf life & acceptability of food products
CO 6	Explain the importance of packaging system to produce safe and convenient foods to the consumer

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		2									
CO 2	3	3	2									2
CO 3	2	2	3									2
CO 4	3	3	2	3								
CO 5	2	2	2	2								2
CO 6	3	2			2	1	1					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the role of packaging in the food processing sector?

2. How food packaging improves sales?

3. Describe the functions of packaging systems to extend the shelf life of food

Course Outcome 2 (CO2)

1. Highlight the advantages and limitations of glass containers?

2. What are the ideal characteristics of food packaging materials?

3. Briefly explain the properties of flexible packaging materials in the food packaging system?

Course Outcome 3(CO3):

1. How will you extend the quality of food with respect to food packaging?

2. Explain about corrugated paper board

3. Discuss the properties and limitations of PET with respect to food packaging.

Course Outcome 4 (CO4):

1. Discuss about active packaging.

2. Briefly explain about edible packaging material.

3. State the purposes of nutritional labelling in food packages

Course Outcome 5 (CO5):

1. Explain the properties of PP, PE, BOPP

2. Discuss on different types of packaging materials

3. Explain the advantages of laminations in food packages

Course Outcome 6 (CO6):

1. Suggest suitable packaging material for whole milk?

2 What are the precautions to be taken for selecting a packaging material for fats and oils?

3Develop a typical packaging label for fruit beverages?

MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER BTECH DEGREE EXAMINATION

Course Code: FTT397

Course name: Advances in food packaging

Max marks: 100 **Time : 3 hrs**

Part A

Answer all questions each question carries 3 marks (Marks = 10x3 = 30 marks)

1. What is the role of food packaging?
2. Define Packaging and differentiate between package and packing.

3. Describe different forms of a packages
4. Explain the qualities of flexible packaging materials
5. What is aseptic Packaging?
6. List out the biological role of laminated plastic materials
7. What is MAP?
8. Enlist various moisture absorbers in food packages
9. Discuss the packaging requirement of dairy products
10. Discuss the functions of packaging systems for dehydrated products?

PART B

Answer anyone full question from each module, each question carries 14 marks

Module 1

11. a) List out the requirements of packages based on the food products (4 mark)
    b) Discuss various functions of packaging. Briefly discuss the properties of packaging materials for their classification? (10marks)

OR

12. a) What is the role of food packaging in extending the shelf life of food products(7 marks)
    b) Give a detailed account on food packaging materials? (7 marks)

Module 2

13. a) Illustrate the properties, advantages and disadvantages of glass containers (7 marks)
    b) Enlist key properties of metal containers (7 marks)

OR

14. a) Discus two-piece single drawn and multiple drawn (DRD) cans? (7 marks)
    b) Give a detailed account on paper and paper board packaging materials? (7 marks)

Module 3

15. a) Enlist various methods of film lamination. Discuss film lamination by adhesive methods (7marks)
    b) How can the problem of plastic waste be reduced? Which types of packaging materials in foods can be produced to reduce this problem of environmental contamination?

OR

16. a) Discuss the manufacturing process of plastics. Compare its advantages and disadvantages over the glass (7marks)
    b) Mention the application of Co-extrusion in plastic films (7marks)

Module 4

17. a) What is active packaging? Explain various types of absorbers and emitters used in packaging of various types of foods. (7marks)

b) Explain various types of antimicrobial packaging systems in foods? (7marks)

OR

18. a) What is the difference between Modified Atmosphere Packaging (MAP) and Controlled Atmospheric Storage (CAS)? (7marks)
    b) Discuss on RFIDs and Recyclability of packaging plastics(7marks)

Module 5

19. a) Discuss the packaging requirements for meat, fish, and poultry (7marks)
    b) Discuss the packaging requirements of instant and extruded foods (7marks)

OR

20. a) Discuss the packaging requirement of fruits and vegetables. Discuss MAP of fruits and vegetables (7marks)
    b) Enlist various properties of food that are influenced by moisture. Enlist various moisture absorbers and discuss anyone in detail (7marks)

Syllabus

Module 1 Introduction to Food Packaging:

Introduction to Food packaging, need of food packaging, Role of packaging in extending shelf life of foods packaging materials and various package forms, Food packaging systems, Product characteristics and package requirements

Module 2 Types of packaging Materials:

Different forms of packaging, Rigid, semi-rigid, flexible forms of packaging, wooden boxes and crates, Paper and paperboards, Glass, Metal container, Types of cans- Tinplate containers, Tin free steel (TFS), Aluminum containers, Composite containers,Lacquers. Properties, advantages and limitations of the following packaging materials: Glass, aluminum, its foil, metal tin containers, Paper and paperboards

Module 3 Flexible packaging

Flexible packaging materials their characteristics, Use of plastics as a packaging material-Types of plastics, Plastic films, laminated plastic materials, Co-extrusion. retortable pouches plastic films- LDPE, and LLDPE, HDPE, PVC, PS, PP, BOPP, nylon lonomers, rubber hydrochloride, natural and PVD, EVA Polyester, cellulose acetate, PET, blister packaging, aseptic Packaging, logistic packaging.

Module 4 Recent Trends in Food Packaging

Advances in Packaging Technology-Introduction, Active packaging, Vacuum Packaging, Controlled atmosphere packaging, Modified atmosphere packaging, Aseptic packaging, Biodegradable plastics, Edible gums, Coatings. Gas packaging, seal and shrink packaging. Form & fill sealing, Aseptic packaging systems, Retort pouches, RFID indicators

Module 5 Packaging systems for Food Products

Packaging systems for- Fruit & vegetable products, Dehydrated foods, Frozen foods, fish and fish products, meat and meat products, Dairy products, carbonated beverage, tea, coffee, alcoholic beverages, confectionery- fat and oil, biscuits, cakes, bread, food grains, storage and handling packaging materials

Text Books

1. Kit L Yam, Dong Sun Lee (2012), Emerging Food Packaging Technologies: Principles and Practice, Woodhead Publishing, ISBN:978-1-84569-809-6.
2. Robertson, G.L. (2013) Food Packaging: Principles and Practice, Third Edition. CRC Press, Taylor & Francis Group; ISBN-13: 978-0849337758.
3. Barry A. Morris (2017), The Science and Technology of Flexible Packaging, Elsevier, 978-0-323-24273-8, https://doi.org/10.1016/C2013-0-00506-3

Reference Books

1. Paine, Frank A., Paine, Heather Y. (1992) A Handbook of Food Packaging, Springer, ISBN 978-1-4615-2810-4
2. Richard Coles, Derek McDowell, Mark J. Kirwan (2009), Food Packaging Technology, Wiley-Blackwell, ISBN: 978-1-405-14771-2.
3. Takashi Kadoya, (2012), Food Packaging, 1st Edition, Academic Press, ISBN: 9780123935908
4. AlexandruGrumezescu Alina Maria Holban, (2017), Food Packaging and Preservation, Volume 9, 1st Edition, Academic Press, ISBN: 9780128115169
5. Miquel Angelo Parente Ribeiro Cerqueira, Ricardo Nuno Correia Pereira, Oscar Leandro da Silva Ramos, Jose António Couto Teixeira, Antonio Augusto Vicente, Edible Food Packaging- Materials and Processing Technologies 1st Edition (2016), CRC Press ISBN 9781482234169

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Introduction to Food Packaging:**	**9**
1.1	Introduction to Food packaging, need of food packaging,	2
1.2	Role of packaging in extending shelf life of foods packaging materials and various package forms	2
1.3	Food packaging systems	3
1.4	Product characteristics and package requirements	2
2	**Module 2 -Types of packaging Materials:**	**9**
2.1	Different forms of packaging, Rigid, semi-rigid, flexible forms of packaging,	1

2.2	wooden boxes and crates, Paper and paperboards, Glass, Metal container,	3
2.3	Types of cans- Tinplate containers, Tin free steel (TFS), Aluminum containers, Composite containers, Lacquers. Properties	3
2.4	advantages and limitations of the following packaging materials: Glass, aluminum, its foil, metal tin containers, Paper and paperboards	2
3	**Module 3 -Flexible packaging**	**9**
3.1	Flexible packaging materials their characteristics, Use of plastics as a packaging material	2
3.2	Types of plastics, Plastic films, laminated plastic materials, Co-extrusion. retortable pouches plastic films- LDPE, and LLDPE, HDPE, PVC, PS, PP, BOPP,	3
3.3	nylon lonomers, rubber hydrochloride, natural and PVD, EVA Polyester, cellulose acetate,	2
3.4	PET, blister packaging, aseptic Packaging, logistic packaging.	2
4	**Module 4 – Recent Trends in Food Packaging**	**9**
4.1	Advances in Packaging Technology-Introduction	2
4.2	Active packaging, Vacuum Packaging,	1
4.3	Controlled atmosphere packaging, Modified atmosphere packaging, Aseptic packaging, Biodegradable plastics,	3
4.4	Edible gums, Coatings.	1
4.5	Gas packaging, seal and shrink packaging. Form & fill sealing, Aseptic packaging systems, Retort pouches, RFID indicators	2
5	**Module 5 – Packaging systems for Food Products**	**9**
5.1	Packaging systems for- Fruit & vegetable products, Dehydrated foods, Frozen foods, fish and fish products	3
5.2	meat and meat products, Dairy products,	2
5.3	carbonated beverage, tea, coffee, alcoholic beverages	1
5.4	confectionery- fat and oil,	1
5.5	biscuits, cakes, bread, food grains	1
5.6	storage and handling packaging materials	1

SEMESTER VI

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd.
2014

FTT302	DAIRY TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: The syllabus is prepared with the view of making the Engineering Graduates capable of carrying out processing of food in industry, by teaching all the major processes happening in food processing sector, from raw material collection till novel processing techniques.

Prerequisite: Nil.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Gain a thorough knowledge on the properties, reception and storage of milk in dairy industries.
CO 2	Get familiarized with the principle, importance and various methods of sterilization and pasteurization followed in dairy industry.
CO 3	Study the effect of homogenization of milk and its efficiency
CO 4	Comprehend the importance of centrifugation and membrane separation in dairy industry
CO 5	Impart the ideas of the manufacture of dairy products

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	3	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	3	-	-	-	-	-	-	-	-
CO 3	3	3	3	2	-	-	-	-	-	-	-	-
CO 4	3	3	3	3	2	-	-	-	-	-	-	-
CO 5	3	3	3	3	2	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	30
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):
Discuss the various cleaning steps and the methods of cleaning.
Explain the process of milk reception and storage

Course Outcome 2 (CO2):
Explain the parts and working of indirect UHT plant based on scraped heat exchanger.
Elucidate the advantages and disadvantages of LTLT pasteurization of milk.

Course Outcome 3(CO3):
Enumerate on the theories of homogenization process
Give a brief on the importance of milk homogenization

Course Outcome 4 (CO4):
Write a short note on ‘Agglomeration’.
Explain the factors affecting clarification.

Course Outcome 5 (CO5):
What are the different methods of atomization process?
Explain the flow chart for the manufacture of paneer

Model Question Paper

QP CODE:

Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code:FTT 302
DAIRY TECHNOLOGY

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. What are the important physico chemical properties of milk?
2. Write down the following property values of milk like pH, Density, Boiling point
3. What are the advantages and disadvantages of pasteurization?
4. Explain the working of a vacreator
5. Mention any two methods to determine the efficiency of homogenization process
6. Explain the factors affecting homogenization
7. Write a note on the major application of centrifugation.
8. Explain the principle of bactofuge treatment
9. List out four stabilizers and sweeteners used in ice cream with its source
10. Define the following terms:
    i. Cheddaring
    ii. Hoping

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Explain the effectiveness of CIP in diary plant with its types.

OR

12. Explain the factors affecting the composition of milk
13. Schematically explain the principle of HTST pasteurization with its merits and demerits

OR

14. a.Explain the different types of in container pasteurizer. (7)
    b) What is meant by 'regeneration' in milk pasteurization? Explain the process (7)
15. Mention the different forms of fat globules in milk and explain the stages of homogenization with a neat sketch.

OR

16. What is a homogenizer? Discuss its mechanism with a neat sketch.
17. What are the different types of centrifuges used for separating cream from milk?

OR

18. Explain the classification of membrane separation with respect to its pore size
19. How can you dry the milk using a spray drier

OR

20. Define the term overrun. Explain the principle and working of all the types of freezers that can be used in ice-cream sector.

Syllabus

Module 1

PROPERTIES, RECEPTION AND STORAGE OF MILK

Milk-Types-Composition-factors affecting composition of milk. Physical-Chemical and Thermal Properties- Reception and storage-cooling of milk - Different types of coolers and cooling systems Cleaning-basic principles-can washing - can washers-cleaning-in centralised and decentralized CIP system - cleaning of various equipment, corrosion control.

Module 2

Pasteurization and Sterilization of milk

Pasteurization - principles, objectives and methods - LTLT/holding pasteurization-types, advantages and disadvantages - HTST pasteurization-components and function of HTST pasteurizer, advantages and disadvantages.

Sterilization - In-bottle sterilization, UHT processing – vacreation - Indirect heating systems using plate heat exchangers, Direct heating – steam injection and infusion

Module 3

Homogenization

Homogenization theory, effect of homogenization of milk

Homogenizer components - valves. Pumps - functions and efficiency of process-operation and maintenance.

Types of homogenizers-stages of homogenization-importance.

Module 4

Centrifugation and membrane separation

Centrifugation-clarification-clarifiers and separators-separation efficiency-factors affecting fat percentage in cream-fat loss in skim milk.

Construction of separator components- bactofuge treatment.

Ultra filtration - Reverse osmosis process - Electro dialysis.

Module 5

Manufacture of dairy products

Butter manufacture – methods - cheese manufacture-methods. Yogurt, paneer.

Skimmed milk powder Drum dryer-spray dryer-construction, powder recovery systems agglomeration.

Ice-cream manufacture-overrun-types of freezers.

Text Books

1. Tufail Ahmed, "Dairy Plant Engineering and Management", CBS Publishers and Distributors, New Delhi, 2001, ISBN-13: 978-8122501186
2. Pieter Walstra, Jan T M Wouters, Tom J Geurts, “Dairy Science and Technology”, Taylor Francis Group, CRC press. 2006. ISBN-13: 978-0824727635
3. De Sukumar, “Outlines Of Dairy Technology”, Oxford University Press.2015, ISBN-13: 978-0195611946

Reference Books

1. Spreer, Edgar "Milk and Dairy Product Technology". Marcel Dekker, 2005. ISBN-13: 978-0824700942
2. Selia, Jane dos Reis Coimbra and Jose A. Teixeir "Engineering Aspects of Milk and Dairy Products". Jane Selia dos Reis Coimbra & Jose A. Teixeir, CRC Press, 2009, ISBN-13: 978-1420090222
3. Eiri Board "Handbook of Milk Processing Dairy Products and Packaging Technology" Engineers India Research Institute, 2008. ISBN-13: 978-8186732960
4. Shivashraya Singh, "Dairy Technology: Vol.01 Milk and Milk Processing". New India Publishing Agency, 2014. ISBN-13: 978-9383305094
5. Megh R. Goyal, Anit Kumar, Anil K. Gupta, "Novel Dairy Processing Technologies: Techniques, Management, and Energy Conservation (Innovations in Agricultural & Biological Engineering)" Apple Academic Press, 2018. ISBN-13: 978-1771886123

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Properties, Reception and Storage of Milk**	
1.1	Milk-Types-Composition- Properties.	2
1.2	Reception and storage-cooling of milk	3
1.3	Cleaning-basic principle- cleaning-in centralised and decentralized CIP system - corrosion control.	4
2	**Size Reduction:**	
2.1	Pasteurization – principles and methods.	2
2.2	LTLT/holding pasteurization-types	2
2.3	HTST pasteurization-components and function of HTST pasteurizer,	2
2.4	Sterilization - In-bottle sterilization– vacreation	2
2.5	UHT processing - Indirect heating systems using plate heat exchangers, Direct heating – steam injection and infusion	2
3	**Homogenization**	
3.1	Homogenization theory, effect of homogenization of milk	2
3.2	Homogenizer components - valves. Pumps - functions and efficiency of process	3
3.3	Types of homogenizers-stages of homogenization-importance.	3
4	**Centrifugation and membrane separation**	
4.1	Centrifugation-clarification-clarifiers and separators-separation efficiency-factors affecting fat percentage in cream-fat loss in	3

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY Estd. 2014

	skim milk.	
4.2	Construction of separator components- bactofuge treatment.	2
4.3	Ultra filtration - Reverse osmosis process - Electro dialysis.	4
5	**Manufacture of dairy products**	
5.1	Butter manufacture – methods - cheese manufacture-methods. Yogurt, paneer.	3
5.2	Skimmed milk powder Drum dryer-spray dryer-construction, powder recovery systems agglomeration.	3
5.3	Ice-cream manufacture-overrun-types of freezers.	3

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

FTT 304	FOOD PROCESS EQUIPMENT AND DESIGN	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students to design different equipments used in food processing operations. This course will give students a clear vision about the basic considerations in process equipment design, design of pulper, storage structures, heat exchangers, evaporators, dryers, extruders, material handling and cleaning and separation devices

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Familiarize the basic considerations in process equipment design
CO 2	Design pulper and storage structures
CO 3	Design and Analyze heat exchangers, evaporators and dryers
CO 4	Design extruders, freezers and cold storage
CO 5	Design Material handling devices
CO 6	Explain the working of Cleaning and Separation devices

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	2									
CO 2	1	3	1									
CO 3	2	2	3									
CO 4	2	2	3									
CO 5	2	2	3									
CO 6	2	1	1									

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define different terms related to properties of material

2. Describe the theories of failure and safety measures

3. Explain the materials and sanitary features of the food equipment

Course Outcome 2 (CO2)

1. Explain design consideration for pressure vessel

2. Explain the design aspects of storage tanks- Horizontal and vertical silos and their equations

3. Explain the design of sterilizers and process vats

4. Explain the design of pulper and crushers- materials of construction

Course Outcome 3(CO3):

1. Explain design consideration for heat exchangers and types

2. Explain the design aspects of single effect and multiple effect evaporators

3. Explain the design of dryers- tray dryers, LSU dryers

Course Outcome 4 (CO4):

1. Explain design consideration for extruders

2. Explain the design aspects of freezers

3. Explain the design consideration of cold storage

Course Outcome 5 (CO5):

1. Explain different material handling devices

2. Explain the working cleaning and separation devices

3. Explain the design consideration of cyclone separator

Model Question paper

QP CODE: **PAGES: 2**

Reg No: _______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 304

Course Name: FOOD PROCESS EQUIPMENT AND DESIGN

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions.

Each question carries 3 Marks

1. Define Hook's law and Poisson's ratio
2. Write down the general procedures for the equipment design
3. Define Rankine's theory-Airy equation-Janssen equation
4. Explain design procedure for pulpers
5. Explain the principle and working of shell and tube heat exchangers
6. Describe the LMTD equation for heat exchangers with a neat diagram
7. Write short notes on types of freezers
8. Describe the factors to be considered during design of cold storage
9. Explain the working of colour separator

10. Explain the working of bucket elevator

PART B

Answer any one Question from each module.

Each Question carries 14 Marks

11. With neat representation explain the stress – strain diagram of a material (14)

OR

12. Explain the nature of equipment and equipment classification in detail (14)

13. Explain the design aspects of storage tanks- Horizontal and vertical silos (14)

OR

14. Explain the design of sterilizers and process vats (14)

15. Explain the design of single effect and multiple effect evaporators (14)

OR

16. Explain the design consideration for PHTC and LSU dryer (14)

17. Explain the design consideration for single and twin screw extruder (14)

OR

18. Explain different types of freezers and construction and operation (14)

19. Define effectiveness of screen. Explain design of air screen cleaners (14)

OR

20. Describe the working principle of disc and spiral separator (14)

****

Syllabus

Module 1

Basic considerations in process equipment design

Nature of equipment, general design procedure, equipment classification. Properties of materials -Types of stresses and strains - Poisson's ratio- Hooke's Law – stress strain diagram- factor of safety. Corrosion - theories of failure- economic considerations- safety measures in equipment design. Materials and sanitary features of the food equipment - Sanitary pipes and fittings –Colour code

Module 2

Design of pulper and storage structures

Design considerations for pressure vessels, design aspects of storage tanks- Horizontal and vertical silos, Silo design-Rankine Theory-Airy equation-Janssen equation, design of sterilizers and process vats, design of pulper and crushers- materials of construction.

Module 3

Design of heat exchangers, evaporators and dryers

Design considerations of heat exchangers –LMTD, plate heat exchanger, shell and tube heat exchangers - design of finned type heat exchanger, design of single effect and multiple effect evaporators, Design of considerations of dryers- tray dryer- PHTC dryer- LSU dryer.

Module 4

Design of extruders, freezers and cold storage

Design of food extruders – single and twin screw extruders, Design of freezers – types of freezers – construction and operation, Design considerations for cold storage – factors to be considered – estimation of cooling load – construction and operation- maintenance of cold storage.

Module 5

Design of Material handling, Cleaning and Separation devices

Material Handling devices-Design -belt conveyor, bucket elevator, screw conveyor, chain conveyor, pneumatic conveyor. Cleaning and grading-screens- effectiveness of screen-Air screen cleaners - design considerations, Disc separator-Spiral Separator-Specific gravity Separator, Pneumatic Separator-Inclined draper-Velvet roll Separator, Design of Cyclone separator-Magnetic Separator - Colour Separator

Text Books

1. George D. Saravacos, Athanasios E. Kostaropoulos, Handbook of Food Processing Equipment, Springer, 2012, 1461352126, 9781461352129

2. Zacharias B. Maroulis, George D. Saravacos, Food Process Design, CRC Press, 2003, ISBN: 0203912012, 9780203912010

3. Amalendu Chakraverty, R. Paul Singh Postharvest Technology and Food Process Engineering, CRC Press, 2016, ISBN: 1466553219, 9781466553217

Reference Books

1. Y.V.C. Rao, Chemical Engineering Thermodynamics, Universities Press.
2. Fogler H.S., Elements of Chemical Reaction Engineering, Prentice Hall of India.
3. Smith J.M., Chemical Engineering Kinetics, McGraw Hill.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Basic considerations in process equipment design**	
1.1	Nature of equipment, general design procedure, equipment classification	2
1.2	Properties of materials -Types of stresses and strains - Poisson's ratio- Hooke's Law – stress strain diagram- factor of safety	1
1.3	Corrosion - theories of failure- economic considerations- safety measures in equipment design.	3
1.4	Materials and sanitary features of the food equipment - Sanitary pipes and fittings –Colour code	3
2	**Design of pulper and storage structures**	
2.1	Design considerations for pressure vessels,	2
2.2	Design aspects of storage tanks- Horizontal and vertical silos	2
2.3	Silo design-Rankine Theory-Airy equation-Janssen equation	2
2.4	Design of sterilizers and process vats	2
2.5	Design of pulper and crushers- materials of construction	2
3	**Design of heat exchangers, evaporators and dryers**	
3.1	Design considerations of heat exchangers -LMTD	3
3.2	plate heat exchanger, shell and tube heat exchangers - design of finned type heat exchanger	2
3.3	design of single effect and multiple effect evaporators	2
3.4	Design of considerations of dryers- tray dryer- PHTC dryer- LSU dryer	2
4	**Design of extruders, freezers and cold storage**	
4.1	Design of food extruders – single and twin screw extruders	3

4.2	Design of freezers – types of freezers –construction and operation	3
4.3	Design considerations for cold storage – factors to be considered estimation of cooling load – construction and operation-maintenance of cold storage	3
5	**Design of Material handling, Cleaning and Separation devices**	
5.1	Material Handling devices-Design -belt conveyor, bucket elevator, screw conveyor, chain conveyor, pneumatic conveyor.	2
5.2	Cleaning and grading-screens- effectiveness of screen-Air screen cleaners - design considerations	2
5.3	Disc separator-Spiral Separator-Specific gravity Separator	2
5.4	Pneumatic Separator-Inclined draper-Velvet roll Separator	2
5.5	Design of Cyclone separator-Magnetic Separator - Colour Separator	3

CODE FTT306	FOOD ADDITIVES AND FLAVOURINGS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: This course will deal with the fundamental of study about the role, activity of chemical and natural food additives

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Understand diverse food additives used in the food industries and its technological function
CO 2	Knowledge on the rules and regulations prevailing for the use of food additives
CO 3	Application of flavouring agents and flavour products in food industry
CO 4	Learn different methods of isolation of flavours from food

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		3			3	2	3				3
CO 2	3			2		2		2				
CO 3	3		2	2								
CO 4	3						3					

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe the beneficial role of food additives with example
2. Explain the functions of preservatives
3. Write a short note on natural food colours

Course Outcome 2 (CO2)

1. Give a detailed note on JECFA on food additives
2. Explain in detail about toxicity evaluation of food additives
3. Describe in detail the FSSAI regulations on food additives

Course Outcome 3(CO3):

1. Define flavouring agents with examples
2. Give an account of different flavour products
3. Explain the mechanism of spray drying of flavor

Course Outcome 4 (CO4):

1. Give a detailed note on flavor isolation
2. Explain the steps involved in processing of oleoresins
3. Write a short note on scoville unit

MODEL QUESTION PAPER

QP CODE:

Reg No.: _______________ **Name: _______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT306

FOOD ADDITIVES AND FLAVORINGS

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Define food additive as per FSSAI?
2. Differentiate intentional and incidental additive with example?
3. Give an account of function of acidulants?
4. Recall Class I and Class II preservative in food applications?
5. What are the types of emulsions encountered in food?
6. List different thickening agents used as a food additive?
7. What is meant by polyols? Give examples?
8. Differentiate dyes and lakes with example?
9. Explain the significance of Scoville unit?
10. What is the application of carrier agent in spray drying?

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Examine the different steps of risk assessment of food additive?

(OR)

12. Explain the role of technological function of different food additive in enhancing the shelf life of food?
13. Detail on the mode of action of antimicrobial action of different preservative?

(OR)

14. Illustrate the process of autooxidation and mechanism of action of antiooxidants?

15. Examine the mechanism of action of emulsifying agents in food applications?

(OR)

16. Importance of stabilizing and thickening agent in food processing with examples?

17. Discuss the application of coloring agent in food industry?

(OR)

18. Evaluate the role of enzymes in food industry with examples?

19. Describe the process of flavour isolation by super critical fluid extraction with a neat sketch ?

(OR)

20. With the help of neat diagram explain the process of flavor analysis using GC MS?

Syllabus

Module 1

Introduction

Food Additives – definition, types, examples, functions, rules and regulations responsible for use of food additives, GRAS, maximum permissible limits, AD1, Risk Assessment, Toxicity Evaluation of food additive.

Module 2

Preservatives

Acidity Regulators – definition, chemical structure, role and importance, pH modulation and taste, acidity profile, permitted acidity regulators, levels of usage and food applications. Preservatives and antioxidants - mode of action on spoilage organisms and pathogens, factors affecting the performance of preservatives, active forms of preservatives, necessity in a food and levels of usage; permitted antioxidants and preservatives, food applications. Case studies / illustrations.

Module 3

Emulsion, surface tension, oil in water and water in oil emulsion, Hydrophilic and Lipophilic balance (HLB), role of emulsifiers, different classes of emulsifiers and their chemical structure, their HLB values and role in emulsion stabilization; role of different stabilizers and other substances in emulsion stability; emulsion formation process and equipment; measurement of emulsion stability; permitted emulsifiers and stabilizers and food applications. Thickeners -definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications.

Module 4

Colour – Natural and synthetic food colors, their chemical structure, shades imparted, stability, permitted list of colors, usage levels and food application.

Artificial sweeteners, polyols, Enzymes - Applications in food processing and preservation.

Module 5

Food flavour – flavouring agents, example, natural, natural identical and artificial flavour, methods of flavour isolation, different flavour products, spray drying of flavour, flavouring agents applications in different food industry, Scoville unit, flavour analysis using GC, GC MS, E Nose, Sensory analysis of flavour.

Text Books

1. Mahindru, S. N. Food Additives- Characteristics Detection and Estimation, TATA McGraw Hill, 2000
2. Wilson, R. Ingredient Handbook Sweeteners, Blackwell, 2007

Reference Books

1. Emerton, V. Food Colors, Blackwell, 2008
2. Peter A Williams and Glyn O Philips, Gums and stabilizers for the Food Industry, RSC, 2006.
3. Branen, A. L. Food Additives 2nd Edition, CRC press, 2002

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Introduction**	**10**
1.1	Food Additive, definition, types of additive, classification, example	2
1.2	functions of additive, Numbering system, safety evaluation	2
1.3	evaluation methods, ADI, NOEL, max	2
1.4	methods of tolerance limits, risk assessment	2
1.5	Government regulations – FSSAI, CODEX	2
2	**Module 2- Preservatives and Antioxidants**	**9**
2.1	Functions of preservative, examples of preservative, types, natural and synthetic	2
2.2	mode of action, uses in food formulations, maximum permissible limit in food products, regulations	2
2.3	Antioxidants - functions, chemistry, mode of action types, example, uses in food formulations, maximum permissible limits	3
2.4	maximum permissible limits, regulations, disadvantages and	2

	advantages	
3	**Module 3 - Acidulants and Thickening agents**	**6**
3.1	Emulsifiers- Types of emulsion, function examples, mode of action	2
3.2	Stabilizers - Types of emulsion, function examples, mode of action	2
3.3	Thickening agents – functions, mode of actions	2
4	**Module 4 - Colouring agents**	**10**
4.1	Coloring agent – natural and artificial colours	`3
4.2	Artificial sweetners, polyols	3
4.3	Enzymes	4
5	**Module 5- Confectionery products**	**10**
5.1	Importance of food flavour, examples of flavouring substances	2
5.2	Different methods of flavour isolation	2
5.3	Different types of flavour products – Flavour Encapsulation	2
5.4	Application of flavouring agents with examples	2
5.5	Process Flavour, Flavour Enhancer	2

FTT308	COMPREHENSIVE COURSE WORK	Category	L	T	P	Credit	Year of Introduction
		PCC	1	0	0	1	2019

Preamble: The course is designed to ensure that the student have firm Knowledge on the basic courses of food technology with technological inspirations. It provides an opportunity for the students to demonstrate their knowledge in various competitive exams.

Pre-requisite: Nil

Course outcomes: After the course, the student will able to:

CO1	Apply the fundamentals of food Technology in various Competitive examinations
CO2	Comprehend the questions of Food technology field for research applications
CO3	Evaluate the Principles of engineering aspects for the application of food engineering Problems
CO4	Analyze the comprehensive knowledge gained in basic courses in the field of Food Technology.

FTT 308 Comprehensive Course Work		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2	1	1	2		3	2			1		1	3	2	3
	CO2	3	2				2				3					
	CO3	3	1			1	2				3				1	
	CO4	3	3			1	2									

Assessment pattern

Bloom's Category	End Semester Examination (Marks)
Remember	25
Understand	15
Apply	5
Analyze	5
Evaluate	

Create	

End Semester Examination Pattern:

A written examination will be conducted by the University at the end of the sixth semester.The written examination will be of objective type similar to the GATE examination. Syllabus for the comprehensive examination is based on following five Food Technology core courses.

FTT 201- FOOD MICROBIOLOGY

FTT 202- FUNDAMENTALS OF HEAT AND MASS TRANSFER

FTT 205- FOOD CHEMISTRY

FTT 301–FOOD PROCESS ENGINEERING

FTT 305- FOOD ANALYSIS

The written test will be of 50 marks with 50 multiple choice questions (10 questions from each module) with 4 choices of 1 mark each covering all the five core courses. There will be no negative marking. The pass minimum for this course is 25. The course should be mapped with a faculty and classes shall be arranged for practising questions based on the core courses listed above.

Written examination	:	50marks
Total	**:**	**50 marks**

Course Level Assessment and Sample Questions

1 What is the unit of water activity?

a. gram
b. gram/liter
c. It is unit less
d. None of the above

2 Which of the following sugars is/are non-reducing?

a. Sucrose
b. Cellulose

c. Maltose
d. All of the above

3 The peptide bond has

a. Planar structure
b. Angular structure
c. Tetrahedral structure
d. Pyramidal structure

4. Sterilization destroys:

a) Only Pathogenic microorganisms
b) Only Spoilage microorganisms
c) All types of microorganisms
d) Only heat resistant organisms

5. Decimal reduction time is the time required to destroy .... % of the microorganisms

a) 10
b) 60
c) 90
d) 100

6. Which among the following is not a non-thermal technology

a) PEF
b) Ultrasound
c) Ohmic heating
d) HPP

7. Food Authority may notify laboratories and research institutions accredited by NABL or any such accreditation agencies, wherein NABL stands for

a. National Accreditation Board for Laboratories
b. National Accreditation Board for Testing Laboratories
c. National Accreditation Board for Calibration Laboratories
d. National Accreditation Board for Testing and Calibration Laboratories

8. Chromatography is a physical method that is used to separate and analyse ___________

a. Simple mixtures

b. Complex mixtures

c. Viscous mixtures

d. Metals

9. According to the Beer Lamberts Law, on which of the following does absorbance not depend?

a. Extinction coefficient of the sample

b. Distance that the light travelled through the sample

c. Solution concentration

d. Colour of the solution

10. If a culture is having 12 bacteria at the 0th hour, the possible number of bacteria in the same culture after 2 hours of incubation:

a) 29, 85,984 b) 72 c) 24 d) 3,456

11.A psychrophilic halophile would be a microbe that prefers

a) Cold temperatures and the absence of oxygen

b) Warm temperatures and increased amounts of pressure

c) Cold temperatures and increased amounts of salt

d) Warm temperatures and increased amounts of acid

12. Which defines best about the HACCP system?

a) Identifying Physical, Chemical and Biological Hazards

b) Accurately monitoring food hygiene hazards

c) Identifying the CCP's, including their location, procedure and process

d) A systematic analysis of all steps and regular monitoring of the control points

13. The literature of heat transfer generally recognizes distinct modes of heat transfer.

How many modes are there?

a) One

b) Two

c) Three

d) Four

14. Convective heat transfer coefficient doesn't depend on

a) Surface area

b) Space

c) Time

d) Orientation of solid surface

15. Convective heat transfer coefficient doesn't depend on

a) Surface area

b) Space

c) Time

d) Orientation of solid surface

Course Code: FTT 308

Comprehensive Course Work

MODULE I

Introduction to food microbiology, types of microorganisms associated with food, intrinsic as well as extrinsic factors affecting spoilage of foods, food poisoning, Microbial toxins and control of various microflora associated with food groups. Isolation preservation, maintenance of pure culture and growth curve. Qualitative and quantitative detection as well as enumeration of microorganisms, rapid methods, biosensors. Food Safety and standards: Microbial quality assurance and control system in the food industry. Beneficial role of microorganism in food industry: probiotics, enzymes and fermentation

MODULE II

Mechanisms and modes of heat transfer-conduction and Fourier law - Thermal conductivity of solid liquid and gases, General Heat conduction Equation. Concept of Individual and Overall heat transfer Coefficient. Basics and concepts, Types of Convection – Free convection – Forced Convection, heat transfer coefficient and overall heat transfer coefficient. Radiation heat transfer- Basic Concepts, Laws of Radiation. Molecular diffusion, Fick's Law, concentration, mass flux, Mass Transfer coefficients: Types of mass Transfer Coefficient, Dimensionless Groups in Mass Transfer. Design principles of absorbers; Industrial absorbers; Distillation-relative volatility, types of distillation, principles of rectification, V-L Equilibria; Simple, Steam and Flash Distillation.

MODULE III

Introduction to Food Chemistry, Water activity-significance, measurement, Carbohydrates-classification, reducing and non-reducing sugars, Protein- Structure, peptide bond, physical and chemical properties, Lipids- structure, classification, Rancidity, modification of fat, Vitamins, minerals- functions, Dietary fiber, Balanced diet, Calorific value of food- Computation

MODULE IV

Thermal processing- Blanching, Pasteurization, Sterilization, Canning, HTST, LTLT, UHT Pasteurizers, Microbial inactivation, F, D Z Values. Size reduction- Laws of size reduction, Equipment, Homogenization. Drying and Psychrometry- Water activity, Moisture content, EMC isotherms, Driers, Psychrometric chart, terms. Refrigeration- COP, Chilling and Freezing, Pre-cooling methods. Extrusion- Principle, Extruded Products. Minimal Processing- Ohmic heating, PEF, HPP, Ultrasound, CAP, MAP, Food Irradiation. Food Packaging- Materials, CAP, MAP, Vacuum

MODULE V

Introduction to Food analysis; various national and international regulatory bodies and their regulations-FSSA, NABL, Codex, EIA; Sampling techniques, Proximate analysis for various components in food; Beer Lambert's law, different types of Spectroscopy, Chromatography, Electrophoresis and their working and principle, applications of ion selective electrodes, biosensors.

CODE FTL332	COURSE NAME FOOD PROCESSING LAB	CATEGORY	L	T	P	CREDIT
		PCC	0	0	3	2

Preamble: This course is designed to demonstrate the principles and methods of food preservation. The students will acquaint knowledge in the formulation of environmental friendly and nutritious food products. They will also develop skills to analyze the food quality and derive strategies to promote healthy living.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply the principles and methods involved in the processing of different foods
CO 2	Analyse various preservation techniques of foods
CO 3	Develop skills to analyze food quality
CO 4	Formulate various nutritive products and work in team
CO 5	Experiment and evaluate different food products

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2								3	3		
CO 2	2								3	3		
CO 3	2								3	3		
CO 4	2								3	3		
CO 5	2								3	3		

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	:15 Marks
(b) Implementing the work/Conducting the experiment	:10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting)	:25 Marks
(d) Viva voce	:20 marks
(e) Record	:5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the principle involved in the dehydration of Vegetables.
2. Illustrate the processing of paneer wit a neat flow chart.
3. Evaluate the steps involved in the processing of Jam.

Course Outcome 2 (CO2):

1. Why is lactic acid added to sauerkraut?
2. Perform dehydration of vegetables
3. How is Amla preserved by osmotic dehydration?

Course Outcome 3 (CO3):

1. Explain the importance of conching in chocolate processing.
2. Perform sensory evaluation of tomato ketchup products by Hedonic Scale.
3. List out the different steps to minimize the storage disorders in fruits and vegetables.

Course Outcome 4 (CO4):

1. Evaluate the steps involved in the processing of Tofu.
2. What are the benefits of blanching vegetables?

3. Are dehydrated fruits and vegetables healthy?

Course Outcome 5 (CO5):

1. How is Mayonnaise is processed, stored and packed?

2. Evaluate the preparation of Toffee.

3. Perform the different stages of sugar cooking.

List of Exercises/Experiments : **(Minimum 12 are mandatory)**

1. Dehydration of vegetables
2. Preparation of Tofu
3. Preparation of Paneer
4. Preparation of Jam
5. Sensory Evaluation of food products by Hedonic Scale
6. Preparation of Sauerkraut
7. Processing, storage and packaging of Mayonnaise
8. Sensory Evaluation by Ranking Test
9. Minimal processing of fruits
10. Stages of sugar cooking/ cookery
11. Preparation of Tomato Ketchup
12. Chocolate processing
13. Preparation of fruit candy
14. Study of preparation of Toffee
15. Study on Freeze Drying
16. Study on Spray Drying
17. Osmotic Dehydration of Amla
18. Rehydration Studies
19. Storage disorders of fruits and vegetables
20. Blanching of Vegetables

Reference Books

1. Morris B. Jacobs , *The chemical analysis of foods and food products,* III Edition, CBS Publishers and distributors New Delhi.
2. Ranganna S , *Hand book of analysis and quality control for fruit and vegetable products,* II Ed., Tata McGraw Hill Publishing Co. New Delhi.
3. Sivasankar B (2002) Food Processing and Preservation, Prentice Hall, India

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTD334	MINIPROJECT	PWS	0	0	3	2

Preamble: This course is designed for enabling the students to apply the knowledge to address real-world situations/problems and find solutions. The course is also intended to estimate the ability of the students in transforming theoretical knowledge studied as part of the curriculum as a solution to the real life problems. The students are expected to design and develop a software/hardware project to innovatively solve a real-world problem.

Prerequisites: Subjects studied up to sixth semester.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Make use of acquired knowledge within the selected area of technology for project development.	Level 3: Apply
CO 2	Identify, discuss and justify the technical aspects and design aspects of the project with a systematic approach.	Level 3: Apply
CO 3	Interpret, improve and refine technical aspects for engineering projects.	Level 3: Apply
CO 4	Associate with a team as an effective team player for the development of technical projects.	Level 3: Apply
CO 5	Report effectively the project related activities and findings.	Level 2: Understand

Mapping of course outcomes with program outcomes

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	3	3	3	-	-	-	3
CO 2	3	3	3	3	3	-	2	3	-	3	2	3
CO 3	3	3	3	3	3	2	3	3	-	2	3	3
CO 4	3	3	2	2	-	-	-	3	3	3	3	3
CO 5	3	-	-	-	2	-	-	3	2	3	2	3

3/2/1: high/medium/low

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the mini project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systms under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution. The review committee should assess the extent to which the implementation reflects the proposed design. A well coded, assembled and completely functional product is the expected output at this stage. The final CIE mark is the average of 1st and 2nd review marks.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for innovative ideas. Zeroth review will not be a part of the CIE evaluation process.

Marks Distribution

Total Marks	CIE	ESE
150	75	75

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Marks awarded by Guide : 15 marks
Project Report : 10 marks
Evaluation by the Committee : 40 Marks

End Semester Examination Pattern:

The following guidelines should be followed regarding award of marks.
(a) Demonstration : 50 Marks
(b) Project report : 10 Marks
(d) Viva voce : 15marks

Course Plan

In this course, each group consisting of three/four members is expected to design and develop a moderately complex software/hardware system with practical applications. This should be a qualitative/quantitative analysis or a product design that may be taken into consideration.

Students should identify a topic of interest in consultation with Faculty-in-charge of miniproject/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews.

The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight.

SEMESTER VI

PROGRAM ELECTIVE I

FTT312	FRUITS AND VEGETABLE PROCESSING	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: The students will gain knowledge about methods used for preserving fruits & vegetables. Better understanding of the concepts of physiological characteristics of fruits and vegetables Better insight about fruit losses during storage and ways to prevent it. Thorough Knowledge and understandings of the specific processing technologies used for different foods and the various products derived from these materials

Prerequisite: Nil.

Course Outcomes: After the completion of the course the student will be able to

CO 1	To study the processing and preservation technologies of fruits and vegetables
CO 2	To give knowledge on the value addition on fruit and vegetable
CO 3	To give knowledge on the Processing technology of fruit beverages
CO 4	To give knowledge on the Processing technology of vegetable products
CO 5	To give knowledge on the Fermented products from fruits and vegetables
CO 6	To give knowledge on the Hygiene and sanitation in Fruit and vegetable processing industry

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	1									
CO 2	1	2	3									
CO 3	3	1	2									
CO 4	3	2	1									
CO 5	3	2	2	1								
CO 6	2	1	2	2								

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	30
Evaluate			

Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the current scenario of Fruit and vegetable processing in India.
2. Explain the effect of hurdle technology in the preservation of fruit and vegetable.

Course Outcome 2 (CO2)

1. Explain the post harvesting preservation techniques for fruits.
2. Explain the chemical changes in vegetables during ripening.

Course Outcome 3(CO3):

1. Explain the methods to determine the end point of jam and jellies.
2. Explain the processing techniques of fruit juices

Course Outcome 4 (CO4):

1. Discuss the minimal processing techniques in preservation of fruits and vegetables
2. Discuss the problems during sauce making

Course Outcome 5 (CO5):

1. Discuss any method for the preparation of fermented products from fruits.
2. Explain the three methods for the preparation of toddy and neera

Course Outcome 6 (CO6):

1. Discuss the GHP and GMP in fruit and vegetable industries
2. Explain the steps of HACCP in fruit and vegetable industries.

API ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Model Question Paper

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER BTECH DEGREE EXAMINATION

Course Code: FTT 312

Course name: FRUITS AND VEGETABLE PROCESSING

Max marks: 100 **Time: 3 hrs**

Part A

Answer all questions each question carries 3 marks (Marks = 10x 3 = 30 marks)

1. Exemplify the principle and methods of preservation (3)
2. Explain how irradiation act as a preservative technique.(3)
3. Explain the chemical changes during the ripening of fruits. (3)
4. Exemplify the maturity indices of fruits and vegetables. (3)
5. Schematically explain the process of three non-fermented fruit beverage.(3)
6. Explain any three equipment’s used in fruit beverage industry.(3)
7. Differentiate sauce and ketchup with the help of process flowchart.(3)
8. Discuss the flowchart of minimally processed food.(3)
9. Describe the processing of vegetable chutney.(3)
10. Explain the GMP and GHP Practices in fruit and vegetable industry. (3)

PART B

Answer all questions each question carries 14 marks (Marks = 14x 5 = 70 marks)

11. a) How starch is converted in acetic acid during vinegar preparation. (5)

    b) List out 10 Fermented products from fruits and vegetables and explain.(5)

c) Elucidate the role of AGMARK in Food processing industries. (4)

OR

12. Explain in detail about properties of food. (14)

13. Explain in detail the storage practices of ripened fruits and vegetables.(14)

OR

14. Elucidate the pre-treatments techniques of fruit and vegetable after harvesting. (14)

15. List out 10 Fermented products from fruits and vegetables and explain.(14)

OR

16. Exemplify the different theories of gel formation using pectin. (14)

17. What is sauerkraut? Explain the method of preparation of sauerkraut.(14)

OR

18. a) Discuss the flowchart of minimally processed food.(5)

b) Describe the processing of vegetable chutney. (5)

c) Write a detailed note on food industry waste management.(4)

19. Mention the FSSAI regulations for fruit and vegetable products (14)

OR

20. Classify the types of vinegar and explain the different methods of vinegar production (14)

21.

Syllabus

Module 1

Introduction: Scope of fruit and vegetable processing industry in India and world present status-constraints-prospective-fruit and vegetables. Classification-overview of principles of preservation-Drying – dehydration-freezing-concentration-canning-chemical preservation. Hurdle technology-intermediate moisture foods, Irradiation – application in fruit and vegetable industry.

Module 2

Characteristics of Fruits and Vegetables

Physical, Textural characteristics, structure and composition. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Fruit ripening- chemical changes-regulations, methods. Storage practices: Control atmospheric- Bead atmosphere-hypotactic storage- cool store-Zero emerge cool chamber- stores striation. Commodity pre-treatments – chemicals, wax coating, pre-packaging, phytonutrients in fruits and vegetables grading, cleaning.Physiological post-harvest diseases chilling injury and disease. Handling and packaging of fruits and vegetables

Module 3

Processing technology of fruits, vegetables & Beverages.

Technology of Jam, jelly, flow chart-equipment Tests for end point determination. Marmalade-method -flow chart-equipment Tests for end point determination. Pectin-commercial pectin manufacturing-Theories of gel formation-fruit preserves. Types of beverages-Juice-RTS-Nectar-Squash syrups-concentrates- cordials-specifications.

Module 4

Processing technology of vegetable products

Minimal processing of vegetables-processing and packaging of fresh cut fruits and vegetables. Processing technology of vegetable wafers, vegetable soup powder-sauces and ketchups. Differences –types tomato and soy sauce-problems in sauce making.Preparation of chutney-pickles-types of pickling-dry salting-brining-vinegar pickling Sauerkraut technology-spoilage in sauerkraut.

Module 5

Fermented products from fruits and vegetables:

Technology of Vinegar fermentation—types of vinegar-methods-slow and quick process-Technology of fermented fruit wines-champagne cider-fortified wines-sherry-vermouth-Neera-Toddy. Hygiene and sanitation in Fruit and vegetable processing industry Quality evaluation –Rules and regulations related to fruit and vegetable products.FSSAI specifications for fruit and vegetable products

Text Books

1. Fellows, P J. Food Processing Technology: Principles and Practice. 2nd Edition, CRC/ Woodhead, 1997. ISBN 0 8493 0887 9, ISBN 1 85573 533 4

2.Y. H. Hui, S. Ghazala, D.M. Graham, K.D. Murrell & W.K. Nip Handbook of Vegetable Preservation and Processing Marcel Dekker (2003), ISBN : 0824743016

3. Sivasankar, B. Food Processing and Preservation, Prentice Hall of India, 2002. ISBN 10: 8120320867ISBN 13: 9788120320864

4. Salunke, D. K and S. S Kadam Hand Book of Fruit Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker, 1995, ISBN 0 8247 9643 8

Reference Books

1. Suman Bhatti, Uma Varma, Fruit and vegetable processing- Organisations and Institutions; Commonwealth Publishers, 2007, ISBN 10: 8123904045 / ISBN 13: 9788123904047

2. Varma L. R. and Joshi V.K, Post-Harvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management vol. I & II, Indus Publishing, 2000, ISBN8173871086, 9788173871085

3. Jongen, Wim: Fruit and vegetable processing-Improving quality; Woodhead publishing, 2002, ISBN: 9781855735484, ISBN: 9781855736641

4. Fruit and vegetable processing, FAO, 1995, ISBN 92-5-103657-8

5. R. P. Srivastava & Sanjeev Kumar Fruit and Vegetable Preservation: Principles &Practices International book distributing Co. Lucknow, ISBN 10: 8123924372, ISBN 13: 9788123924373

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction:**	
1.1	Scope of fruit and vegetable processing industry in India and world present status-constraints-prospective-fruit and vegetables	2
1.2	Classification-overview of principles of preservation-Drying – dehydration-freezing-concentration-canning-chemical preservation	2
1.3	Hurdle technology-intermediate moisture foods, Irradiation – application in fruit and vegetable industry	2
2	**Characteristics of Fruits and Vegetables**	
2.1	Physical, Textural characteristics, structure and composition.	1
2.2	Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables	2
2.3	Fruit ripening- chemical changes-regulations, methods. Storage practices: Control atmospheric- Bead atmosphere-hypotactic storage- cool store-Zero emerge cool chamber- stores striation.	2
2.4	Commodity pre-treatments – chemicals, wax coating, pre-packaging, phytonutrients in fruits and vegetables grading, cleaning.Physiological post-harvest diseases chilling injury and disease. Handling and packaging of fruits and vegetables	2
3	**Processing technology of fruits, vegetables & Beverages.**	
3.1	Technology of Jam, jelly, flow chart-equipment Tests for end point determination.	2
3.2	Marmalade-method -flow chart-equipment Tests for end point determination.	2
3.3	Pectin-commercial pectin manufacturing-Theories of gel formation-fruit preserves.	1
3.4	Types of beverages-Juice-RTS-Nectar-Squash syrups-concentrates- cordials-specifications	3
4	**Processing technology of vegetable products**	
4.1	Minimal processing of vegetables-processing and packaging of fresh cut fruits and vegetables.	2

4.2	Processing technology of vegetable wafers, vegetable soup powder-sauces and ketchups.	1
4.3	Differences –types tomato and soy sauce-problems in sauce making.	2
4.4	Preparation of chutney-pickles-types of pickling-dry salting-brining-vinegar pickling Sauerkraut technology-spoilage in sauerkraut	2
5	**Fermented products from fruits and vegetables**	
5.1	Technology of Vinegar fermentation—types of vinegar-methods-slow and quick process.	2
5.2	Technology of fermented fruit wines-champagne cider-fortified wines-sherry-vermouth-Neera-Toddy.	2
5.3	Hygiene and sanitation in Fruit and vegetable processing industry Quality evaluation –Rules and regulations related to fruit and vegetable products.FSSAI specifications for fruit and vegetable products	2

FTT 322	FOOD PRODUCT DESIGN AND DEVELOPMENT	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: The main aim of this paper is to enable the students, to be capable for planning and preparing a project for food processing unit and to execute and evaluate the same.

Prerequisite: Nil.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Gain knowledge on the basic concepts of product development and innovation strategy
CO 2	Learn to apply the concept of Product Development Process
CO 3	Understanding about knowledge base for Product Development
CO 4	Analyse the role of consumers in product development
CO 5	Manage and improve the product development process

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	2	1	-	-	-	-	-	-	-	2	-
CO 2	1	3	2	-	-	-	-	-	-	-	3	-
CO 3	1	1	2	-	-	-	-	-	-	-	3	2
CO 4	3	3	2	-	-	-	-	-	-	-	3	2
CO 5	2	3	3	-	-	-	-	-	-	-	3	2

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	30
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):
1. How can you design a product development process? List out the major features
2. What are the various strategies and possibilities in innovation of food product?

Course Outcome 2 (CO2):
1. Explain the important points to be remembered when a new product has to be distributed and marketed.
2. Explain various techniques for managing product development

Course Outcome 3(CO3):
1. Explain about the role and behaviour of consumer in product development
2. How can you integrate consumer needs and wants in product development?

Course Outcome 4 (CO4):
1. Explain the principles involved in product development process
2. Explain about the establishment of outcomes, budget and constraints in product development

Course Outcome 5 (CO5):
1. How can we evaluate product development?
2. With help of a case study explain the successful new product development in a food company

Model Question Paper

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT 322
FOOD PRODUCT DESIGN AND DEVELOPMENT

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. How will you bring about Product launch and evaluation of a new food product?
2. How can you sense the possibilities of innovation for supporting the product development in your company?
3. Differentiate embodied and disembodied technology
4. What are the different sources of knowledge required for product development?
5. List put various attributes for evaluating product development
6. What are the factors affecting food choice?
7. What are the different levels of PD management?
8. What are the different types of flexibilities in product development?
9. How will you integrate innovation metrics into the business?
10. Differentiate anticipation and reaction capabilities

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Explain the different means of measuring success and failure of product development

Or

12. Identify the ways for evaluating innovation possibilities of your company for efficient product development
13. Explain various technological knowledge that a person should have when developing a new product.

Or

14. Elaborate on the knowledge required for the selection and conversion of raw materials.
15. How can you integrate consumer needs and wants in product development?

Or

16. Explain different ways and factors for understanding the food choice of consumers.

17. What are the major principles on which product development management depends?

Or

18. Identify and elaborate the specific outcomes for product strategy development needed by the product development manager from the project leader to build up the outcomes needed by the top management
19. How will you evaluate product development? Explain the basic steps for benchmarking product development.

Or

20. How do you think people in each level of company contribute to management of product development?

Syllabus

Module 1

Concept behind food product design and development process

Concept of product development - product success and failure - factors for success- Market survey process for product development, managing for product's success.

Innovation strategy - possibilities for innovation, building up strategy - product development programme - Stages of product development process - product life cycle - Product development, product commercialization, product launch and evaluation.

Module 2

Knowledge base for product development

Technology, knowledge and the food system - knowledge management - Knowledge for the conversion of raw material properties

Module 3

Role of consumers:

Role of consumers in product development - consumer behaviour - Food preferences - Avoiding and acceptance of consumers.

Integration of consumer needs in product development.

Module 4

Managing the product development process

Principles of product development management - People in product development management

Decision making - Establishing outcomes - budgets and constraints

Module 5

Improving the product development process

Improving the product development process - key message - Evaluating product development - Product Stability - evaluation of shelf life - changes in sensory attributes and effects of environmental conditions

Case studies of successful product developments.

Text Books

1. Clarke & Wright W., Managing New Product and Process Development. Free Press, 1999, ISBN-13: 978-0029055175
2. Earle R, Earle R & Anderson A, Food Product Development, Woodhead Publishing, 2001, 978-1-84569-722-8
3. Karl Ulrich & Steven Eppinger Product Design and Development (Irwin Marketing) 6th Edition. McGraw-Hill Education; 6th edition (April 27, 2015), ISBN-13: 978-0078029066

Reference Books

1. Earle and Earle Creating New Foods. Chadwick House Group. 2001. ISBN 1-902375-12-2 / 1-902423-41-0
2. Fuller. New Food Product Development - from Concept to Market Place. CRCPress.2004. ISBN 9781439818640
3. Brody, Aarn L. and John B. Lord "Developing new Food Products for a Changing Marketplace", 2 nd Edition, CRC / Taylor & Francis, 2008. DOI https://doi.org/10.1201/9781420004328

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Concept behind food product design and development process**	
1.1	Concept of product development, product success and failure, factors for success	3
1.2	Market survey process for product development, managing for product's success.	1
1.3	Innovation strategy -possibilities for innovation, building up strategy, product development programme	2
1.4	Stages of product development process - product life cycle	2
2	**Knowledge base for product development**	
2.1	Technology knowledge and the food system - knowledge management	3
2.2	Knowledge for the conversion of raw material properties	4
3	**Role of consumers**	
3.1	Role of consumers in product development - consumer behaviour	3
3.2	Avoiding and acceptance of consumers - Integration of consumer needs in development	4
4	**Managing the product development process**	
4.1	Principles of product development management and people involved in it.	2
4.2	Decision making	2
4.3	Improving the product development process	3
5	**Improving the product development process**	

5.1	Improving the product development process - key message	2
5.2	Evaluating product development - Product Stability evaluation of shelf life, changes in sensory attributes and effects of environmental conditions	3
5.3	Case studies of successful product developments.	2

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT332	BAKERY AND CONFECTIONERY	PEC	2	1	0	3

Preamble:
This course will deals with the fundamental study of equipment and raw material identification while focusing on the needs of bakers to understand measurements, scaling and basic baking techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Analyze the fundamental raw materials vital in bakery units
CO 2	Explain the important unit operations used in bakery and confectionery technology
CO 3	Discover an idea about the basic concepts of setting up the bakery units.
CO 4	Classify the different types of confectioneries in food sector
CO 5	Apply knowledge in the processing of different confectionary products and its packaging requirements

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2					3						
CO 2	3											
CO 3	2		2									
CO 4	2											
CO 5	3						3					

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe the beneficial role of water as major ingredients in bakery industry.
2. Explain the functions of salt in baking.
3. Write a short note on gluten and its properties.

Course Outcome 2 (CO2)

1. Give a detailed note on different bread making methods.
2. Explain in detail about short dough and hard dough method.
3. Describe in detail the major unit operations involved in biscuit manufacture

Course Outcome 3(CO3):

1. List out and state the use of any 10 minor equipment's used in bakery
2. Exemplify the design features of internal structure and fittings of a bakery unit.
3. Elucidate the 4D approach of pest control in a bakery industry.

Course Outcome 4 (CO4):

1. Give a detailed note on packaging of confectionary items.
2. Explain the steps involved in processing of chocolate.
3. Write a short note on flat bloom

Course Outcome 5 (CO5):

1. Highlight the steps involved in the processing of chewing gum.
2. What are boiled sweets? Explain.

3. Give a detailed account on processing of tablets.

Model Question paper

QP CODE:

Reg No : ………………. **Name : …………………..**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
COURSE CODE: FTT332
BAKERY AND CONFECTIONARY

Max Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions, each question carries 3 marks)

1. Describe the beneficial role of water as a major ingredient in bakery industry.
2. Explain the functions of salt in baking
3. Explain the conventional bread making methods.
4. How dough temperature is controlled? Explain
5. What are the pest control methods used in bakery unit?
6. Describe the basic packaging requirements of bakery unit.
7. What are sugar alcohols? Explain.
8. Write a short note on technical considerations of confectionary industry.
9. Write a short note on pan coating of confectionary products.
10. How fermentation affects quality of cocoa bean.

PART B

(Answer one full question from each module, each carries 14 marks)

11. Give the functions of egg in baking.

Or

12. Write a short note on chemical leavening agents.
13. What are the bread faults? Substantiate with examples and the necessary remedies.

Or

14. Describe in detail the major unit operations involved in bread preparation.
15. Explain the types of major and minor equipment used in the bakery.

Or

16. List out the factors to be considered for setting up of a bakery unit.
17. What are the type of sugars used in confectionary industry?

Or

18. Explain the steps involved in processing of chocolate
19. Give a detailed account on processing of toffee.

Or

20. Exemplify in detail on liquorice processing.

Syllabus

Module 1

Introduction: History of bakery and confectionery-trends-Raw materials used in Bakery Flour types-characteristics-water-salt-usage-function-yeast –production enzymes used-function-role of sugar and milk-leavening agents-types functions.

Module 2

Mixing-fermentation-proofing-Baking-Bread making Technology-types of breads-bread faults-remedies-Biscuits/Cakes processing-types-ingredients Processing of Pizza and pastry.

Module 3

Equipment required-Quality and standards-Regulations to be followed Packaging requirement for bakery products, Bakery unit layout.

Module 4

Chocolate processing-steps-chocolate confectionery-ingredients- Quality and standards-Regulations to be followed-Packaging requirements for confectionery products.

Module 5

General technical aspects of industrial sugar confectionery- composition effects-change of state-Boiled sweets-ingredients- processing-crystallized confectionery- Liquorice Processing-Aerated confectionery-chewing gum bubble gum-Tablets-Lozenges-sugar panning-granulated confectionery medicated confectionery.

Text Books

1. Cauvain, Stanley P, and Young, Linda S., Technology of Bread Making, Second Edition Aspen publication. Maryland, 1999

2. Matz, Samuel A., akery Technology and Engineering, Third Edition, Chapman & Hall, London.

Reference Books

1. Bernard. W. Minifie., PhD “Chocolate, Cocoa, and confectionery” (Science and Technology), 3 rd edition, CBS publishers and Distributors, New Delhi-110002.

2. Ewald Notter, The art of confectioner, sugar work and pastillage, Wiley Publishers

3. Y H Hui, Bakery products science and technology, Blackwell Publishers

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Introduction**	**8**
1.1	History of bakery and confectionery-trends	1
1.2	Raw materials used in Bakery -Flour types-characteristics	2
1.3	Water-salt-usage-function-yeast -production enzymes used	2
1.4	Function-role of sugar and milk	1
1.5	Leavening agents-types functions	2
2	**Module 2- Bakery unit operations**	**8**
2.1	Mixing-fermentation-proofing-Baking-Bread making Technology	2
2.2	Types of breads-bread faults-remedies	2
2.3	Biscuits/Cakes processing-types-ingredients	2
2.4	Processing of Pizza and pastry	2
3	**Module 3- Setting up of bakery units**	**6**
3.1	Equipment required-Quality and standards	2
3.2	Regulations to be followed	2
3.3	Packaging requirement for bakery products, Bakery unit layout	2
4	**Module 4- Chocolate Processing**	**5**
4.1	Chocolate processing-steps-chocolate confectionery-ingredients	2
4.2	Quality and standards-Regulations to be followed	2
4.3	Packaging requirements for confectionery products	1
5	**Module 5- Confectionery products**	**9**
5.1	Types of confectioneries-classification	2
5.2	Boiled sweets-ingredients-processing-crystallized confectionery	2
5.3	Liquorice processing-Aerated confectionery-chewing gum-bubble gum	2
5.4	Sugar panning- granulated confectionery	2
5.5	Medicated confectionery-Lozenges-Processing of Toffee	1

FTT342	FOOD BIOTECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course deals with the basics of Molecular Biology, Genetic Engineering and production process of various metabolites, genetically modified foods while focusing on the application of these in various Food industries.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Acquire an idea about the basics and applications of biotechnology in food through molecular biology.
CO 2	Familiarize the fundamentals of Genetic Engineering and Tissue culture techniques.
CO 3	Develop knowledge about different types of fermentations, fermented foods and bioproducts.
CO 4	Understand the production of Functional foods and Genetically modified foods, its ethical issues and testing methods.
CO 5	Analyze the role of enzymes in various food industries.

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**3**				**2**		**2**					
CO 2	**2**						**2**					
CO 3	**2**											
CO 4	**2**							**2**				
CO 5	3						2					

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20

Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Applications of Biotechnology in Food industries.

2. Explain the salient features of B-DNA with a neat sketch.

3. Explain in detail about transcription in Prokaryotes.

Course Outcome 2 (CO2)

1. Elaborate on the mechanism of gene regulation of Lac operon.

2. Write about the basic steps in Recombinant DNA technology.

3. Explain the basic steps in plant tissue culture.

Course Outcome 3(CO3):

1. Jot out the production of various fermented foods.

2. Explain in detail about the industrial production of Lactic acid.

3. Give notes on production of SCP.

Course Outcome 4 (CO4):

1. Explain about the concepts and working of Nutrigenomics.

2. How does the ELISA test help in testing for genetically modified organisms?

3. Discuss the ethical issues concerning genetically modified foods on human health and the environment.

Course Outcome 5 (CO5):

1. Write about various endogenous enzymes involved in the texture and colour of different foods.

2. Explain about the application of enzymes in Dairy industries.

3. Explain about the application of enzymes in Meat industries.

MODEL QUESTION PAPER

QP CODE:

Reg No.: _______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT342

Course Name: FOOD BIOTECHNOLOGY (FT)

Max. Marks: 100 **Duration: 3 hours**

PART A

Answer all questions, each question carries 3 marks.

1. Give applications of Biotechnology in Food.
2. Difference between Transcription and Translation.
3. Define Operon and its parts.
4. List out the characteristics of Vectors.
5. Give the flow chart for the production of Beer.
6. What is SCP and explain its importance.
7. What are Functional Foods and its significance.
8. Explain the Ethical issues concerning GM Foods.
9. What are immobilized enzymes?
10. Application of enzymes in Bakery

PART-B

(Answer one full question from each module, each question carries 14 marks)

11.(a) Elucidate the structure of B-DNA. (4)

(b)Explain in detail about the Prokaryotic replication with a neat diagram. (10)

(OR)

12.(a) List out the types of RNA and mention its characteristics. (4)

(b)Write in detail about the Transcription in Prokaryotes. (10)

13. Explain the gene regulation by Trp operon with relevant figures wherever applicable. (14)

(OR)

14.(a) Summarize the process of recombinant DNA technology. (7)

(b) Write about restriction endonucleases. (7)

15.(a) What is the importance of food fermentations in nutritional enhancement? (4)

(b)Explain the production of any two fermented Dairy products. (10)

(OR)

16.(a) Elaborate on the commercial production process of Citric Acid. (7)

(b) With the help of a neat flow chart give details of edible mushroom production. (7)

17.(a) Why is it required to label and trace genetically modified foods? (4)

(b) Discuss the ethical issues concerning genetically modified foods on human health and the environment. (10)

(OR)

18. Elaborate on the different testing methods for genetically modified foods. (14)

19.(a) Give details on immobilized enzymes in food processing. (4)

(b) What are the enzymes used in Meat and Baking Industry? Explain with examples. (10)

(OR)

20.(a) How do endogenous enzymes affect the colour, texture of food? (4)

(b) What are the enzymes used in Dairy and Fruit Industry? Explain with examples. (10)

Syllabus

Module 1:

Application of Biotechnology in Food, Pharmaceutical and other Industries. Basics of Molecular Biology – Chemistry and Biology of DNA, RNA and proteins-DNA replication, transcription and translation in prokaryotes.

Module 2:

Regulation of gene expression in prokaryotes, Recombinant DNA Technology, Basics of strain improvement techniques, Vectors in Biotechnology, Plant tissue culture, Animal /Insect cell culture as a tool of biotechnology.

Module 3:

Fermented Foods: Dairy products, Oriental fermentations, Alcoholic Beverages. Process of production of commercially important organic acids-Citric Acid, Lactic Acid, Amino acids. Bioproducts for food industries- SCP, Mushroom. Natural Bio preservatives - Nisin.

Module 4:

Concepts, working, significance of Nutrigenomics, Nutraceuticals and Functional Foods. Genetically Modified Foods- Plant and Animal origin. Ethical issues concerning GM Foods, testing for Genetically modified organisms, labeling and traceability, Biosafety- Public perception of GM foods, GMO Act- 2004

Module 5:

Role of immobilized enzymes in food processing-Endogenous enzymes in food quality- color, texture, flavor and nutritional quality. Application of enzymes in Bakery, Meat, Fruit, Vegetable and Dairy Industries.

Text Books

1. Joshi,V.K and Singh,R.S, "Food Biotechnology Principles and Practices", IK International Publishing House Pvt.Ltd

2. Satyanarayana U, "Biotechnology", Arunavazhan Publishers

3. National Research Council –"Application of Biotechnology to traditional fermented foods", National Academy Press, Washington, 1992.

Reference Books

1. David Latchman*, Basic Molecular and Cell Biology, 3rd Edition.* BMJ Publishing group, 1997. First Indian Reprint 2006.

2. *Gene cloning and DNA Analysis- An Introduction-4th Edition, T.A. Brown Publishers, Blackwell Sciences Ltd. UK, 2001.*

3. H.S.Chawla, *Introduction to plant Biotechnology,*2nd Edition , Oxford Publishers and IBH Publishing Company Pvt. Ltd, New Delhi.

4. Lopez G.I.G and Canovas,G.V.B *Food Science and Food Biotechnology, ,* CRC Press,Florida,USA 2003.

5. Joshi .V.K and Pandey Biotechnology: *Food Fermentations, Vol 1 and 2,* Education Publishers, 2002.

6. Lee, B.H Joshi,V.K and Pandey A, *Fundamentals of Food Biotechnology,* 1999.

7. Rita Singh*, Food Biotechnology,* Global Vision Publication House, Delhi, 2004.

Course Contents and Lecture Schedule:

No	Topic	No. of Lectures
1	**Module 1 – Introduction to Biotechnology**	**7**
1.1	Introduction to subject and discussion about the Applications of Biotechnology in food, Pharma and other industries.	1
1.2	Structure of DNA and its types	1
1.3	Structure of RNA and its types	1
1.4	DNA replication in Prokaryotes	2
1.5	Transcription in Prokaryotes	1
1.6	Translation in Prokaryotes	1
2	**Module 2-Genetic Engineering**	**7**
2.1	Gene regulations in Prokaryotes-Operon concept	1
2.2	Gene regulations in Prokaryotes-Lac, Trp operons	2
2.3	Recombinant DNA technology	1
2.4	Strain Improvement techniques	1
2.5	Vectors in Biotechnology	1
2.6	Plant Tissue Culture and Animal Tissue Culture	1
3	**Module 3- Application of Food Biotechnology**	**7**
3.1	Fermented Foods, types, Oriental fermentations	1
3.2	Importance of food fermentations in food preservation and nutritional enhancement.	1
3.3	Process of production of commercially important organic acids- Citric Acid, Lactic Acid	2
3.4	Process of production of Amino acids.	1
3.5	Bioproducts for food industries- Mushroom, SCP	1
3.6	Natural Biopreservatives - Nisin.	1
4	**Module 4- GM and Functional Foods**	**7**
4.1	Nutrogenomics-concepts, working, significance and relevance	1
4.2	Nutraceuticals and Functional Foods.	1
4.3	Genetically Modified Foods	1
4.4	Testing of Genetically Modified Foods	2
4.5	Ethical issues concerning GM Foods	1
4.6	Current guidelines of GMO" S, GMO Act- 2004	1
5	**Module 5- Enzymes of Importance in Food.**	**8**
5.1	Role of immobilized enzymes in food processing	1
5.2	Endogenous enzymes in food quality	1

5.3	Application of enzymes in Bakery Meat.	2
5.4	Application of enzymes in Fruits, Vegetables	2
5.5	Application of enzymes in Dairy Industries.	2

FTT352	REFRIGERATION AND COLD CHAIN	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: Students will learn the basic concepts and principles of air conditioning and refrigeration and to identify the components of refrigeration system. They will be able to understand psychrometric terms and processes and its application in food processing

Prerequisite: Nil.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Familiarize Basic refrigeration cycles and concepts
CO 2	Identify the components of Refrigeration system
CO 3	Compare different types of refrigeration systems
CO 4	Analyse psychrometric processes and cycles
CO 5	Exemplify the basics of Air Conditioning
CO6	Analyse the components of cold chain

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	1									
CO 2	1	2	3									
CO 3	3		2	1								
CO 4	3	1	2									
CO 5	3	1		2								
CO 6	2	1	2									

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	30
Evaluate			

Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define Relative COP
2. Compare Primary and secondary refrigerents

Course Outcome 2 (CO2)

1. List out the components of vapour compression refrigeration system
2. Explain the deviations from theoretical VCR cycle in actual cases

Course Outcome 3(CO3):

1. List out the refrigerants used in cryogenic storage
2. Elaborate on absorption refrigeration systems

Course Outcome 4 (CO4):

1. Explain Wet bulb depression
2. Elaborate on the components of psychrometric chart

Course Outcome 5 (CO5):

1. Define Air conditioning
2. Elaborate on comfort conditions
3. **Course Outcome 6 (CO6**):
1. Compare chilling and freezing injury
2. List out the types of cold storage

Model Question Paper

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER BTECH DEGREE EXAMINATION

Course Code: FTT 352

Course name: REFRIGERATION AND COLD CHAIN

Max marks: 100 Time: 3 hrs

Part A

Answer all questions each question carries 3 marks (Marks = 10x 3 = 30 marks)

1. Define i) refrigeration ii) COP iii) latent heat iv) sensible heat v) 1TR.
2. Briefly describe Reversed Carnot cycle
3. Explain swept volume and compressor capacity
4. Explain high side float valves
5. Explain cryogenic freezing
6. Explain three fluid refrigeration system
7. What is meant by Psychrometry? Explain its significance.
8. Compare absolute humidity and relative humidity.
9. Define thawing. Describe thaw indicators.
10. Explain Q10 Value.

PART B

Answer all questions each question carries 14 marks (Marks = 14x 5 = 70 marks)

11. a) Discuss basic components of a vapour compression refrigeration system. (7)

b) Compare vapour compression and vapour refrigeration system. (7)

OR

12. Explain super-heating and sub-cooling in vapour compression refrigeration system with the help of P-H diagram (14)

13. Explain the different types of compressors used in refrigeration (14)

OR

14. Compare dry expansion and flooded evaporators (14)

15. Elaborate on Practical Vapour absorption refrigeration system with neat diagram (14)

OR

16. Explain the working principle of Lithium bromide refrigeration system with neat sketch. (14)

17. Elaborate on psychrometric process with diagram (14)

OR

18. Compare summer and winter air conditioning system (14)

19. Explain Temperature -time indicators and their significance (14)

OR

20. a)Define cold chain. Explain the components of cold chain (7)

b) Explain the types of cooling load and its calculation (7)

Syllabus

Module 1

Basic refrigeration cycles and concepts

Refrigerants: Primary and secondary refrigerants; common refrigerants-Ammonia, Freon, HFC, HCFC -Brine, their properties and comparison. Refrigeration-units of refrigeration - coefficient of performance- Reversed Carnot cycle simple vapour compression system– T-S diagram – P-H chart.

Module 2

Refrigeration Components

Compressor-Basic terminology -Reciprocating, Rotary and Centrifugal Compressors. Condenser- Air cooled condensers- Water cooled condensers -Evaporative condensers- Cooling tower, Spray pond. Evaporator-Classification of evaporator-Flooded evaporator-Dry expansion evaporator.

Refrigeration Controls: Low sand high side float valves, capillary tube, thermostatic expansion valve, automatic expansion valve.

Module 3

Absorption Refrigeration System

Simple vapour absorption refrigeration systems. Practical Vapour absorption refrigeration system. Refrigerant absorbent pairs-Three fluid refrigeration, Lithium Bromide Refrigeration System. Cryogenics-Cryogenic Freezers.

Module 4

Psychrometry

Psychrometric properties-psychrometric chart. Saturation line-relative humidity line-constant specific volume lines – constant thermodynamic wet bulb temperature lines-constant enthalpy lines.

Psychrometric process- solving problems using psychrometric chart. Air Conditioning-Human and Industrial air conditioning systems.

Module 5

Cold Chain

Cold chain- Need for cold chain- shelf- life- Q10 Value - just -in-time deliveries. Temperature limits-Chilling and freezing injury, cold – shortening; PPP and TTT concepts. Temperature monitoring -Critical temperatures- Temperature -time indicators.Time-temperature correlation-the kinetic approach, effective temperature-Transportation regulations. Role of packaging in cold chain-Thaw indicators-Cooling Load-Cold storages.

Text Books

1. Arora, and Chandra, Refrigeration and Air Conditioning, Prentice Hall India Learning Private Limited (2010), ISBN-13: 978-8120339156.
2. D.K. Chavan and G.K. Pathak, Refrigeration and Air conditioning, STANDARD BOOK HOUSE, 1 Edition (2016), ISBN-13: 978-8189401528.
3. C.P Arora, Refrigeration and Air Conditioning, McGraw Hill Education, 3 edition,2017, ISBN-13: 978-9351340164

Reference Books

1. R .S Khurmi and J.K. Gupta, Textbook of Refrigeration and Air-conditioning, S Chand Publications, 2006, ISBN-13: 978-8121927819
2. Ahmadul Ameen, Refrigeration and Air-conditioning, PHI Learning Pvt. Ltd., 2006, ISBN: 8120326717, 9788120326712
3. Amalendu Chakraverty, R. Paul Singh Postharvest Technology and Food Process Engineering, CRC Press, 2016, ISBN: 1466553219, 9781466553217
4. Sahay K.M. & Singh K.K, Unit Operations of Agricultural Processing, Vikas Publishing House Pvt Limited, 2nd Edition, 2004, ISBN: 8125911421, 9788125911425
5. Zeki Berk, Food Process Engineering and Technology, Academic Press 3rd Edition(2018), ISBN: 9780128120187

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Basic refrigeration cycles and concepts**	
1.1	Refrigerants: Primary and secondary refrigerants.	2
1.2	Common refrigerants-Ammonia, Freon, HFC, HCFC -Brine, their properties and comparison.	2
1.3	Refrigeration-units of refrigeration - coefficient of performance-Reversed Carnot cycle simple vapour compression system-T-S diagram – P-H chart.	2
2	**Refrigeration Components**	
2.1	Compressor-Basic terminology -Reciprocating, Rotary and Centrifugal Compressors.	1
2.2	Condenser- Air cooled condensers- Water cooled condensers -Evaporative condensers- Cooling tower, Spray pond. Evaporator-	2
2.3	Classification of evaporator-Flooded evaporator-Dry expansion evaporator.	2
2.4	Refrigeration Controls: Low sand high side float valves, capillary tube, thermostatic expansion valve, automatic expansion valve.	2
3	**Absorption Refrigeration System**	
3.1	Simple vapour absorption refrigeration systems	2
3.2	Practical Vapour absorption refrigeration system	2
3.3	Refrigerant absorbent pairs- Three fluid refrigeration, Lithium Bromide Refrigeration System	1
3.4	Cryogenics-Cryogenic Freezers	3
4	**Psychrometry**	
4.1	psychrometric properties- psychrometric chart	2
4.2	Saturation line -relative humidity line-constant specific volume lines -constant thermodynamic wet bulb temperature lines-constant enthalpy lines.	2
4.3	Psychrometric process- solving problems using psychrometric chart.	2
4.4	Air Conditioning-Human and Industrial air conditioning systems	2
5	**Cold Chain**	
5.1	Cold chain- Need for cold chain- shelf- life- Q10 Value - just – in-	2

	time deliveries	
5.2	Temperature limits- Chilling and freezing injury, cold – shortening; PPP and TTT concepts	2
5.3	Temperature monitoring -Critical temperatures- Temperature -time indicators. Time -temperature correlation-the kinetic approach, effective temperature- Transportation regulations. Role of packaging in cold chain- Thaw indicators-Cooling Load	2

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

FTT 362	MODELLING AND SIMULATION IN FOOD PROCESSING	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: At the end of this course, it will be possible to familiarize basics of modelling, modelling of fluid flow system, reactors, staged operations such as distillation, heat exchangers and extraction, simulation of major food process system such as reactors, heat exchangers and membrane separation system.

Prerequisite: Principles of Chemical Engineering.

Course Outcomes: After the completion of the course the student will be able to

CO 1	apply the basic concepts of various models and fundamentals laws in model development
CO 2	develop mathematical models for various fluid flow systems and reactors
CO 3	develop mathematical models for various staged operations such as extraction , distillation, heat exchangers and membrane separation processes
CO 4	apply the concepts of simulations and novel techniques to simulate chemical systems
CO 5	simulate the various food processing systems such as tank, reactor, distillation column and heat exchangers

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3	2	2		3							
CO 3	3	2	2									
CO 4	3											
CO 5	3	2	2		3							

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	10	10	20
Apply	20	20	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Distinguish between probabilistic model and deterministic model.
2. Define degrees of freedom for a process model.
3. Explain in detail about principles of formulation of mathematical model.

Course Outcome 2 (CO2):

1. Develop the Component continuity equation for pseudo first order reaction which takes place in CSTR.
2. Develop the general modeling scheme for any fluid flow problems.
3. Develop the mathematical model for a continuous, jacketed flow boiling system in which the feed is supplied as a liquid and product is withdrawn as vapour. List out the assumptions made while developing model and represent the model using basic integration block diagrams.

Course Outcome 3(CO3):

1. With simple example show that staged operations are modeled by difference equations.
2. Develop the mathematical model for the Counter current double heat exchanger at transient conditions and give a pictorial representation of the model. State your assumptions.
3. Develop the mathematical model for multistage counter-current extraction unit with reaction for dynamic simulation and state all the assumptions.

Course Outcome 4 (CO4):

1. Distinguish between the truncation errors and round off errors of any numerical scheme.

FOOD TECHNOLOGY

2. List any iterative convergence methods used in numerical simulations.
3. Compare and contrast between Euler's explicit and Euler's implicit methods.

Course Outcome 5 (CO5):

1. Consider a reaction $A \rightarrow B$ carried out in a plug flow reactor. The differential equation for species A is

$$u \frac{dCA}{dz} = -kC_A$$

The initial condition is: at z=0, C_A=1 mol/m^3. The rate constant of the reaction is 0.1 s^{-1}. Using Runge-Kutta fourth order method, determine the concentration of A at 5 m from entrance. Take u=1 m/s.

2. Discuss the simulation procedure involved in the determination of temperature in the heat exchanger.
3. Consider a stirred vessel which initially contains 760 kg of solvent at 25^{0}C. 12 kg/min of solvent flows into the stirred vessel at 25^{0}C and exits out also at the same rate. At t=0 the flow of steam is started in a coil in the stirred vessel. The heat supplied by steam to the solvent is given by $Q=UA(T_S-T)$, where UA is the overall heat transfer coefficient multiplied by coil area through which heat exchange takes place and T_S is the temperature of steam and is 150^0. UA=11.5 kJ/min-K. The specific heat of the solvent is C_P=2.3 kJ/kg-K. Show that

$$\frac{dT}{dx} \ (^0C/s) = 0.023 - 0.000373T$$

   a. Determine the solvent temperature after 50 min.
   b. Also determine the maximum temperature that can be reached in the tank.

MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________ **Name: _______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT362

MODELLING AND SIMULATION IN FOOD PROCESSING

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Distinguish between probabilistic model and deterministic model.
2. Define degrees of freedom for a process model.
3. Distinguish between basic information flow diagram and basic integration block diagrams.

4. Develop the Component continuity equation for pseudo first order reaction which takes place in CSTR.
5. Define radical kinetics with suitable examples.
6. Develop the general modeling scheme for any fluid flow problems.
7. Distinguish between distributed parameter model and lumped parameter model.
8. With simple example show that staged operations are modeled by difference equations.
9. List any iterative convergence methods used in numerical simulations.
10. Compare and contrast between Euler's explicit and Euler's implicit methods.

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

PART B

(Answer one full question from each module, each question carries 14 marks)

11. a) Consider a plug flow reactor in which a first order reaction takes according to the following stoichiometry A $\xrightarrow{K_1}$ B. Concentration of A C_A decreases in axial direction as A is consumed in the reaction. Density ρ, Velocity v and concentration C_A can all vary with time and axial direction. Plug flow condition is assumed, it means that there is no velocity, density and concentration gradients in radial directions. Develop component continuity equation for component A and B for this reactor. (9)

    b) Explain in detail about principles of formulation of mathematical model (5)

[OR]

12. Explain in detail about the classification of models. (14)
13. a) Develop the mathematical model for a continuous, jacketed flow boiling system in which the feed is supplied as a liquid and product is withdrawn as vapour. List out the assumptions made while developing model and represent the model using basic integration block diagrams. (9)

    b) Prove that the following Ordinary differential equation is stiff, when step size h ≥ 2/a $\left(\frac{dx}{dt}\right) = -ax \,; x(0) = 1 \,, where\ a > 0.$ (5)

[OR]

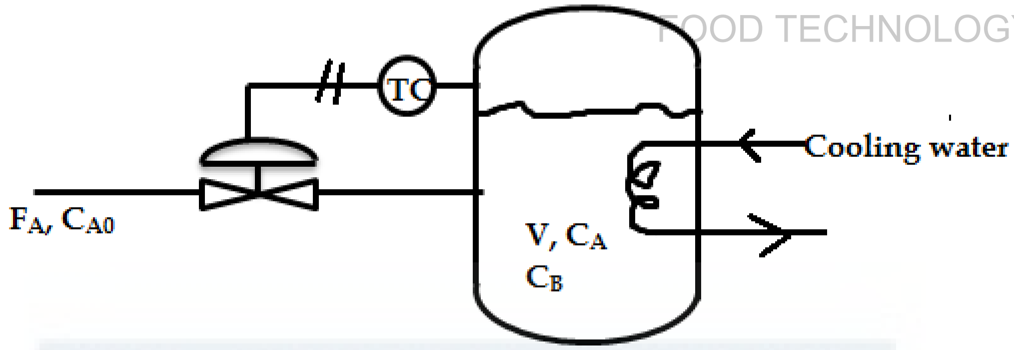
14. A semi batch reactor is run at constant temperature by varying the rate of addition of one of the reactants, A. The irreversible, exothermic reaction is first order in reactants A and B.

    $$A+B \xrightarrow{k_1} C$$

    The tank is initially filled to its 40 percent level with pure reactant B at a concentration C_{PQ}. Maximum cooling water flow is begun, and reactant A is slowly added to the perfectly stirred vessel. Develop the equations describing the system. Without solving the equations, sketch the profiles of F_A, C_A and C_B with time during the batch cycle. (14)

2014

FOOD TECHNOLOGY



15. a) Develop the reaction kinetics model for the following reaction that takes place in isothermal liquid phase CSTR. The input molar flow rate of the reactant is F_i(mol/min) and the molar flow rate of product is F_0 (mol/min). The reaction stochiometry is given below (8)

$$A + B \rightleftharpoons C + D$$

$$C + B \rightleftharpoons E$$

$$A + E \rightleftharpoons F$$

b) Develop a mathematical model for gas flowing through three tanks interconnected through valves. State all the assumptions made and make a pictorial representation of the model. (6)

[OR]

16. a) An open reservoir feed the water through a long pipe to an enclosed vessel compressing the gas space. Because the feed line has a large diameter, the momentum of water is significant level to compress the gas space. Construct the mathematical model that defines the transient pressure surge in the enclosed vessel. State clearly all the assumptions made and sketch the information flow diagram. (12)

b) State the significance rate limiting step in reaction kinetics models. (2)

17. Develop the mathematical model 15 stage binary distillation column for dynamic simulation such that terminal compositions of the column can be controlled and state all the assumptions made in the formulation of model. (14)

[OR]

18. a) Develop the mathematical model for the Counter current double heat exchanger at transient conditions and give a pictorial representation of the model. State your assumptions. (8)

b) Develop the mathematical model for multistage counter-current extraction unit with reaction for dynamic simulation and state all the assumptions. (6)

19. a) Consider a reaction A $\rightarrow$ B carried out in a plug flow reactor. The differential equation for species A is

$$u\frac{dCA}{dz} = -kC_A$$

The initial condition is: at z=0, C_A=1 mol/m^3. The rate constant of the reaction is 0.1 s^{-1}. Using Runge-Kutta fourth order method, determine the concentration of A at 5 m from entrance. Take u=1 m/s. (10)

b) Distinguish between the truncation errors and round off errors of any numerical scheme. (4)

[OR]

20. Consider a stirred vessel which initially contains 760 kg of solvent at 25^0C. 12 kg/min of solvent flows into the stirred vessel at 25^0C and exits out also at the same rate. At t=0 the flow of steam is started in a coil in the stirred vessel. The heat supplied by steam to the solvent is given by Q=UA(T_S-T), where UA is the overall heat transfer coefficient multiplied by coil area through which heat exchange takes place and T_S is the temperature of steam and is 150^0. UA=11.5 kJ/min-K. The specific heat of the solvent is C_P=2.3 kJ/kg-K. Show that

$$\frac{dT}{dx}\,(^0\mathrm{C/s})=0.023-0.000373T$$

i. Determine the solvent temperature after 50 min.
ii. Also determine the maximum temperature that can be reached in the tank.

(14)

Syllabus

Module 1

Introduction to mathematical modelling: uses, principles of formulation, Classification of models –Simple vs. dynamic, Transport phenomena based vs statistical; fundamental laws of modelling, model building, modelling difficulties. Population balance models and applications; Empirical models; Model parameters estimation

Module 2

Mathematical models for simple operations: simple hydraulic tank, continuous flow tank, enclosed vessel, mixing vessel with and without reaction, steam jacketed vessel, steam jacketed vessel with mixing, continuous flow boiling system

Module 3

Modelling of Staged operations: Extraction, Distillation column, Modelling of Distributed systems- tubular reactor, heat exchangers, membrane separation process

Module 4

Basics of simulation: Introduction to flow sheet simulation; Sequential modular approach; Equation oriented approach; Partitioning and tearing; recycle convergence methods, Simulation examples of fluid flow processes; Monte Carlo simulation. Inventory and queuing problem

Module 5

Simulation of food process system: simple hydraulic tank, continuous flow tank, mixing vessel with and without reaction, Distillation column, heat exchangers

Text Books

1. Roger G.E Franks, Mathematical modelling in chemical engineering, John Wiley and sons, 1972

2. Luyben W.L, Process modelling, simulation and control for chemical engineers, McGraw Hill (ISE) 1990.

Reference Books

1. M.M. Denn, "Process Modelling", Wiley, New York, (1990)

2. C.D. Holland and A.L. Liapis, "Computer Methods for solving Dynamic Separation Problems", McGraw Hill, (1983)

3. C.D. Holland, "Fundamentals of Modelling Separation Processes ", Prentice Hall, (1975).

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to mathematical modelling**	**7**
1.1	Uses, principles of formulation, Classification of models –Simple vs. dynamic, Transport phenomena-based vs statistical;	3
1.2	Fundamental laws of modelling, model building, modelling difficulties.	2
1.3	Population balance models and applications; Empirical models; Model parameters estimation	2
2	**Mathematical models for simple operations**	**7**
2.1	Simple hydraulic tank, continuous flow tank, enclosed vessel, mixing vessel with and without reaction	3
2.2	steam jacketed vessel, steam jacketed vessel with mixing, continuous flow boiling system	4
3	**Modelling of Staged operations**	**8**
3.1	Extraction, Distillation column	4
3.2	Modelling of Distributed systems- tubular reactor, heat exchangers, membrane separation process	4
4	**Basics of simulation**	**7**
4.1	Introduction to flow sheet simulation; Sequential modular approach; Equation oriented approach; Partitioning and tearing; recycle convergence methods,	3
4.2	Simulation examples of fluid flow processes; Monte Carlo simulation. Inventory and queuing problem	4
5	**Simulation of food process system**	**7**
5.1	simple hydraulic tank, continuous flow tank, mixing vessel with	4

	and without reaction	
5.2	Distillation column, heat exchangers	3

FTT 372	NANOTECHNOLOGY IN FOOD	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: Goal of this course is to develop the knowledge for students in nanoparticles, its synthesis, characterization and unique properties. This course is very essential for learning the possible application of nanotechnology in the food industry exploiting the characteristic features of the nanomaterials.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the history of nanotechnology, nanoparticles and its properties.
CO 2	Develop a basic knowledge in synthesis and characterization of nanoparticles.
CO 3	Recognize nano-engineered food ingredients and additives.
CO 4	Understand the application of various nanoparticles in food packaging andnano-sensing
CO 5	Understand the toxic effects and risk associated with engineered nanoparticles

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2										1
CO 2	3	2	2									1
CO 3	2	2	3									1
CO 4	2	2										1
CO 5	2	3										1

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State the definitions of following terms in nanotechnology: -
   a. Nanowires
   b. Nanotubes
   c. Nanocomposites

2. Describe the physical and chemical properties of nanomaterials

3. Discuss how the properties of quantum dots can be exploited in food industry.

Course Outcome 2 (CO2)

1. Describe the mechanism behind the synthesis of nanomaterials.

2. Write in detail any three methods of characterization of nanomaterial.

3. Differentiate physical, chemical and biological method of synthesis of nanomaterials

Course Outcome 3(CO3):

1. Discuss on any two application of nanotechnology for improving the quality of food

2. Write in detail about the concept of nano additives.

3. Discuss on application of nanoparticles for detection of contaminants.

Course Outcome 4 (CO4):

1. Describe the speciality of nanocoating and its possible application in food industry
2. Describe the role of nanomaterials in intelligent packaging
3. Discuss the antimicrobial efficacy of nanomaterials and its potential applications

Course Outcome 5 (CO5):

1. Discuss the health hazards related to the usage of nanomaterials
2. Discuss the environmental impact of nanomaterials
3. Describe about usage regulations of nanoparticles for safety

Model Question paper

Total Pages:

Reg No.:________________ Name:____________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT372

Course Name: NANOTECHNOLOGY IN FOOD

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each question carries 3 marks. Marks

1	Detail the contributions of Richard Feyman in the field of nanotechnology	3
2	Write on nanotubes and its unique features	3
3	Elucidate the working principle of Scanning Electron Microscopy	3
4	Differentiate Bottom up and top down approach of nanomaterial synthesis	3
5	Describe on nano additives and its significance in food industry	3

6		Explain nanosensors and its working principle	3
7		Describe the role of nanocomposites in food applications	3
8		Write about the concept of smart packaging and its significance in food industry	3
9		Explain the possible toxicity of metal nanoparticles	3
10		Describe the regulations in using nanomaterials in food industries	3

PART B

Answer any one question from each or question, each carries 14 marks

11	a)	Write about different forms of carbon nanomaterials and its applications	(7)
	b)	Discuss on the possible applications of quantum dots in food industry	(7)
		OR	
12	a)	Describe the physical and chemical properties of nanomaterials	(10)
	b)	Explain the advantage of using biocompatible nanomaterials in food industries	(4)
13		Differentiate physical, chemical and biological method of synthesis of nanomaterials	(14)
		OR	
14	a)	Illustrate the working principle of XRD	(5)
	b)	Compare and explain the working of AFM and TEM.	(9)
15		Explain the formulation of functionalized nanomaterials and its potential application	(14)
		OR	

16 Write in detail about the role of nanomaterials in improving the food quality (14)

17 Write in detail about the salient features of nano coatings (14)

OR

18 Discuss the mode of antimicrobial action of nanomaterials (14)

19 Discuss the potential health hazards of nanomaterials (14)

OR

20 Explain the measures taken for monitoring and regulating the nanomaterial toxicity (14)

Syllabus

Module 1

Introduction to nanotechnology

Introduction to nanotechnology- Definition, History. Nanoparticles - Physical, Chemical and Biological properties. Quantum dots, nanocomposites, nanofibers, nanowires, nanotubes, nanoforms of carbon

Module II

Synthesis and characterization of nanomaterials:

Bottom up Synthesis and Top down Approach – Physical, chemical and Biological methods of nanoparticles synthesis. Characterization of nanomaterials – UV Visible Spectroscopy, X-ray diffraction technique, Scanning Electron Microscopy, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques -AFM, SPM, STM, SNOM, ESCA, SIMS.

Module III

Nano-engineered food ingredients and additives:

Nano materials for food applications - functionalized nanomaterials, nano additives. Food processing and food safety and bio-security - Nanotechnology for improving food quality, detection of contaminants, Electrochemical sensors for food analysis

Module IV

Nanotechnology in food packaging and food preservation:

Nanomaterials for bacterial, fungal and viral inhibition – properties, mode of action. Nanopackaging for enhanced shelf life -nano composites, nano coatings, nanomembranes. Role in active packaging - Smart/ Intelligent packaging

Module V

Potential hazards and regulations:

Potential hazards - health risks, toxicity of nanoparticles, effects of inhaled particles - respiratory systems, skin exposure to nanoparticles, hazards and risks of exposure to nanoparticles. Environmental toxicology of engineered nanoparticles. Monitoring nanoparticles - Risk governance, General regulations on safety aspects, Regulation aspects of nano scale food ingredients.

Text Books

1. Introduction to nanotechnology by Charles P. Poole and Frank J. Owens. Wiley Publishing, 2008. ISBN-13: 978-0471079354
2. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials by Thomas Varghese & K.M. Balakrishna. Atlantic Publishing, 2012. ISBN-13: 978-8126916375.
3. Nanotechnology in Agriculture and Food Science by Monique A. V. Axelos and Marcel Van de Voorde. Wiley VCH, 2017. ISBN: 978-3-527-33989-1
4. Nanotechnologies in Food by Qasim Chaudhary, Laurence Castle, Richard Watkins. RSC Publishing, 2017. Print ISBN: 978-1-78262-171-3
5. Nanotoxicity: From In Vivo and In Vitro Models to Health Risks. by Saura C. Sahu (Editor), Daniel A. Casciano. Wiley-Blackwell, 2009. ISBN-13: 978-0470741375.

Reference Books

1. Nanotechnology in the Agri-Food Sector: Implications for the Future by Prof. Dr. Lynn J. Frewer, Prof. Dr. Willem Norde, Arnout Fischer and Dr. Frans Kampers. Wiley-VCH Verlag GmbH & Co. KGaA, 2011. Print ISBN:9783527330607
2. Nanotechnology in the Food, Beverage and Nutraceutical Industries by Qingrong

Huang. Woodhead Publishing, 2012. ISBN-13: 978-1845697396
3. Advances in Nanosensors for Biological and Environmental Analysis by Akash Deep and Sandeep Kumar. Elsevier, 2019. ISBN-13: 978-0128174562.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to nanotechnology (6)**	
1.1	Introduction to nanotechnology – Definitions and history	1
1.2	Nanoparticles - Physical, Chemical and Biological properties	2
1.3	Quantum dots, nanocomposites, nanofibers, nanowires, nanotubes, nanoforms of carbon	3
2	**Synthesis and characterization of nanomaterials (8)**	
2.1	Bottom up Synthesis and Top down Approach	1
2.2	Physical, chemical and Biological methods of nanoparticles synthesis	1
2.3	Characterization of nanomaterials – UV Visible Spectroscopy, X-ray diffraction technique, Scanning Electron Microscopy, Transmission Electron Microscopy	3
2.4	Surface Analysis techniques - AFM, SPM, STM, SNOM, ESCA, SIMS.	3
3	**Nano-engineered food ingredients and additives (7)**	
3.1	Nano materials for food applications - functionalized nanomaterials, nano additives	3
3.2	Food processing and food safety and bio-security - Nanotechnology for improving food quality	4
4	**Nanotechnology in food packaging and food preservation (7)**	
4.1	Nanopackaging for enhanced shelf life	4
4.2	Nanomaterials with antimicrobial activity	3
5	**Potential hazards and regulations (7)**	
5.1	Potential hazards - health risks	3
5.2	Environmental toxicology	2
5.3	Monitoring and regulations nano safety	2

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEMESTER VI

MINOR

KTU
Estd.
2014

FTT382	FOOD ANALYSIS	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: This course is designed to introduce the basic concepts of Food Analysis, explain the principles behind Sampling and proximate analysis, review the Government regulations related to the analysis of food materials and to strengthen the knowledge about the different equipment and techniques employed in food analysis.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	To be familiar with the Government Regulations pertaining to Food Analysis
CO 2	Identify the different methodologies employed in proper Sampling of food
CO 3	Review the principles behind the analysis of various food components
CO 4	To recognise the different techniques employed for analysis of components in food
CO 5	To gain knowledge of the instrumentation and Working of equipment used for Food Analysis

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3										
CO 2	3	2	2		3							
CO 3	2	3										
CO 4	1	1	3									
CO 5	2	2										

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is meant by accreditation? What is the function of NABL in the accreditation process?
2. Why is it necessary to analyse food? What are the different types of food anaysis?
3. Define sampling and describe sampling plan?
4. Give details of role of AOAC in food analysis.

Course Outcome 2 (CO2)

1. How will you determine the fat content of a given sample by Soxhlet method?
2. What is the significance of moisture estimation in food products? Explain Karl Fischer Titration technique for moisture analysis.
3. What is proximate analysis? Explain in detail.

Course Outcome 3(CO3):

1. Explain the principles of Spectroscopy in relation to Beer-Lambert's law.
2. Illustrate the principle and working of Fluorescence Spectroscopy.
3. What do you mean by absorption spectra and emission spectra? What is it's application in spectroscopy?

Course Outcome 4 (CO4):

1. What is Chromatography? Explain briefly about any three types of Chromatography.
2. What is HPLC? Describe the principle and instrumentation.
3. How does separation takes place in Gel filtration chromatography? Explain with a neatly labelled sketch.

Course Outcome 5 (CO5):

1. What is Radioimmunoassay? Illustrate the procedure for RIA with suitable diagrams.
2. How will you carry out Polyacrylamide gel electrophoresis?

3. Explain the methods used for analysing extraneous matter present in food.

MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________ **Name: _______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT382

FOOD ANALYSIS

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Write a short note on the national agency that regulates food safety and standards in India.
2. Define Sampling. What is meant by the term, 'Sampling Plan'?
3. What is proximate analysis?
4. What are the applications of TGA and DSC?
5. What do you mean by electromagnetic spectrum?
6. Explain Beer's Lambert's Law.
7. What is meant by RF? How will you interpret RF value?
8. What are Supercritical fluids? Explain with an example.
9. Differentiate between AGE and PAGE.
10. What is the principle of Isoelectric focusing?

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Give an account of NABL accreditation.

(OR)

12. Explain the role of the export inspection council and export inspection agencies in our country.
13. Detail on the solvent extraction methods for analysis of lipids.

(OR)

14. How will you determine ash content by dry and wet ashing method?
15. Write an essay on UV-Visible spectrophotometer with a neat sketch.

(OR)

16. How can you employ Atomic Absorption and Emission Spectroscopy for mineral analysis?
17. How does separation take place in Gel filtration chromatography?

(OR)

18. Explain the principle, working and instrumentation of High performance liquid chromatography?

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY Estd. 2014

19. What is Polyacrylamide gel electrophoresis? How will you carry out Polyacrylamide gel electrophoresis?

(OR)

20. Detail on the methods to analyse extraneous matter in foods.

Syllabus

Module 1

Introduction to food analysis : Significance and types of analysis - Government regulations - regulations of FSSAI 2006 – CAC -AOAC - Export Inspection Council - NABL accreditation - Sampling as per FSSA 2006.

Module 2

Proximate and other methods of analysis: Proximate analysis – Moisture and Total Solids - Ash, Fat, Carbohydrate, Protein Analysis, pH and Titratable Acidity, Analysis of extraneous matter - Thermal Analysis – TGA, DSC.

Module 3

Spectroscopy: Spectroscopy principles - Beer Lambert's law - deviation from Beer Lambert's law - Construction of Calibration curve, UV Visible spectroscopy, Fluorescence spectroscopy.

Module 4

Chromatography: Principles of Chromatography- Column chromatography - Thin layer chromatography - Gel filtration Chromatography - Gas-liquid chromatography-High-performance liquid chromatography - Supercritical fluid chromatography.

Module 5

Electrophoresis: Principle of Gel electrophoresis – AGE, PAGE, SDS-PAGE, Capillary Electrophoresis - Isoelectric focusing - 1 D and 2 D electrophoresis - Radio Immunoassay - Rocket Electrophoresis

Text Books

1. Nielsen, Suzanne (Ed.), Food Analysis, 2010, Springer US, ISBN 978-1-4614-2589-2
2. Semih Otles, "Methods of Analysis of Food Components and Additives", Published October 17, 2016, by CRC Press, ISBN 9781138199149

Reference Books

1. Semih Otles, Handbook of Food Analysis Instruments, 2016, CRC Press, ISBN 9780429147340
2. Adriana S. Franca and Leo M.L. Nollet, Spectroscopic Methods in Food Analysis, 2018, CRC Press, ISBN 9781498754613 (978-1-4987-5461-3)

3. Leo M. L. Nollet, Handbook of Food Analysis Vol I and II, Second Edition, Revised and Expanded, 2004 by Marcel Dekker, Inc, ISBN: 0-8247-5036-5

4. Rui M. S. Cruz, Igor Khmelinskii, Margarida Vieira, Methods in Food Analysis, 2014, CRC Press, ISBN 9781138582477

5. Kent K. Stewart and John R. Whitaker, Modern Methods Of Food Analysis, AVI PUBLISHING COMPANY, INC, ISBN 978-94-011-7381-0

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to food analysis (9)**	
1.1	Significance and types of analysis - Government regulations	3
1.2	Regulations of FSSAI 2006 – CAC -AOAC - Export Inspection Council - NABL accreditation	3
1.3	Sampling as per FSSA 2006	3
2	**Proximate and other methods of analysis (9)**	
2.1	Proximate analysis – Moisture and Total Solids - Ash, Fat, Carbohydrate, Protein Analysis	3
2.2	pH and Titratable Acidity, Analysis of extraneous matter	3
2.3	Thermal Analysis – TGA, DSC	3
3	**Spectroscopy (9)**	
3.1	Spectroscopy principles - Beer Lambert's law - deviation from Beer Lambert's law - Construction of Calibration curve,	3
3.2	UV Visible spectroscopy, Fluorescence spectroscopy,	3
3.3	Atomic Absorption and Emission Spectroscopy	3
4	**Chromatography (9)**	
4.1	Principles of Chromatography	3
4.2	Column chromatography - Thin layer chromatography - Gel filtration Chromatography - Gas-liquid chromatography-	3
4.3	High-performance liquid chromatography - Supercritical fluid chromatography	3
5	**Electrophoresis (9)**	
5.1	Principle of Gel electrophoresis	3
5.2	AGE, PAGE, SDS-PAGE, Capillary Electrophoresis - Isoelectric focusing - 1 D and 2 D electrophoresis	3
5.3	Radio Immunoassay - Rocket Electrophoresis	3

FTT384	FOOD QUALITY, SAFETY AND REGULATION	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble:

This subject covers the basic concept of food safety, food quality control and quality assurance. To enable students to impart ways to describe, control and manage food quality, to give ideas on food safety and to know food standards and specifications. It also covers laws and regulations related to the manufacture, distribution, and sale of food products in India.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the principles that make a food product safe for consumption
CO 2	Be able to apply the principles of Food Science to control and assure the quality of food products
CO 3	Analyze the hazards, risk and implementation of quality assurance system
CO 4	Understand government regulations required for the manufacture and sale of food products

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3					2						
CO 2	3	3							2			
CO 3	3	3	3	3		3			2			3
CO 4	3	3						2				

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Identify the different food hazards

2. Give an account of linear work flow

3. Explain different methods of pest control

Course Outcome 2 (CO2)

1. Differentiate quality control and quality assurance

2. Describe different methods of food authentication

3. Explain the factors affecting quality of food product.

Course Outcome 3(CO3):

1. Define Risk and explain risk assessment process?

2. Explain different steps of HACCP?

3. Give an account of benefits of HACCP ?

Course Outcome 4 (CO4):

1. Explain the role of CODEX in ensuring food quality

2. Give an account of BIS

3. Mention the role of ISO in ensuring food safety?

MODEL QUESTION PAPER
QP CODE:
Reg No.:_______________ **Name: _______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT 384
FOOD QUALITY, SAFETY AND REGULATION

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. State two principles behind food safety ?
2. Role of linear work flow in ensuring food safety in food industry?
3. Define the term hazard and risk?
4. Differentiate contamination and cross contamination?
5. Give an account of extrinsic factors affecting quality of food?
6. Define the term food authentication?
7. Identify the role of CCP in food safety?
8. What is the significance of HACCP in food industry?
9. Role of CODEX in food safety and standards.
10. State the functions of FSSAI?

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Give an account of Schedule 4 of FSSA 2006 in ensuring food safety

(OR)

12. Explain Pest Control Activities followed in food industry?
13. Detail on the different steps involved in Hazard analysis and risk assessment in food process operation.

(OR)

14. How will you conduct food recall and traceability in food industry with example?
15. Write an essay factors affecting quality of finished product?

(OR)

16. How can you employ different quality control tools in food industry?
17. Illustrate the different steps involved in HACCP implementation?

(OR)

18. Summarize the process of ISO 22000 implementation in food industry?
19. Analyse the different initiatives of FSSAI in ensuring food safety

(OR)

20. Describe the significance of BRC in ensuring food safety in international trade?

Syllabus

Module 1

Introduction: Food Safety, Principles of food safety, need for food safety culture, consequences of unsafe food, challenges in food safety, recent statistics of food borne illness, GMP, Schedule 4 of FSSAI, Design and construction of food premises, cleaning and disinfection facilities, Control of rats and rodents, insects and microbes, Personal hygiene.

Module 2

Hazards -Definition of hazards, types of hazards with examples and mode of control, Risk, Risk Assessment, Contamination and cross contamination, methods of preventing contamination, Food Recall and Traceability.

Module 3

Quality Control: Quality aspect in food supply chain and food processing industry, factors affecting food quality, quality evaluation methods, food authentication, rapid methods of food quality evaluation Different quality control tools.

Module 4

Quality Assurance: HACCP, Principles of HACCP and steps in HACCP, CCP, Determination, HACCP worksheet, TQM, ISO 22000, Internal Auditing, Documentation and application of quality assurance in food industry.

Module 5

Regulations: Food Standards and Specification –Global Food Safety Initiative, WTO, SPS Agreement, FSSA 2006- its origin, Salient features of Act, Regulations, FSSAI, its activities for ensuring food safety in India, BIS, BRC, FAO, AGMARK, CODEX, CODEX INDIA, National Codex Committee of India, ToR, Shadow Committee.

Text Books

1. Andres Vasconcellos J. 2005. Quality Assurance for the Food industry - A practical approach. CRC press.

2. Inteaz Alli. 2004. Food quality assurance - Principles & practices. CRC Press. New York

Reference Books

1.Sara Mortimore and Carol Wallace. 2013. HACCP - A practical approach. Third edition. Chapman and Hall, London.

2. Roday, S. 1998. Food Hygiene and Sanitation, Tata McGraw-Hill Education.

3 Neal D. Fortin. 2009. Food regulation, Wiley Publishers.

4. Naomi Rees. David Watson. 2000. International standards for food safety, An Aspen Publications. 5. O'Rourke. 2005. European Food law, 3rd Edition, Thomson, Sweet and Maxwell.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Food Safety**	**7**
1.1	Introduction to subject – objectives and course outcome	1
1.2	Principles of food safety, need for food safety culture, consequences of unsafe food, challenges in food safety, recent statistics of food borne illness	1
1.3	Sanitation in warehose, storage shipping and receiving of raw material	2
1.4	Design and construction of food premises, cleaning and disinfection facilities	1
1.5	Control of rats and rodents, insects and microbes	2
2	**Hazards**	**9**
2.1	Definition of hazards, types of hazards with examples and mode of control	1
2.2	Contamination and cross contamination	1
2.3	Risk, Risk Assessment	2
2.4	Methods of preventing contamination	2
2.5	Food Recall and Tracebility	1
3	**Quality Control**	**8**
3.1	Definition of food quality- ways for describing food quality ,factors affecting food quality	2
3.2	Nutritional quality of food – evaluation methods	1
3.3	Quality aspect in food supply chain and food processing industry Different quality control tools	1
3.4	Methods of food quality evaluation	2
3.5	Authentication of meat, dairy and oil products	2
4	**Quality Assurance**	**10**
4.1	Quality assurance – quality management system in food industry TQM	2
4.2	HACCP – History, introduction and significance	2
4.3	Principles of HACCP and steps in HACCP	2
4.4	Critical control point and CCP monitoring and control	2
4.5	HACCP worksheet – preparation with case study	2
5	**Regulations**	**11**
5.1	Food Standards and Specification –Global Food Safety Initiative, WTO, SPS Agreement	2
5.2	FSSA 2006- its origin, Salient features of Act,Regulations,	2
5.3	BIS,BRC,FAO, AGMARK,ISO,FSMS	2
5.4	CODEX, CODEX INDIA, National Codex Committee of India, ToR, Shadow Committee	1
5.5	Food Standards and Specification –Global Food Safety Initiative, WTO,SPS	1

	Agreement	
5.6	Initiatives of FSSAI in ensuring food safety	1
5.7	FAO, AGMARK,	1
5.8	ISO, FSMS	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd.
2014

FTT 386	ENTREPRENEURSHIP DEVELOPMENT IN FOOD TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge in the field of entrepreneurship in food processing sector

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Describe the basics of Human Resource Management
CO 2	Exemplify decision making factors of entrepreneurs
CO3	Paraphrase the concept of Entrepreneurship
CO 4	Comprehend Swot Analysis and Business Poilcy
CO 5	Familiarize the requirements to start a Food Business

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2										1
CO 2	3	2	2									1
CO 3	2	2	3									1
CO 4	2	2										1
CO 5	2	3										1

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe the functions of human resource management
2. Describe the labour welfare and employee compensation
3. Illustrate the influence of social, political and economic systems for decision making by individual entrepreneurs.
4. Describe the emerging business in this field.

Course Outcome 2 (CO2)

1. Describe the concept of entrepreneurship.
2. Elucidate on how an enterprises can be managed?
3. Illustrate on the various schemes and incentives for promotion of Entrepreneurship
4. Describe the Government Policy on Small and Medium Enterprises (SMEs/SSIs)

Course Outcome 3(CO3):

1. Describe SWOT analysis
2. Describe opportunities for an entrepreneur in food processing sector
3. Elucidate on various venture capital funding system
4. Describe the export and import policies related to food sector

Course Outcome 4 (CO4):

1. Describe on how to set up a food processing plant
2. Describe the factors to considered while setting up a plant
3. Elucidate on the sources of finance for setting of dairy farms & processing units
4. Describe on the s Elucidate on the sources of finance for setting of dairy farms & processing units
5. Describe on guidelines for obtaining ISO/HACCP certification

Course Outcome 5 (CO5):

1. Describe the concepts and functions of marketing
2. Elucidate on the marketing research and marketing information system
3. Illustrate on the market channel
4. Describe on the price determination and pricing policy for food products
5. Explain the features of WTO

Model Question paper

		Total Pages:
Reg No.:_______________		Name:___________________________
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY SIXTH SEMESTER B.TECH DEGREE EXAMINATION		
Course Code: FTT386		
Course Name: ENTREPRENEURSHIP DEVELOPMENT IN FOOD TECHNOLOGY		
Max. Marks: 100		Duration: 3 Hours
PART A		

	Answer all questions, each question carries 3 marks.	Marks
1	What are the functions of HRM?	3
2	What do you mean by globalization?	3
3	List out the characteristics of an entrepreneur	3
4	What is MSME?	3
5	What is SWOT analysis?	3
6	What do you mean by contract farming?	3
7	What is FSSAI?	3

8		What is HACCP?	3
9		What is WTO?	3
10		Describe the price policy of food products?	3
		PART B	
		Answer any one question from each or question, each carries 14 marks	
11	a)	Elucidate on the employee communication	(7)
	b)	Give a brief note on HR development	(7)
		OR	
12	a)	Describe the Influence of social, political and economic systems for decision making by individual entrepreneurs.	(14)
13	a)	Describe on how to manage an enterprise?	(14)
		OR	
14	a)	What are the various schemes and incentives for promotion of Entrepreneurship	(7)
	b)	What are the Government Policy on Small and Medium Enterprises (SMEs/SSIs)	(7)
15	a)	Explain the opportunities for entrepreneurs in food industry	(7)
	b)	Detail venture capital funding	(7)
		OR	
16	a)	Describe the Export and import policies related to food sector	(14)
17	a)	How to set up a food processing plant? What are the factors to be considered in setting up industries?	(14)

		OR	
18		Detail the guidelines for ISO and HACCP guidelines	(14)
19	a)	Describe the concepts and functions of marketing?	(7)
	b)	Elucidate the various market channels?	(7)
		OR	
20	a)	What are the International Marketing and International Trade-features for food processing sector	(14)
		****	

Syllabus

Module 1

Introduction:-

Human Resource Management- functions- Job satisfaction and morale- employee communication - performance appraisal- employee compensation- labour welfare- grievances, HR development. - Influence of social, political and economic systems for decision making by individual entrepreneurs - Globalization and the Emerging Business

Module II
Entrepreneurship

Entrepreneurship- Concept- entrepreneurial and managerial characteristics- managing an enterprise- importance of planning, monitoring, evaluation and follow up- entrepreneurship development programs-Government Schemes and Incentives for Promotion of Entrepreneurship-Government Policy on Small and Medium Enterprises (SMEs/SSIs)

Module III

Swot analysis and business policy

Swot Analysis of Food Industry- opportunities for entrepreneurs in food industry-Venture Capital - Contract farming and Joint Ventures, Public-Private Partnerships -Recruitment and Training of Manpower- Export and import policies related to food sector

Module IV
Food Business

Setting up a food business- factors to be considered- Product Certification of food-Requirements for Registration/License of Food businesses –FSSAI requirements-Sources of finance for setting of dairy farms & processing units-Guidelines for obtaining ISO/HACCP certification

Module V
Marketing

Marketing-Concept and functions-Consumer buying behaviour- Marketing Research and Marketing Information Systems- Marketing channel-retailing, wholesaling and distribution-price determination and pricing policy of food products- International Marketing and International Trade-features-Role of WTO

Text Books:	
1	K. P. Sudheer and V. Indira, Entrepreneurship Development in Food Processing, New India Publishing Agency, 2017, ISBN: 9386546736, 9789386546739
2	Jeffrey H. Dorfman, Economics and Management of the Food Industry, Routledge, 2014, ISBN: 1134456492, 9781134456499
3	N. V. R. Naidu, Management and Entrepreneurship, I. K. International Pvt Ltd, 2010, ISBN: 8190675788, 9788190675789
Reference Books:	
1	Jaynal Ud-din Ahmed, Khundrakpam Devananda Singh, Entrepreneurship Development: Issues and Perspectives, New Century Publications, 2015, ISBN: 8177084143, 9788177084146
2	P. C Tulsian and Vishal Pandey, Business Organisation And Management, Pearson India, 2011, ISBN: 9788131716342
3	Sangeeta Sharma , Entrepreneurship Development, PHI Learning Pvt. Ltd., 2016, ISBN: 812035270X, 9788120352704
4	Geoffrey Lancaster, Lester Massingham, Essentials of Marketing Management, Routledge, 2010, ISBN: 1136939652, 9781136939655
5	S. Anil Kumar, Small Business and Entrepreneurship, I. K. International Pvt Ltd, 2008, ISBN: 8190694235, 9788190694230

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Rice Processing (9)**	
1.1	Human Resource Management- functions- Job satisfaction and	2

	morale- employee communication	
1.2	performance appraisal- employee compensation- labour welfare-grievances, HR development.	2
1.3	Influence of social, political and economic systems for decision making by individual entrepreneurs.	3
1.4	Globalization and the Emerging Business	2
2	**Wheat and Barley processing (9)**	
2.1	Entrepreneurship- Concept- entrepreneurial and managerial characteristics-	3
2.2	managing an enterprise- importance of planning, monitoring, evaluation and follow up- entrepreneurship development programs	2
2.3	Government Schemes and Incentives for Promotion of Entrepreneurship	2
2.4	Government Policy on Small and Medium Enterprises (SMEs/SSIs)	2
3	**Corn, oats and millet processing (9)**	
3.1	Swot Analysis of Food Industry- opportunities for entrepreneurs in food industry	3
3.2	Venture Capital - Contract farming and Joint Ventures, Public-Private Partnerships	2
3.3	Recruitment and Training of Manpower	2
3.4	Export and import policies related to food sector	2
4	**Value added products from cereals: (9)**	
4.1	Setting up a food business- factors to be considered- Product Certification of food	2
4.2	Requirements for Registration/License of Food businesses – FSSAI requirements	2
4.3	Sources of finance for setting of dairy farms & processing units	2
4.4	Guidelines for obtaining ISO/HACCP certification	3
5	**Legumes and storage structure: (9)**	
5.1	Marketing-Concept and functions-Consumer buying behaviour	2
5.2	Marketing Research and Marketing Information Systems-Marketing channel-retailing, wholesaling and distribution	1
5.3	price determination and pricing policy of food products	2
5.4	International Marketing and International Trade-features-Role of WTO	2
5.5	Marketing-Concept and functions-Consumer buying behaviour	2

SEMESTER VI

HONOURS

FTT394	EMERGING TECHNIQUES IN FOOD QUALITY AND SAFETY	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: Goal of this course is to develop the knowledge of students in the basic area of emerging technologies involved in food quality as well as food safety This is essential for the better understanding of Food Quality and Safety. This course will enable students to understand the development of new approaches to food quality evaluation.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Learn the historical developments in food safety, different aspects of food quality, strategy and criteria for food safety
CO 2	Identify the role of food safety and quality evaluation, texture profile analysis and measurement of sensory attributes
CO 3	Learn the different methods in food quality and safety evaluation system
CO 4	Understand the methods involved in the detection of chemical composition and internal quality of foods
CO 5	To identify the techniques for food quality measurements and food quality and safety inspection

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3			3						
CO 2	3	3	3			1						
CO 3	2	2	2		1	1						2
CO 4	2	2	3			1		1				
CO 5	3	2	2			3						2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	50
Analyse	5	5	10
Evaluate	5	5	10
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List out the methods for food quality evaluation
2. What are the different ways of describing food quality?
3. Illustrate quality control tools and explain in detail
4. Write a note on various criteria in food safety
5. Discuss the need for quality control and safety

Course Outcome 2 (CO2)

1. Mention the role of food quality and safety evaluation
2. List out the various methods for sensory evaluation
3. Enlist the technologies for the detection of biological and chemical risk factors
4. Define the term Rheology and give examples of rheological phenomena and their relation to the structure and composition of the food

Course Outcome 3(CO3):

1. Discuss on fuzzification of sensory test data
2. Describe the application of nanotechnology in detection of food-borne pathogens
3. Write about the advances of nanotechnology in sensory evaluation
4. Explain the major points to be noticed during extraction of colour features using computer vision system

Course Outcome 4 (CO4):

1. Explain the principle of NIR spectroscopy
2. Illustrate common NIR spectroscopy instrument configuration
3. List out the categories of gas sensors and its features
4. Mention the schematic representation of biosensor signal transduction

Course Outcome 5 (CO5):

1. Write about the principle of magnetic resonance
2. Draw the layout of contact type ultrasonic transducer for fruit
3. Explain the method used for determination of fruit firmness by non-destructive ultrasonic measurement
4. How do you detect the fecal contamination on apples using hyper spectral imaging?
5. What are the various applications of nuclear magnetic resonance in food quality measurements?

MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________ **Name: _______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT394

EMERGING TECHNIQUES IN FOOD QUALITY AND SAFETY

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Discuss on microbiological criteria for food safety and quality
2. List out the various methods of nutritional quality assessment
3. Write about texture profile analysis
4. Write in detail on instrumental measurement on texture specific gravity
5. Comment on role of artificial intelligence in sensory evaluation.
6. Discuss the principle involved in computer vision systems for food quality assessment
7. Write a note on functions and applications of NIR spectroscopy
8. What is electronic nose and discuss on why it needs to be implemented for the detection of food flavour
9. Discuss on phenomena of magnetic resonance
10. What are hyperspectral and multispectral imaging technique for food quality and safety inspection

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Explain the different methods for chemical and microbiological analysis for food quality

(OR)

12. Write about different aspects of food quality and mention various quality control tools

13. Write about the use of rheological properties in food science and engineering in detail

(OR)

14. Explain the characteristic features of instrumental measurement of various sensory attributes with special emphasis on colour and viscosity

15. Explain the concept of computer vision systems for assessment of food qualities

(OR)

16. Explain in detail about nanotechnology in food quality and safety evaluation system
17. What are biosensors? Write about its working principle and applications in food quality and safety evaluation with supporting figures

(OR)

18. Discuss the main concerns about NIR spectroscopy for evaluation of chemical composition and internal quality in foods
19. Explain briefly on principles, equipment and applications of nuclear magnetic resonance imaging in quality measurements

(OR)

20. Explain the ultrasound systems for food quality evaluation

Syllabus

Module 1

Criteria for quality control: Principles of food safety – Historical developments - need for quality control and safety- strategy and criteria for food safety - microbiological criteria for safety and quality- Ways of describing food quality: Composition, appearance, kinesthetic and flavour attributes Nutritional quality of foods and its assessment (content and quality of nutrients). Definition- Aspects of quality - Quality control tools. Methods of food quality evaluation - Reference and standard methods for chemical and microbiological analysis, Comparison of newer and rapid methods.

Module 2

The role of food quality and safety evaluation. Sensory quality and its evaluation, instrumental measurement of sensory attributes such as colour, viscosity, texture specific gravity. Rheological and textural characteristics, Use of rheological properties in food science and engineering. Texture profile analysis.

Module 3

Sensory evaluation using artificial intelligence, Application of Computer Vision Systems for Objective Assessment of Food Qualities- Evaluation of Color- Evaluation of Texture- Evaluation of shape and size. Nanotechnology in Food Quality and Safety Evaluation System

Module 4

NIR Spectroscopy for Chemical Composition and Internal Quality in Foods- Principle of the Technique- Device and Apparatus-Applications. Electronic Nose for Detection of Food Flavour and Volatile Components. Biosensors for Evaluating Food Quality and Safety

Module 5

Quality Measurements Using Nuclear Magnetic Resonance and Magnetic Resonance Imaging- Principles of Magnetic Resonance-Equipment and applications. Ultrasound Systems for Food Quality Evaluation. Hyperspectral and Multispectral Imaging Technique for Food Quality and Safety Inspection

Text Books

1. Yong-Jin Cho (2011) Emerging Technologies for Food Quality and Food Safety Evaluation, Taylor and Francis Group

2. Krammer, A. and Twigg, B.A, "Quality control for the food industry". 3 rd Ed.,AVI. Westport 1970.

Reference Books

1. Amerine MA, Pangborn RM & Rosslos E B. Principles of Sensory Evaluation of Food. Academic Press, 1965.

2. Early R..Guide to Quality Management Systems for Food Industries. Blackie Academic.1995

3. Jellinek G. Sensory Evaluation of Food - Theory and Practice. Ellis Horwoood, 1985

4. Krammer A & Twigg BA. Quality Control in Food Industry. Vol. I, II. AVI Publ. 1973.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**History, principles of food safety and quality control**	**8**
1.1	Introduction, criteria for food safety, ways of describing food quality	3
1.2	Nutritional quality of foods and its assessment and quality control tools	3
1.3	Methods of food quality evaluation	2
2	**The role of food quality and safety evaluation**	**10**
2.1	Sensory quality and its evaluation	3
2.2	Rheological and textural characteristics	4
2.3	Texture profile analysis	2
3	**Food quality analysis**	**9**
3.1	Sensory evaluation using artificial intelligence	3
3.2	Application of Computer Vision Systems	3
3.3	Nanotechnology in Food Quality and Safety Evaluation System	3
4	**Techniques in food industry**	**9**

4.1	NIR Spectroscopy	3
4.2	Electronic Nose	4
4.3	Biosensors	2
5	**Techniques for quality measurements**	**9**
5.1	Nuclear Magnetic Resonance	2
5.2	Ultrasound Systems for Food Quality Evaluation	3
5.3	Hyperspectral and Multispectral Imaging Technique	4

FTT 396	FOOD RHEOLOGY AND MICROSTRUCTURE	CATEGORY	L	T	P	CREDIT
		VAC	4	0	0	4

Preamble:
This course will deals with the fundamental study of Rheology and Food microstructure and mainly focus the rheological and microstructural properties, determination methods and significance in food processing.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Understand the rheological properties of food and their significance in food processing
CO 2	Apply the knowledge of viscoelastic properties in handling and processing of foods
CO 3	Differentiate different types of viscometers, understand their working and applications in food industry
CO 4	Develop the conceptual knowledge of food microstructure which can be utilized at industrial levels.
CO 5	Understand the working principle and applications of different techniques used to study food microstructure

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		2	1									
CO 2	3	2	2	1		2						
CO 3	2				3	**2**						
CO 4	2	1	1			**2**						
CO 5	2				**3**							

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20

Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY Estd. 2014

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What you mean by Young's Modulus?
2. What is Poisson's ratio? Explain its evaluation methods.
3. Define the term Rheology and explain various rheological properties of food.

Course Outcome 2 (CO2)

1. Explain the properties of Newtonian fluids with suitable examples.
2. Elucidate the applications of viscoelasticity in food industry.
3. List out any four Non Newtonian fluids and describe their properties.

Course Outcome 3 (CO3):

1. List out any five types of viscometers used in food industry.
2. Describe the principle, working and applications of Torsion Gelometer.
3. Explain the principle and applications of Rotational viscometers in food industry.

Course Outcome 4 (CO4):

1. Give a detailed note on packaging of confectionary items.
2. Explain the steps involved in processing of chocolate.
3. Write a short note on flat bloom

Course Outcome 5 (CO5):

1. What you mean by Food microstructure? Explain
2. Elucidate the effect of processing on food microstructure.
3. Describe the significance of microstructure in quality and stability of foods

MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT396

FOOD RHEOLOGY AND MICROSTRUCTURE

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Define the term Rheology. List out any two applications in food industry.
2. What do you mean by Stress-strain behaviour?
3. Differentiate between Apparent viscosity and intrinsic viscosity.
4. Define the term Viscoelasticity. List out any two viscoelastic property.
5. Write a short note on Rotational viscometers.
6. Differentiate between Capillary tubes and Falling sphere viscometers.
7. What are the factors affecting Food microstructure?
8. Explain how microstructure affects the quality and stability of frozen foods?
9. List out the techniques used to study Food microstructure.
10. Explain the principle of Light microscopy.

PART B

Answer any five full questions, each carries 14 marks.

11. a) Explain the Stress-strain behaviour with the help of a neat diagram. (7)
    b) Define the term Rheology and describe the rheological properties of food.(7)

OR

12. a) Write a short note on classical ideal materials. (8)
    b) Give a brief account on Rheological models. (6)

13. a) Explain the major three types of deformations. (6)
    b) Define Viscoelasticity and explain the viscoelastic properties of food. (8)

OR

14. a) Explain the properties of Newtonian and Non Newtonian fluids. (8)
    b) Write a detailed note on Phase transition in food processing. (6)

15. Elucidate the application of Rheology in fluid food processing. (14)

OR

16. a) Explain the principle and working of Torsion Gelometer. (6)
    b) Describe the various Dough testing instruments used in food industry. (8)
17. a) Write a short note on Engineered food microstructure. (7)
    b) How Non-thermal technologies are used in microstructure fabrication? (7)

OR

18. Explain the role of microstructure in quality and stability of foods. (14)
19. Write a brief note on the principle, working and applications of Electron Microscopy and Transmission Electron Microscopy. (14)

OR

20. a) Exemplify the principle, working applications of Polarizing microscopy. (8)
    b) Distinguish between Light and Fluorescence microscopy. (6)

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SYLLABUS

Module 1

Some Basic concepts of Rheology: Introduction to Rheology, Biological systems and Mechanical properties, Force deformation behaviour, Uniaxial stress, Young's modulus, Stress strain behaviour, Elastic plastic behaviour, Evaluation of Poisson's ratio, Bulk stress strain behaviour, Physical state of a material, Classical ideal materials, Time effects (viscoelasticity), Rheological equations, Rheological models

Module 2

Rheological Properties: Types of Deformation: Shear Flow, Extensional (Elongational) Flow, Volumetric Flows, Viscoelastic characterization of materials-Stress-strain behaviour, Creep, Stress relaxation, Dynamic tests, Viscoelastic behaviour, Viscometry, Apparent viscosity, Intrinsic viscosity, Newtonian and Non-Newtonian fluids, Pseudoplastic flow behaviour, Thixotropic flow behaviour, Dilatant flow behaviour, Rheopectic flow behaviour, Plastic flow behaviour, Phase transition in foods.

Module 3

Measurement of Rheological property and Applications: Different viscosity measurement and viscometers: Rotational viscometers, Vibrational (Oscillation) viscometer, Bostwick consistometer, Pressure-Driven Flow Viscometers, Capillary tubes and Falling sphere type, Torsion Gelometer for Solid Foods, Texture of Foods: Dough testing instruments, Application of Rheology in fluid food handling and processing

Module 4

Fundamentals of Food Microstructure: Food Structuring; Introduction, Food structure, Factors affecting structure, Microstructure Elements and their Interactions: Water, Protein, Fat, Polysaccharides and other components in food, Microstructure and its relationship with quality and stability of foods: Frozen foods, confectionary and bakery products, Extruded foods, Dried foods, Non-thermal processing Technologies for Fabrication of Microstructures, Engineered food microstructure

Module 5

Methods to Study Food Microstructure: Examination of food microstructure: Light Microscopy, Fluorescence microscopy, Confocal Laser Scanning Microscopy (CLSM), Polarizing microscopy, X ray Analysis, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Immunolabeling Techniques

Text Books

1. Understanding and controlling the microstructure of complex foods, D. Julian McClements, CRC Press
2. Sakamon Devahastin, Food Microstructure and its Relationship with Quality and Stability, First Edition, Woodhead Publishing
3. Nuri N Mohesenin, Physical Properties of Plant and Animal Materials, Gordon & Breach Science Publishers, 1986.
4. M. A. Rao, Rheology of Fluid Foods and Semi Solids Principles and Applications, Second Edition, Springer.
5. Food Microstructures, Microscopy, Measurement and modelling, Edited by: V. J Morris and K. Groves, Woodhead Publishing.
6. Food Physics Physical Properties- Measurement and Applications, Ludger O Figura, Springer.

References

1.Aguilera J. M, Food Microstructure, *Food Microbiology,* Vol 1

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Some Basic concepts of Rheology**	**9**
1.1	Introduction to Rheology, Biological systems and Mechanical properties	2
1.2	Force deformation behaviour, Uniaxial stress, Young's modulus, Stress strain behaviour	2
1.3	Elastic plastic behaviour, Evaluation of Poisson's ratio, Bulk stress strain behaviour	2
1.4	Classical ideal materials, Time effects (viscoelasticity)	1
1.5	Rheological equations, Rheological models	2
2	**Module 2- Rheological Properties**	**9**
2.1	Types of Deformation: Shear Flow, Extensional (Elongational) Flow, Volumetric Flows	2
2.2	Viscoelastic characterization of materials- Stress-strain behaviour, Creep, Stress relaxation, Dynamic tests	2
2.3	Viscoelastic behaviour, Viscometry, Apparent viscosity, Intrinsic viscosity, Newtonian Fluids	2
2.4	Non- Newtonian fluids, Pseudoplastic flow behaviour, Thixotropic flow behaviour, Dilatant flow behaviour, Rheopectic flow behaviour, Plastic flow behaviour	2
2.5	Phase transition in foods	1
3	**Module 3- Measurement of Rheological property and Applications**	**9**
3.1	Rotational viscometers, Vibrational (Oscillation) viscometer	2
3.2	Bostwick consistometer, Pressure-Driven Flow Viscometers	2
3.3	Capillary tubes and Falling sphere type	2
3.4	Texture of Foods: Dough testing instruments	1
3.5	Torsion Gelometer for Solid Foods	1
3.6	Application of Rheology in fluid food handling and processing	1
4	**Module 4- Fundamentals of Food Microstructure**	**9**
4.1	Food Structuring; Introduction, Food structure, Factors affecting structure	2
4.2	Microstructure Elements and their Interactions: Water, Protein, Fat, Polysaccharides and other components in food	2
4.3	Microstructure and its relationship with quality and stability of foods: Frozen foods, Confectionary and Bakery products, Extruded foods	2
4.4	Non-thermal processing Technologies for Fabrication of Microstructures	2

4.5	Engineered food microstructure	1
5	**Module 5- Methods to study Food Microstructure**	**9**
5.1	Light Microscopy	1
5.2	Fluorescence microscopy	2
5.3	Confocal Laser Scanning Microscopy (CLSM (TEM), Immunolabeling Techniques	2
5.4	Polarizing microscopy	1
5.5	X ray Analysis	1
5.6	Scanning Electron Microscopy (SEM), Transmission Electron Microscopy	2

FTT 398	FOOD PRODUCTS MONITORING AND CONTROL	CATEGORY	L	T	P	CREDIT
		VAC	4	0	0	4

Preamble: Goal of this course is to gain the knowledge of instrumentation in the field of monitoring and control and also to familiarize monitoring and control of Flavour, Colour, Structure and Chemical contamination of food.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain concept of monitoring and control of process as well products in food industries
CO 2	Integrating instrumentation for monitoring and control
CO 3	Apply monitoring and control for flavour & colour
CO 4	Apply monitoring and control for food structure
CO 5	Apply monitoring and control for chemical contamination
CO 6	Finding advanced instruments for monitoring and control

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	2		1			1				
CO 2	1	3	1									
CO 3	2		2		3							
CO 4	2		2			3						
CO 5	2	2		3								
CO 6	2	1			1				1			

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	70
Analyse			

Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define loop elements and their functions

2. Describe different quality factors in process control

3. Explain response surface simulation modelling

Course Outcome 2 (CO2)

1. Explain E nose and E tongue

2. Explain the design aspects of bio-sensors

3. Explain the working of ultrasonic instrument

Course Outcome 3(CO3):

1. Explain Gas chromatographic technique

2. Explain Caramelization and Maillard browning process

3. Explain the working principle of reflectance spectrophotometer

Course Outcome 4 (CO4):

1. Explain glass transition process in dairy products

2. Explain the method for finding the crystal characteristics of milk fat in ghee

3. Explain the working of Spectropolarimetry

Course Outcome 5 (CO5):

1. Explain the method for finding the heavy metals in food products

2. Explain the working of HPLC

Course Outcome 6 (CO6):

1. Explain Microwave and NIR absorption technique

2. Explain the working of Electronspin spectroscopy

Model Question paper

QP CODE: **PAGES: 2**

Reg No: _______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (HONOURS)

Course Code: FTT398

Course Name: FOOD PRODUCTS MONITORING AND CONTROL

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions.

Each question carries 3 Marks

1. Define different modes of process control
2. Define quality and explain quality prediction model
3. Explain the working of Chemo sensors
4. Explain conductance technique for microbial assay
5. Explain the principle and working of LC- MS
6. Describe the principle and working of hunter lab

7. Write short notes on dynamic light scattering
8. Describe starch gelatinization process
9. Explain the working of spectrofluorimetric technique
10. Explain the working of automated milk analyser

PART B

Answer any one Question from each module.

Each Question carries 14 Marks

11. Explain in detail the differentiation and programming methods used in simulation (14)

OR

12. Explain the method for finding textural and flavour characteristics (14)

13. Explain the working principle of immune sensors and DNA probe (14)

OR

14. Explain the principle of microwave measurements of product variable (14)

15. Explain the working of FTIR (14)

OR

16. Explain the principle and working of SCF for the extraction of volatile compounds (14)

17. Explain particle size analysis by laser diffraction (14)

OR

18. Explain the influence of heat processing and freezing treatments on protein denaturation (14)

19. Explain proximate principles in cheese and milk powder (14)

OR

20. Describe the method for detection and quantification of drug residues (14)

****

Syllabus

Module 1

Introduction to Product monitoring and process control

The concept of Product and Process Monitoring in food industries. Process Control – Objectives, Control loop, Loop elements and their functions, Modes of process control, Control techniques, control equipment.

Definition of quality - Optimization paradigm, Quality-prediction model based on quality kinetics and process state equations. Quality factors- appearance, texture and flavour. Appearance factors – size and shape, colour ad gloss, consistency. Textural Factors – measuring texture, texture changes. Flavour Factors – influence of colour and texture on flavour - Taste Panels.

Simulation modelling – Process and Product Optimization - Optimization procedures – Search methods, Response surface, Differentiation & Programming methods - Neural Networks - Optimization software

Module 2

Instrumentation for monitoring and control

Real-time Instrumentation – Sensors - Chemo sensors, biosensors, immune-sensors and DNA probes base devices with working principles. Requirements of on-line sensors. Biosensors – Construction, types, working principles, applications, merits and limitations.

E-Nose & E-Tongue – Simulation of natural organs, Components & their functions, Applications.

Computer based monitoring and control - Advanced instruments - microwave measurements of product variables, ultrasonic instrumentation, conductance/impedance techniques for microbial assay.

Module 3

Monitoring and control of Flavour & Colour

Flavour analysis - Flavour bioassays – Gas Chromatography, Olfactometry techniques - Isolation, Separation and detection/Identification of flavour compounds – GC-MS, LC-MS, NMR, FTIR - Analysis of chiral compounds

Formation of flavour compounds in milk and milk products during heat processing like UHT processing, caramelization and extrusion cooking. Fermentation and ripening and storage - Maillard Browning.

Aroma loss or retention during the drying process - Industrial processes for extraction of desirable and undesirable volatile components from fresh and/or stored products by supercritical fluid (SCF) technique.

Colour Characterization - Colour and appearance - gloss and translucence, monitoring through visual colorimeter, tri-stimulus colorimeters and reflectance spectrophotometer, CIE, Hunter- Lab, Munsel and other systems of three-dimensional expression of colour. Colour-based Sorting of foods, Computer Vision – Principles, applications and Benefits.

Module 4

Monitoring and control of food structure

Application of Thermal Analysis - Pulse Nuclear Magnetic Resonance (PNMR) spectroscopy in determination of solid-fat content (SFC) – Glass transitions in dairy products, Starch gelatinization

Elucidation of crystal characteristics of milk fat in ghee and other fat-rich products by means of X-ray Crystallography with reference to the impact of cooling and storage/handling conditions on the crystal nature and product texture – structure texture relationship

Influence of heat processing and freezing treatments on protein denaturation and other conformational as well as aggregation-disaggregation phenomena as monitored through Spectropolarimetry, Circular Dichroism etc.

Particle-size analysis - Image analysis, Dynamic light scattering, Laser diffraction, Sieving etc

Module 5

Emerging techniques in monitoring and control

Raman Spectroscopy and ElectronSpin Spectroscopy – Working principles and applications - Monitoring of irradiated foods, detection of lipid auto- oxidation.

Microwave & NIR absorption/reflection methods for Compositional analyses – Automated milk analysers; Proximate principles in cheese and milk powder

Ultrasound in product monitoring: Speed- and Attenuation-based measurements of liquid levels, density and mass flow.

Monitoring of Chemical Contaminants - Heavy metal quantification by Atomic Absorption Spectrophotometer, Quantification of Agrochemicals by HPLC, Spectrofluorimetric, determination of mycotoxins, Detection and quantification of Drug Residues

Subjective food-quality characteristics - Pitfalls and Promises

Text Books

1. Hazard Analysis and Risk-Based Preventive Controls: Improving Food Safety in Human Food Manufacturing for Food Businesses by Hal King and Wendy Bedale. Academic Press, 2017. ISBN-13: 978-0128094754.

2. Production Planning, Modeling and Control of Food Industry Processes by Pablo Cano Marchal, Juan Gómez rtega and Javier Gámez García. Springer, 2019. ISBN-13: 978-3030013721.

3. Postharvest Sensors for Everyday Life: Environmental and Food Engineering by Subhas Chandra Mukhopadhyay, Octavian Adrian Postolache, Krishanthi P. Jayasundera and Akshya K. Swain. Springer 2017. ISBN-13: 978-3319473215.

Reference Books

1. Handbook of Food Structure Development (Food Chemistry, Function and Analysis) by Fotis Spyropoulos and Douglas Goff. Royal Society of Chemistry, 2019. ISBN-13: 978-1788012164.
2. Instrumentation and Sensors for the Food Industry by E Kress-Rogers and C J B Brimelow. Woodhead Publishing; 2 edition, 2001. ISBN-13: 978-1855735606.
3. Flavor Science: Sensible Principles and Techniques by Terry E. Acree and Roy Teranishi. Wiley VCH 1993. ISBN-13: 978-0841225169.
4.Electronic Nose and Its Application in Food Processing Sector by Ganesan Jeevarathinam, Thirupathi Pandiarajan and Venkatachalam Thirupathi. LAP Lambert Academic Publishing, 2015. ISBN-13: 978-3659421686.
5. Automatic Control of Food Manufacturing Processes by I. McFarlane. Springer; 2nd ed. 1995. ISBN-13: 978-0751402070.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Product monitoring and process control**	
1.1	The concept of Product and Process Monitoring in food industries. Process Control – Objectives, Control loop, Loop elements and their functions, Modes of process control, Control techniques, control equipment	3
1.2	Definition of quality - Optimization paradigm, Quality-prediction model based on quality kinetics and process state equations. Quality factors- appearance, texture and flavour. Appearance factors – size and shape, colour ad gloss, consistency. Textural Factors – measuring texture, texture changes. Flavour Factors – influence of colour and texture on flavour - Taste Panels.	3
1.3	Simulation modelling – Process and Product Optimization - Optimization procedures – Search methods, Response surface, Differentiation & Programming methods - Neural Networks - Optimization software	3
2	**Instrumentation for monitoring and control**	
2.1	Real-time Instrumentation – Sensors - Chemo sensors, biosensors, immune-sensors and DNA probes base devices with	4

	working principles. Requirements of on-line sensors. Biosensors – Construction, types, working principles, applications, merits and limitations.	
2.2	E-Nose & E-Tongue – Simulation of natural organs, Components & their functions, Applications.	3
2.3	Computer based monitoring and control - Advanced instruments - microwave measurements of product variables, ultrasonic instrumentation, conductance/impedance techniques for microbial assay.	3
3	**Monitoring and control of Flavour & Colour**	
3.1	Flavour analysis - Flavour bioassays – Gas Chromatography, Olfactometry techniques - Isolation, Separation and detection/Identification of flavour compounds – GC-MS, LC-MS, NMR, FTIR - Analysis of chiral compounds	3
3.2	Formation of flavour compounds in milk and milk products during heat processing like UHT processing, caramelization and extrusion cooking. Fermentation and ripening and storage - Maillard Browning. Aroma loss or retention during the drying process - Industrial processes for extraction of desirable and undesirable volatile components from fresh and/or stored products by supercritical fluid (SCF) technique.	3
3.3	Colour Characterization - Colour and appearance - gloss and translucence, monitoring through visual colorimeter, tri-stimulus colorimeters and reflectance spectrophotometer, CIE, Hunter-Lab, Munsel and other systems of three-dimensional expression of colour. Colour-based Sorting of foods, Computer Vision – Principles, applications and Benefits.	4
4	**Monitoring and control of food structure**	
4.1	Application of Thermal Analysis - Pulse Nuclear Magnetic Resonance (PNMR) spectroscopy in determination of solid-fat content (SFC) - Glasstransitions in dairy products, Starch gelatinization	2
4.2	Elucidation of crystal characteristics of milk fat in ghee and other fat-rich products by means of X-ray Crystallography with reference to the impact of cooling and storage/handling conditions on the crystal nature and product texture – structure texture relationship	3
4.3	Influence of heat processing and freezing treatments on protein	3

	denaturation and other conformational as well as aggregation-disaggregation phenomena as monitored through Spectropolarimetry, Circular Dichroism etc.	
4.4	Particle-size analysis - Image analysis, Dynamic light scattering, Laser diffraction, Sieving etc	2
5	**Emerging techniques in monitoring and control**	
5.1	Raman Spectroscopy and ElectronSpin Spectroscopy – Working principles and applications - Monitoring of irradiated foods, detection of lipid auto- oxidation. Microwave & NIR absorption/reflection methods for Compositional analyses – Automated milk analysers; Proximate principles in cheese and milk powder	3
5.2	Ultrasound in product monitoring: Speed- and Attenuation-based measurements of liquid levels, density and mass flow.	2
5.3	Monitoring of Chemical Contaminants - Heavy metal quantification by Atomic Absorption Spectrophotometer, Quantification of Agrochemicals by HPLC, Spectrofluorimetric, determination of mycotoxins, Detection and quantification of Drug Residues	3
5.4	Subjective food-quality characteristics - Pitfalls and Promises	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

COMMON COURSES

(S5 & S6)

Estd. 2014

MCN 301	DISASTER MANAGEMENT	Category	L	T	P	CREDIT	YEAR OF INTRODUCTION
		Non - Credit	2	0	0	Nil	2019

Preamble: The objective of this course is to introduce the fundamental concepts of hazards and disaster management.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Define and use various terminologies in use in disaster management parlance and organise each of these terms in relation to the disaster management cycle (Cognitive knowledge level: **Understand**).
CO2	Distinguish between different hazard types and vulnerability types and do vulnerability assessment (Cognitive knowledge level: **Understand**).
CO3	Identify the components and describe the process of risk assessment, and apply appropriate methodologies to assess risk (Cognitive knowledge level: **Understand**).
CO4	Explain the core elements and phases of Disaster Risk Management and develop possible measures to reduce disaster risks across sector and community (Cognitive knowledge level: **Apply**)
CO5	Identify factors that determine the nature of disaster response and discuss the various disaster response actions (Cognitive knowledge level: **Understand**).
CO6	Explain the various legislations and best practices for disaster management and risk reduction at national and international level (Cognitive knowledge level: **Understand**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2				2				2		2
CO2	2	3	2		2	2	3			3		2
CO3	2	3	2	2	2	2	3			3		2
CO4	3	3	3		2	2	3					2
CO5	3	3			2	2	3					2
CO6	3					2	3	3				2

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	30
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A.

Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

MCN 301 Disaster Management

Module 1

Systems of earth

Lithosphere- composition, rocks, soils; Atmosphere-layers, ozone layer, greenhouse effect, weather, cyclones, atmospheric circulations, Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere

Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs assessment.

Module 2

Hazard types and hazard mapping; Vulnerability types and their assessment- physical, social, economic and environmental vulnerability.

Disaster risk assessment –approaches, procedures

Module 3

Disaster risk management -Core elements and phases of Disaster Risk Management

Measures for Disaster Risk Reduction – prevention, mitigation, and preparedness.

Disaster response- objectives, requirements; response planning; types of responses.

Relief; international relief organizations.

Module 4

Participatory stakeholder engagement; Disaster communication- importance, methods, barriers; Crisis counselling

Capacity Building: Concept – Structural and Non-structural Measures, Capacity Assessment; Strengthening Capacity for Reducing Risk

Module 5

Common disaster types in India; Legislations in India on disaster management; National disaster management policy; Institutional arrangements for disaster management in India.

The Sendai Framework for Disaster Risk Reduction- targets, priorities for action, guiding principles

Reference Text Book

1. R. Subramanian, Disaster Management, Vikas Publishing House, 2018

2. M. M. Sulphey, Disaster Management, PHI Learning, 2016

3. UNDP, Disaster Risk Management Training Manual, 2016

4. United Nations Office for Disaster Risk Reduction, Sendai Framework for Disaster Risk Reduction 2015-2030, 2015

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?

2. What are disasters? What are their causes?

3. Explain the different types of cyclones and the mechanism of their formation

4. Explain with examples, the difference between hazard and risk in the context of disaster management

5. Explain the following terms in the context of disaster management (a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

Course Outcome 2 (CO2):

1. What is hazard mapping? What are its objectives?

2. What is participatory hazard mapping? How is it conducted? What are its advantages?

3. Explain the applications of hazard maps

4. Explain the types of vulnerabilities and the approaches to assess them

Course Outcome 3 (CO3):

1. Explain briefly the concept of ‘disaster risk’

2. List the strategies for disaster risk management ‘before’, ‘during’ and ‘after’ a disaster
3. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy

Course Outcome 4 (CO4):

1. What is disaster prevention? Distinguish it from disaster mitigation giving examples
2. What are the steps to effective disaster communication? What are the barriers to communication?
3. Explain capacity building in the context of disaster management

Course Outcome 5 (CO5):

1. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction
2. Explain the importance of communication in disaster management
3. Explain the benefits and costs of stakeholder participation in disaster management
4. How are stakeholders in disaster management identified?

Course Outcome 6 (CO6):

1. Explain the salient features of the National Policy on Disaster Management in India
2. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction
3. What are Tsunamis? How are they caused?
4. Explain the earthquake zonation of India

Model Question paper

QP CODE: **PAGES:3**

Reg No:______________ **Name :______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MCN 301

Course Name: Disaster Management

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?
2. What are disasters? What are their causes?
3. What is hazard mapping? What are its objectives?
4. Explain briefly the concept of 'disaster risk'
5. List the strategies for disaster risk management 'before', 'during' and 'after' a disaster
6. What is disaster prevention? Distinguish it from disaster mitigation giving examples
7. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction
8. Explain the importance of communication in disaster management
9. What are Tsunamis? How are they caused?
10. Explain the earthquake zonation of India

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. a. Explain the different types of cyclones and the mechanism of their formation [10]

b. Explain with examples, the difference between hazard and risk in the context of disaster management
[4]

OR

12. Explain the following terms in the context of disaster management [14]

(a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

13. a. What is participatory hazard mapping? How is it conducted? What are its advantages?

[8]

b. Explain the applications of hazard maps [6]

OR

14. Explain the types of vulnerabilities and the approaches to assess them [14]

15. a. Explain the core elements of disaster risk management [8]

b. Explain the factors that decide the nature of disaster response [6]

OR

16. a. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy [6]

b. Explain the different disaster response actions [8]

17. a. Explain the benefits and costs of stakeholder participation in disaster management [10]

b. How are stakeholders in disaster management identified? [4]

OR

18. a. What are the steps to effective disaster communication? What are the barriers to communication? [7]

b. Explain capacity building in the context of disaster management [7]

19. Explain the salient features of the National Policy on Disaster Management in India

[14]

OR

20. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction [14]

Teaching Plan

	Module 1	5 Hours
1.1	Introduction about various Systems of earth, Lithosphere-composition, rocks, Soils; Atmosphere-layers, ozone layer, greenhouse effect, weather	1 Hour
1.2	Cyclones, atmospheric circulations, Indian Monsoon; hydrosphere-Oceans, inland water bodies; biosphere	1 Hour
1.3	Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard,	1 Hour
1.4	Exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, Disaster risk management, early warning systems	1 Hour
1.5	Disaster preparedness, disaster prevention, disaster, Mitigation, disaster response, damage assessment, crisis counselling, needs assessment.	1 Hour
	Module 2	**5 Hours**
2.1	Various Hazard types, Hazard mapping; Different types of Vulnerability types and their assessment	1 Hour
2.2	Vulnerability assessment and types, Physical and social vulnerability	1 Hour
2.3	Economic and environmental vulnerability, Core elements of disaster risk assessment	1 Hour
2.4	Components of a comprehensive disaster preparedness strategy approaches, procedures	1 Hour
2.5	Different disaster response actions	1 Hour
	Module 3	**5 Hours**
3.1	Introduction to Disaster risk management, Core elements of Disaster Risk Management	1 Hour
3.2	Phases of Disaster Risk Management, Measures for Disaster Risk Reduction	1 Hour
3.3	Measures for Disaster prevention, mitigation, and preparedness.	1 Hour

3.4	Disaster response- objectives, requirements. Disaster response planning; types of responses.	1 Hour
3.5	Introduction- Disaster Relief, Relief; international relief organizations.	1 Hour
	Module 4	**5 Hours**
4.1	Participatory stakeholder engagement	1 Hour
4.2	Importance of disaster communication.	1 Hour
4.3	Disaster communication- methods, barriers. Crisis counselling	1 Hour
4.4	Introduction to Capacity Building. Concept – Structural Measures, Non-structural Measures.	1 Hour
4.5	Introduction to Capacity Assessment, Capacity Assessment; Strengthening, Capacity for Reducing Risk	1 Hour
	Module 5	**5 Hours**
5.1	Introduction-Common disaster types in India.	1 Hour
5.2	Common disaster legislations in India on disaster management	1 Hour
5.3	National disaster management policy, Institutional arrangements for disaster management in India.	1 Hour
5.4	The Sendai Framework for Disaster Risk Reduction and targets	1 Hour
5.5	The Sendai Framework for Disaster Risk Reduction-priorities for action, guiding principles	1 Hour

HUT 300	Industrial Economics & Foreign Trade	Category	L	T	P	CREDIT
		HSMC	3	0	0	3

Preamble: To equip the students to take industrial decisions and to create awareness of economic environment.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Explain the problem of scarcity of resources and consumer behaviour, and to evaluate the impact of government policies on the general economic welfare. (Cognitive knowledge level: **Understand**)
CO2	Take appropriate decisions regarding volume of output and to evaluate the social cost of production. (Cognitive knowledge level: **Apply**)
CO3	Determine the functional requirement of a firm under various competitive conditions. (Cognitive knowledge level: **Analyse**)
CO4	Examine the overall performance of the economy, and the regulation of economic fluctuations and its impact on various sections in the society. (Cognitive knowledge level: **Analyse**)
CO5	Determine the impact of changes in global economic policies on the business opportunities of a firm. (Cognitive knowledge level: **Analyse**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2										3	
CO2	2	2			2	2	3				3	
CO3	2	2	1								3	
CO4	2	2	1			1					3	
CO5	2	2	1								3	

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	**15**	**15**	**30**
Understand	**20**	**20**	**40**
Apply	**15**	**15**	**30**

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment - Test (2 numbers)	: 25 marks
Continuous Assessment - Assignment	: 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B.

Part A	: 30 marks
Part B	: 70 marks

Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 3 sub-divisions and carries 14 marks.

SYLLABUS

HUT 300 Industrial Economics & Foreign Trade

Module 1 (Basic Concepts and Demand and Supply Analysis)

Scarcity and choice - Basic economic problems- PPC – Firms and its objectives – types of firms – Utility – Law of diminishing marginal utility – Demand and its determinants – law of demand – elasticity of demand – measurement of elasticity and its applications – Supply, law of supply and determinants of supply – Equilibrium – Changes in demand and supply and its effects – Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.

Module 2 (Production and cost)

Production function – law of variable proportion – economies of scale – internal and external economies – Isoquants, isocost line and producer's equilibrium – Expansion path – Technical progress and its implications – Cobb-Douglas production function - Cost concepts – Social cost: private cost and external cost – Explicit and implicit cost – sunk cost - Short run cost curves - long run cost curves – Revenue (concepts) – Shutdown point – Break-even point.

Module 3 (Market Structure)

Perfect and imperfect competition – monopoly, regulation of monopoly, monopolistic completion (features and equilibrium of a firm) – oligopoly – Kinked demand curve – Collusive oligopoly (meaning) – Non-price competition – Product pricing – Cost plus pricing – Target return pricing – Penetration pricing – Predatory pricing – Going rate pricing – Price skimming.

Module 4 (Macroeconomic concepts)

Circular flow of economic activities – Stock and flow – Final goods and intermediate goods - Gross Domestic Product - National Income – Three sectors of an economy- Methods of measuring national income – Inflation- causes and effects – Measures to control inflation- Monetary and fiscal policies – Business financing- Bonds and shares -Money market and Capital market – Stock market – Demat account and Trading account - SENSEX and NIFTY.

Module 5 (International Trade)

Advantages and disadvantages of international trade - Absolute and Comparative advantage theory - Heckscher - Ohlin theory - Balance of payments – Components – Balance of Payments deficit and devaluation – Trade policy – Free trade versus protection – Tariff and non-tariff barriers.

Reference Materials

1. Gregory N Mankiw, ‘Principles of Micro Economics’, Cengage Publications
2. Gregory N Mankiw, ‘Principles of Macro Economics’, Cengage Publications
3. Dwivedi D N, ‘Macro Economics’, Tata McGraw Hill, New Delhi.
4. Mithani D M, ‘Managerial Economics’, Himalaya Publishing House, Mumbai.
5. Francis Cherunilam, ‘International Economics’, McGraw Hill, New Delhi.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Why does the problem of choice arise?
2. What are the central problems?
3. How do we solve the basic economic problems?
4. What is the relation between price and demand?
5. Explain deadweight loss due to the imposition of a tax.

Course Outcome 2 (CO2):

1. What is shutdown point?
2. What do you mean by producer equilibrium?
3. Explain break-even point;
4. Suppose a chemical factory is functioning in a residential area. What are the external costs?

Course Outcome 3 (CO3):

1. Explain the equilibrium of a firm under monopolistic competition.
2. Why is a monopolist called price maker?
3. What are the methods of non-price competition under oligopoly?

4. What is collusive oligopoly?

Course Outcome 4 (CO4):

1. What is the significance of national income estimation?
2. How is GDP estimated?
3. What are the measures to control inflation?
4. How does inflation affect fixed income group and wage earners?

Course Outcome 5 (CO5):

1. What is devaluation?
2. Suppose a foreign country imposes a tariff on Indian goods. How does it affect India's exports?
3. What is free trade?
4. What are the arguments in favour of protection?

Model Question paper

QP CODE: **PAGES:3**

Reg No:______________ **Name :______________**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIFTH /SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 300

Course Name: Industrial Economics & Foreign Trade

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Why does an economic problem arise?

2. What should be the percentage change in price of a product if the sale is to be increased by 50 percent and its price elasticity of demand is 2?

3. In the production function Q= $2L^{1/2}K^{1/2}$ if L=36 how many units of capital are needed to produce 60 units of output?

4. Suppose in the short run AVC 4. Suppose in the short run AVC<P<AC. Will this firm produce or shut down? Give reason.

5. What is predatory pricing?

6. What do you mean by non- price competition under oligopoly?

7. What are the important economic activities under primary sector?

8. Distinguish between a bond and share?

9. What are the major components of balance of payments?

10. What is devaluation? **(10 x 3 = 30 marks)**

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Prepare a utility schedule showing units of consumption, total utility and marginal utility, and explain the law of diminishing marginal utility. Point out any three limitations of the law.

b) How is elasticity of demand measured according to the percentage method? How is the measurement of elasticity of demand useful for the government?

Or

12. a) Explain the concepts consumer surplus and producer surplus.

b) Suppose the government imposes a tax on a commodity where the tax burden met by the consumers. Draw a diagram and explain dead weight loss. Mark consumer surplus, producer surplus, tax revenue and dead weight loss in the diagram.

MODULE II

13. a) What are the advantages of large-scale production?

b) Explain Producer equilibrium with the help of isoquants and isocost line. What is expansion path?

Or

14. a) Explain break-even analysis with the help of a diagram.

b) Suppose the monthly fixed cost of a firm is Rs. 40000 and its monthly total variable cost is Rs. 60000.

i. If the monthly sales is Rs. 120000 estimate contribution and break-even sales.
ii. If the firm wants to get a monthly profit of Rs.40000, what should be the sales?

c) The total cost function of a firm is given as $TC=100+50Q - 11Q^2+Q^3$. Find marginal cost when output equals 5 units.

MODULE III

15. a) What are the features of monopolistic competition?

b) Explain the equilibrium of a firm earning supernormal profit under monopolistic competition.

Or

16. a) Make comparison between perfect competition and monopoly.

b) Explain price rigidity under oligopoly with the help of a kinked demand curve.

MODULE IV

17. a) How is national income estimated under product method and expenditure method?

b) Estimate GDPmp, GNPmp and National income

Private consumption expenditure	= 2000 (in 000 cores)
Government Consumption	= 500
NFIA	= -(300)
Investment	= 800
Net=exports	=700
Depreciation	= 400
Net-indirect tax	= 300

Or

18. a) What are the monetary and fiscal policy measures to control inflation?

b) What is SENSEX?

MODULE V

19. a) What are the advantages of disadvantages of foreign trade?

b) Explain the comparative cost advantage.

Or

20. a) What are the arguments in favour protection?

b) Examine the tariff and non-tariff barriers to international trade.

(5 × 14 = 70 marks)

Teaching Plan

Module 1 (Basic concepts and Demand and Supply Analysis)		**7 Hours**
1.1	Scarcity and choice – Basic economic problems - PPC	1 Hour
1.2	Firms and its objectives – types of firms	1 Hour
1.3	Utility – Law of diminishing marginal utility – Demand – law of demand	1 Hour
1.4	Measurement of elasticity and its applications	1 Hour
1.5	Supply, law of supply and determinants of supply	1 Hour
1.6	Equilibrium – changes in demand and supply and its effects	1 Hour
1.7	Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.	1 Hour
Module 2 (Production and cost)		**7 Hours**
2.1	Productions function – law of variable proportion	1 Hour
2.2	Economies of scale – internal and external economies	1 Hour
2.3	producers equilibrium – Expansion path	1 Hour
2.4	Technical progress and its implications – cob Douglas Production function	1 Hour
2.5	Cost concepts – social cost: private cost and external cost – Explicit and implicit cost – sunk cost	1 Hour
2.6	Short run cost curves & Long run cost curves	1 Hour
2.7	Revenue (concepts) – shutdown point – Break-even point.	1 Hour
Module 3 (Market Structure)		**6 hours**
3.1	Equilibrium of a firm, MC – MR approach and TC – TR approach	1 Hour
3.2	Perfect competition & Imperfect competition	1 Hour
3.3	Monopoly – Regulation of monopoly – Monopolistic competition	1 Hour
3.4	Oligopoly – kinked demand curve	1 Hour
3.5	Collusive oligopoly (meaning) – Non price competition	1 Hour
3.6	Cost plus pricing – Target return pricing – Penetration, Predatory pricing – Going rate pricing – price skimming	1 Hour

Module 4 (Macroeconomic concepts)		7 Hours
4.1	Circular flow of economic activities	1 Hour
4.2	Stock and flow – Final goods and intermediate goods – Gross Domestic Product - National income – Three sectors of an economy	1 Hour
4.3	Methods of measuring national income	1 Hour
4.4	Inflation – Demand pull and cost push – Causes and effects	1 Hour
4.5	Measures to control inflation – Monetary and fiscal policies	1 Hour
4.6	Business financing – Bonds and shares – Money market and capital market	1 Hour
4.7	Stock market – Demat account and Trading account – SENSEX and NIFTY	1 Hour
Module 5 (International Trade)		**8 Hours**
5.1	Advantages and disadvantages of international trade	1 Hour
5.2	Absolute and comparative advantage theory	2 Hour
5.3	Heckscher – Ohlin theory	1 Hour
5.4	Balance of payments - components	1 Hour
5.5	Balance of payments deficit and devaluation	1 Hour
5.6	Trade policy – Free trade versus protection	1 Hour
5.7	Tariff and non tariff barriers.	1 Hour

HUT 310	Management for Engineers	Category	L	T	P	Credit
		HMC	3	0	0	3

Preamble: This course is intended to help the students to learn the basic concepts and functions of management and its role in the performance of an organization and to understand various decision-making approaches available for managers to achieve excellence. Learners shall have a broad view of different functional areas of management like operations, human resource, finance and marketing.

Prerequisite: Nil

Course Outcomes After the completion of the course the student will be able to

CO1	Explain the characteristics of management in the contemporary context (Cognitive Knowledge level: **Understand**).
CO2	Describe the functions of management (Cognitive Knowledge level: **Understand**).
CO3	Demonstrate ability in decision making process and productivity analysis (Cognitive Knowledge level: **Understand**).
CO4	Illustrate project management technique and develop a project schedule (Cognitive Knowledge level: **Apply**).
CO5	Summarize the functional areas of management (Cognitive Knowledge level: **Understand**).
CO6	Comprehend the concept of entrepreneurship and create business plans (Cognitive Knowledge level: **Understand**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				1	2	2	2		2	1	1
CO2	2				1	1		2	1	2	1	1
CO3	2	2	2	2	1							
CO4	2	2	2	2	1						2	1
CO5	2					1	1		1	2	1	
CO6		2	2	2	1	1	1	1	1	1	1	1

Abstract POs defined by National Board of Accreditation			
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Test 1 (Marks in percentage)	Test 2 (Marks in percentage)	End Semester Examination (Marks in percentage)
Remember	15	15	30
Understand	15	15	30
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**50**	**100**	**3 Hours**

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

HUT 310 Management for Engineers (35 hrs)

Module 1 (Introduction to management Theory- 7 Hours)

Introduction to management theory, Management Defined, Characteristic of Management, Management as an art-profession, System approaches to Management, Task and Responsibilities of a professional Manager, Levels of Manager and Skill required.

Module 2 (management and organization- 5 hours)

Management Process, Planning types , Mission, Goals, Strategy, Programmes, Procedures, Organising, Principles of Organisation, Delegation, Span of Control, Organisation Structures, Directing, Leadership, Motivation, Controlling..

Module 3 (productivity and decision making- 7 hours)

Concept of productivity and its measurement; Competitiveness; Decision making process; decision making under certainty, risk and uncertainty; Decision trees; Models of decision making.

. Module 4 (project management- 8 hours)

Project Management, Network construction, Arrow diagram, Redundancy. CPM and PERT Networks, Scheduling computations, PERT time estimates, Probability of completion of project, Introduction to crashing.

Module 5 (functional areas of management- 8 hours)

Introduction to functional areas of management, Operations management, Human resources management, Marketing management, Financial management, Entrepreneurship, Business plans, Corporate social responsibility, Patents and Intellectual property rights.

References:

1. H. Koontz, and H. Weihrich, Essentials of Management: An International Perspective. 8th ed., McGraw-Hill, 2009.
2. P C Tripathi and P N Reddy, Principles of management, TMH, 4th edition, 2008.
3. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, Marketing Management: A South Asian Perspective. 14th ed., Pearson, 2012.
4. M. Y. Khan, and P. K. Jain, Financial Management, Tata-McGraw Hill, 2008.
5. R. D. Hisrich, and M. P. Peters, Entrepreneurship: Strategy, Developing, and Managing a New Enterprise, 4th ed., McGraw-Hill Education, 1997.
6. D. J. Sumanth, Productivity Engineering and Management, McGraw-Hill Education, 1985.
7. K.Ashwathappa, 'Human Resources and Personnel Management', TMH, 3 rd edition, 2005.
8. R. B. Chase, Ravi Shankar and F. R. Jacobs, Operations and Supply Chain Management, 14th ed. McGraw Hill Education (India), 2015.

Sample Course Level Assessment Questions

Course Outcome1 (CO1): Explain the systems approach to management?

Course Outcome 2 (CO2): Explain the following terms with a suitable example Goal, Objective, and Strategy.

Course Outcome 3 (CO3): Mr. Shyam is the author of what promises to be a successful novel. He has the option to either publish the novel himself or through a publisher. The publisher is offering Mr. Shyam Rs. 20,000 for signing the contract. If the novel is successful, it will sell 200,000 copies. Else, it will sell 10,000 copies only. The publisher pays a Re. 1 royalty per copy. A market survey indicates that there is a 70% chance that the novel will be successful. If Mr. Shyam undertakes publishing, he will incur an initial cost of Rs. 90,000 for printing and marketing., but each copy sold will net him Rs. 2. Based on the given information and the decision analysis method, determine whether Mr. Shyam should accept the publisher's offer or publish the novel himself.

Course Outcome 4 (CO4): Explain the concepts of crashing and dummy activity in project management.

Course Outcome 5 (CO5): Derive the expression for the Economic order quantity (EOQ)?

Course Outcome 6 (CO6): Briefly explain the theories of Entrepreneurial motivation.?

Model Question Paper

QP CODE: PAGES: 4

Reg No:_______________ Name:_________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 310

Course name: Management for Engineers

Max Marks: 100 **Duration: 3 Hours**

PART-A (Answer All Questions. Each question carries 3 marks)

1. “Management is getting things done through other.” Elaborate.

2. Comment on the true nature of management. Is it a science or an art?

3. Planning is looking ahead and controlling is looking back. Comment with suitable examples

4. Explain the process of communication?

5. Explain the hierarchy of objectives?

6. Explain the types of decisions?

7. Describe the Economic man model?

8. Explain the concepts of crashing and dummy activity in project management.

9. Differentiate the quantitative and qualitative methods in forecasting.

10. What are the key metrics for sustainability measurement? What makes the measurement and reporting of sustainability challenging?

PART-B (Answer any one question from each module)

11. a) Explain the systems approach to management. **(10)**

b) Describe the roles of a manager **(4)**

OR

12. a) Explain the 14 principles of administrative management? **(10)**

b) Explain the different managerial skills (**4)**

13. a) What are planning premises, explain the classification of planning premises. **(10)**

b) Distinguish between strategy and policy. How can policies be made effective. **(4)**

OR

14 a) Explain three motivational theories. **(9)**

b) Describe the managerial grid. **(5)**

15. a) Modern forest management uses controlled fires to reduce fire hazards and to stimulate new forest growth. Management has the option to postpone or plan a burning. In a specific forest tract, if burning is postponed, a general administrative cost of Rs. 300 is incurred. If a controlled burning is planned, there is a 50% chance that good weather will prevail and burning will cost Rs. 3200. The results of the burning may be either successful with probability 0.6 or marginal with probability 0.4. Successful execution will result in an estimated benefit of Rs. 6000, and marginal execution will provide only Rs. 3000 in benefits. If the weather is poor, burning will be cancelled incurring a cost of Rs. 1200 and no benefit. i) Develop a decision tree for the problem. (ii) Analyse the decision tree and determine the optimal course of action. **(8)**

b) Student tuition at ABC University is $100 per semester credit hour. The Education department supplements the university revenue by matching student tuition, dollars per dollars. Average class size for typical three credit course is 50 students. Labour costs are $4000 per class, material costs are $20 per student, and overhead cost are $25,000 per class. (a) Determine the total factor productivity. (b) If instructors deliver lecture 14 hours per week and the semester lasts for 16 weeks, what is the labour productivity? **(6)**

OR

16. a) An ice-cream retailer buys ice cream at a cost of Rs. 13 per cup and sells it for Rs. 20 per cup; any remaining unsold at the end of the day, can be disposed at a salvage price of Rs. 2.5 per cup. Past sales have ranged between 13 and 17 cups per day; there is no reason to believe that

sales volume will take on any other magnitude in future. Find the expected monetary value and EOL, if the sales history has the following probabilities: **(9)**

Market Size	13	14	15	16	17
Probability	0.10	0.15	0.15	0.25	0.35

b) At Modem Lumber Company, Kishore the president and a producer of an apple crates sold to growers, has been able, with his current equipment, to produce 240 crates per 100 logs. He currently purchases 100 logs per day, and each log required 3 labour hours to process. He believes that he can hire a professional buyer who can buy a better quality log at the same cost. If this is the case, he increases his production to 260 crates per 100 logs. His labour hours will increase by 8 hours per day. What will be the impact on productivity (measured in crates per labour-hour) if the buyer is hired? What is the growth in productivity in this case? **(5)**

17. a) A project has the following list of activities and time estimates:

Activity	**Time (Days)**	**Immediate Predecessors**
A	1	-
B	4	A
C	3	A
D	7	A
E	6	B
F	2	C, D
G	7	E, F
H	9	D
I	4	G, H

(a) Draw the network. (b) Show the early start and early finish times. (c) Show the critical path. **(10)**

b) An opinion survey involves designing and printing questionnaires, hiring and training personnel, selecting participants, mailing questionnaires and analysing data. Develop the precedence relationships and construct the project network. **(4)**

OR

18. a) The following table shows the precedence requirements, normal and crash times, and normal and crash costs for a construction project:

Activity	Immediate Predecessors	Required Time (Weeks)		Cost (Rs.)	
		Normal	Crash	Normal	Crash
A	-	4	2	10,000	11,000
B	A	3	2	6,000	9,000
C	A	2	1	4,000	6,000
D	B	5	3	14,000	18,000
E	B, C	1	1	9,000	9,000
F	C	3	2	7,000	8,000
G	E, F	4	2	13,000	25,000
H	D, E	4	1	11,000	18,000
I	H, G	6	5	20,000	29,000

Draw the network. (b) Determine the critical path. (c) Determine the optimal duration and the associated cost. **(10)**

b) Differentiate between CPM and PERT. **(4)**

19. a) What is meant by market segmentation and explain the process of market segmentation **(8)**

b) The Honda Co. in India has a division that manufactures two-wheel motorcycles. Its budgeted sales for Model G in 2019 are 80,00,000 units. Honda's target ending inventory is 10,00, 000 units and its beginning inventory is 12, 00, 000 units. The company's budgeted selling price to its distributors and dealers is Rs. 40, 000 per motorcycle. Honda procures all its wheels from an outside supplier. No defective wheels are accepted. Honda's needs for extra wheels for replacement parts are ordered by a separate division of the company. The company's target ending inventory is 3,00,000 wheels and its beginning inventory is 2,00,000 wheels. The budgeted purchase price is Rs. 1,600 per wheel.

(a) Compute the budgeted revenue in rupees.

(b) Compute the number of motorcycles to be produced.

Compute the budgeted purchases of wheels in units and in rupees.? **(6)**

OR

20. a) a) "Human Resource Management policies and principles contribute to effectiveness, continuity and stability of the organization". Discuss. (b) What is a budget? Explain how sales budget and production budgets are prepared? **(10)**

b) Distinguish between the following: (a) Assets and Liabilities (b) Production concept and Marketing concept (c) Needs and Wants (d) Design functions and Operational control functions in operations **(4)**

Teaching Plan

Sl.No	TOPIC	SESSION
	Module I	
1.1	Introduction to management	1
1.2	Levels of managers and skill required	2
1.3	Classical management theories	3
1.4	neo-classical management theories	4
1.5	modern management theories	5
1.6	System approaches to Management,	6
1.7	Task and Responsibilities of a professional Manager	7
	Module 2	
2.1	Management process – planning	8
2.2	Mission – objectives – goals – strategy – policies – programmes – procedures	9
2.3	Organizing, principles of organizing, organization structures	10
2.4	Directing, Leadership	11
2.5	Motivation, Controlling	12
	Module III	
3.1	Concept of productivity and its measurement Competitiveness	13
3.2	Decision making process;	14
3.3	Models in decision making	15
3.4	Decision making under certainty and risk	16
3.5	Decision making under uncertainty	17
3.6	Decision trees	18
3.7	Models of decision making.	19
	Module IV	
4.1	Project Management	20

Sl.No	TOPIC	SESSION
	Module I	
4.2	Network construction	21
4.3	Arrow diagram, Redundancy	22
4.4	CPM and PERT Networks	23
4.5	Scheduling computations	24
4.6	PERT time estimates	25
4.7	Probability of completion of project	26
4.8	Introduction to crashing	
	Module V	
5.1	Introduction to functional areas of management,	28
5.2	Operations management	29
5.3	Human resources management ,	30
5.4	Marketing management	31
5.5	Financial management	32
5.6	Entrepreneurship,	33
5.7	Business plans	34
5.8	Corporate social responsibility, Patents and Intellectual property rights	35

SEMESTER VII

FOOD TECHNOLOGY

FTT401	FOOD PROCESSING AND PRESERVATION	CATEGORY	L	T	P	CREDIT
		PCC	2	1	0	3

Preamble:

This course helps to acquaint with principles of different techniques used in processing and preservation of foods. Students will be able to understand innovative food processing and preservation technologies to develop and apply enterprising and innovative ideas to food production nutrition and health promotion.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	To understand the basic concepts and principles of food preservation.
CO 2	To Choose suitable high and low temperature preservation methods for various food processing industry
CO 3	To understand the suitability of concentration and evaporation techniques for food product development and preservation.
CO 4	Mechanisms involved in processing and preservation of different food groups.
CO 5	Concept and safety concerns of Genetically modified foods.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	2	1									
CO2	1	1		1	2							
CO3	1	1		1	2							1
CO4	2	1										
CO5	1			1								1

Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

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Mark distribution:

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Define food preservation ?
2. What is meant by aseptic processing?

Course Outcome 2 (CO2) :

1. Write a note on HTST ?
2. What is meant by lyophilisation?

Course Outcome 3(CO3):

1. Explain the role of evaporators in food processing?
2. List out the factors affecting dehydration of foods?

Course Outcome 4 (CO4):

1. Write a note on novel food preservation methods?
2. Describe the process of reverse osmosis?

Course Outcome 4 (CO5)

1. Write a note on Genetically modified foods?
2. Describe the application of nanotechnology in food?

Module 1 (7 hours)

Basic principles of food preservation. Scope of food processing; historical developments; principles of food processing and preservation. Use and application of enzymes and microorganisms in processing and preservation of foods; food fermentations, pickling, smoking etc; Food additives: definition, types and functions, permissible limits and safety aspects.

Module 2(7 hours)

Processing and preservation by heat – blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying, etc. Processing and preservation by low-temperature- refrigeration, freezing, and dehydro-freezing Packaging technologies - CAP, MAP, Vacuum packaging.

Module 3 (7 hours)

Processing and preservation by drying, concentration and evaporation-types of dryers and their suitability for different food products; ultra- filtration, reverse osmosis. Processing and preservation by non-thermal methods, irradiation, high pressure, pulsed electric field, hurdle technology.

Module 4 (7 hours)

Processing and method of preparation- Cereals and Pulses, Fruits and Vegetables, Dairy, Meat and poultry, Extruded products, Bakery and Confectionary, Fermented products.

Module 5 (7 hours)

Recent interventions in foods - Genetically Modified Foods (GMF) and their health implications, safety concerns of genetically modified foods; Nutrigenomics - interaction between gene-diet-disease, future perspectives of Nutrigenomics foods - benefits and risk; Application of 3D printing in food industry, Nanotechnology – applications.

Text Books

1. Potter NN & Hotchkiss 1997. Food Science. 5th Ed. CBS.
2. Fellows PJ. 2005. Food Processing Technology: Principle and Practice. 2nd Ed. CRC.
3. Ramaswamy H & Marcotte M. 2006. Food Processing: Principles and Applications. Taylor & Francis.
4. Food Processing: Principles and Applications, J. Scott Smith, Y.H. Hui, Wiley India Pvt Ltd (28 October 2013).
5. Manay, N. S. and Shadaksharaswamy, 1997, Foods Facts and Principles, New Age international (P) Ltd., Publishers New Delhi

References

1. Swaminathan, M. S. 1993, Food Science and Experimental Foods, Ganesh and Co., Chennai
2. Benion, M. 1970, Introductory foods, Eighth edition, The Mc Millan Co., London.

3. Food Process Engineering and Technology, Akash Pare
4. Jelen P. 1985. Introduction to Food Processing. Prentice Hall.

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 401

Course Name: FOOD PROCESSING AND PRESERVATION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all ten full questions, each carries 3 marks. (3×10=30 marks)

1. Describe the principles of Food Preservation?
2. Elaborate the applications of enzymes in food industry?
3. Explain the process of canning?
4. Differentiate between CAP and MAP?
5. Write short notes on the advantages and disadvantages of non-thermal preservation technologies?
6. Describe the process of reverse osmosis?
7. Write a short note on fermentation. List out the examples of fermented products
8. List out the ingredients used in bakery and confectionery processing?
9. Explain the process of 3D printing with suitable example
10. List out the applications of Nanotechnology in the field of food packaging?

PART B

Answer any five full questions, each carries 14 marks. (5×14=70 marks)

11. Explain the need for food preservation and scope for food processing in India.

Or

12. What are the major classes of food additives used in food processing? Explain with suitable examples

13. What are the different preservation techniques using high and low temperatures?

Or

14. How is food's shelf life extended under Vacuum circumstances and What are the special advantages of Vacuum Packaging?

15. Write a detailed note on minimal processing of foods and explain the following technologies of food processing: (a) High Pressure Processing (b) Pulsed Electric Field

Or

16. What are different types of dryers used in the food industry? Write a short note about this?
17. What are processed foods? Explain the different processing methods involved in cereal processing?

Or

18. Explain the term extrusion and the processing of any two extruded products.
19. What are Genetically modified foods? What are the major issues concerning GM foods?

Or

20. Write a short note on nanomaterial synthesis?

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Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1-Introduction to food Preservation**	**7**
1.1	Basic principles of food preservation. Scope of food processing; historical developments; principles of food processing and preservation	2
1.2	Use and application of enzymes and microorganisms in processing and preservation of foods	2
1.3	food fermentations, pickling, smoking	2
1.4	Food additives: definition, types and functions, permissible limits and safety aspects.	1
2	**Module 2- Preservation techniques**	**7**
2.1	Processing and preservation by heat – blanching, pasteurization, sterilization and UHT processing,	2
2.2	canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying, etc.	2
2.3	Processing and preservation by low-temperature-refrigeration, freezing, and dehydro-freezing	2
2.4	Packaging technologies - CAP, MAP, Vacuum packaging.	1
3	**Module 3- Novel Preservation techniques**	**7**
3.1	Processing and preservation by drying, concentration and evaporation-types of dryers and their suitability for different food products;	3
3.2	Membrane processing - ultra- filtration, reverse osmosis.	2
3.3	Non-thermal methods - irradiation, high pressure, pulsed electric field, hurdle technology.	2
4	**Module 4 – Processing of food**	**7**
4.1	Processing and method of preparation	1
4.2	Cereals and Pulses, Fruits and Vegetables	2
4.3	Dairy, Meat and poultry processing	2
4.4	Extruded products, Bakery and Confectionary, Fermented products.	2
5	**Recent interventions in foods**	**7**
5.1	Genetically Modified Foods (GMF) and their health implications, safety concerns of genetically modified foods	2
5.2	Nutrigenomics - interaction between gene-diet-disease, future perspectives of Nutrigenomics foods - benefits and risk	2
5.3	Application of 3D printing in food industry	2
5.4	Nanotechnology – applications.	1

FTT 413	FOOD PACKAGING TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

This course will deal with various concepts and principles involved in food packaging and explain the objectives and need of food packaging in food processing sector.The course will help the students to understand the role of packaging in maintain the quality and shelf life of the product and also familiarize the students about modern packaging techniques.

Prerequisite: Nil

Course Outcomes:

CO 1	Explain the importance of packaging system to produce safe and convenient foods to the consumer
CO 2	Apply the knowledge of food packaging in various food processing sector.
CO 2	Enable the students to develop modern packaging technologies
CO 3	Students can understand the advantages and limitations of various packaging materials
CO 4	Develop skills in the area of food packaging required in various food processing industries
CO 5	Choose new type of packaging material to improve the shelf life& acceptability of food products
CO 6	Explain the importance of packaging system to produce safe and convenient foods to the consumer

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3		2									
CO 2	3	3	2									2
CO 3	2	2	3									2
CO 4	3	3	2	3								
CO 5	2	2	2	2								2

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CO 6	3	2			2	1	1					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

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Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the role of packaging in food processing sector?

2. How food packaging improves sale?

3. Describe the functions of packaging systems to extend the shelf life of food

Course Outcome 2 (CO2)

1. Highlight the advantages and limitations of glass containers?

2. What are the ideal characteristics of food packaging materials?

3. Briefly explain the properties of flexible packaging materials in food packaging system?

Course Outcome 3(CO3):

1. How will you extend the quality of food with respect to food packaging?

2. Explain about corrugated paper board

3. Discuss the properties and limitations of PET with respect to food packaging.

Course Outcome 4 (CO4):

1. Discuss about active packaging.

2. Briefly explain about edible packaging material.

3. State the purposes of nutritional labelling in food packages

Course Outcome 5 (CO5):

1. Explainthe properties of PP, PE, BOPP

2. Discuss on different types of packaging materials

3. Explain the advantages of laminations in food packages

Course Outcome 6 (CO6):

1. Suggest suitable packaging material for whole milk?

2 What are the precautions to be taken for selecting a packaging material for fats and oils?

3Develop a typical packaging label for fruit beverages?

MODEL QUESTION PAPER
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER BTECH DEGREE EXAMINATION
Course Code: FTT 413
Course name: Food Packaging Technology

Max marks: 100 Time : 3 hrs

Part A

Answer all questions each question carries 3 marks (Marks = 10x3 = 30 marks)

1. What is the role of food packaging?
2. Define Packaging and differentiate between package and packing.
3. Describe different forms of a packages
4. Explain the qualities of flexible packaging materials
5. What is aseptic Packaging?
6. List out the biological role of laminated plastic materials
7. What is MAP?
8. Enlist various moisture absorbers in food packages
9. Discuss the packaging requirement of dairy products
10. Discuss the functions of packaging systems for dehydrated products?

PART B

Answer anyone full question from each module, each question carries 14 marks

Module 1

11. a) List out the requirements of packages based on the food products (4 mark)
    b) Discuss various functions of packaging. Briefly discuss the properties of packaging materials for their classification? (10marks)

OR

12. a) What is the role of food packaging in extending the shelf life of food products (7 marks)
    b) Give a detailed account on food packaging materials? (7 marks)

Module 2

13. a) Illustrate the properties, advantages and disadvantages of glass containers (7 marks)
    b) Enlist key properties of metal containers (7 marks)

OR

14. a) Discus two-piece single drawn and multiple drawn (DRD) cans? (7 marks)
    b) Give a detailed account on paper and paper board packaging materials? (7 marks)

Module 3

15. a) Enlist various methods of film lamination. Discuss film lamination by adhesive methods (7marks)

    b) How the problem of plastic waste can be reduced? Which types of packaging materials in foods can be produced to reduce this problem of environmental contamination?

OR

16. a) Discuss the manufacturing process of plastics. Compare its advantages and disadvantages over the glass (7marks)

    b) Mention the application of Co-extrusion in plastic films (7marks)

Module 4

17. a) What is active packaging? Explain various types of absorbers and emitters used in packaging of various types of foods. (7marks)

    b) Explain various types of antimicrobial packaging systems in foods? (7marks)

OR

18. a) What is the difference between Modified Atmospheric Packaging (MAP) and Controlled Atmospheric Storage (CAS)? (7marks)

    b) Discuss on RFIDs and Recyclability of packaging plastics(7marks)

Module 5

19. a) Discuss the packaging requirements for meat, fish, and poultry (7marks)

    b) Discuss the packaging requirements of instant and extruded foods (7marks)

OR

20. a) Discuss the packaging requirement of fruits and vegetables. Discuss MAP of fruits and vegetables (7marks)

    b) Enlist various properties of food that are influenced by moisture. Enlist various moisture absorbers and discuss anyone in detail (7marks)

Syllabus

Module 1 Introduction to Food Packaging (7 hours)

Introduction to Food packaging, need of food packaging, Role of packaging in extending shelf life of foods packaging materials and various package forms, Food packaging systems, Product characteristics and package requirements

Module 2 Types of packaging Materials (7 hours)

Different forms of packaging, Rigid, semi-rigid, flexible forms of packaging, wooden boxes and crates, Paper and paperboards, Glass, Metal container, Types of cans- Tinplate containers, Tin free steel (TFS), Aluminum containers, Composite containers,Lacquers. Properties, advantages and limitations of the following packaging materials: Glass, aluminum, its foil, metal tin containers, Paper and paperboards

Module 3 Flexible packaging (7 hours)

Flexible packaging materials their characteristics, Use of plastics as a packaging material-Types of plastics, Plastic films, laminated plastic materials, Co-extrusion. retortable pouches plastic films- LDPE, and LLDPE, HDPE, PVC, PS, PP, BOPP, nylon lonomers, rubber hydrochloride, natural and PVD, EVA Polyester, cellulose acetate, PET, blister packaging, aseptic Packaging, logistic packaging.

Module 4 Recent Trends in Food Packaging (7 hours)

Advances in Packaging Technology-Introduction, Active packaging, Vacuum Packaging, Controlled atmospheric packaging, Modified atmosphere packaging, Aseptic packaging, Biodegradable plastics, Edible gums, Coatings. Gas packaging, seal and shrink packaging. Form & fill sealing, Aseptic packaging systems, Retort pouches, RFID indicators

Module 5 Packaging systems for Food Products(7 hours)

Packaging systems for- Fruit & vegetable products, Dehydrated foods, Frozen foods, fish and fish products, meat and meat products, Dairy products, carbonated beverage, tea, coffee, alcoholic beverages, confectionery- fat and oil, biscuits, cakes, bread, food grains, storage and handling packaging materials

Text Books

1. Kit L Yam, Dong Sun Lee (2012), Emerging Food Packaging Technologies: Principles and Practice, Woodhead Publishing, ISBN:978-1-84569-809-6.
2. Robertson, G.L. (2013) Food Packaging: Principles and Practice, Third Edition. CRC Press, Taylor & Francis Group; ISBN-13: 978-0849337758.
3. Barry A. Morris (2017), The Science and Technology of Flexible Packaging, Elsevier, 978-0-323-24273-8, https://doi.org/10.1016/C2013-0-00506-3

Reference Books

1. Paine, Frank A., Paine, Heather Y. (1992) A Handbook of Food Packaging, Springer, ISBN 978-1-4615-2810-4
2. Richard Coles, Derek McDowell, Mark J. Kirwan (2009), Food Packaging Technology, Wiley-Blackwell, ISBN: 978-1-405-14771-2.
3. Takashi Kadoya, (2012), Food Packaging, 1st Edition, Academic Press, ISBN: 9780123935908
4. AlexandruGrumezescu Alina Maria Holban, (2017), Food Packaging and Preservation, Volume 9, 1st Edition, Academic Press, ISBN: 9780128115169
5. Miquel Angelo Parente Ribeiro Cerqueira, Ricardo Nuno Correia Pereira, Oscar Leandro da Silva Ramos, Jose Antonio Couto Teixeira, Antonio Augusto Vicente, Edible Food Packaging- Materials and Processing Technologies 1st Edition (2016), CRC Press ISBN 9781482234169

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 – Introduction to Food Packaging:**	**7**
1.1	Introduction to Food packaging, need of food packaging,	1
1.2	Role of packaging in extending shelf life of foods packaging materials and various package forms	2
1.3	Food packaging systems	2
1.4	Product characteristics and package requirements	2
2	**Module 2 -Types of packaging Materials:**	**7**
2.1	Different forms of packaging, Rigid, semi-rigid, flexible forms of packaging,	1
2.2	wooden boxes and crates, Paper and paperboards, Glass, Metal container,	2
2.3	Types of cans- Tinplate containers, Tin free steel (TFS), Aluminum containers, Composite containers, Lacquers. Properties	2
2.4	advantages and limitations of the following packaging materials: Glass, aluminum, its foil, metal tin containers, Paper and paperboards	2
3	**Module 3 -Flexible packaging**	**7**
3.1	Flexible packaging materials their characteristics, Use of plastics as a packaging material	2
3.2	Types of plastics, Plastic films, laminated plastic materials, Co-extrusion. retortable pouches plastic films- LDPE, and LLDPE, HDPE, PVC, PS, PP, BOPP,	2
3.3	nylon lonomers, rubber hydrochloride, natural and PVD, EVA Polyester, cellulose acetate,	1

3.4	PET, blister packaging, aseptic Packaging, logistic packaging.	2
4	**Module 4 – Recent Trends in Food Packaging**	**7**
4.1	Advances in Packaging Technology-Introduction	2
4.2	Active packaging, Vacuum Packaging,	1
4.3	Controlled atmospheric packaging, Modified atmosphere packaging, Aseptic packaging, Biodegradable plastics,	2
4.4	Edible gums, Coatings.	1
4.5	Gas packaging, seal and shrink packaging. Form & fill sealing, Aseptic packaging systems, Retort pouches, RFID indicators	1
5	**Module 5 – Packaging systems for Food Products**	**7**
5.1	Packaging systems for- Fruit & vegetable products, Dehydrated foods, Frozen foods, fish and fish products	2
5.2	meat and meat products, Dairy products,	1
5.3	carbonated beverage, tea, coffee, alcoholic beverages	1
5.4	confectionery- fat and oil,	1
5.5	biscuits, cakes, bread, food grains	1
5.6	storage and handling packaging materials	1

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FTT423	TECHNOLOGY OF FOOD EMULSIONS FOAMS AND GELS	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course is designed to introduce the basic concepts of Food Emulsions, foams, gels their properties and applications in food industries.

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the basic properties of food dispersion and applications in food processing
CO 2	Apply emulsifiers in food processing by understanding its properties
CO 3	Explain the principle of gel formation and various uses in food industry
CO 4	Understand the significance of thickeners and gelling agents in conserving food quality.
CO 5	Explain various techniques used for the quality analysis of emulsions and gels.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2											
CO 2	3											
CO 3	2											
CO 4	2											
CO 5	2											

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10

Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What are the factors affecting food dispersions?
2. List out the properties of food dispersions and applications in food processing.
3. Explain the formation of forms and factors affecting its stability.

Course Outcome 2 (CO2)

1. Explain the HLB concept in food emulsifiers
2. Classify emulsifiers used in food industry.
3. Elucidate the role of emulsifiers in food processing.

Course Outcome 3(CO3):

1. What are the applications of pectin in food industry?
2. What are the factors affecting gel formation?
3. What is pectin? Classify it.

Course Outcome 4 (CO4):

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1. What is the significance of xanthan gum as a gelling agent?
2. Write a short note on vegetable gums.
3. Explain the role of gelling agents in the textural properties of food.

Course Outcome 5 (CO5):

1. Explain the techniques used for evaluating the structure of food emulsions.
2. Explain the Spectroscopic techniques used for the textural analysis of emulsions.
3. What are the techniques used for analysing the stability of emulsions?

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MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT423
TECHNOLOGY OF FOOD EMULSIONS, FOAMS AND GELS

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. What do you mean by food dispersions?
2. Define aerosols.
3. Write down any four examples for food stabilizers.
4. What is the role of surfactants in food processing?
5. What are the applications of gelatine?
6. Differentiate between High methoxyl pectin and Low methoxyl pectin.
7. Write down the functions of thickeners and gelling agents in food processing.
8. List out any six gelling agents approved by fssai.
9. What are the Rheological properties of food gels?
10. What are the factors affecting emulsion stability?

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Define food dispersions, properties and give a detailed account on factors affecting food dispersions.

(OR)

12. Write a brief note on Foams its formation, stability, inhibition and breaking.

13. Elucidate on food emulsions, properties, types and applications.

(OR)

14. Elaborate on common emulsifiers and stabilizers used in food industry.

15. Exemplify the theories of gel formation.

(OR)

16. Write a brief note on pectin, sources, properties, manufacturing and applications.

17. Elaborate on thickeners and gelling agents from polysaccharide sources.

(OR)

18. Elucidate the functional properties of thickeners and gelling agents.

19. Explain the FSSAI regulations for emulsifiers and gelling agents.

(OR)

20. What are the commonly used techniques to analyse emulsion stability?

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Syllabus

Module 1 (7 hours)

Dispersions and foams: Food dispersions, definition, dispersed phase and continuous phase, characteristics, factors affecting food dispersions, Spray, mist and aerosols, Foams, Formation of forms, Foam stability, Foam inhibition and breaking, Applications in food industry.

Module 2(7 hours)

Food Emulsions: Types of emulsions, making emulsions, Stabilizers, Surface acting agents, emulsifiers, Types, properties and functions in food, typical food emulsions, HLB concept in food emulsifiers; emulsion formation and stability; polymers and surfactants.

Module 3(7 hours)

Gels: Theory of gel formation, factors affecting gel formation, pectic substances and jellies, fruit pectin gels, Sources of pectin, types, properties, manufacturing, milk jellies, Gelatine, Sources and properties, Applications in food industry.

Module 4(7 hours)

Thickeners and Gelling agents: Definition, functional properties, Polysaccharides- Starches: arrowroot, cornstarch, potato starch, sago, tapioca, agar, Carrageenan, microcrystalline cellulose, Vegetable gums: guar gum, xanthan gum, locust bean gum, Protein- Collagen, egg white, whey.

Module 5(7 hours)

Quality Analysis: Techniques for evaluation of structure for food emulsions, foams and gels, Rheology of food gels, Emulsion stability- Visual observation, Microscopy observation, Particle size analysis, Charge analysis, Spectroscopic techniques, FSSAI regulations for emulsifiers and gelling agents.

Reference

Techniques and methods to study functional characteristics of emulsion systems, Yin-Ting Hu,
Yuwen Ting, Jing-Yu Hu, Shu-Chen Hsieh, Journal of food and drug analysis, 25(1): 16-26.

Text Books

1. Williams and Philips, Gums and stabilizers for food industry, CRC Press, RSc

2. Sahay K. M and Singh K. K, Food stabilizers, Thickeners and gelling agents, Wiley Blackwell

3. Robert J Whiehurst, Emulsifiers in Food Technology, CRC Press, Blackwell Publishing

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Dispersions and foams**	**7**
1.1	Food dispersions, definition, dispersed phase and continuous phase, characteristics	2
1.2	Factors affecting food dispersions, Spray, mist and aerosols	2
1.3	Foams, Formation of forms, Foam stability, Foam inhibition and breaking	2
1.4	Applications in food industry	1
2	**Food Emulsions**	**7**
2.1	Types of emulsions, making emulsions, Stabilizers, Surface acting agents	2
2.2	Emulsifiers, Types, properties and functions in food	2
2.3	Typical food emulsions, HLB concept in food emulsifiers; emulsion formation and stability;	2
2.4	Polymers and surfactants	1
3	**Gels**	**7**
3.1	Theory of gel formation, factors affecting gel formation, pectic substances and jellies	2
3.2	Fruit pectin gels, Sources of pectin, types, properties, manufacturing, milk jellies, Gelatine, Sources and properties,	3
3.3	Applications in food industry.	2
4	**Thickeners and Gelling agents**	**7**
4.1	Definition, functional properties, polysaccharides- Starches: arrowroot, cornstarch, potato starch, sago, tapioca, agar	2
4.2	Carrageenan, microcrystalline cellulose, Vegetable gums: guar gum, xanthan gum, locust bean gum	3
4.3	Protein- Collagen, egg white, whey	2
5	**Quality Analysis**	**7**
5.1	Techniques for evaluation of structure for food emulsions, foams and gels, Rheology of food gels	2
5.2	Emulsion stability- Visual observation, Microscopy observation, Particle size analysis, Charge analysis, Spectroscopic techniques	2
5.3	FSSAI regulations for emulsifiers and gelling agents	3

FTT433	NON-THERMAL PROCESSING	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The syllabus is prepared with the view of making the Engineering Graduates capable of carrying out processing of food in industry, by applying novel techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Evaluate the non thermal processes like high pressure processing and pulsed electric field technology in food industry
CO 2	Explain in detail about all membrane technology so that it can be applied in processing industry.
CO 3	Process the food items through novel heating methods.
CO 4	Carry out extrusion for producing food items with novel characteristic features.
CO 5	Appraise the need of hurdle technology and image processing in food processing

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	**3**	**2**				**2**						
CO 2	**3**		**2**			**2**						
CO 3	**3**		**2**			**2**						
CO 4	**3**					**2**						
CO 5	3											

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

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Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the basic principle behind HPP?
2. Explain the applications of HPP in food industry.
3. Evaluate the process of microbial inactivation by HPP technology.

Course Outcome 2 (CO2)

1. Explain the principle behind microfiltration technique
2. What are the industrial applications of nanofiltration
3. Explain the process of pulsed electric field processing.

Course Outcome 3(CO3):

1. Explain the basic principle behind radiofrequency processing
2. What are the applications of pulsed X rays in food processing
3. Explain the basic process of ohmic heating

Course Outcome 4 (CO4):

1. Differentiate single and twin screw extruders
2. What are the different ways in which we can apply extrusion techniques in food sector.
3. Explain the manufacturing process of any one extruded food item from corn.

Course Outcome 5 (CO5):

1. Explain the application of hurdle technology in food processing
2. How can nanotechnology improve the quality of foods.
3. Evaluate the concept of image processing technology.

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Model Question paper

QP CODE:

Reg No:_______________

Name :_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT 433

Course Name: NON TERMAL PROCESSING

Max.Marks:100 **Duration: 3 Hours**

PART A

(Answer all Questions. Each question carries 3 Marks)

1. Classify HPP system
2. How microbial inactivation can be effected by HPP
3. What are the characteristic features a membrane should have to be used in reverse osmosis process
4. Explain the equation for calculating pulse frequency in PEF
5. Compare microwave heating and electrical resistance heating
6. What are the advantages of radiofrequency heating over conventional heating methods?
7. What is coextrusion?
8. What is throttling factor?
9. Give examples for physicochemical hurdles in food processing
10. What are nanofoods?

Part B

(Answer any one Question from each module. Each question carries 14 Marks)

11. (a) How can you apply HPP in food processing sector? (6)

(b) Explain the process of HPP in processing (8)

(OR)

12. (a) Explain the scope and importance of processing in current food sector (14)

13. (a) Explain the principle of nanofiltration (7)

(b) With the help of schematic representation explain the process of ultrafiltration (7)

(OR)

14. (a) Explain the principle and application of PEF in food processing (14)

15. (a) What are the important properties of ultrasound which makes it useful in food processing (7)

(b) How radiofrequency processing support food processing (7)

(OR)

16. (a) Explain the process and applications of IR heating in food processing (14)

17. (a) With the help of neat schematic representation explain the working and principle of an extruder (14)

(OR)

18. (a) Explain the effect of extrusion in food (7)

(b) Explain the production of any two extruded cereal products (7)

19. (a) Explain the important hurdles that play a part in food preservation (7)

(b) Explain the process of combination preservation in detail. (7)

(OR)

20. (a) Explain the applications of nanotechnology in food processing and preservation (14)

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Syllabus

Module 1: Introduction and High Pressure Processing (6 hours)

Introduction to food process engineering- Scope and importance- High Pressure processing – principle, equipment and process of HPP treatment, microbial inactivation, Application of HPP in food processing.

Module 2: Membrane Technologies and Pulsed Electric Field (8 hours)

Membrane technologies in food processing – Overview of Membrane technology. Micro-filtration, Ultra filtration (UF), Nano filtration(NF) and Reverse Osmosis (RO) and their industrial applications. Pulsed electric field processing - Principle, process, microbial inactivation, application in food processing sector .

Module 3: Processing of food using novel techniques (7 hours)

Ultrasonic processing: Properties and application of ultrasonic processing techniques. Microwave processing, Oscillating magnetic field in preservation, generating fields, mechanism of destruction of microbes, Radiation preservation of foods,

Module 4 : Extrusion Technology and Pulsed Light Technology (7 hours)

Food extrusion technology – theory, Equipment and its functioning, Types of extruders, Effect of extrusion on foods. Application of extrusion cooking in food industry, examples of extruded food, Pulsed Light Technology- working

Module 5: Hurdle technology and Image Processing Technology (7 hours)

Hurdle technology - Concept of hurdle technology and its application- Nanotechnology its Principles and applications in foods, Image processing; technology

Text Books

1. James G Brennan, Alistair S Grandison (Ed.), Food processing Handbook, Wiley – VCH, 2011

2. P G Smith, Introduction to Food Process Engineering, Springer, 2011

3. Zeki Berk, Food process engineering and technology, Elsevier, 2013

Reference Books

1. Geankoplis, C.J. “Transport Processes and Separation Process Principles”, 4th Edition, Prentice Hall, 2003.

2. McCabe W.L., Smith J.C. "Unit Operations in Chemical Engineering", 7th Edition, McGraw – Hill Int., 2001

3. Richardson, J.E. et al., "Coulson & Richardson's Chemical Engineering" Vol.2 (Particle Technology & Separation Processes") 5th Edition, Butterworth – Heinemann / Elsevier, 2003.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction and High Pressure Processing**	**6**
1.1	Introduction to food process engineering	2
1.2	Principle ,equipment and process of HPP	2
1.3	Microbial inactivation, Applications of HPP	2
2	**Membrane Technologies and Pulsed Electric Field**	**8**
2.1	Principle and process of different membrane filtration techniques	2
2.2	Industrial applications of membrane separation techniques	1
2.3	Pulsed electric field technology, generation of wave forms	1
2.4	Principle , processing technique	2
2.5	Microbial inactivation and applications of PEF	2
3	**Processing of food using novel techniques**	**8**
3.1	Ultrasonic processing: Properties and application of ultrasonic processing techniques.	2
3.2	Microwave processing technology	1
3.3	Oscillating magnetic field in preservation, generating fields	2
3.4	Mechanism of destruction of microbes	1
3.5	Radiation preservation of foods	2
4	**Extrusion Technology and Pulsed Light**	**7**
4.1	Principle behind the extrusion process	1
4.2	Application of extrusion in food industry	2
4.3	Example of extruded foods	2
4.3	Pulsed light Technology- Working	2
5	**Hurdle technology and Image Processing Technology**	**6**
5.1	Hurdle technology and its applications	2
5.2	Principle of nanotechnology and its effects in food processing	2
5.3	Image processing technology	2

FTT 443	SPICES AND PLANTATION CROPS TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The course will provide knowledge to students on the chemistry involved and types of equipment's used for the processing of coffee, tea, spices and cocoa. This course will help the students to develop value added products from plantation and spices

Prerequisites: Nil

Course outcomes:

After the completion of the course students will be able to:

CO 1	To define the different unit operations and its equipment's involved in coffee, tea and cocoa processing
CO 2	To gain knowledge in processing of plantation crops and spices and also its value-added products.
CO 3	To develop value added products from plantation products and spices
CO 4	To demonstrate appropriate technique for the extraction of spice oil and oleoresin with quality standards
CO 5	To acquire a confident to get placement in any kind of cereals and spices industry with minimum post-harvest losses and maximum benefit to the industry

Mapping of course outcomes with program outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	**3**											
CO 2	**3**	**3**										**2**
CO 3	**2**	**2**										**2**
CO 4	**3**	**3**		**3**								
CO 5	**2**	**2**										**2**
CO 6	**3**	**3**		**2**	**1**	**1**	**1**					

Assessment Pattern:

Bloom's category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyze	10	10	30
Evaluate			
Create			

Mark Distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 Marks
Continuous Assessment Test (2 Numbers) : 25 Marks
Assessment/Quiz/Course project : 15 Marks

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course level assessment questions:

Course Outcome 1 (CO1):

1. Describe the roasting process done in the coffee
2. Explain the manufacturing process involved in the coffee
3. How the quality of coffee can be tested

Course Outcome 2 (CO2):

1. What are the types of tea
2. Explain the manufacturing of tea
3. How green tea is different from black tea

Course Outcome 3 (CO3):

1. How the cocoa beans are processed

2. Explain the chemistry and manufacturing of chocolate
3. Discuss on the manufacturing of cocoa liquor

Course Outcome 4 (CO4):

1. Explain the production of pepper and technology involved
2. Discuss on the production of major spices

Course Outcome 5 (CO5):

1. Explain the manufacturing of oils and oleoresin in minor spices.
2. Dicuss on the post harvesting method involved for the spices

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MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER BTECH DEGREE EXAMINATION

COURSE CODE: FTT 443

COURSE NAME: SPICES AND PLANTATION CROPS TECHNOLOGY

Max:100
TIME:3HRS

PART -A

ANSWER ALL QUESTIONS (3x 10 = 30 Marks)

1. Discuss on the changes taking place due to fermentation process in coffee (3)
2. Differentiate between the CTC and Oolong tea (3)
3. Explain the types of chocolate (3)
4. Discuss on the cocoa process (3)
5. Discuss on the chemistry of small cardamom (3)
6. Explain the process of manufacturing of oleoresin in garlic (3)
7. Discuss on instant tea (3)
8. Discuss on the quality test done for the chocolates (3)
9. Discus on extraction of oil from pepper (3)
10. Describe the fermentation changes in the cocoa bean (3)

PART -B

ANSWER ALL QUESTIONS (5 x 14 = 70 Marks)

Questions

11.	a.	Compare and contrast the various methods of decaffeination of green coffee.	7
	b.	Describe the demucilaging methods in coffee bean processing.	7
12.	a.	Evaluate the different types of hulling equipment used in coffee bean processing with schematic diagrams.	7
	b.	Discuss the steps involved in instant coffee production with a neat flow diagram.	7
13.	a.	Discuss the manufacture of black tea with a special emphasis on withering and fermentation.	10
	b.	Enlist the grades and their synonyms for Indian black tea.	4
14.	a.	Outline the process flow sheet for the production of green tea and discuss with special emphasis on harvesting and withering.	7

	b.	Review the quality specifications of black tea with respect to Prevention of Food Adulteration Act 1954.	7
15.	a.	Discriminate the alkalisation step in cocoa bean processing.	4
	b.	Elaborate the post harvest activities of cocoa bean with emphasis on types of fermentation and drying.	10
16.	a.	State the objectives and discriminate the principle and equipment of chocolate conching process.	7
	b.	Appraise the liquid crystallization process in chocolate manufacturing process.	7
17.	a.	Evaluate the technology involved in the production of various types of pepper products.	7
	b.	Illustrate the methods and extraction of volatile oil from major spices with suitable diagrams.	7
18.	a.	Discuss the garlic dehydration process and their quality issues with a neat diagram.	7
	b.	Determine the production of cinnamon quills and its by-products.	7
19.	a.	Elaborate the methods and manufacture of oleoresin and its value added products from minor spices.	14
20.	a	Discuss the post harvest processing vanilla beans and highlight their quality specifications.	14

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

Syllabus

Module 1 Chemistry and Technology of Coffee (7 hours)

Coffee: Occurrence, Chemical constituents- Harvesting, Fermentation of coffee beans: changes taking place during fermentation- Drying & Roasting- Process flow sheet for the manufacture of coffee powder, Instant coffee, technology- Chicory chemistry – Quality grading of coffee

Module 2 Chemistry and Technology of Tea (7 hours)

Occurrence – chemistry of constituents- Harvesting – types of tea – green, oolong and CTC-Chemistry and technology of CTC tea- Manufacturing process – Green tea manufacture-Instant tea manufacture- Grading of tea

Module 3 Chemistry and Technology of Cocoa and Cocoa Products (7 hours)

Occurrence – Chemistry of the cocoa bean- Changes taking place during fermentation of cocoa bean – Processing of cocoa bean- Cocoa powder – cocoa liquor manufacture. -Manufacture of Chocolates – Types- Chemistry and technology of chocolate manufacture-Quality control of chocolates.

Module 4 Chemistry and Technology of Major Spices (7 hours)

Pepper: Method of manufacture of Oleoresins and Essential oils- Pepper: Chemistry of the volatiles- Cardamom (Small): Method of manufacture of Oleoresins and Essential oils-Cardamom (Small): Chemistry of the volatiles-Chilli: Method of manufacture of Oleoresins and Essential oils- Chilli: Chemistry of the volatiles- Method of manufacture of Oleoresins and Essential oils- -Turmeric: Method of manufacture of Oleoresins and Essential oils- Turmeric: Chemistry of the volatiles- Quality control - Defining quality, Major international quality specifications, The American Spice Trade Association (ASTA)- Quality control - The European Spice Association (ESA), Quality assurance systems

Module 5 Chemistry and Technology of Minor Spices (7 hours)

Cinnamon: Method of manufacture of Oleoresins and Essential oils- Cinnamon: Chemistry of the volatiles- Chemistry of the volatiles- Garlic: Method of manufacture of Oleoresins and Essential oils, Chemistry of the volatiles- Clove: Method of manufacture of Oleoresins and Essential oils, Chemistry of the volatiles- Vanilla: Method of manufacture of Oleoresins and Essential oils. Chemistry of the volatiles- Coconut- Areca nut- Oil palm- Cashew

Text Books:

1. Amalendu Chakraverty, Arun S. Mujumdar, G. S. Vijaya Raghavan & Hosahalli S. Ramaswamy: “Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices”, CRC Press, 2003.

2. K.V. Peter, “Handbook of herbs & spices”, Volume1, ISBN: 0857095684, 9780857095688, Elsevier, 2012.
3. N. Kumar, “Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants”, Oxford & IBH Publishing Co Pvt. Ltd; 2nd Revised edition, ISBN-10: 8120417763, ISBN-13: 978-8120417762, 2018.

Reference Books

1. Chi-Tang Ho, Jen-Kun Lin, Fereidoon Shahidi. “Tea and Tea Products: Chemistry and Health-Promoting Properties, Nutraceutical Science and Technology”, CRC Press, 2008.
2. Susheela Raghavan, “Handbook Seasoning, Spices & Flavoring”, Second Edition, CRC Press, Publication, 2006.
3. K.V. Peter, “Handbook of Herbs and Spices” Volume 1 Woodhead Publishing, CRC Press, 2001. ISBN 10: 1855735628 ISBN 13: 9781855735620

Course contents and lecture schedule

No.	**TOPICS**	**LECTURE NO.**
1	**MODULE 1 -Chemistry and Technology of Coffee**	**7**
1.1	***Coffee:*** Occurrence, Chemical constituents	1
1.2	Harvesting, Fermentation of coffee beans: changes taking place during fermentation	1
1.3	Drying & Roasting,	2
1.4	Process flow sheet for the manufacture of coffee powder, Instant coffee, technology	2
1.5	Chicory chemistry – Quality grading of coffee	1
2	**Module 2 Chemistry and Technology of Tea**	**7**
2.1	Occurrence – chemistry of constituents	1
2.2	Harvesting – types of tea – green, oolong and CTC	1
2.3	Chemistry and technology of CTC tea	2
2.4	Manufacturing process – Green tea manufacture	2
2.5	Instant tea manufacture- Grading of tea	1
3	**Module 3 Chemistry and Technology of Cocoa and Cocoa Products**	**7**
3.1	Occurrence – Chemistry of the cocoa bean	2
3.2	Changes taking place during fermentation of cocoa bean – Processing of cocoa bean	2

3.3	Cocoa powder – cocoa liquor manufacture- Manufacture of Chocolates – Types	1
3.4	Chemistry and technology of chocolate manufacture - Quality control of chocolates	2
4	**Module 4 Chemistry and Technology of Major Spices**	**7**
4.1	***Pepper:*** Method of manufacture of Oleoresins and Essential oils- Chemistry of the volatiles	1
4.2	***Cardamom (Small):*** Method of manufacture of Oleoresins and Essential oils. - Chemistry of the volatiles	2
4.3	***Chilli:*** Method of manufacture of Oleoresins and Essential oils- Chemistry of the volatiles	2
4.5	***Turmeric:*** Method of manufacture of Oleoresins and Essential oils.- Chemistry of the volatiles - Quality control - Defining quality, Major international quality specifications, The American Spice Trade Association (ASTA)- Quality control - The European Spice Association (ESA), Quality assurance systems	2
5	**Module 5 Chemistry and Technology of Minor Spices**	**7**
5.2	***Coriander:*** Method of manufacture of Oleoresins and Essential oils- Chemistry of the volatiles	2
5.3	***Cinnamon:*** Method of manufacture of Oleoresins and Essential oils. - Chemistry of the volatiles	2
5.5	***Clove:*** Method of manufacture of Oleoresins and Essential oils, Chemistry of the volatiles- ***Vanilla:*** Method of manufacture of Oleoresins and Essential oils. Chemistry of the volatiles- Coconut- Areca nut- Oil palm- Cashew	3

FTT453	MEAT AND FISH PROCESSING TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The syllabus is prepared with the view of making the engineering graduates to study about the unit operation in meat and fish preservation techniques and products.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Categorize various equipment involved in production, processing and acceptance of meat and poultry.
CO 2	Investigate the processed products and by-product utilization of meat and poultry.
CO 3	Plan various safety and sanitation parameters in a meat and poultry industry.
CO 4	Evaluate about the care in handling and transportation of fish at sea and on land
CO 5	Distinguish the quality of cured and smoked fish in preservation

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2										
CO 2	2					2						
CO 3						3		3				
CO 4						**3**		**3**				
CO 5						3		3				

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Estd.
2014

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1) How stress and environmental factors affect post-mortem changes of muscle?
2) Explain the basic ante-mortem animal handling principles
3) What is the difference between normal contraction and rigor shortening?

Course Outcome 2 (CO2)

1) Write a note on by-product utilisation of meat.
2) Explain the processing of surimi.
3) Explain the two major classifications of meat Kabab?

Course Outcome 3(CO3):

1) Describe three major categories of MFPO.
2) What are the sanitary requirements of meat processing plants?
3) What are the major steps involved in implementation of HACCP?

Course Outcome 4 (CO4):

1) Discuss the good practices during loading and storage of fishery products
2) Explain about the packaging and storage of frozen fish and shrimp.

3) Elucidate on the quality changes during frozen storage and the shelf life of frozen fish products.

Course Outcome 5 (CO5):

1) What is curing? What are the ingredients of curing and explain its importance?
2) Write a note on the different methods of curing.
3) Evaluate the difference between curing and smoking of fish

Model Question paper

QP CODE:

Reg No:_______________

Name :_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT 453

Course Name: MEAT AND FISH PROCESSING TECHNOLOGY

Max.Marks:100 **Duration: 3 Hours**

PART A

(Answer all Questions. Each question carries 3 Marks)

1) What are the three phases of Rigor mortis?
2) What is a lairage?
3) What is PSE meat?
4) What is the difference between normal contraction and rigor shortening?
5) List out the steps in HACCP.
6) Exemplify the two important fish harvesting methods.
7) Elucidate on the spoilage factors of fish.
8) Explain the different methods of cooling fish on board vessels.
9) What is a fatty fish? Give an example.
10) Give a brief on the different types of ice used for the cooling of fish.

Part B

(Answer any one Question from each module. Each question carries 14 Marks)

11) Write a short note on meat freezing technique.

OR

12) Describe in detail radappertization, radicidation, radurization

13) What are the major steps involved in implementation of HACCP?

OR

14) What are the ingredients of curing and explain its importance?

15) What are the sanitary requirements of meat processing plants?

OR

16) What are the microbial requirements in offal handling?

17) Write a note on the different methods of curing.

OR

18) Elucidate on the quality changes during frozen storage and the shelf life of frozen fish products.

19) Explain about the packaging and storage of frozen fish and shrimp.

OR

20) Discuss the good practices during loading and storage of fishery products.

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Syllabus

Module 1 (7 hours)

Introduction

Current level of production, consumption and export of meat products. Meat composition from different sources; muscle structure and compositions; Effect of feed, breed and management on production and quality, post-mortem muscle chemistry; meat colour and flavours; meat microbiology and safety.

Module 2(7 hours)

Beef &mutton

Beef, mutton, pork as human foods. Modern abattoirs, typical layout and features, Ante-mortem handling and design of handling facilities; stunning methods; steps in slaughtering and dressing; and inspection; inedible by-products; effects of processing on meat tenderization; abattoir equipment and utilities.

Module 3 (7 hours)

Safety, sanitation and processing technologies

Chilling and freezing of carcass and meat; canning, pickling, curing and smoking; prepared meat products like salami, kebabs, sausages; intermediate moisture and dried meat products; radiation processing, canning of meat.

Meat plant sanitation and safety. Regulations and procedures; HACCP, MFPO. Regulatory bodies. By-product utilization of meat and poultry processing.

Module 4 (7 hours)

Handling and transportation: Care in Handling and transportation of fish at sea; Handling and transportation on land; Ship board refrigeration equipments; Cold chain. design of refrigerated and insulated trucks;

Module 5 (7 hours)

Cured and Smoked Fish: Salt curing of fish; Storage of salted fish; Quality of finished products; Production of cold smoke fish; Hot smoked fish and light salted and light smoked fish; smoked fish using curing liquid.

Text Books

1. *Lawrie, R.A. —Meat Science, Second Edition. Pergamon Press, Oxford, UK. 1975.*
2. *G.J.Mountney, Scholarly articles for Poultry Products Technology*
3. *Stadelmen, W.J. and Cotterill, O.J., —Egg Science and Technology, Second Edition, AVI, Westport, 1977.*
4. *Edmund WL. Snack Foods Processing. AVI Publ*

5.*Gordon BR.1997 Snack Food.AVI Publ*

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Reference Books

1. Joseph Kerry, John Kerry and David Ledwood. ―Meat Processing , Woodhead Publishing Limited, England (CRC Press), 2002.
2. Mead, G. Poultry Meat Processing and Quality , Woodhead Publishing, England, 2004.

3. Gerasimov, G.V. and Antonova, MT. "Techno-Chemical Control of fish Processing Industry". Amerind Publishing Co. Pvt. Ltd., 1979.

4. Borgess, G.H.O., Cutting, C.L., Lovern, J.A. and Waterman, U. "Fish Handling and Processing". Chemical Publishing Co., 1967.

5. Fish & Fisheries of India; Jhingram VG; 1983, Hindustan Pub Corp

6. Fish as Food, Vol. I-IV; George Borgstrom, Academic Press 5. Fish Processing Technology , Rogestein & Rogestein

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**7**
1.1	Current level of production, consumption and export of meat products.; Meat composition from different sources	2
1.2	Muscle structure and compositions, Effect of feed, breed and management on production and quality	2
1.3	Post-mortem muscle chemistry; meat colour and flavours; meat microbiology and safety	3
2	**Beef & mutton**	**7**
2.1	Beef, mutton, pork as human foods. Modern abattoirs, typical layout and f mortem handling and design of handling facilities;	2
2.2	steps in slaughtering and dressing	2
2.3	stunning methods; offal handling and inspection; equipment and utilities.	2
2.4	Inedible by-products; effects of processing on meat tenderization; abattoir	1
3	**Safety, sanitation and processing technologies**	**7**
3.1	Chilling and freezing of carcass and meat; radiation processing, canning of meat.	2
3.2	Canning, pickling, curing and smoking;	1
3.3	prepared meat products like salami, kebabs, sausages; intermediate moisture and dried meat products;	1
3.4	Meat plant sanitation and safety. Regulations and procedures; HACCP, MFPO.	1
3.5	Regulatory bodies. By-product utilization of meat and poultry processing	2
4	**Handling and transportation**	**7**
4.1	Care in Handling and transportation of fish at sea;	1
4.2	Handling and transportation on land;	2
4.3	Ship board refrigeration equipments	2
4.3	Cold chain-design of refrigerated and insulated trucks	2
5	**Cured and Smoked Fish**	**7**
5.1	Salt curing of fish; Storage of salted fish	2
5.2	Quality of finished products; Production of cold smoke fish	3
5.3	Hot smoked fish and light salted and light smoked fish; smoked fish using curing liquid.	2

FTT 463	POST- HARVEST PHYSIOLOGY AND SPOILAGE IN FOOD	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: Students will be able to identify the physiology changes and their reasons occurring after fruit and vegetable harvest and methods for quality improvement.

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Identify the physiological and biochemical changes in horticultural produce after harvest and apply suitable control methods
CO 2	Use suitable ripening techniques for the development of safe and quality ripened products
CO 3	Identify various storage methods for the shelf-life extension of horticultural produce
CO 4	Acquire insight on various factors involved in spoilage and the techniques for its control
CO 5	Apply the knowledge of quality control for the quality improvement of fruits and vegetables

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3											
CO 2			3					3				
CO 3	2											
CO 4	2											
CO 5	3											

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Estd.
2014

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. **Explain the factors that affects transpiration loss in horticultural produce.**
2. **Describe various methods adopted for measuring respiration rate.**
3. **Classify horticultural produce based on respiration.**

Course Outcome 2 (CO2)

1. **What is Yang cycle?**
2. **What are the factors affecting ripening?**
3. **Classify horticultural produce based on ethylene generation rate.**

Course Outcome 3(CO3):

1. **Write a short note on CAS**
2. **Elaborate on storage conditions of fruits and vegetables.**
3. **What are the features of MAP?**

Course Outcome 4 (CO4):

1. **Explain the biotic factors involved in spoilage.**

2. **List out and describe the abiotic factors involved in spoilage.**
3. **What are the symptoms of freezing injury?**

Course Outcome 5 (CO5):

1. **Elaborate on the destructive methods used for quality evaluation.**
2. **Explain the principle and applications of waxing.**
3. **Exemplify the insect control methods used in post-harvest phase.**

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MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT463
POST- HARVEST PHYSIOLOGY AND SPOILAGE IN FOOD

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Define respiration.
2. What is the effect of respiration on quality of fruits and vegetables?
3. Distinguish between Climacteric and non-climacteric fruits.
4. What are the properties of ethylene?
5. Distinguish between MAP and CAP
6. What do you mean by maturity indices?
7. List out the abiotic and biotic factors involved in spoilage.
8. What is chilling injury?
9. What do you mean by GMP?
10. List out the principles of HACCP.

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Give a detailed account on respiration in horticultural produce.

(OR)

12. Explain the composition and life cycle of horticultural produce.

13. Briefly explain the Yang cycle with a neat diagram.

(OR)

14. Elaborate on ethylene generators and control methods.

15. Write a brief note on maturity indices and methods.

(OR)

16. With a neat diagram explain the principle and working of a CAS system.

17. Exemplify the various abiotic and biotic factors involved in spoilage.

(OR)

18. Elucidate the causes, effects and control methods of chilling and freezing injury.

19. Write a detailed note on harvesting methods.

(OR)

20. Explain the significance of HACCP and GMP in quality.

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Syllabus

Module 1 (7 hours)

Introduction: Basic post- harvest physiology, definition, respiration and gas exchange, Effect of respiration on physiology, factors affecting respiration, Respiration control methods, Changes during post- harvest, physical and chemical changes, transpiration, water stress.

Module 2 (8 hours)

Factors affecting post-harvest physiology: Preharvest factors on postharvest life, harvesting and handling injuries, storage conditions; temperature, RH, composition and its modification, Ethylene, Role of ethylene in ripening, Climacteric and non-climacteric fruits, ethylene biosynthesis, ethylene generators, ethylene control methods.

Module 3 (7 hours)

Handling and storage: Maturity indices, Assessment of crop maturity, Changes during ripening, physical and chemical changes, change in colour, texture, flavour during storage, Harvesting methods, Storage conditions and types, Storage characteristics of different fruits and vegetables, MAP and CAP.

Module 4 (7 hours)

Factors involved with spoilage: Biotic and abiotic factors; temperature, insect infestation, microbes; fungi, virus, bacteria etc., mechanical damage, chilling injury, freezing injury, quality and safety factors

Module 5 (6 hours)

Quality Improvement techniques: Harvesting and handling techniques, coatings and treatments, insect control and microbial control, Post- harvest treatments**,** GAP, GHP, GMP, HACCP, measurement of product quality methods; destructive and non- destructive tests; physical chemical, biological, visual methods

Text Books

1. Post- harvest physiology and pathology of vegetables, by Jerry A Bartz, Jeffrey K Brecht, 2 nd edition, Marcel Dekker Inc. NY
2. Post-Harvest Technology of Horticulture crops, by Sudheer K P and Indira V, New India Publishing Agency

Reference Books

A.K Thomson, Fruit and Vegetables Harvesting, Handling and Storage, Blackwell Publishing

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**7**
1.1	Basic post- harvest physiology, definition, respiration and gas exchange	2
1.2	Effect of respiration on physiology, factors affecting respiration, Respiration control methods	2
1.3	Changes during post- harvest, physical and chemical changes	1
1.4	Transpiration, water stress.	2
2	**Factors affecting post-harvest physiology**	**8**
2.1	Preharvest factors on postharvest life, harvesting and handling injuries,	2
2.2	storage conditions; temperature, RH, composition and its modification, Ethylene	2
2.3	Role of ethylene in ripening, Climacteric and non-climacteric fruits, ethylene biosynthesis	2
2.4	ethylene generators, ethylene control methods	2
3	**Handling and storage**	**7**
3.1	Maturity indices, Assessment of crop maturity	2
3.2	Changes during ripening, physical and chemical changes, change in colour, texture, flavour during storage, Harvesting methods,	2
3.3	Storage conditions and types, Storage characteristics of different fruits and vegetables	1
3.4	MAP and CAP	2
4	**Factors involved with spoilage**	**7**
4.1	Biotic and abiotic factors; temperature, insect infestation, microbes; fungi, virus, bacteria etc., mechanical damage,	3
4.2	Chilling injury, freezing injury	2
4.3	Quality and safety factors	2

5	**Quality Improvement techniques**	**6**
5.1	Harvesting and handling techniques, coatings and treatments, insect control and microbial control, Post- harvest treatments	2
5.2	GAP, GHP, GMP, HACCP	2
5.3	Destructive and non- destructive tests; physical chemical, biological, visual methods	2

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FTT473	INSTRUMENTATION AND PROCESS CONTROL IN FOOD INDUSTRY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course aims to provide basic understanding of designing and implementing practical control strategies in process industries.

Prerequisite: Differential equation

Course Outcomes: After the completion of the course the student will be able to

CO 1	Analyse open loop systems
CO 2	Analyse and apply the knowledge of linear closed loop system
CO 3	Develop working knowledge of control system by frequency response
CO 4	Understand different temperature measuring instruments
CO 5	Knowledge on different pressure and viscosity measuring instruments

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2	2										
CO 2	2			2								
CO 3	2		2									
CO 4	2											
CO 5	2											

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. **What is process control? What is Laplace transform of simple functions?**
2. **What is linear open loop systems?**
3. **Explain with example response of first order system.**

Course Outcome 2 (CO2)

1. **Explain different controllers and final control element.**
2. **What is closed loop transfer functions?**
3. **Describe response of simple control systems.**

Course Outcome 3(CO3):

1. **What is stability of a system?**
2. **Explain the steps to solve by root locus method.**
3. **What is Bode plot diagrams?**

Course Outcome 4 (CO4):

1. **What is static and dynamic characteristics of an instrument?**
2. **What are the laws of thermoelectricity?**
3. **Explain different methods of measuring temperature ?**

Course Outcome 5 (CO5):

1. **List different techniques to measure high pressure .**
2. **How will you measure vacuum in industries?**
3. **Explain the viscosity measuring instruments.**

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT473
INSTRUMENTATION AND PROCESS CONTROL IN FOOD INDUSTRY

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Find the Laplace transform of the function f(t)=1.
2. State final value and initial value theorem.
3. Define overshoot and decay ratio.
4. What is transportation lag ?
5. Define stability .
6. What is Bode plot?
7. Define fidelity.
8. What is a thermocouple?
9. What do you mean by absolute pressure?
10. List some viscosity measuring instruments.

PART B
(Answer one full question from each module, each question carries 14 marks)

11. a) Find the Laplace transform of 1)step function 2)exponential function 3)sine function.
(7) b) Solve dx/dt+x=1, x(0)=0
(7)

(OR)

12. A tank is having a time constant of 1 minute and a resistance of 1/9 ft/cfm is operating at steady state with an inlet flow of 10ft3/min. At time t=0 the flow is suddenly increased to 100ft3/min for 0.1 min by adding an additional 9ft3 of water to the tank

uniformly over a period of 0.1 min. plot the response in tank level and compare with the impulse response. (14)

13. a)Explain in detail underdamped overdamped and critically damped system (10)
b) what is servo and regulator problem .
(4)

(OR)

14. a)Explain different controllers used in industries (10)

b)write the benefits of adding integral and derivative control modes (4)

15. Plot the root locus diagram for the open loop transfer function

G= K/(s+1)(s+2)(s+3)
. (14)

(OR)

16.a) What is gain margin and phase margin (10)

b)write about Bode stability criterion
. (4)

17. Explain static and dynamic characteristics of ana instrument (14)

(OR)

18. a) Explain the electrical methods of measuring temperature (10)

b)What is a thermistor ?
(4)

19. Write note on different types of manometers (14)

(OR)

20. With neat diagram explain the working of any two viscometer (14)

Syllabus

Module 1

Introduction to process dynamics and control – definition of terms- Laplace transform – transform of simple functions- derivatives and integrals- properties of laplace transforms- final value theorem -initial value theorem- transition of transforms and functions- examples- inversion by partial fraction – solution of differential equation- qualitative nature of solutions- linear loop open system – first order systems -mercury thermometer- liquid level and mixing processes – response of these to different types of forcing functions- systems in series – interacting and non interacting types and generalization of results

Module 2

Linear open loop systems – second order systems – mercury thermometer in well and manometer – impulse and step response of under damped , critically damped and over damped system, their derivation – closed loop system – servo and regulator problems – block diagram development – controllers- types, basic principles and transfer functions -PID, PI and PD

Module 3

Introduction to stability of linear system- Routh Hurwitz criterion for stability – root locus technique- plotting the root locus diagram – transportation lag and its effect on root locus diagram- Introduction to frequency response – Bode diagram for first order system – bode stability criterion , gain margin and phase margin

Module 4

Introduction – definition of instrumentation – performance characteristics of an instrument – static and dynamic characteristics- temperature measurement – three types of thermometer -liquid filled, vapour pressure and gas type – bimetallic thermometer – resistance thermometer – principles of thermoelectricity like Seebeck effect, Peltier effect ,Thomson effect - laws of thermoelectricity – law of intermediate metals -law of intermediate temperature -selection of thermocouple material – radiation methods like pyrometry, optical pyrometry, thermistor

Module 5

Pressure measurement – manometer of Utube ,well type and inclined type – micromanometers -Prandtl type and air micromanometer – kenetometer , barometer , bourdon tube , flat and corrugated diaphragm, capsules -Mc Leod guage ,thermal conductivity gauge ,Pirani gauge ,ionization gauge ,radioactive gauge- viscosity measurement- Ostwald method and two float viscometer

Text Books

1. Ronald R.Coughnowr , “*Process Systems Analysis and Control*”, Mc Graw Hill, 1991.

2. Eckman DP , *Industrial instrumentation* ,Wiley Eastern

Reference Books

1. Stephanopoulose G. , *Chemical Process Control, An introduction to theory and practice* , Prentice Hall.

2. Jain RK, *Mechanical and industrial Measurements,* Khanna.

3.Harriot P, *Process control* , Tata Mc Graw Hill.

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Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to process dynamics**	
1.1	Laplace transforms of simple functions	3
1.2	Linear open loop system	2
1.3	Response of first order system	2
2	**Open loop systems**	
2.1	Controllers and final control elements	3
2.2	Closed loop transfer functions	3
2.3	Response of simple control systems	2
3	**Stability**	
3.1	Control system by frequency response.	3
3.2	Routh locus stability	3
3.3	Bode plot stability	2
4	**Instrumentation**	
4.1	Static and dynamic characteristics of instrument.	2
4.2	Temperature measuring instruments	3
4.3	Laws of thermoelectricity	2
5	**Pressure measurning instruments**	
5.1	Measurement of pressure and vaccum	3
5.2	Measurement of viscosity	3

Semester VII

OPEN ELECTIVE

FTT415	FOOD PROCESS ENGINEERING	CATEGORY	L	T	P	CREDIT
		OEC	2	1	0	3

Preamble: This course is designed to introduce the basic concepts of Food Processing, techniques used and its applications in food industries.

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the basic properties of food and applications in food processing
CO 2	Apply the processing methods in various food processing applications
CO 3	Explain the principle and working of size reduction equipment used in food industry.
CO 4	Understand the significance of various minimal processing technologies in conserving food quality.
CO 5	Apply the principle of dehydration in food preservation.

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2											
CO 2	3											
CO 3	2											
CO 4	2					2						
CO 5	3		2			2						

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the difference between grading and sorting?
2. List out the sensory properties of food. What are the methods used to evaluate the sensory properties of food?
3. Explain the wet and dry cleaning methods followed in food industry.

Course Outcome 2 (CO2)

1. Explain the principle and working of an extruder.
2. List out and explain the types of freezers used in food industry.
3. What is blanching? Explain the methods of blanching.

Course Outcome 3(CO3):

1. Explain the principle and working of an attrition mill.
2. Write a brief note on energy consumption of size reduction.
3. What do you mean by size reduction? Elucidate its significance in food industry.

Course Outcome 4 (CO4):

1. Explain the principle and working of PEF technology.
2. Write a short note on food irradiation.
3. Write a brief note on high pressure processing.

Course Outcome 5 (CO5):

1. Distinguish between wet bulb and dry bulb temperature.
2. Explain the significance of Psychrometric chart in food dehydration.
3. What are the advantages of food dehydration?

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT415
FOOD PROCESS ENGINEERING

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. What is the difference between Pasteurization and Sterilization?
2. What is 12 D concept?
3. What is significance of grading and sorting?
4. What is the working principle of roll mill?
5. What are the applications of Psychrometric chart?
6. List out the advantages of food processing.
7. Distinguish EMC chilling and critical moisture content.
8. Define Rittinger's law.
9. Differentiate between CAP and MAP.
10. What is the principle of Cold plasma technology?

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Give a detailed account on grading and sorting in food industry.

(OR)

12. Write a brief note on properties of food.

13. Give an account of heat sterilization methods

(OR)

14. Elaborate on canning in food industry.

15. Exemplify the principle and laws of size reduction.

(OR)

16. With a neat diagram explain the principle and working of ball mill and hammer mill.

17. Write a detailed note on food packaging.

(OR)

18. Elucidate the principle, working and applications of hurdle technology.

19. With a neat diagram explain the parts, principle and working of a spray drier.

(OR)

20. With a neat diagram explain the principle, working and applications of a freeze drier.

Syllabus

Module 1 (7 hours)

Introduction to food processing: Scope and importance of food processing, Properties of food- Physical, Chemical, nutritional and functional, Sensory properties, Sensory analysis, Cleaning- wet and dry methods, grading and sorting, Equipment used, Effect of processing on nutritional and sensory characteristics.

Module 2 (7 hours)

Processing methods: Blanching, Pasteurization, Heat sterilization, In container method and UHT processing, Microbial inactivation, F, D, Z Values, Canning, Extrusion, Fermentation, Microwave processing, Freezing and Chilling, Freezer types.

Module 3 (7 hours)

Size Reduction: Size reduction of solids, principles, laws of size reduction, kicks. Bond, rittinger, equipment; roller mill, impact mill, attrition mill, tumbling mills, methods, particle size distribution, energy consumption, Applications.

Module 4 (7 hours)

Minimal processing : Cold plasma Technology, Ohmic heating, Pulsed Electric field heating, High pressure processing, Food Irradiation, Ultrasound, Hurdle Technology, Food filling and packaging systems, packaging materials, CAP, MAP, Vacuum

Module 5 (7 hours)

Drying and Psychrometry: water activity, moisture content, drying rate curve, EMC, isotherms, Driers; Tray, tunnel, puff, fluidized bed, spray, Rotary drier etc. Freeze drying, Drying time prediction. Dehydrated products, Psychrometry, basic principles, Psychrometric chart, terms, numerical solving.

Text Books

1. Introduction to Food Process Engineering by P G Smith
2. Food processing Handbook by James G brennan
3. Food process engineering and technology by zeki Berk

Reference Books

1. P. J Fellows, Food Processing Technology Principles and Practices, CRC Press, Woodhead Publishing

2. Sahay K. M and Singh K. K, Unit Operations of Agricultural Processing, Vikas Publishing

3. Peter Zeuthen and Leif Bogh Sorenson, Food Preservation Techniques, CRC Press, Woodhead Publishing

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to food processing**	**7**
1.1	Scope and importance of food processing, Properties of food- Physical, Chemical, nutritional and functional	2
1.2	Sensory properties, Sensory analysis	2
1.3	Cleaning, grading and sorting, Equipment used	2
1.4	Effect of processing on nutritional and sensory characteristics.	1
2	**Processing methods**	**7**
2.1	Blanching, Pasteurization, Heat sterilization, In container method and UHT processing, Microbial inactivation, F, D, Z Values,	2
2.2	Canning, Extrusion	2
2.3	Fermentation, Microwave processing	2
2.4	Freezing and Chilling, Freezer types	1
3	**Size Reduction**	**7**
3.1	Size reduction of solids, principles, laws of size reduction, kicks. Bond, rittinger	3
3.2	Equipment; roller mill, impact mill, attrition mill, tumbling mills, methods	2
3.3	Particle size distribution, energy consumption, Applications.	2
4	**Minimal processing**	**7**
4.1	Cold plasma Technology, Ohmic heating, Food Irradiation	3
4.2	Pulsed Electric field heating, High pressure processing, Ultrasound, Hurdle Technology	2
4.3	Food filling and packaging systems, packaging materials, CAP, MAP, Vacuum	2
5	**Drying and Psychrometry**	**7**
5.1	water activity, moisture content, drying rate curve, EMC, isotherms,	2
5.2	Driers; Tray, tunnel, puff, fluidized bed, spray, Rotary drier etc. Freeze drying, Drying time prediction. Dehydrated products,	3
5.3	Psychrometry, basic principles, Psychrometric chart, terms, numerical solving.	2

CODE FTT425	INSTRUMENTAL METHODS IN FOOD ANALYSIS	CATEGORY	L	T	P	CREDIT
		OEC	2	1	0	3

Preamble:

This course will deal with the different analytical techniques of food. This course gives understanding about various chemical and instrumental methods of analysis of food. The course will focus on providing graduate students with a detailed knowledge of modern techniques used in research and development as well as inspection of food products in industry, analytical laboratory and government

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the fundamentals of spectroscopy principle, instrumentation and applications
CO 2	Identify chromatographic techniques and the application of these techniques to the separation and analysis of multi-component samples
CO 3	Summarize different hyphenated techniques of instrumental methods in food analysis
CO 4	Knowledge on application of different biological methods in food analysis
CO 5	Describe the application of innovative instrumental techniques for food analysis

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2	3										
CO 2	3	2	2									
CO 3	2	3		3								
CO 4	2	2	3									
CO 5	2	2		2								

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State and explain Beer Lambert's law?
2. How will you construct calibration curve?
3. Describe the instrumentation of Double beam UV Visible Spectrophotometer?

Course Outcome 2 (CO2)

1. Examine the principle behind chromatography?
2. How does separation take place in Gel filtration chromatography? Explain with a neatly labelled sketch
3. Illustrate the instrumentation of HPLC with a neat sketch?

Course Outcome 3(CO3):

1. Explain the principles behind mass spectroscopy?
2. Identify the application of hyphenated techniques in food analysis?
3. Describe the instrumentation of GC MS ?

Course Outcome 4 (CO4):

1. What is Immunoassay? Explain briefly about any three types of Chromatography.
2. How does separation takes place in Gel filtration chromatography? Explain with a neatly labelled sketch.
3. Give an account of PCR and its applications

Course Outcome 5 (CO5):

1. Justify the application of biosensors in food quality evaluation.
2. Discuss the application of scanning electron microscopy in food analysis?
3. Explain the methods used for analysing texture of food

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY Estd 2014

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT425
INSTRUMENTAL METHODS IN FOOD ANALYSIS

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Write a short note on immunoassay
2. Give an account of detectors used in spectroscopy
3. What is proximate analysis?
4. What are the applications of HPLC in food analysis?
5. What do you mean by hyphenated technique?
6. Explain Beer's Lambert's Law.
7. What is meant by RF? How will you interpret RF value?
8. What are Supercritical fluids? Explain with an example.
9. Enumerate the role of biosensors in rapid method of analysis
10. What is the principle of Isoelectric focusing?

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Explain the instrumentation of double beam UV Visible Spectrophotometer .

(OR)

12. Discuss the application of IR Spectroscopy in food quality evaluation ?

13. Detail on the component parts of HPLC with a neat sketch?

(OR)

14. How will you separate and isolate food components using chromatographic techniques?

15. Write an essay on instrumentation of GC MS with neat sketch.

(OR)

16. How can you employ LC MS for pesticide residue analysis?

17. Evaluate the biological methods available for food quality analysis?

(OR)

18. Explain the different methods used in evaluating food authentication ?

19. Examine the principle and process behind biosensors in food quality control?

(OR)

20. Detail on the recent advancements in food texture analysis ?

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

Syllabus

Module 1 (7 hours)

Spectroscopy: Food Analysis, Nature and Concept of Food analysis, Spectroscopy, Electromagnetic spectrum, Beer Lamberts law, Absorbance, Construction of calibration curve, Principle, instrumentation of single and double beam UV-Visible spectrophotometer, IR, NMR and Raman Spectroscopy

Module 2 (7 hours)

Chromatography

Basis of chromatography (mobile and stationary phases, Chromatography: Theory & Principle, chromatographic parameter (partition coefficient, capacity factor, retention & dead time, Resolution& their calculation), Types of chromatographic techniques , HPLC, GC – Instrumentation and application

Module 3 (7 hours)

Hyphenated technique

Mass Spectroscopy and Chromatography coupling technique - Basics of mass spectrometry, components of mass spectrometer, applications of mass spectroscopy, Gas chromatography, GC MS, LCMS – instrumentation and applications

Module 4 (7 hours)

Biological Techniques

DNA and protein-based methods**,** Fundamental principle and instrumentation of the system, measurement techniques and interpretation of Polymerase Chain Reaction, Real Time Polymerase Chain Reaction, Enzyme Linked Immunosorbent Assay, Radio Immuno Assay, Use of PCR for detection of genetically modified organisms, Electrophoresis techniques

Module 5 (7 hours)

Innovative Analytical Techniques

Biosensor, nanotechnology and biosensor – applications in food industry, Instrumental measurement of texture of food, viscometer, viscoanalysis, texture analysis, Scanning electron microscopy (SEM) – Principle, Instrumentation, applications, TEM

Text Books

1. Nielsen, Suzanne (Ed.), Food Analysis, 2010, Springer US, ISBN 978-1-4614-2589-2

2. Food Analysis by HPLC. Leo M.L. Nollet (Editor). Second Edition, CRC Press; 2000

Reference Books

1. Semih Otles, Handbook of Food Analysis Instruments, 2016, CRC Press, ISBN 9780429147340

2. Adriana S. Franca and Leo M.L. Nollet, Spectroscopic Methods in Food Analysis, 2018, CRC Press, ISBN 9781498754613 (978-1-4987-5461-3)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd 2014

3. Kent K. Stewart and John R. Whitaker, Modern Methods Of Food Analysis, AVI PUBLISHING COMPANY, INC, ISBN 978-94-011-7381-0

4.Chromatography: Concepts and Contrasts. James M. Miller (Author), second edition, Wiley Interscience; 2004.

5. Applications of Vibrational Spectroscopy in Food Science, 2 Volume Set. Eunice Li-Chan (Editor), John Chalmers and Peter Griffiths (Co-Editors). John Wiley & Sons Ltd. Chichester, England. 2010.

6. Infrared and Raman Spectroscopy of Biological Materials (Practical Spectroscopy). HansUlrich Gremlich and Bing Yan (Eds). Marcel Dekker, NY, USA. 2001).

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Spectroscopy**	**7**
1.1	Spectroscopy – Electromagnetic spectrum, principle, calibration curve	2
1.2	instrumentation of single and double beam UV-Visible spectrophotometer	2
1.3	IR, NMR and Raman Spectroscopy – Instrumentation, applications	3
2	**Chromatography**	**7**
2.1	Basis of chromatography (mobile and stationary phases, Chromatography: Theory & Principle	3
2.2	HPLC – Principle, Components, working and application	2
2.3	GC – Principle, Components, working and application	2
3	**Hyphenated technique**	**7**
3.1	Basics of mass spectrometry, components of mass spectrometer, applications of mass spectroscopy	3
3.2	GC MS – Principle, Components, working and application	2
3.3	LC MS – Principle, Components, working and application	2
4	**Biological Techniques**	**7**
4.1	Biological methods - DNA and protein-based methods, principle, different methods available	3
4.2	Immunoassay methods and electrophoresis methods – types, application	2
4.3	DNA based methods – PCR, DNA fingerprinting	2
5	**Innovative Analytical Techniques**	**7**
5.1	Biosensors – applications in food quality evaluation	2
5.2	Nanotechnology – application in food quality analysis	3
5.3	Texture analysis, viscosity analysis	2

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY Estd. 2014

FTT435	UNIT OPERATIONS IN FOOD TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		OEC	2	1	0	3

Preamble: This course provides an introduction to the basic concept and techniques of various unit operations like mixing, filtration, evaporation, crystallisation and size reduction.

Prerequisite: Principles of chemical engineering.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the unit operations mixing and agitation and the equipment used for it in food industry
CO 2	Knowledge on unit operations such as evaporation and evaporators
CO 3	Knowledge on unit operations such as evaporation and evaporators.
CO 4	Analyse the different functions of filtration and filtering equipment in food processing
CO 5	Understand size reduction and size reducing equipment in industry.

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	1	1	2								
CO 2	3	1		2								
CO 3	3	1	1	1								
CO 4	3	1		1								
CO 5	3	1										

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is meant by agitation and mixing?
2. Derive equation for flow rate and power requirement in agitated vessel.
3. List various mixers used in food industries.

Course Outcome 2 (CO2)

1. Define and explain the theory of evaporation.
2. Explain the classification and various evaporators used in industries.
3. Derive calculation of capacity ,economy for single effect evaporator

Course Outcome 3(CO3):

1. .Define and explain the theory of crystallisation.
2. Classify various crystallisers used in industries.
3. Explain solubility, saturation and supersaturation.

Course Outcome 4 (CO4):

1. Define and explain the theory of filtration.
2. Classify various filters used in industries.
3. Derive the expression for pressure drop across the filter media

Course Outcome 5 (CO5):

1. Explain the laws of comminution.
2. List different size reducing equipment
3. What is mean by screening? and what are the different types of screens used in industries.

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT 435
UNIT OPERATIONS IN FOOD TECHNOLOGY
Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. What is the difference between agitation and mixing?
2. Define mixing index.
3. How evaporation differ from drying , crystallization and distillation ?
4. What is economy and capacity of an evaporator?
5. What is mother liquor in crystallisation?
6. Define saturation and supersaturation .
7. What is filter aid ?
8. Compare dead end and cross flow filtration.
9. What do you mean by screen efficiency?
10. State three laws of comminution.

PART B
(Answer one full question from each module, each question carries 14 marks)

11(a) By dimensional analysis estimate the power requirement of an agitator (9)

(b) A biscuit dough is prepared by mixing flour and other ingredients along with tracer material (2% mass). After 10 minutes of mixing 6 random samples are collected and their composition (% of tracer material) is given

2.021 1.925 1.826 2.125 2.210 2.015

Calculate the mixing index after 10 min of mixing. (5)

(OR)

12(a) . Explain different types of mixers used for mixing of dry powders. (10)

(b) Explain axial and radial mixing. (4)

13. Explain the classification of MEV based on feed supply. (14)

(OR)

14(a).A continuous SEV concentrates 9072kg/hr of 1% salt solution entering at 311K to a final concentration of 1.5 % .The vapour space of the evaporator is at 101.32KPa and the steam supplied is saturated atb 143.3KPa . The overall heat transfer coefficient is 1704W/m2K. Calculate heat transfer area required .Assume the solution has same boiling point as water. Given heat capacity of feed =4.14KJ/kgK , hv =2257KJ/kg , Ts = 383.2K , .
(10)

(b) Explain the working of agitated thin film evaporator. (4)

15(a). Explain the characteristics of crystals. (9)

(b) Explain different methods for supersaturation. (5)

(OR)

16(a). Explain the working of Swensor Walker crystallizer (7)

(b) Write short note on primary nucleation. (7)

17(a). Compare the time requirement for filtration at constant rate and constant pressure filtration . (10)

(b) With neat sketch explain the working of rotary filter (4)

(OR)

18(a). In a plate and frame filter press operating under constant pressure filtration 283lt of filtrate were collected in 30minutes.What will be the volume of filtrate collected in the next 30 minutes. Assume medium resistance is small. Also find out the rate of filtration at the end of filtration.
. (7)

(b)Explain the classification of filtration. (7)

19. Compare a)wet and dry grinding b)open and closed circuit grinding and c)free crushing and choke crushing.

(14)

(OR)

20. Explain different industrial screens with neat sketch

(14)

Syllabus

Module 1 (7 hours)

Agitation and mixing : Definition - principle – purpose , mixing of low and moderate viscosity liquids – agitation equipment -impellors-paddle-turbine- propellors ,flow pattern -prevention of swirling -standard design- circulation velocity rate in agitated vessel, flow number – power consumption - mixing index –mixing of high viscosity liquids, pastes and plastics – kneader - extruder – mixing rolls ,mixing of dry granular solids – ribbon mixer - vertical screw -tumbling mixers

Module 2 (7 hours)

Evaporation: Definition -principle- equipment- method of operation of evaporators – single and multiple effect evaporators- capacity – economy – MEV classification based on feed supply – effect of processing variables on evaporator operation – application in food industry – types of evaporators – short tube , long tube , falling film ,agitated thin film evaporators – vapour recompression

Module 3 (7 hours)

Crystallisation : Definition – principle – characteristics of crystals – equilibrium data- solubility- solubility curves- saturation – supersaturation – methods for supersaturation – Miers solubility curve – nucleation – primary , secondary – crystal growth – crystallizers – classification – agitated tank, swensor walker ,vacuum crystalliser , Oslo crystalliser, draft tube baffle crystallizers.

Module 4 (7 hours)

Filtration: Definition- theory – filter media-requirements of filter media- classification of filtration , equation for pressure drop- Darcy's equation -cake resistance -medium resistance time required for constant rate and constant pressure filtration – compressibility factor – washing of filter cake -optimum filtration cycle –continuous filtration equation – filter aid- industrial filters – plate and frame – rotary-centrifugal filters – gas cleaning methods -cyclone separator -electrostatic precipitator- scrubbing

Module 5 (7 hours)

Size Reduction : Laws of comminution - mechanism and efficiency of size reduction – principles of important size reduction equipment – types and equipment for all ranges – closed circuit and open circuit grinding – free crushing and choke feeding – wet and dry grinding – screening – effectiveness and capacity of screens and factors affecting them- types of industrial screens

Text Book

1. Mc Cabe WL Smith.JC& Harriott P, “Unit Operations in Chemical Engineering”, Mc Graw Hill.

2. Transport process and unit operations by Geancoplis C.J

Reference Books

1. Unit operations in food engineering byAlbert Ibartz and Gustavo V B

2. Foust, A S etal.,Principles of unit operations ,John Wiley and Sons

3. Coulson, J.M. and etal. Coulson and Richardsons Chemical Engineering .

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**AGITATION AND MIXING**	**7**
1.1	Definition and principle of agitation and mixing	2
1.2	Derive equation for flow rate and power requirement in agitated vessel	3
1.3	Various mixers used in food industries.	2
2	**EVAPORATION**	**7**
2.1	Definition and the theory of evaporation.	3
2.2	Classification and various evaporators used in industries.	2
2.3	Calculation of capacity ,economy for single effect evaporator.	2
3	**CRYSTALLISATION**	**7**
3.1	Definition and the theory of crystallisation.	3
3.2	Classification and various crystallisers used in industries.	2
3.3	Solubility, saturation and supersaturation.	2
4	**FILTRATION**	**7**
4.1	Definition and the theory of filtration.	2
4.2	Classification and various filters used in industries.	3
4.3	Derivation of pressure drop across the filter media.	2
5	**SIZE REDUCTION**	**7**
5.1	Laws of comminution	3
5.2	Size reducing equipment	2
5.3	screening	2

Estd. 2014

FTT445	NON-THERMAL PROCESSING	CATEGORY	L	T	P	Credit
		OEC	2	1	0	3

Preamble:

Students should be able to analyze the principles and methods of non-thermal processing technologies and their application in food processing industries. Thorough understanding of the specific processing technologies for different food items is expected after the completion of this course.

Course outcomes:

After the completion of the course students will be able to:

CO 1	To gain knowledge about the principles of non-thermal processing and pulsed electric field food processing
CO 2	To understand fundamentals behind ultrasound, UV and microwave food processing
CO 3	To analyze applications of ozone and dense phase CO_2 processing
CO 4	To assess the effects of irradiation and ohmic heating on food materials
CO 5	To be familiarized with the concepts of hurdle technology, oscillating magnetic fields and minimal processing of foods

Mapping of the course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2							
CO2	3	2	1	1	2							
CO3	3	2	1	1	2							
CO4	3	2	1	1	2							
CO5	3	2	1	1	2							

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Estd. 2014

Assessment Pattern:

Bloom's category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyze	10	10	30
Evaluate			
Create			

Mark Distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 Marks

Continuous Assessment Test (2 Numbers) : 25 Marks

Assessment/Quiz/Course project : 15 Marks

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course level assessment questions:

Course Outcome 1 (CO1):

1. What are the different non-thermal food processing techniques?

2. Analyze pulsed electric field processing.

3. Describe about high pressure food processing.

Course Outcome 2 (CO2):

1. How is ultrasound food processing beneficial?

2. What are UV and pulsed light processing of foods?

3. How is microwave processing carried out?

Course Outcome 3 (CO3):

1. Describe ozone processing of foods.

2. What is meant by dense phase CO_2 processing?

Course Outcome 4 (CO4):

1. How is ionizing radiation utilized for food processing?

2. Describe the applications of ohmic heating with respect to food processing.

Course Outcome 5 (CO5):

1. Analyze food processing by oscillating magnetic fields.

2. What is meant by Hurdle technology?

Model Question paper:

QP Code: **Reg No:**

Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course code: FTT 445

NON-THERMAL PROCESSING

Max. Marks: 100 **Duration: 3 hours**

PART A

(3X10=30)

(Answer all questions)

1. List the different non thermal food processing technologies.
2. Give the principle for Pulsed Electric field processing.
3. Write a note on the applications of high-pressure food processing.
4. Define acoustic cavitation.
5. Define ionic conduction and dipole rotation.
6. How is ozone processing carried out?
7. Name the major process control parameters with respect to dense phase CO_2 processing.
8. Differentiate between ohmic heating and microwave heating.
9. How is minimal processing employed in food industries?
10. How does oscillating magnetic field inactivate microorganisms?

PART B

(14X5=70)

(Answer one full question from each module)

11. Elaborate the role played by emerging non thermal processing technologies in food and allied industries.

OR

12. Describe the microbial inactivation mechanism by pulsed electric field processing and high-pressure food processing.

13. Explain the applications of ultrasound processing and microwave processing of foods.

OR

14. Analyze the nutritional and quality parameters of processed foods using UV and pulsed light processing.

15. List the factors that regulate ozone processing of foods. Also, explain how do they affect food quality.

OR

16. Explain the application of dense phase CO2 processing in food industry.

17. Describe the advantages and disadvantages of using ionizing radiation for food processing.

OR

18. Explain the mechanism of ohmic heating and its effect on food quality.

OR

19. What are the objectives of minimally processed foods? Analyze their biological effects.

OR

20. How do magnetic fields inactivate microorganisms. Explain the associated mechanism and their applications.

Syllabus

Module 1 (7 hours)

Pulsed electric field and high-pressure food processing

Introduction – Emerging Non-thermal processing technologies – Pulsed Electric field processing – Microbial inactivation – Effects on quality parameters – Shelf life of treated foods – Future trends – High Pressure Food Processing - Applications – Microbiological safety – Impact on quality attributes

Module 2 (7 hours)

Ultrasound and microwave processing

Ultrasound processing of foods – Applications – Effect on quality parameters –Ultra violet and pulsed light processing – applications – Microbial inactivation mechanism – Effects on nutritional and quality parameters – Microwave heating – general principles – Microwave processing of foods.

Module 3 (7 hours)

Ozone processing and dense phase CO_2 processing

Ozone processing – applications – Factors affecting efficacy of ozone processing – Microbial inactivation mechanism – Effect on food quality – Dense phase carbon dioxide processing – applications – process control parameters - Microbial inactivation mechanism – Effect on food quality - Use of cold plasma in food processing.

Module 4 (7 hours)

Food radiation and ohmic heating

Food irradiation- radiation sources- absorbed dose- advantages and limitations- chemical, nutritional and microbiological changes in irradiated foods- commercial applications – irradiation and the International Food Trade - Ohmic heating – applications – Mechanism – Effects on food quality.

Module 5 (7 hours)

Oscillating magnetic fields, minimal processing and cold plasma

Oscillating magnetic fields for food processing – applications – Magnetic fields and microorganisms – Mechanisms of magnetic field inactivation - Hurdle technology- Non thermal methods of hurdles – Minimal processing of foods - Engineering effects- biological effects- applications.

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TEXT BOOKS

1. Gustavo V. Barbosa- Canovas, Usha R. Pothakamury, Enrique Palou & Barry G. Swanson. 1998. Nonthermal Preservation of Foods. Marcel Dekker Inc. New York.
2. Cullen, P.J., Tiwari, B.K. and Valdramidis V.P. 2012. Novel thermal and non thermal technologies for fluid foods. Academic press, 32 Jamestown Road, London NW1 7BY, UK.
3. Fellows, P. 2000. Food Processing Technology. CRC Press

REFERENCE BOOKS

1. Gustavo V. Barbosa-Cánovas, María S. Tapia and M. Pilar Cano, 2005. Novel Food Processing Technologies, CRC Press. ISBN: 0-8247-5333-X
2. Gustava C Barbosa-Canovas, Q Howard Zhang, 1999. Pulsed Electric Fields in Food Processing Lancaster Pa: Technomic Publishing Co. ISBN 1566767830.
3. Gould, G.W. 1995a. New Methods of Food Preservation. Blackie Academic and Professional, Glasgow, UK.
4. Lozano, J., Anon, M.C., Parada-Arias, E., and Barbosa-Canovas, G.V. 2000. Advances in Food Engineering. Technomic Publishing Co., Lancaster, PA.
5. Non-thermal Processing of Foods, Edited By O. P. Chauhan, ISBN 9781138035843, Published January 18, 2019 by CRC Press

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Course content and lecture schedule:

No:	Topic	No: of Lectures
1	**Pulsed electric field and high-pressure food processing**	**7**
1.1	Introduction to emerging non-thermal processing technologies	2
1.2.	Pulsed Electric field processing –Microbial inactivation – Effects on quality parameters – Shelf life of treated foods – Future trends	3
1.3.	High Pressure Food Processing - Applications – Microbiological safety – Impact on quality attributes	2
2	**Ultrasound and microwave processing**	**7**
2.1	Ultrasound processing of foods – Applications – Effect on quality parameters	3
2.2	Ultra violet and pulsed light processing – applications – Microbial inactivation mechanism – Effects on nutritional and quality parameters	2
	Microwave heating – general principles – Microwave processing of foods	2
3	**Ozone processing and dense phase CO_2 processing**	**7**
3.1	Ozone processing – applications – Factors affecting efficacy of ozone processing – Microbial inactivation mechanism – Effect on food quality	3
3.2	Dense phase carbon dioxide processing –applications – process control parameters - Microbial inactivation mechanism – Effect on food quality	2
3.3	Use of cold plasma in food processing	2
4	**Food radiation and ohmic heating**	**7**
4.1	Food irradiation- radiation sources- absorbed dose- advantages and limitations-	2
4.2	Chemical, nutritional and microbiological changes in irradiated foods- commercial applications – Irradiation and the International Food Trade	3
4.3	Ohmic heating – applications – Mechanism – Effects on food quality.	2
5	**Oscillating magnetic fields, minimal processing and cold plasma**	**7**

5.1	Oscillating magnetic fields for food processing – applications	2
5.2	Magnetic fields and microorganisms – Mechanisms of magnetic field inactivation	2
5.3	Hurdle technology- Non thermal methods of hurdles	1
5.4	Minimal processing of foods - Engineering effects- biological effects- applications	2

Course Code	Course Name	L-T-P - Credits	Year of Introduction
FTL 411	**FOOD PRESERVATION LAB**	**0-0-3 - 2**	**2021**

Preamble: Objective of this course is to develop the knowledge of students in the area of Food preservation. This course is designed to demonstrate the major preservation methods of foods and also shows the effects of processing and preservation methods on nutritional and sensory quality of food. Students will evaluate the shelf life of food using various preservation techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Work effectively in teams and practice documentation of experiments conducted
CO 2	Apply the principles of food processing to develop quality and safe value-added food products
CO 3	Summarize principles of food preservation to enhance the shelf life of processed products
CO 4	Explain the working of various food processing equipment and other devices in laboratory level
CO 5	Demonstrate the preservation of fruits using heat treatment

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3						2		3			
CO 2			2			3						
CO 3	3											
CO 4			2									
CO 5	3								3	3	3	

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Assessment	:	30 marks
Internal Test (Immediately before the second series test)	:	30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	: 15 Marks
(b) Implementing the work/Conducting the experiment	: 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting)	: 25 Marks
(d) Viva voce	: 20 marks
(e) Record	: 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Determination of time required for blanching of different vegetables
2. Perform sensory evaluation of food products by Ranking test
3. Perform sensory evaluation of food products by Hedonic Test

Course Outcome 2 (CO2)

1. Processing of fish balls, meat pickle, fish pickle
2. Preparation of different types of pickle
3. Processing and storage of saurkraut

Course Outcome 3(CO3):

1. Dehydration of vegetable / fruits using different dryers
2. Processing, packaging and storage of mayonnaise, margarine, peanut butter
3. Minimal processing of vegetables

Course Outcome 4 (CO4):

1. Perform drying of tomato using drying equipments
2. How to package fresh fruits and vegetables
3. Perform the tray drying of carrot

Course Outcome 5 (CO5):

1. Explain the time required for blanching of different vegetables
2. Explain the factors affecting blanching.
3. How drying affects the quality of fruits and vegetables

List of Exercises/Experiments: (Minimum 12 are mandatory)

1. To study the effect of temperature on the keeping quality of milk
2. To study the sensory and other quality parameters of the milk
3. Preparation, packaging and storage of various milk products- yoghurt, khoa, paneer,
4. Channa, curd, rasagola, gulab jamun, peda, milk powder
5. Determination of time required for blanching of different vegetables
6. Dehydration of vegetable / fruits using different dryers
7. Minimal processing of vegetables
8. Preparation, packaging and storage of Jam, Jelly, Marmalade, Squash, RTS, Fruit bar, candies
9. Preparation of tomato ketchup, sauce, puree, paste
10. Processing of fish balls, meat pickle, fish pickle
11. Preparation of different types of pickle
12. Processing and storage of saurkraut
13. Processing of wine, beer
14. Processing of tofu, tempeh, ske, souti, cider, feni
15. Vinegar processing
16. Preparation of new product and organizing an exhibition cum sale
17. Processing, packaging and storage of mayonnaise, margarine, peanut butter
18. Sensory evaluation of food products by Duo-trio test
19. Sensory evaluation of food products by Ranking test
20. Sensory evaluation of food products by Hedonic Test

Text Book:

1. Morris B. Jacobs , The chemical analysis of foods and food products, III Edition, CBS Publishers and distributors New Delhi.
2. ISI hand book of food analysis
3. Ranganna S , Hand book of analysis and quality control for fruit and vegetable products, II Ed., Tata McGraw Hill Publishing Co. New Delhi.
4. Official Method of analysis of AOAC
5. Rui M. S. Cruz, Igor Khmelinskii, Margarida Vieira, Methods in Food Analysis1st Edition, 2014 CRC Publishers

FTQ413	SEMINAR	CATEGORY	L	T	P	CREDIT
		PWS	0	0	3	2

Preamble: The course 'Seminar' is intended to enable a B.Tech graduate to read, understand, present and prepare report about an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his seminar guide. This course can help the learner to experience how a presentation can be made about a selected academic document and also empower her/him to prepare a technical report.

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Course Objectives:

- To do literature survey in a selected area ofstudy.
- To understand an academic document from the literate and to give a presentation about it.
- To prepare a technical report.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1	Identify academic documents from the literature which are related to her/his areas of interest (Cognitive knowledge level: **Apply**).
CO2	Read and apprehend an academic document from the literature which is related to her/ his areas of interest (Cognitive knowledge level: **Analyze**).
CO3	Prepare a presentation about an academic document (Cognitive knowledge level: **Create**).
CO4	Give a presentation about an academic document (Cognitive knowledge level: **Apply**).
CO5	Prepare a technical report (Cognitive knowledge level: **Create**).

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1		2	1					3
CO2	3	3	2	3		2	1					3
CO3	3	2			3			1		2		3
CO4	3				2			1		3		3
CO5	3	3	3	3	2	2		2		3		3

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

General Guidelines

- The Department shall form an Internal Evaluation Committee (IEC) for the seminar with academic coordinator for that program as the Chairperson/Chairman and seminar coordinator & seminar guide as members. During the seminar presentation of a student, all members of IEC shall be present.
- Formation of IEC and guide allotment shall be completed within a week after the University examination (or last working day) of the previous semester.
- Guide shall provide required input to their students regarding the selection of topic/ paper.
- Choosing a seminar topic: The topic for a UG seminar should be current and broad based rather than a very specific research work. It's advisable to choose a topic for the Seminar to be closely linked to the final year project area. Every member of the project team could choose or be assigned Seminar topics that covers various aspects linked to the Project area.
- A topic/paper relevant to the discipline shall be selected by the student during the semester break.
- Topic/Paper shall be finalized in the first week of the semester and shall be submitted to the IEC.
- The IEC shall approve the selected topic/paper by the second week of the semester.
- Accurate references from genuine peer reviewed published material to be given in the report and to be verified.

Evaluation pattern

Total marks: 100, only CIE, minimum required to pass 50

Seminar Guide: 20 marks (Background Knowledge – 10 (The guide shall give deserving marks for a candidate based on the candidate's background knowledge about the topic selected), Relevance of the paper/topic selected – 10).

Seminar Coordinator: 20 marks (Seminar Diary – 10 (Each student shall maintain a seminar diary and the guide shall monitor the progress of the seminar work on a weekly basis and shall approve the entries in the seminar diary during the weekly meeting with the student), Attendance – 10).

Presentation: 40 marks to be awarded by the IEC (Clarity of presentation – 10, Interactions – 10 (to be based on the candidate's ability to answer questions during the interactive session of her/his presentation), Overall participation – 10 (to be given based on her/his involvement during interactive sessions of presentations by other students), Quality of the slides – 10).

Report: 20 marks to be awarded by the IEC (check for technical content, overall quality, templates followed, adequacy of references etc.).

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FTD415	PROJECT PHASE I	CATEGORY	L	T		CREDIT
		PWS	0	0		2

Preamble:

The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

- To apply engineering knowledge in practical problemsolving.
- To foster innovation in design of products, processes orsystems.
- To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: **Apply**).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: **Apply**).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: **Apply**).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: **Apply**).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: **Analyze**).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: **Apply**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1
CO4					2			3	2	2	3	2

CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

PROJECT PHASE I

Phase 1 Target

- Literature study/survey of published literature on the assigned topic
- Formulation of objectives
- Formulation of hypothesis/ design/ methodology
- Formulation of work plan and task allocation.
- Block level design documentation
- Seeking project funds from various agencies
- Preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility study
- Preparation of Phase 1 report

Evaluation Guidelines & Rubrics

Total: 100 marks (Minimum required to pass: 50 marks).

- Project progress evaluation by guide: 30 Marks.
- Interim evaluation by the Evaluation Committee: 20 Marks.
- Final Evaluation by the Evaluation Committee: 30 Marks.
- Project Phase - I Report (By Evaluation Committee): 20 Marks.

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor).

Evaluation by the Guide

The guide/supervisor shall monitor the progress being carried out by the project groups on a regular basis. In case it is found that progress is unsatisfactory it shall be reported to the Department Evaluation Committee for necessary action. The presence of each student in the group and their involvement in all stages of execution of the project shall be ensured by the guide. Project evaluation by the guide: 30 Marks. This mark shall be awarded to the students in his/her group by considering the following aspects:

Topic Selection: innovativeness, social relevance etc. (2)

Problem definition: Identification of the social, environmental and ethical issues of the project problem. (2)

Purpose and need of the project: Detailed and extensive explanation of the purpose and need of the project. (3)

Project Objectives: All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified. (2)

Project Scheduling & Distribution of Work among Team members: Detailed and extensive Scheduling with timelines provided for each phase of project. Work breakdown structure well defined. (3)

Literature survey: Outstanding investigation in all aspects. (4)

Student's Diary/ Daily Log: The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily/weekly activity diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily/weekly activity diary shall be signed after every day/week by the guide. (7)

Individual Contribution: The contribution of each student at various stages. (7)

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EVALUATION RUBRICS for PROJECT Phase I: Interim Evaluation						
No.	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
1-a	Topic identification, selection, formulation of objectives and/or literature survey. (Group assessment) [CO1]	10	The team has failed to come with a relevant topic in time. Needed full assistance to find a topic from the guide. They do not respond to suggestions from the evaluation committee and/or the guide. No literature review was conducted. The team tried to gather easy information without verifying the authenticity. No objectives formed yet.	The team has identified a topic. The originally selected topic lacks substance and needs to be revised. There were suggestions given to improve the relevance and quality of the project topic. Only a few relevant references were consulted/ studied and there is no clear evidence to show the team's understanding on the same. Some objectives identified, but not clear enough.	Good evidence of the group thinking and brainstorming on what they are going to build. The results of the brainstorming are documented and the selection of topic is relevant. The review of related references was good, but there is scope of improvement. Objectives formed with good clarity, however some objectives are not realistic enough.	The group has brainstormed in an excellent manner on what they were going to build. The topic selected is highly relevant, real world problem and is potentially innovative. The group shows extreme interest in the topic and has conducted extensive literature survey in connection with the topic. The team has come up with clear objectives which are feasible.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-b	Project Planning, Scheduling and Resource/ Tasks Identification and allocation. (Group assessment) [CO4]	10	No evidence of planning or scheduling of the project. The students did not plan what they were going to build or plan on what materials / resources to use in the project. The students do not have any idea on the budget required. The team has not yet decided on who does what. No project journal kept.	Some evidence of a primary plan. There were some ideas on the materials /resources required, but not really thought out. The students have some idea on the finances required, but they have not formalized a budget plan. Schedules were not prepared. The project journal has no details. Some evidence on task allocation among the team members.	Good evidence of planning done. Materials were listed and thought out, but the plan wasn't quite complete. Schedules were prepared, but not detailed, and needs improvement. Project journal is presented but it is not complete in all respect / detailed. There is better task allocation and individual members understand about their tasks. There is room for improvement.	Excellent evidence of enterprising and extensive project planning. Gantt charts were used to depict detailed project scheduling. A project management/version control tool is used to track the project, which shows familiarity with modern tools. All materials / resources were identified and listed and anticipation of procuring time is done. Detailed budgeting is done. All tasks were identified and incorporated in the schedule. A well-kept project journal shows evidence for all the above, in addition to the interaction with the project guide. Each member knows well about their individual tasks.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
Phase 1 Interim Evaluation Total Marks: 20						

EVALUATION RUBRICS for PROJECT Phase I: Final Evaluation

Sl. No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
1-c	Formulation of Design and/or Methodology and Progress. (Group assessment) [CO1]	5	None of the team members show any evidence of knowledge about the design and the methodology adopted till now/ to be adopted in the later stages. The team has not progressed from the previous stage of evaluation.	The students have some knowledge on the design procedure to be adopted, and the methodologies. However, the team has not made much progress in the design, and yet to catch up with the project plan.	The students are comfortable with design methods adopted, and they have made some progress as per the plan. The methodologies are understood to a large extent.	Shows clear evidence of having a well-defined design methodology and adherence to it. Excellent knowledge in design procedure and its adaptation. Adherence to project plan is commendable.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
1-d	Individual and Teamwork Leadership (Individual assessment) [CO3]	10	The student does not show any interest in the project activities, and is a passive member.	The student show some interest and participates in some of the activities. However, the activities are mostly easy and superficial in nature.	The student shows very good interest in project, and takes up tasks and attempts to complete them. Shows excellent responsibility and team skills. Supports the other members well.	The student takes a leadership position and supports the other team members and leads the project. Shows clear evidence of leadership.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-e	Preliminary Analysis/ Modeling / Simulation/ Experiment / Design/ Feasibility study [CO1]	10	The team has not done any preliminary work with respect to the analysis/modeling/ simulation/experiment/design/feasibility study/ algorithm development.	The team has started doing some preliminary work with respect to the project. The students however are not prepared enough for the work and they need to improve a lot.	There is some evidence to show that the team has done good amount of preliminary investigation and design/ analysis/ modeling etc. They can improve further.	Strong evidence for excellent progress in the project. The team has completed the required preliminary work already and are poised to finish the phase I in an excellent manner. They have shown results to prove their progress.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)

1-f	Documentatio n and presentation. (Individual & group assessment). [CO6]	5	The team did not document the work at all. The project journal/diary is not presented. The presentation was shallow in content and dull in appearance. The individual student has no idea on the presentation of his/her part.	Some documentation is done, but not extensive. Interaction with the guide is minimal. Presentation include some points of interest, but overall quality needs to be improved. Individual performance to be improved.	Most of the project details were documented well enough. There is scope for improvement. The presentation is satisfactory. Individual performance is good.	The project stages are extensively documented in the report. Professional documentation tools like LaTeX were used to document the progress of the project along with the project journal. The documentation structure is well-planned and can easily grow into the project report. The presentation is done professionally and with great clarity. The individual's performance is excellent.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
Total		**30**	**Phase - I Final Evaluation Marks: 30**			

EVALUATION RUBRICS for PROJECT Phase I: Report Evaluation						
Sl. No.	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
1-g	Report [CO6]	20	The prepared report is shallow and not as per standard format. It does not follow proper organization. Contains mostly Unacknowledged content. Lack of effort in preparation is evident.	Project report follows the standard format to some extent. However, its organization is not very good. Language needs to be improved. All references are not cited properly in the report.	Project report shows evidence of systematic documentation. Report is following the standard format and there are only a few issues. Organization of the report is good. Most of references are cited properly.	The report is exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and equations are properly numbered, and listed and clearly shown. Language is excellent and follows standard styles.
			(0 - 7 Marks)	(8 - 12 Marks)	(13 - 19 Marks)	(20 Marks)
Phase - I Project Report Marks: 20						

SEMESTER VII

MINOR

FTD481	MINI PROJECT	CATEGORY	L	T	P	CREDIT
		PWS	0	0	3	4

Preamble:

Mini Project Phase I: A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The object of Project Work I is to enable the student to take up investigative study in the broad field of Food Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on a group of three/four students, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Block level design documentation
- Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the Department;

CO1	Identify and synthesize problems and propose solutions to them.
CO2	Prepare work plan and liaison with the team in completing as per schedule.
CO3	Validate the above solutions by theoretical calculations and through experimental
CO4	Write technical reports and develop proper communication skills.
CO5	Present the data and defend ideas.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3					3	3		2
CO2	3			3				3	3	3	3	
CO3	3	3	3	3	3					3		
CO4					3			3	3	3		1
CO5	3	3	3	3				3		3	3	1

*1-slight/low mapping, 2- moderate/medium mapping, 3-substantial/high mapping

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the mini project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systms under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution. The review committee should assess the extent to which the implementation reflects the proposed design. A well coded, assembled and completely functional product is the expected output at this stage. The final CIE mark is the average of 1st and 2nd review marks.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for innovative ideas. Zeroth review will not be a part of the CIE evaluation process.

Marks Distribution

Total Marks	CIE	ESE
150	75	75

Continuous Internal Evaluation Pattern:
Attendance : 10 marks
Marks awarded by Guide : 15 marks
Project Report : 10 marks
Evaluation by the Committee : 40 Marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks.
(a) Demonstration : 50 Marks
(b) Project report : 10 Marks
(d) Viva voce : 15marks

Course Plan

In this course, each group consisting of three/four members is expected to design and develop a moderately complex software/hardware system with practical applications. This should be a working model. The basic concept of product design may be taken into consideration.

Students should identify a topic of interest in consultation with Faculty-in-charge of miniproject/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews**.**

The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight.

SEMESTER VII

HONOURS

CODE FTT 495	RESEARCH METHODOLOGY AND STATISTICS	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble:

This course will enable students to carry out their project work with a research bias. It will also help them to formulate a research problem, and develop skill in the critical analysis of research papers. Statistical analysis of the data and how to write a research paper based on research findings are other objectives of this course.

Prerequisite:

Probability, Statistics and Numerical Methods FTT 202

Course Outcomes: After the completion of the course the students will be able to

CO 1	Pursue their project work with a research bias.
CO 2	Formulate a viable research problem.
CO 3	Develop skill in the critical analysis of research articles and reports.
CO 4	Gain thorough knowledge on statistical analysis of research data, and ethics in research.
CO 5	Write a technical paper based on research findings.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3		3								
CO 2	3	3		3								
CO 3	3	3	1	3								
CO 4	3	3	1	3								
CO 5	3	3	1	3								

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	10	10	10
Apply	10	10	40
Analyse	10	10	20
Evaluate	10	10	20
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Elaborate the research method.
2. Briefly discuss various types of research work.

Course Outcome 2 (CO2)

1. Discuss the importance of literature review in defining a problem
2. How do you identify research gaps from the review of available literature?

Course Outcome 3(CO3):

1. Discuss various methods of collection of data.
2. Discuss the importance of ANOVA in research design and analysis.

Course Outcome 4 (CO4):

1. Briefly discuss IPR and Patent Law.
2. What are the criteria for scholarly publication of research findings?

Course Outcome 5 (CO5):

1. Elaborate the process of report writing.
2. What are the characteristics of good presentation – oral and writing?

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER BTECH DEGREE EXAMINATION

Course Code: FTT 495

Course name: Research Methodology and Statistics

Max marks: 100 **Time: 3 hrs**

Part A

Answer all questions each question carries 3 marks (Marks = 10x 3 = 30 marks)

1. Enlist the basic concepts of research. (3)
2. With a suitable example, explain the scientific method. (3)
3. Elaborate the importance of literature review in defining a research problem. (3)
4. What are the difference between review articles and monographs? (3)
5. Briefly discuss the methods of data collection. (3)
6. What is sampling error? (3)
7. What are the ethical issues in research? (3)
8. What do you understand by plagiarism? Name two online tools for plagiarism check. (3)
9. Elaborate the process of report writing. (3)
10. What are the characteristics of good oral presentation before a scholars' committee? (3)

PART B

Answer all questions each question carries 14 marks (Marks = 14x 5 = 70 marks)

11. What are the different types of research? Substantiate your answer with a suitable example for each. (14)

OR

12. Elaborate the importance of research methodology in food science and technology. How does the research methodology help in the design and development of new food products? (14)

13. Discuss the importance of web as a source for literature review. (14)

OR

14. How do you design a research problem? What are primary and secondary sources of literature? (14)

15. What are the different types of probability and non-probability sampling? (14)

OR

16. What is data analysis? Explain the procedure for hypothesis testing? (14)

17. What are Intellectual Property Rights? Discuss ownership of patents and transferability. (14)

OR

18. Enumerate the Principles laid down by ICMR that is to be followed when using human beings for research. Give the details pertaining to Principles of Informed Consent and the Principles of Competence. (14)

19. What do you understand by the term 'Peer Review?' Discuss the 'simple blind' and 'double blind' methods. (14)

OR

20. What is citation analysis? Discuss the importance and usefulness of citation analysis as a tool for research evaluation. (14)

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SYLLABUS

Module I (9 hours)

Introduction to Research Methodology

Basic concepts of research – The Research Method, Objectives of research, Types of research – Descriptive Vs Analytical, Applied Vs Fundamental, Quantitative Vs Qualitative, Conceptual Vs Empirical. Criteria of good research.

Module II (9 hours)

Research Formulation and Design

Design and formulation of the research problem, Selection of the problem, Importance of literature review in defining a problem. Literature review – primary and secondary sources, Reviews, Monographs, Patent Literature, Databases, Searching the Web, Web as a source. Identification of research gap areas from literature.

Module III (9 hours)

Data Collection and Analysis

Observation and collection of data, Methods of data collection, Sampling methods – probability and non-probability, Standard Deviation, ANOVA, Students t- test, Tests for Hypothesis. Statistical software SPSS, Sigma STAT, GRETL.

Module IV (9 hours)

Research Ethics, IPR and Scholarly Publishing

Ethical issues in research, Ethical Committees (human, animal, plant), Principles laid down by ICMR for using human beings for research. Principles of informed consent and competence. IPR and patent law – Ownership and transferability of patents. Commercialization, Trademarks, Copyrights, Royalty, TRIPS. Scholarly Publishing – IMRAD Concept and design of technical research paper, Citation, Acknowledgement and Conflict of Research Interest, Plagiarism, Reproducibility and Accountability.

Module V (9 hours)

Interpretation and Report Writing

Peer review – Simple blind and double blind methods, Meaning and technique of interpretation, Process of Report writing, Layout and types, Art and science of Oral presentations, Characteristics of good presentation – Power point tool, Creating and Customizing Presentation. Citation analysis – importance in research evaluation.

Text Books

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.

2. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

Reference Books

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
3. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 - Introduction to Research Methodology**	**9**
1.1	Basic concepts of research	2
1.2	The Research Method, Objectives of research	2
1.3	Descriptive Vs Analytical, Applied Vs Fundamental Research	2
1.4	Quantitative Vs Qualitative, Conceptual Vs Empirical Research	2
1.5	Criteria of good research	1
2	**Module 2 - Research Formulation and Design**	**9**
2.1	Design and formulation of the research problem	2
2.2	How to select a research problem	1
2.3	Importance of literature review in defining a problem	2
2.4	Literature review – primary and secondary sources	1
2.5	Reviews, Monographs, Patent Literature and Databases	1
2.6	Web as a source for literature review	1
2.7	Identification of research gap areas from literature	1
3	**Module 3 - Data Collection and Analysis**	**9**
3.1	Observation and collection of data	1
3.2	Methods of data collection	2
3.3	Sampling methods, Standard Deviation	2
3.4	ANOVA, Students t- test, Tests for Hypothesis	2

3.5	Statistical software SPSS, Sigma STAT, GRETL.	2
4	**Module 4 - Research Ethics, IPR and Scholarly Publishing**	**9**
4.1	Ethical issues in research, Ethical Committees (human, animal, plant)	2
4.2	IPR and patent law - Commercialization, Trademarks, Copyrights, Royalty, TRIPS	3
4.3	Scholarly Publishing – IMRAD Concept and design of technical research paper	2
4.3	Citation, Acknowledgement and Conflict of Research Interest, Plagiarism, Reproducibility and Accountability	2
5	**Module 5 - Interpretation and Report Writing**	**9**
5.1	Citation analysis, Meaning and technique of interpretation, Process of Report writing, Layout and types	3
5.2	Art and science of oral presentations	3
5.3	Characteristics of good presentation – Power point tool, Creating and Customizing Presentation	3

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

FTT497	FOOD BUSINESS LAWS AND LEGISLATION	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: This course is designed to introduce the basic food standards, laws and legislative bodies**.** This course gives understanding of the safety regulations and food acts for food standardization.

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Recognize the concept of food safety and standards and rules established to enforce safety and purity of food products
CO 2	Summarize different types of food hazards and contaminations and know about food safety aspects of novel methods of food processing
CO 3	To gain knowledge of the food safety aspects of novel methods of food processing
CO 4	Distinguish various food safety regulations, risk assessment and voluntary quality standards and certification
CO 5	Relate different types of food acts and food standardization

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3					3						
CO 2	3					3						
CO 3	3					3		2				
CO 4	3	2				3						
CO 5	3					3						

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	60
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the function of FPO?
2. What are the responsibilities of Various Authorities under PFA?
3. Explain the Important features and Definitions of IMS act
4. Give details of laws related to permitted additives like colours

Course Outcome 2 (CO2)

1. Enumerate the sources of microbial contamination
2. Elaborate on Pesticide residues in food
3. Classify food hazards with examples

Course Outcome 3(CO3):

1. Explain the principle of HPP with its application in food processing
2. What are the advantages of food irradiation?
3. Elaborate on food safety aspects of PEF

Course Outcome 4 (CO4):

1. Write a note on CODEX Alimentarius commission and its functions
2. Explain the important features of GMP
3. What are the different elements of effective risk communication ?

Course Outcome 5 (CO5):

1. Outline the benefits and principles of BRC/IOP packaging standard
2. What are the steps involved in ISO 14000 certification process?
3. Differentiate between SQF 1000 and SQF 2000

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2014

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: ________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT 497
FOOD BUSINES LAWS AND REGULATIONS

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Demonstrate the different strategies of food safety
2. Describe the important features and definitions of IMS act
3. Consider one food industry of your choice and analyse different types of hazards with examples
4. What are pesticide residues and why do they turn up in your food?
5. What do you mean by JECFA?
6. Explain the role of FSSAI
7. Give a detailed description on functions of OIE
8. What are the similarities between SPS and TBT agreements?
9. Write about GAHP with special emphasis on benefits.
10. Enumerate the salient features of ISO 17025

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Give an account of Prevention of Food Adulteration Act 1954 and its important features (OR)

12. Elaborate on important features of 'The vegetable oil products (Regulation) order' 1998 and laws pertaining to vegetable oils

13. Explain in detail on the hazards in foods

(OR)

14. Discuss the construction details of Pulsed Electric Field with its advantages and disadvantages

15. Elaborate on Essential Commodities Act, 1955 with special emphasis on important features and various sections

(OR)

16. Give a detailed description on WHO/FAO expert bodies and their functions

17. Describe the important features of ‘Export Act 1963’

(OR)

18. Explain WTO agreements

19. Consider one food industry of your choice and elaborate on application of HACCP principles through the analysis of a case study

(OR)

20. Elaborate on management and technical requirements specific to food testing laboratories in terms of physical and chemical parameters

Syllabus

Module 1 (9 hours)

Introduction: Introduction, concept of food safety and standards, food safety strategies. Prevention of Food Adulteration Act 1954 & 1955, rules established in India to enforce safety and purity of food products; Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment; Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants etc.

Module 2(9 hours)

Food hazards and contaminations: Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical factors. Food safety aspects of novel methods of food processing such as PEF, high pressure processing, thermal and non thermal processing, irradiation of foods

Module 3 (9 hours)

Food Safety Regulation: Indian and Food Regulatory Regime (Existing and new), PFA Act and Rules, Food Safety and Standards Act, 2006, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.

Module 4(9 hours)

Food Acts: Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Customs Act and Import Control Regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK.

Module 5 (9 hours)

Risk Assessment and Food Standardization: Risk assessment studies: Risk management, risk characterization and communication. Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices. An Overview and structure of 9001:2000/2008, ISO 9001:2000, ISO 22000:2005, ISO 9000, ISO 22000, ISO 14000, ISO 17025, FSSC 22000, BRC, BRC IOP, IFS, SQF 1000, SQF 2000.

Text Books

1. Jacob MB (1999). The chemical analysis of foods and food products. CBS Publ. New Delhi

2. Pomeranze Y (2004). Food analysis - Theory and Practice CBS Publications, New Delhi.

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3. Rees, Naomi and David Watson ―International Standards for Food Safety, Aspen Publication, 2000.

4. Shapton DA (1994). Principles and practices of safe processing of foods. Butterworth Publication, London.

5. Winton AL (1999) Techniques of food analysis, Allied Science Publications New Delhi.

Reference Books

1. Mehta, Rajesh and J. George ―Food Safety Regulations, Concerns and Trade : The Developing Country Perspective^, Macmillan, 2005.

2. Schmidt, Ronald H. and Rodrick, G.E. ―Food Safety Handbooks, Wiley Interscience, UK, 2005.

3. Singal RS (1997). Handbook of indices of food quality and authenticity. Woodhead Publ. Cambridge, UK.

4. The Prevention of Food Adulteration Act, 1954D, Commercial Law Publishers India) Pvt. Ltd.

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Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**9**
1.1	Introduction, concept of food safety and standards, food safety strategies.	2
1.2	Prevention of Food Adulteration Act 1954 & 1955, rules established in India to enforce safety and purity of food products	2
1.3	Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment	2
1.4	Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants etc.	3
2	**Food hazards and contaminations**	**9**
2.1	Food hazards and contaminations - biological	2
2.2	Food hazards and contaminations - chemical	2
2.3	Food hazards and contaminations - physical	2
2.4	Food safety aspects of novel methods of food processing	2
2.5	Irradiation of foods	1
3	**Food Safety Regulation**	**9**
3.1	Indian and Food Regulatory Regime (Existing and new), Global Scenario	2
3.2	PFA Act and Rules	2
3.3	Food Safety and Standards Act, 2006	1
3.4	Essential Commodities Act, 1955, Codex Alimentarius	2
3.5	WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.	2
4	**Food Acts**	**9**
4.1	Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc).	2
4.2	WTO: Introduction to WTO Agreements: SPS and TBT Agreement	3
4.3	Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Customs Act and Import Control Regulations	2
4.4	Other Voluntary National Food Standards: BIS, AGMARK.	2
5	**Risk Assessment and Food Standardization**	**9**
5.1	Risk assessment studies: Risk management, risk characterization and communication.	2
5.2	Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices	1
5.3	An Overview and structure of 9001:2000/2008, ISO 9001:2000, ISO 22000:2005, ISO 9000, ISO 22000	2
5.5	ISO 14000, ISO 17025, FSSC 22000, BRC, BRC IOP	2
5.6	IFS, SQF 1000, SQF 2000	2

FTT 499	AGRO INDUSTRIAL PROJECT PLANNING AND MANAGEMENT	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: The objective of the course is to provide insight to students and encouragement to become entrepreneur infood processing sector

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Acquire knowledge regarding management concepts
CO 2	Knowledge on financial and marketing management techniques
CO 3	Understand about the market strategy, selection of market for product launching, consumer testing by market survey.
CO 4	Knowledge on patent and its significance

Mapping of course outcomes with program outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2					2	2	2				
CO 2	2											
CO 3	2	2	2	2			2	2		2	2	2
CO 4	3	2					2	2	2	2	2	

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Define batch production?
2. What are the factors to be considered before launching a new product?

Course Outcome 2 (CO2) :

1. Give a brief on break even analysis?
2. What do you mean by financial ratio analysis?

Course Outcome 3(CO3):

1. How will you conduct consumer survey for new product development?.
2. What are the factors affecting purchasing behaviour pattern of consumers?

Course Outcome 4 (CO4):

1. Define Patent?
2. Mention the significance of patent in food product development?

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MONTH & YEAR

Course Code: FTT 499

Agro industrial Project Planning and Management

Max. Marks: 100 **Duration: 3hours**

PART A

(Answer all questions; each question carries 3 marks)

1 Differentiate batch and continuous production in food industry?
2. Define inventory control? Give an account of inventory control technique?
3. Explain the financial ratio analysis?
4. Mention the factors affecting new product development in food industry?
5. Give an account of factors affecting consumer buying behaviour??
6. Explain the Sanitary and phytosanitary agreement?
7. Explain the role of WTO in establishing rules for international trade?
8. Explain the role of GATT in promoting international trade?
9. Define Patent?

10. Mention the significance of patent in food product development

PART-B

Answer any 5 questions, each question carries 14 marks

11. Discuss ABC analysis with respect to inventory management?

(OR)

12. Discuss in detail the process planning concept in food processing.

13. Explain PDCA cycle and its significance in food business management?.

(OR)

14. Explain assessing, acquiring and allocating funds in a food industry? Give an account of various government schemes available for food industry

15. Describe the application of breakeven analysis in food industry.

(OR)

16. Describe the factors affecting consumer buying behaviour with respect to food products?

17. What do you know about decision making processes and tools?

(OR)

18. Explain in detail about break even analysis

19. Describe the importance and Intellectual property rights

(OR)

20. Explain the process of patent application for food processing industry?

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SYLLABUS

MODULE 1 (9 hours)

Production and Inventory Management

Introduction to Food and agri business Management- nature of processing industry, production, planning – Batch and continuous production, process planning, definition and concepts, inventory control- classification, economic ordering, inventory models, ABC Analysis

MODULE 2 (9 hours)

Financial Management

Assessing, acquiring and allocating funds, cash flow statement- balance sheet, financial ratio, break even analysis, concept, application in food industry – project appraisal

MODULE 3 (9 hours)

Market Management

Concepts- consumer market, business market, marketing environment- market segmentation- market measurement and forecasting- advertisement- publicity market information system- market research-management of distribution channel, Consumer buying behaviour, factors influencing consumer buying behaviour. Export trade- Government regulations, GAIT, WTO regulation

MODULE 4 (9 hours)

Intellectual Property Rights and Patent

Kind of patents- Indian patent law, meanings scope objectives- Kind of patent applications- Procedure for obtaining patent – Patent applications- Drafting, claims, patent oppositions, enforcement and revocation – Fee structure – Source of patent information – Patent databases, IP- Licencing and Technology transfer

MODULE 5- Business Plan Reports (9 hours)

Preparation of project report; Market feasibility reports; Break even Analysis Techno- economic feasibility report on an identified opportunity-any food processing; bakery and confectionary , fruit and vegetable processing, oil and fat ,milk and milk products etc

Text Books

1.Patnkar, S.V. Financial Management. Everest Publishing House Everest, Pashuram Apartment, 12, Sankalp Society, Paud Phata Road, Opp. Jog Hospital, Pune- 411 038.

2. Jain, S.C. Management in Agriculture Finance. Vora and Company. Publishers Pvt. Ltd., 3 Round Building, Kalbadevi, Mumbai – 400 002.

3. Prasana Chandra. Financial Management. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

4. Kahlon, A. S. and Karam Singh. Managing Agricultural Finance - Theory and Practice. Allied Publisher Pvt. Lt., 165, J. N. Heredia Marg, Ballard Estate, Mumbai – 400 038.

Reference Books:

1. Philip Kotler, 1985, Marketing management, Prentice Hall of India
2. Brigham, Eugene F, 1989, Fundamentals of Financial Mangement, The Dryden Press
3. Sherilaker, 1985, Marketing Mangement, Himalaya Publishing Company
4. Mehta P. L, Management Economics- Analysis, problems and cases, Sultan Chand and Sons, New Delhi
5. K.P. Sudheer and V.Indira.2018. Entrepreneurship and skill development in Horticultural Processing. New India Publishing Agency, New Delhi

Course Contents and Lecture Schedule:

No	Topic	No. of Lectures
1	**Production and Inventory Management**	**9**
1.1	Introduction to Food Industry Management- nature of processing industry	2
1.2	Batch and continuous production	2
1.3	process planning, definition and concepts, inventory control	2
1.4	economic ordering, inventory models	1
1.5	ABC Analysis	2
2	**Financial Management**	**9**
2.1	Assessing, acquiring and allocating funds,	2
2.2	cash flow statement- balance sheet,	2
2.3	break even analysis – concept and significance	2
2.4	project appraisal	3
3	**Market Management**	**9**
3.1	Concepts- consumer market, business market,.	2
3.2	Marketing environment- market segmentation	2
3.3	Market measurement and forecasting- advertisement- publicity market information system	2
3.4	Consumer buying behaviour, factors influencing consumer buying behaviour	3
3.5	Export trade- Government regulations, GAIT, WTO regulation	
4	**Intellectual Property Rights and Patent**	**9**
4.1	Kind of patents- Indian patent law, meanings scope objectives	2
4.2	Kind of patent applications- Procedure for obtaining patent	2
4.3	Patent applications- Drafting, claims, patent oppositions, enforcement and revocation	2
4.4	Source of patent information – Patent databases	1
4.5	IP- Licencing and Technology transfer	2
5	**Business Plan Reports**	**9**
5.1	Preparation of project report	2
5.2	Market feasibility reports	2
5.3	Break even Analysis	1
5.4	Techno- economic feasibility report on an identified opportunity	2
5.5	Preparation of project report	2

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SEMESTER VIII

FOOD TECHNOLOGY

KTU Estd. 2014

FTT 402	FOOD PLANT LAYOUT AND DESIGN	CATEGORY	L	T	P	CREDIT
		PCC	2	1	0	3

Preamble:

At the end of this course, it will be possible to familiarize basic concepts of plant layout and design with special reference to food process industries and also able to select a location for the food industry and develop a plant layout using the systematic layout planning procedure.

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Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply the design considerations and food safety standards in development of plant design and layout for food processing industry.
CO 2	Choose the plant location and plant layout for the new or existing food industry.
CO 3	Apply the systematic layout planning in development of plant layout.
CO 4	Prepare flow sheet for the material movement and utility consumption in food industry.
CO 5	Design and develop plant layout and plant design for food processing industries.

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2				2						
CO 2	2	2	2									
CO 3	3	2	2		2					2	2	
CO 4	3	2										
CO 5	2	3	3								2	

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	10	10	20
Apply	20	20	40
Analyse	5	5	10
Evaluate	5	5	10

Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Do food safety standards have significance on the design on plant layout? If so substantiate with suitable example.
2. Is there any special design considerations involved food plant design? How it differs from other processing industries? Explain the various factors.

Course Outcome 2 (CO2)

1. An US based firm has randomly selected five location sites for starting a food processing plant in India. How will they find out the best one among the five sites? Illustrate with suitable technique by assuming the data.
2. Explain the various the factors affect the selection of plant location.

Course Outcome 3(CO3):

1. Identify the various activity areas involved in the bread manufacturing plant and develop the activity relationship diagram for the same.
2. Details the systematic layout planning procedure with example.
3. Develop a plant layout for a food industry using any constructions software package.

Course Outcome 4 (CO4):

1. A design engineer is involved in the development of plant layout for the beer manufacturing plant. Identify the various unit operations and machineries involved in it and create a flow sheet for the same.
2. Develop a flow sheet for the various utilities necessary for the functioning of the milk processing plant.

Course Outcome 5 (CO5):

1. Develop a plant layout of Curd processing plant and explain the unit operations involved in each section and equipment used.
2. Prepare the plant layout of palm oil processing plant and poultry processing plant with neat sketch.

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MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT402
FOOD PLANT LAYOUT AND DESIGN

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Define and differentiate plant design and plant layout with example
2. Explain the importance of ISO, HACCP, and other food product order in plant design
3. Mention the need for selecting a suitable plant location
4. Write down the controllable and uncontrollable factors in plant location selection
5. Explain the types of ventilation and their significance in plant layouts
6. Classify the computer program packages used in layout planning with example.
7. Draw the material flow diagram of the orange juice processing plant.
8. Mention the objectives of the plant layout.
9. List out the situations, when we need a plant design.
10. Draw the activity relationship diagram for the onion drying plant.

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Write down the steps involved in the plant design with a neat flow chart and explain the each step in detail. (14)

[OR]

12. a) Explain the design considerations factors involved in the food plant design. (10)
    b) Detail the feasibility study involved in the plant design. (4)
13. Explain in detail about the various factors to be considered in selecting a plant location. (14)

[OR]

14. List out the various techniques to select a plant location and explain them in detail.
    . (14)
15. Develop a plant layout for any food processing plant using systematic layout planning (SLP). (14)

[OR]

16. Write in detail about the ALDEP program to develop a layout planning.

(14)

17. a) Write about the various flooring used in the food industry with suitable examples.

(10)

b) Comment on the building type used in the construction of food industries.

(4)

[OR]

18. a) Detail the safety arrangements needed in the food industry.

(7)

b) Draw a general food plant layout by considering the various design aspects.

(7)

19. Draw a plant layout for bread manufacturing plant and explain unit operations involved in each section and equipment used.

(14)

[OR]

20. Draw a plant layout for Milk processing plant and explain unit operations involved in each section and equipment used.

(14)

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Syllabus

Module 1 (7 hours)

Introduction: Basic concepts of plant layout and design with special reference to food process industries, manufacturing processes-concept –types, Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design

Module 2 (7 hours)

Plant location and plant layout: Plant location, location theory and models, Plant location factors-plant site selection, Economic plant size-plant layout objectives-classical and practical layout, Characteristics of an efficient layout

Module 3 (7 hours)

Plant layout procedure: Preparation of flow sheets for material movement and utility consumption in food plants, SLP and its application in development of plant layout, computerised layout planning-types-application in development of plant layout

Module 4 (7 hours)

Food plant layout considerations: Building planning, flooring and types, Basic understanding of equipment layout and ventilation in food process plants, miscellaneous aspects of plant layout and design like provision for packaging and labelling, waste disposal, safety arrangements etc, Development of general food plant layout and design.

Module 5 (7 hours)

Development of food plant layout: Plant layout and design of Baking oven and frying plant, fruits and vegetables processing industries including beverages, milk and milk products, fat and oil processing, meat and poultry processing

Text Books

1. James M Moore, "Plant Layout and Design", Mcmillan & Co.,

Reference Books

1. J M Apple, " Plant layout and Material Handling", John Willey & Sons,
2. Slade, F.H, "Food processing plant". Leonardhill Books, London1967
3. Hall,H.S and Y.Rosen, "Milk plant layout" (F.A.O. Publication) 1976

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to plant layout and design**	**7**
1.1	Basic concepts of plant layout and design with special reference to food process industries	3
1.2	Manufacturing processes-concept -types	1
1.3	Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design	3
2	**Plant location and plant layout**	**7**
2.1	Plant location, location theory and models, Plant location factors-plant site selection	4
2.2	Economic plant size-plant layout objectives-classical and practical layout, Characteristics of an efficient layout	3
3	**Plant layout procedure**	**7**
3.1	Preparation of flow sheets for material movement and utility consumption in food plants	2
3.2	SLP and its application in development of plant layout	2
3.3	computerised layout planning-types-application in development of plant layout	3
4	**Food plant layout considerations**	**7**
4.1	Building planning, flooring and types, Basic understanding of equipment layout and ventilation in food process plants	3
4.2	miscellaneous aspects of plant layout and design like provision for packaging and labelling, waste disposal, safety arrangements etc,	2
4.3	Development of general food plant layout and design.	2
5	**Development of food plant layout**	**7**
5.1	Plant layout and design of Baking oven and frying plant, fruits and vegetables processing industries including beverages	4
5.2	milk and milk products, fat and oil processing, meat and poultry processing	3

CODE FTT414	COURSE NAME FAT AND OIL PROCESSING TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

This course will help the students to understand the physical and chemical properties of fats and oils. This course will also deal with various methods of processing, production, and packaging of various types of fats and oils and also gives an insight in to the quality standards to be followed.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the importance of fats and oils.
CO2	Describe the various process of manufacturing oils and fats
CO3	Evaluate the quality attributes and safety aspects of oils and fats.
CO4	Select suitable packaging materials
CO5	Familiarise with the industrial applications of fats and oils.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2			2						2		
CO2	2		2					2				
CO3	2			2	1		1					
CO4	2				1			1				
CO5	1				1					2		

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/ Quiz/ Course project : 15 marks

End Semester Examination Pattern: There will be two parts: Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub division and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1)

1.What are the physical and chemical properties of fats and oils?

2. Explain the chemical reactions of oil.

3. What are sources of vegetable oils.

Course Outcome 2 (CO2)

1.Explain the process of hydrogenation of oils.

2. Describe the production process of rice bran oil.

3.What is Zenith process.

Course Outcome 3 (CO3)

1.What are the quality parameters of oil?

2. What are the characterisation of oil refining?

3.Explain the innovative applications of fats and oils.

Course Outcome 4 (CO4)

1.What are the desirable properties of packaging materials for edible oils.

2.Ennumerate the different types of packaging materials in fats and oils.

3. How do you select packaging material for vanaspati and ghee. Explain.

Course Outcome 5 (CO5)

1.Enumerate the various industrial applications of fats and oils.

2.Discuss the criteria for selection of site for oil industry.

3.Describe the safety aspects to be followed in oil industry.

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Model Question Paper

QP CODE: **Pages:**

Reg No………………….

Name: ……………………….

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B. TECH DEGREE EXAMINATION
MONTH & YEAR

Course Code: FTT 414

Course Name: Fat and Oil Processing Technology

Max.Marks:100 **Duration:3 H ours**

Part A

Answer all ten full questions each carries 3 marks (3X10= 30 marks)

1. Enumerate the physical and chemical properties of fats and oils.
2. What are fatty acids? Explain.
3. Explain in brief extraction of oils by hydraulic press.
4. Explain the process of producing virgin coconut oil.
5. Explain the process of hydrogenation of fats.
6. Explain any one method of refining of edible oils.
7. What are speciality oils? Give some examples.
8. List the desirable properties of packaging materials for edible oils.
9. Discuss on the criteria for selection of site for oil extraction plant.
10. List out the industrial applications of edible oils.

Part B

Answer any five full questions each carries 14 marks (5 X 14 = 70 Marks)

11. Classify the sources of vegetable oil. Explain in detail the method of production of mustard and sesame oil.

OR

12. What are the different functions of oils in human body? Explain the method of producing rice bran oil.
13. Explain with a neat sketch the working of hydraulic press in oil extraction.

OR

14. Explain in detail the steps involved in solvent extraction process.
15. What is meant by refining of oils and what are its objectives? What is Zenith process?

OR

16. Explain in detail the manufacturing of vanaspati and margarine?
17. Explain in detail different types of speciality oils

OR

18. Define Rancidity? What are the causes for rancidity in oils and how it can be prevented?
19. Give and account of ISI and AGMARK standards.

OR

20. What is the importance of quality regulations in oil industry? What are the steps initiated in India to implement quality standards in oil industry?

Syllabus

Module 1: Physical and Chemical Properties (7 hours)

Fats and oils – formation – functions of oil in human body - fatty acids – double bonds and their position in oil – Geneva type classification - sources of vegetable oils – production status-oil content – coconut, palm, peanut, rice bran, sesame, mustard and sunflower seeds oil – physical and chemical properties of fats and oils - chemical reactions of oil – hydrolysis – hydrogenation, oxidation and polymerization.

Module 2: Extraction Methods (7 hours)

Oil extraction methods –mechanical expression – ghani, power ghani, rotary, hydraulic press, screw press, expellers, filter press - principle of operation and maintenance-solvent extraction process – steps involved, continuous solvent extraction process for rice bran, soy bean and sunflower-oil extraction process for groundnut and cotton seed-production of special oils – palm oil, virgin coconut oil – extraction process.

Module 3: Refining of Oils (7 hours)

Refining of oils – objectives – characterization - degumming – Zenith process – deacidification process – continuous acid refining-bleaching of oil –decolourising agents-deodorization and winterization processes- Hydrogenation of Fats – Vanaspati and Margarine – Ghee and butter

Module 4: Speciality oils and oil products (7 hours)

Conjugated Linoleic acid – Gamma linolenic acid – Oils from Microorganisms – Lecithin- Transgenic oils – Germ oils from different sources – Fish oil . Packaging of edible oils – requirements/ properties – types – tinplate, semi rigid, glass, Polyethylene Terephthalate, Poly Vinyl Chloride, flexible pouches – packaging for Vanaspati and ghee changes during storage of oil –rancidity – causes – atmospheric oxidation and enzyme action – free fatty acid – colour-non edible oils – castor oil, linseed oil, vegetable waxes – production and processing.

Module 5: Industrial Applications and Quality Standards (7 hours)

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Industrial applications of fats and oils – quality regulations - manufacture of soap, candle, paints and varnishes - ISI and AGMARK standards – site selection for oil extraction plant- safety aspects- HACCP standards in oil industries.

Text books

1. Harry Lawson, "Food oils and Fats - Technology, Utilization and Nutrition", CBS Publishers and Distributors, New Delhi, 1997.

2. Gunstone F.D., "Oils and Fats in Food Industry", Blackwell Publishing, United Kingdom,
ISBN – 13: 9781405181212, 2008.

Reference book

1. Gunstone F.D., "Vegetable Oils in Food Technology: Composition, Properties and Uses", 2nd Edition, Wiley - Blackwell Publishing Ltd., ISBN 9781444332681, 2011.

Course Contents and Lecture Schedule

No.	Topics	No. of Lectures
	Module 1	**7**
1.1	Fats and oils – formation – functions of oil in human body - fatty acids – double bonds and their position in oil.	3
1.2	Geneva type classification - sources of vegetable oils – production status-oil content – coconut, palm, peanut, rice bran, sesame, mustard and sunflower seeds oil.	2
1.3	Physical and chemical properties of fats and oils.	1
1.4	Chemical reactions of oil – hydrolysis – hydrogenation, oxidation and polymerization.	1
	Module 2	**7**
2.1	Oil extraction methods –mechanical expression – ghani, power ghani, rotary, hydraulic press, screw press, expellers, filter press.	2
2.2	Principle of operation and maintenance-solvent extraction process – steps involved, continuous solvent extraction process for rice bran, soy bean and sunflower-oil.	3

2.3	Oil extraction process for groundnut and cotton seed-production of special oils – palm oil, virgin coconut oil – extraction process.	2
	Module 3	**7**
3.1	Refining of oils – objectives – characterization - degumming	2
3.2	Zenith process – deacidification process – continuous acid refining-bleaching of oil –decolourising agents-deodorization and winterization processes.	2
3.3	Hydrogenation of Fats – Vanaspati and Margarine – Ghee and butter.	3
	Module 4	**7**
4.1	Conjugated Linoleic acid – Gamma linolenic acid – Oils from Microorganisms – Lecithin- Transgenic oils – Germ oils from different sources – Fish oil	3
4.2	Packaging of edible oils – requirements/ properties – types – tinplate, semi rigid, glass, Polyethylene Terephthalate, Poly Vinyl Chloride, flexible pouches – packaging for Vanaspati and ghee.	2
4.3	Changes during storage of oil –rancidity – causes – atmospheric oxidation and enzyme action – free fatty acid – colour-non edible oils – castor oil, linseed oil, vegetable waxes – production and processing.	2
	Module 5	**7**
5.1	Industrial applications of fats and oils – quality regulation.	2
	Manufacture of soap, candle, paints and varnishes - ISI and AGMARK standards.	2
5.2	Site selection for oil extraction plant.	1
	Safety aspects- HACCP standards in oil industries.	2

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FTT 424	FOOD STORAGE ENGINEERING	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The goal of this course is to provide students with a fundamental understanding of traditional and modern storage structures and to make students technically ready for the food industry through a practical, problem-solving approaches. The students would go through the understanding of traditional storage structures, importance of safe and scientific storage structures, factors affecting storage. They would acquire knowledge of modern-day storage structures such as silos, warehouses, cold storages etc. This course also would be covering the supporting structure such as dryers, freezers etc.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	To understand the requirements of safe and scientific storage of grains and the operations involved
CO2	To study the types and the methods for small scale safe storage of food grains
CO3	To study the large scale and modern safe storage of food grains
CO4	To study analyse and design refrigerated storage system
CO5	To understand the principle of operation of supporting equipment used in small- and large-scale food storage systems.

Mapping of the course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1							
CO2	2	1	2	2	2							
CO3	3	2	2	2	2							
CO4	3	2	2	2	2							
CO5	3	2	2	2	2							

Assessment Pattern:

Bloom's category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	10	10	30
Analyze	10	10	30
Evaluate			
Create			

Mark Distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course level assessment questions:

Course Outcome 1 (CO1):

1. What are basic requirements of safe and scientific food storage?
2. What are different pre and post storage operations?
3. Describe different Factors that influence drying.

Course Outcome 2 (CO2):

1. Discuss about improved storage structure.
2. Describe any two traditional storage structures?
3. Discuss Factors affecting storage.

Course Outcome 3 (CO3):

1. Describe the characteristics of bulk food storage materials
2. Discuss about Rankine's earth pressure coefficient
3. Applying Airy theory and calculate the maximum lateral pressure in silos

Course Outcome 4 (CO4):

1. What are the desirable properties of refrigerant?
2. Describe Plank’s Equation.
3. Calculate cooling load in a cold storage

Course Outcome 5 (CO5):

1. Discuss about any two driers assisting in food storage
2. Discuss about any two freezers assisting in food storage
3. Describe about belt conveyor, chain conveyor for food storage.

Model Question paper:

QP Code: **Reg No:**

Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR

Course code: FTT 424

FOOD STORAGE ENGINEERING

Max. Marks: 100 **Duration: 3 hours**

PART A

(3X10=30)

(Answer all questions)

1. Describe any direct method for moisture content determination
2. Discuss about any one pre-storage cleaning operation.
3. Outline the design of Morai type storage structure with a schematic diagram
4. Outline the design of Improved Bukhari type storage structure with a schematic diagram
5. Define Bulk density.
6. Discuss about internal and external friction.
7. Differentiate between sensible heat and latent heat
8. Explain Plank's Equation.
9. Describe about fluidized bed drier.
10. How belt conveyor supports in food storage?

PART B

(Answer one full question from each module each question carries 14 marks)

11. Explain equilibrium moisture content and describe any three direct moisture determination methods and three indirect moisture determination methods

OR

12. Describe any four cleaners or separators used for pre-storage operations
13. Outline Pusa Bin, Brick and Cement Bin and explain the construction

OR

14. a Discuss about Bunker storage structure, Cover and plinth storage structure (7)
    b Explain Temperature and Moisture migration in storage structures with a diagrammatic representation (7)
15. a. A RC.C cylindrical grain storage bin has internal diameter of 10 m and is 30 m deep. It is completely filled with paddy weighing 1200 kg/m3. The angle of internal friction for paddy can be taken as 350, while the angle of friction between paddy and bin wall is 30°. The ratio of horizontal and vertical pressure intensity k, is 0.4. Calculate the lateral pressure intensity at 15 m and 24 m depth using Janssen theory. (7)

b. Describe Rankine's earth pressure coefficient in silos (7)

OR

16. Discuss about silo flow problems i) Arching ii) Ratholing/Piping iii) Irregular flow iv) Wide residence time distribution

17. Describe the desirable properties of refrigerant.

OR

18. Cold storage of internal dimension (7Lx5Wx5H) was constructed. Wall being constructed with Brick layer of 0.30 m Thickness plastered with cement 0.08 m of thickness. Concrete roof of thickness 0.20 m and concrete floor of 0.50 m adds to this. All the wall areas are insulated with 80 mm polyurethane form. Ambient temperature is 32 °C and store temperature is 4 °C and door opening is limited to 3 times a day. Predict total cooling load (Given that Thermal conductivity of Brick 0.6 W/mK, Thermal conductivity of concrete 0.8 W/mK, Thermal conductivity of Poly urethane 0.28 W/m K, Temperature of Floor = 10 °C, Energy per cubic meter of air = 2 KJ/m^3 °C).

19. Discuss about any four driers assisting in food storage.

OR

20. Discuss about any four types of freezing equipments as supporting structures for food storage.

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Syllabus

Module 1

Introduction to Food and grain storage (7 hours)

Scope, importance, basic requirements, safe and scientific storage, pre and post storage operations; cleaning and grading, screening, types of screens, effectiveness of screen, screen cleaners/graders, vibratory air-screen cleaners, rotary air-screen cleaners disk separators, indented cylinder separator, spiral separator, specific gravity separator, destoner, pneumatic and aspirator separator, magnetic separator, fluidised bed separator, cyclone separator, colour separator, Drying, moisture content and its measurement, moisture content determination methods, direct methods, indirect methods, equilibrium moisture content, hysteresis effect, types of drying, solar/sun drying, mechanical drying, contact drying, convective drying, freeze drying, super-heated steam drying, fluidized bed drying, Factors that Influence drying, process conditions, food properties etc, inspection etc., spoilage, control measures,

Module 2 (7 hours)

Traditional and small-scale storage methods

Traditional storage structures, mud bin, drums, gunny bags etc., small scale storage structures, brick, concrete types, Local storage structures, Morai, Bukhari, Kothar, Kuthla, improved storage structures Pusa Bin, Brick and Cement Bin, Bunker storage structure, Cover and plinth storage structure, Factors affecting storage, Temperature and Moisture migration in storage structures.

Module 3 (7 hours)

Modern and large-scale storage:

Characteristics of Bulk materials, Bulk storage, Silos; types- deep, shallow, Bulk density, True density, Apparent density, Angle of repose, Angle of rupture, Plane of rupture, Angle of repose, Internal and external friction, Pressure distribution in silos, Rankine's earth pressure coefficient, Airys, Janssens equations, silo flow pattern, numerical, warehouses; considerations, Selection of site for storage types, specific volume of bagged grains and importance, Percentage utilization of warehouse-numerical.

Module 4 (7 hours)

Refrigerated and Frozen storage

Cold storage, Sensible heat, latent heat, natural refrigeration, mechanical refrigeration, vapour compression system, heat pump, desirable properties of refrigerant, thermodynamic properties, safe working properties, physical properties, refrigeration equipment, compressor, condenser, evaporator, expansion valve, piping and pumps, electric motors, Refrigeration load calculations, cold storage components, vapour barriers, Frozen storage, Freezing Rate and Freezing Point, Plank’s Equation, Thawing, Physical Properties of Frozen Food, Food Quality During Frozen Storage, Controlled and Modified Atmosphere storage, hermetic storage, Storage conditions for raw and processed fruits, vegetables, meat, dairy etc. Storage requirements

Module 5 (7 hours)

Supporting structure:

Types of driers, Cabinet (Tray) Drier, Tunnel Drier, Conveyor (Belt) Drier, Fluidised Bed Drier, Pneumatic (Flash) Drier, Rotary Drier, Vacuum Cabinet (Tray or Shelf) Drier, Double Cone Vacuum Drier, Freeze Dryer, Spray Dryer, Drum (Roller, Film) Drier, humidifier, dehumidifier, Freezing Equipment, Plate Freezer, Blast Freezer, Fluidised Bed Freezer, Scraped Surface Freezer, Cryogenic and Immersion Freezing, conveyors for solid and liquid food storage, belt conveyor, chain conveyor, screw conveyor, Pneumatic conveyor, bucket elevator, Aeration, ventilation, Fans and Blowers, Economic aspects of storage.

Text Books

1. G. Boumans, Grain Handling and Storage, Elsevier, 1985
2. James G. Brennan & Alistair S. Grandison eds, Food Processing Handbook, 2e, Wiley-VCH, 2011
3. K.M. Sahay & K.K Singh, Unit Operations of agricultural Processing, Vikas Publishing House Pvt Ltd, 2e, 2015
4. P G Smith, Introduction to Food Process Engineering, Springer, 2e, 2011
5. Zeki Berk, Food process engineering and technology, Elsevier, 2013

Reference Books

1. Dennis R. Heldman, Richard W. Hartel, Principles of Food Processing, Aspen Publishers, Inc 1997
2. Himangshu Barman, Post-Harvest Food Grain Storage, Agrobios (India), 2008
3. James G Brennan, Food processing Handbook, Wiley-VCH, 2e. 2006

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd 2014

Course content and lecture schedule:

No:	Topic	No: of Lectures
1	**Introduction to Food and grain storage**	**7**
1.1	Basic requirements, safe and scientific storage	2
1.2.	Pre and post storage operations	3
1.3.	Types of drying,	2
2	**Traditional and small-scale storage methods**	**7**
2.1	Traditional storage structures	2
2.2	Local storage structures	2
	Improved storage structures and Factors affecting storage	3
3	**Modern and large-scale storage**	**7**
3.1	Characteristics of Bulk materials, Bulk storage	3
3.2	Silos; types and characteristics, numericals	2
3.3	Warehouses; considerations, Selection of site for storage types,	2
4	**Refrigerated and Frozen storage**	**7**
4.1	Cold storage, desirable properties of refrigerant, refrigeration equipment	2
4.2	Refrigeration load calculations	3
4.3	Frozen storage, Controlled and Modified Atmosphere storage	2
5	**Supporting structure**	**7**
5.1	Types of driers	2
5.2	Freezing Equipment	3
5.3	Types of Conveyors, economic aspects of storage	2

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Estd. 2014

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT 434	Food Supply Chain Management	PEC	2	1	0	3

Preamble:

This course will help the students to understand the fundamentals on logistic and supply chain management in food industries. It also helps to study the various aspects of food supply chain management globally, and the pervasiveness of Information Technology in SCM.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand logistics and supply chain management
CO2	Know about the procurement and warehousing strategies in SCM
CO3	Gain knowledge on use of application of refrigeration in food supply chain.
CO4	Understand the importance of information technology in packaging and supply.
CO5	Know about the relevance and concept of documentation in supply chain management.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3				2		1					
CO2	3					2	2					
CO3	3		3				3	1				
CO4	3	2								1		1
CO5	3							2	1		2	

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End Semester Examination
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/ Quiz/ Course project : 15 marks

End Semester Examination Pattern: There will be two parts: Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub division and carry 14 marks.

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Course Level Assessment Questions

Course Outcome 1 (CO1)

1.What is the scope and significance of logistics and supply chain management?

2.Explain on drivers of supply chain management.

3.Describe the challenges of supply chain management in food industry.

Course Outcome 2 (CO2)

1.What are the strategic planning for material sourcing?

2.Describe on the inventory models and control techniques in supply chain.

3. What is demand and supply management?

Course Outcome 3 (CO3)

1.What is refrigerated cold chain system.

2.Discuss on the challenges in post harvest food management.

3.What are the major technologies in maintaining cold chain system.

Course Outcome 4 (CO4)

1.Enumerate the different types of packaging and packaging materials in supply chain marketing?

2. Explain on the labelling details for export and import packaging?

3. How information technology supports in supply chain management?

Course Outcome 5 (CO5)

1. Explain about the risk management in global logistics?

2.What are the export and import procedures in supply chain management?

3. Enumerate the Indian agencies involved in performance metrics?

Model Question Paper

QP CODE: **Pages:**

Reg No………………….

Name: ……………………….

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B. TECH DEGREE EXAMINATION

MONTH & YEAR

Course Code: FTT 434

Course Name: Food Supply Chain Management

Max.Marks:100 **Duration:3 Hours**

Part A

Answer all ten full questions each carries 3 marks (3X10= 30 marks)

1. What is logistics and supply chain management?
2. What are the primary and secondary activities of supply chain management?
3. What are the forecasting techniques in supply chain?
4. Describe the warehouse strategies involved in food supply chain management.
5. What are the factors influencing refrigerated cold chain.
6. Enumerate the various technologies used in refrigerated cold chain.
7. What are the applications of packaging in logistics?
8. What is containerization?
9. What is the role of customer relationship management in LSCM?
10. Enumerate the Indian agencies involved in performance metrics.

Part B

Answer any five full questions each carries 14 marks (5 X 14 = 70 Marks)

11. Explain in detail the scope, significance and drivers of logistics and supply chain management.

OR

12. Describe the primary and secondary activities of supply chain management.
    Explain the roles and challenges of supply chain management in food industry.

13. What is demand and supply management. Discuss the inventory models and control techniques in supply chain management.

OR

14. Explain in detail the various strategies focused on supply chain management.

15. Illustrate any two refrigeration methods used in cold chain.

OR

16. Discuss on detail the storage requirements of various perishable materials during transportation.

17. Discuss the types of packaging and packaging materials used in logistics? Explain.

OR

18. Explain in detail the role of information technology in supply chain management.

19. Elaborate on the export and import procedure and documentation in logistics and supply chain management.

OR

20. Discuss the role of Indian agencies in performance metrics of supply chain management.

Syllabus

Module 1 (7 hours)

Logistics and supply chain management - Scope, Significance and Drivers; Basic Model – Primary and Secondary Activities; Role and Challenges of Logistics and supply chain management in food industry.

Module 2 (7 hours)

Demand and supply management, Forecasting techniques, Strategic planning for material sourcing, Outsourcing strategies, Warehouse strategies, Inventory models and control techniques.

Module 3 (7 hours)

Introduction to Refrigerated Cold Chain - Importance and challenges in post harvest management- Major technologies in maintaining cold chain- Dry ice, Liquid nitrogen, Mechanical refrigeration system and Eutectic plates, Factors influencing refrigerated cold chain. Storage requirements of fruits and vegetables, milk and milk products, meat and meat products and marine products during transit.

Module 4 (7 hours)

Applications of Packaging in logistics, Types of packaging and packaging materials, Export & import packaging and labelling details, Containerization, Pervasiveness of IT in Supply Chain Management – ERP, Bar-coding, RFID, GPS, E-Procurement**.**

Module 5 (7 hours)

Export and import procedure and Documentation, Risk management in global logistics, Customer relationship management in LSCM Module. Supply chain business opportunities, Market, Assessment, Technical Analysis, and Financial Analysis, Forecasting, Facilities and Aggregate Planning. Performance metrics in Supply Chain, Indian agencies- EIC, EIA, APEDA, MEPEDA.

Text Books

1. D K Agarwal, Logistics and supply chain management, Macmillan Publishers India Ltd., Eighth Impressions, 2010.
2. R. P. Mohanty, S.G. Deshmukh, Supply Chain Management Theories and Practices, DreamtechPress, 2005.
3. Ron Basu. J. Nevan Wright, Total Supply Chain Management. 1st edition, Elsevier,2008

Reference book

1. Ajay Kumar Gupta,. The Complete book on Cold Storage, Cold Chain and Warehouse (with controlled Atmosphere storage and rural Godowns), 5th edition, 2022

Course Contents and Lecture Schedule

No.	Topics	No. of Lectures
1.	**Module 1**	**7**
1.1	Logistics and supply chain management - Scope, Significance and Drivers	**2**
1.2	Basic Model – Primary and Secondary Activities of supply chain management	**3**
1.3	Role and Challenges of Logistics and supply chain management in food industry.	**2**
2.	**Module 2**	**7**
2.1	Demand and supply management, Forecasting techniques	**2**
2.2	Strategic planning for material sourcing, Outsourcing strategies, Warehouse strategies,	**3**
2.3	Inventory models and control techniques.	**2**
3.	**Module 3**	**7**
3.1	Introduction to Refrigerated Cold Chain - Importance and challenges in post harvest management-	**3**
3.2	Major technologies in maintaining cold chain- Dry ice, Liquid nitrogen, Mechanical refrigeration system and Eutectic plates,	**2**
3.3	Factors influencing refrigerated cold chain- Storage requirements of fruits and vegetables, milk and milk products, meat and meat products and marine products during transit.	**2**
4.	**Module 4**	**7**
4.1	Applications of Packaging in logistics, Types of packaging and	**2**

	packaging materials,	
4.2	Export & import packaging and labelling details, Containerization.	**2**
4.3	Pervasiveness of IT in Supply Chain Management – ERP, Bar-coding, RFID, GPS, E-Procurement**.**	**3**
5.	**Module 5**	**7**
5.1	Export and import procedure and Documentation, Risk management in global logistics, Customer relationship management in LSCM Module.	**2**
5.2	Supply chain business opportunities, Market, Assessment, Technical Analysis, and Financial Analysis, Forecasting, Facilities and Aggregate Planning.	**2**
5.3	Performance metrics in Supply Chain, Indian agencies- EIC, EIA, APEDA, MEPEDA.	**3**

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
FTT 444	EXTENSION AND TRANSFER OF TECHNOLOGY	PEC	2	1	0	3

Preamble:

Goal of this course is to develop the knowledge of students to extension and technology transfer in respect to food processing. The course will help to understand the role of intellectual property legislations in food business and also learn how to manage the production, processing and marketing of food and agricultural products

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the current technologies and practices in food processing sector
CO 2	Familiarize different strategies in food business
CO 3	Explain how to position a technology for the end user
CO 4	Understand different technology and market alignment techniques
CO 5	Acquaint knowledge on different technology evaluation methods

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2	2				1						1
CO 2	2	2	2									2
CO 3	3	3				2						2
CO 4	2	2		3		2						1
CO 5	2	2		2			1					2

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Explain different food processing sector?
2. How to apply market research?
3. Describe different marketing channels

Course Outcome 2 (CO2)

1. What is intellectual property?
2. Explain trade mark registration process in India
3. Briefly explain the concept of Nash equilibrium

Course Outcome 3(CO3)

1. ‘Position the technology based on quality’ explain the concept
2. What is null hypothesis?
3. Write two examples of hypothesis

Course Outcome 4 (CO4)

1. Discuss about positioning the technology for end user.

2. What is Hypothesis?

3. Who needs SWOT Analysis

Course Outcome 5 (CO5)

1. Explain about technology alignment.

2. What are the advantages of using prototype model?

3. What is the role risk analysis in food processing industry?

Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 444

Course Name: Extension and Transfer of Technology

Max marks: 100 Time: 3 hrs

PART A

Answer all questions each question carries 3 marks (Marks = 10x3 = 30 marks)

1. What is the role of market study?
2. Draw the movements of food in supply chain.
3. What is copyright?
4. What is the concept of USP?
5. Discuss about positioning the technology based on price?
6. Explain Testing of hypothesis
7. List out risk assessment steps
8. How to attract your target market?
9. What is ABC Analysis?
10. What do you mean by TOT

PART B

Answer anyone full question from each module, each question carries 14 marks

Module 1

11. a) Explain why market research is important (4 mark)

    b) Discuss about different stakeholders in food supply chain (10marks)

OR

12. Discuss about major emerging technologies in food processing sector (14 marks)

Module 2

13. a) Draw the flow chart of patent granting procedure in India (4 marks)

b) Explain Trade mark filing procedure in India (10 marks)

OR

14. a) Discus different marketing strategies of food business (7 marks)

b) Give a detailed account on Nash Equilibrium? (7 marks)

Module 3

15 a) Explain different types of hypotheses (10marks)

b) How will hypothesis help in scientific method? (4 marks)

OR

16. a) Discuss SWOT Analysis (10marks)

b) Mention the importance of SWOT Analysis (4marks)

Module 4

17. a) What is target market? How to find target market(10marks)

b) Discuss on how to run prototype test? (4marks)

OR

18. a) Explain prototype development process (14marks)

Module 5

19. a) Discuss EOQ and EBQ (7marks)

b) Explain PERT Network analysis (7marks)

OR

20. a) What are the objectives of Technology Park? (4marks)

b) Discuss the role of institutions in technology transfer Research (10marks)

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Syllabus

Module 1 (7 hours)

Introduction**:** Current technologies and practices in food processing sector, Value chain in Food processing sector, Product process service, Study of market/ research, Marketing channel, Food business stakeholders, Market size barriers, Players in the Indian food industry

Module 2(7 hours)

Strategy: Strategy- Nash equilibrium. Social, environmental, legal obligation for technology, Intellectual Property Rights, WIPO, Intellectual Properties: Patent, Trademarks, Copyright, Geographical Indications. Filing process and Procedures in India

Module 3 (7 hours)

Positioning: Positioning the technology for end user, Hypothesis- Types and characteristics, Procedure for testing hypothesis, SWOT Analysis, Determine strength weakness, opportunities and threats.

Module 4 (7 hours)

Proto type: Design of proto type, testing – Quality standards, Finding the target, Market alignment, Technology alignment, Risk analysis, Revenue expense valuation

Module 5 (7 hours)

Evaluation of technology: Inventory management, EOQ, EBQ, ABC and VED analysis, CPM and PERT network analysis, Role of Government and non-Government organisations in technology transfer

Text Books

1. Phillis L Speser. (2006). The Art and Science of Technology Transfer, John Wiley & Sons SBN: 978-0-471-70727-1
2. Nithyananda K. V. (2009) Intellectual Property Rights: Protection and Management. Kindle Edition. Cengage India Publisher.
3. ATTC Network (2010) The Change Book: A Blueprint for Technology Transfer. Author House Publisher. ISBN-10: 1452027366, ISBN-13: 978-1452027364

Reference Books

1. M Rashid Khan. (2011). Changing the World by Technology Transfer: Licensing and Commercializing of Intellectual Properties. Publisher: Xlibris. ISBN-10: 1456897063. ISBN-13: 978-1456897062.
2. K P Sudheer, Indira V (2017). Entrepreneurship Development in Food Processing, 1st Edition, ISBN-10- 9789386546739, ISBN-13: 978-9386546739

3. Samantha R B, Christopher S H, Albert N L, (2013) Models and Methods of University Technology Transfer (Foundations and Trends(r) in Entrepreneurship) 5th Edition. Now Publishers Inc;
4. Kunju O. Abdul Rahiman. (1992). Transfer of Agricultural Technology First Edition. Concept Publishing Company Pvt. Ltd. ISBN: 9788170223948, 8170223946

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 Introduction:**	**7**
1.1	Current technologies and practices in food processing sector	2
1.2	Value chain in Food processing sector, Product process service, Study of market/ research, Marketing channel,	2
1.3	Food business stakeholders, Market size barriers, Players in the Indian food industry	3
2	**Module 2 - Strategy:**	**7**
2.1	Nash equilibrium. Social, environmental, legal obligation for technology,	2
2.2	Intellectual Property Rights, WIPO, Intellectual Properties: Patent, Trademarks, Copyright, Geographical Indications.	2
2.3	Filing process and Procedures in India	3
3	**Module 3 – Positioning the Technology**	**7**
3.1	Positioning the technology for end user	2
3.2	Hypothesis- Types and characteristics, Procedure for testing hypothesis	2
3.3	SWOT Analysis, Determine strength weakness, opportunities and threats	3
4	**Module 4 – Proto type**	**7**
4.1	Design of proto type, testing – Quality standards	2
4.2	Finding the target	2
4.3	Market alignment, Technology alignment	2
4.4	Risk analysis, Revenue expense valuation	1
5	**Module 5 – Evaluation of technology**	**7**
5.1	Inventory management, EOQ, EBQ, ABC and VED analysis	2
5.2	CPM and PERT network analysis	2
5.3	Role of Government and non-Government organisations in technology transfer	3

FTT 454	NUTRACEUTICALS AND FUNCTIONAL FOODS	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course will examine bioactive components of functional foods and nutraceuticals, their sources, chemistry, process technology, efficacy, safety and regulation. Thorough knowledge and understanding of functional foods and nutraceuticals help the students to design innovative functional food products. An understanding on the health benefits of various nutraceuticals are emphasized.

Prerequisite: Food Chemistry FTT 201

Course Outcomes: After the completion of the course the students will be able to

CO 1	Have a general knowledge on development of functional foods and nutraceuticals
CO 2	Distinguish differences between conventional foods vs. functional foods as well as nutraceuticals vs. pharmaceuticals
CO 3	Understand that several natural ingredients used in the food preparation are important sources of nutraceuticals.
CO 4	Gain thorough knowledge on nutraceuticals as the bridge between food and medicine
CO 5	Enlist potential health benefits of functional foods and know the basic physicochemical properties of various nutraceuticals.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1		2		1	1					
CO 2	2	2	2	2		2	2					
CO 3	3	2	1			1	1					

CO 4	**2**	**3**	**3**	**1**		**1**						
CO 5	**2**	**3**	**3**	**2**		**2**	**1**					

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	**10**	**10**	**10**
Understand	**20**	**20**	**20**
Apply	**10**	**10**	**50**
Analyse	**10**	**10**	**20**
Evaluate			
Create			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

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End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What are the natural sources of nutraceuticals?

2. Discuss the prospects and scope of nutraceuticals in food industry?

Course Outcome 2 (CO2)

1. List out the importance of biomarkers in food technology?

2. What are functional proteins, functional lipids and functional carbohydrates?

Course Outcome 3(CO3):

1. Elaborate on various secondary metabolites found in vegetables and fruits.

2. Discuss on the role of anti-oxidants in cancer prevention.

Course Outcome 4 (CO4):

1. Elaborate on the characteristic features of nutraceuticals as food and medicine.

2. List out certain nutraceutical-rich food supplements already proven their efficacies.

Course Outcome 5 (CO5):

1. Discuss briefly on recent trends in functional food research.

2. What do you understand by the concept of personalized medicine?

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Model Question paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER BTECH DEGREE EXAMINATION

Course Code: FTT 454

Course name: Nutraceuticals and Functional Foods

Max marks: 100 **Time: 3 hrs**

Part A

Answer all questions each question carries 3 marks (Marks = 10x 3 = 30 marks)

1. Define functional foods. (3)

2. Explain how nutraceuticals are important in the diet. (3)

3. Distinguish between fortified foods and dietary supplements. (3)

4. Write a note on nutrigenetics and nutrigenomics. (3)

5. What is the importance of biomarkers in food technology? (3)

6. What are probiotics and prebiotics? (3)

7. Explain the sources and activities of Lycopene, Solasodine and Capsaicin? (3)

8. Discuss the concept of food as medicine. (3)

9. Enlist the importance of kelp, phycocyanin and single cell protein. (3)

10. What are the regulatory features and safety issues of nutraceuticals? (3)

PART B

Answer all questions each question carries 14 marks (Marks = 14x 5 = 70 marks)

11. What are functional foods? What are some examples of functional foods? Discuss their importance and health benefits.

OR

12. Define Nutraceuticals. Write detailed note on role of nutraceuticals for specific situations along with suitable examples. (14)

13. Discuss the role of cereal products as functional foods along with suitable examples and their health benefits. (14)

OR

14. What are functional beverages? Design a functional beverage suitable for a diabetic patient. (14)

15. Define Phytochemicals. Discuss in detail the different classes of phytochemicals and explain their role as nutraceuticals. (14)

OR

16. Enlist 7 phytochemicals that are accepted as nutraceuticals. Mention their sources. (14)

17. How phytochemicals can be useful in development of functional foods? Enlist three phytochemicals that can be used in alternative medicine. (14)

OR

18. Write an essay on nutraceutical rich food supplements. (14)

19. Discuss the marketing and regulatory issues of functional foods and food suppleemnts. (14)

OR

20. Discuss on functional foods as immunomodulators. (14)

SYLLABUS

Module I (7 hours)

Introduction to Nutraceuticals as Science

Historical overview to functional foods and nutraceuticals. Classification and future prospects of nutraceuticals. Sources of nutraceuticals, dietary supplements, fortified foods, phytochemicals. Zoo chemicals and microbes in food. Scope of nutraceuticals in food industry, national and global scenario.

Module II (7 hours)

Functional Foods

Conventional foods vs. Functional foods as well as nutraceuticals vs. pharmaceuticals. Introduction to biomarkers and food technology. Functional Lipids, Functional Carbohydrates from cereals, Functional Proteins. Nutrigenetics and Nutrigenomics. Probiotics, prebiotics and postbiotics, Functional beverages. Design a health drink suitable for diabetic patient.

Module III (7 hours)

Properties, structure, and function of various nutraceuticals.

Natural occurrence of certain phytochemicals - Dietary anti-oxidants and flavonoids, Glucosamine, Octacosanol, Lycopene, Solasodine, Capsaicin, Carnitine, Melatonin and Ornithine alpha ketoglutarate. Carotenoids, phytoestrogens, omega – 3 fatty acids. Role of anti-oxidants in cancer prevention.

Module IV (7 hours)

Food as medicines

Nutraceuticals bridging the gap between food and medicine - Nutraceuticals in treatment for cognitive decline, Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers. Brief idea about some Nutraceutical rich supplements such as Bee pollen, Caffeine, Green tea, Curcumin, Lecithin, Mushroom extract, Cordyceps, Chlorophyll, Phycocyanin, Kelp and single cell protein from Spirulina.

Module V (7 hours)

Marketing, Safety, and Regulatory aspects of nutraceuticals and Functional Foods

Health claims, regulations, and safety issues – National and International. Research frontiers in functional foods, delivery of immunomodulators through functional foods. Concept of personalized medicine.

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Text Books

1. Robert E C Wildman, Robert Wildman, Taylor C Wallace (2006). Handbook of Nutraceuticals and Functional Foods. Second edition. eBook ISBN9780429195563. DOI https://doi.org/10.1201/9781420006186
2. Gibson GR & William CM. Functional Foods – Concept to Product (2000). CRC Press. ISBN-13: 978-0849308512
3. Goldberg Israel. Functional Foods: designer Foods, Pharma Foods, nutraceuticals (1994). Chapman & Hall, New York, London, ISBN: 0412988518 9780412988516

Reference Books

1. Aluko, Rotimi. Functional Foods and Nutraceuticals (2012), Springer-Verlag New York Inc., ISBN: 1461434793 9781461434795
2. Hanson, James R. "Natural Products: The Secondary Metabolites" (2003), Royal Society of Chemistry, ISBN: 0854044906 9780854044900
3. Vattem D. A, Maitin V. Functional Foods, Nutraceuticals and Natural Products: Concepts and Applications (2016), DEStech Publications, Inc., P A, USA. ISBN: 9 6-1-87 0 01-595 1-0

https://gavsispanel.gelisim.edu.tr/Document/bgcol/20190220115348732_dcfb1798-bc12-4788-a50f-ec72d7f69ef4.pdf

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Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1 - Introduction to Nutraceuticals as Science**	**7**
1.1	Historical overview to functional foods and nutraceuticals	1
1.2	Classification, sources and future prospects	1
1.3	Dietary supplements and fortified foods	2
1.4	Zoo chemicals and microbes in food	1
1.5	Scope of nutraceuticals in food industry, national and global scenario.	2
2	**Module 2 - Functional Foods**	**7**
2.1	Conventional foods vs. Functional foods, as nutraceuticals vs. pharmaceuticals	1
2.2	Introduction to biomarkers and food technology	1
2.3	Functional Lipids, Functional Carbohydrates from cereals, Functional Proteins.	1
2.4	Nutrigenetics and Nutrigenomics	1
2.5	Probiotics, prebiotics and postbiotics	1
2.6	Functional beverages	1
2.7	Design a health drink suitable for diabetic patient	1
3	**Module 3 - Properties, structure, and function of nutraceuticals**	**7**
3.1	Dietary anti-oxidants and flavonoids	1
3.2	Glucosamine, Octacosanol, Lycopene, Solasodine, Capsaicin, Carnitine, Melatonin and Ornithine alpha ketoglutarate	2

3.3	Carotenoids, phytoestrogens, omega – 3 fatty acids.	2
3.4	Role of anti-oxidants in cancer prevention.	2
4	**Module 4 - Nutraceuticals as food and medicine**	**7**
4.1	Nutraceuticals in treatment for cognitive decline	1
4.2	Nutraceuticals for Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers	3
4.3	Importance of Bee pollen, Caffeine, Green tea, Curcumin, Lecithin, Mushroom extract, Cordyceps, Chlorophyll, Phycocyanin, Kelp and single cell protein from Spirulina.	3
5	**Module 5 - Marketing, Safety, and Regulatory aspects**	**7**
5.1	Health claims, regulations, and safety issues	2
5.2	Research frontiers in functional foods	2
5.3	Immunomodulators, Concept of personalized medicine	3

Course Code FTT 464	FOOD TOXICOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The main objective of this course is to develop an understanding of the nature and properties of toxic substances in foods and their implications for health.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Acquire an idea about scope, basic principles of food toxicology, classifications and the factor affecting toxicity.
CO 2	To Familiarize about natural and derived food toxicants and their mode of action.
CO 3	Develop knowledge about Food allergens, toxicity of additives and difference between safety, hazard and toxicity.
CO 4	Understand the methods for the Determination of toxins and their risk assessment
CO 5	Gain knowledge of toxic substances in food and their toxic effects in people.

Mapping of course outcomes with program outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2			2		2						
CO 2	2					2						
CO 3	2					2						
CO 4	2				2							
CO 5	2					2						

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20

Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Explain the principles of Toxicology.
2. What are the different classifications of food toxins?
3. List out the factors affecting toxicity.

Course Outcome 2 (CO2)

1. Elaborate on the different types of toxins and their mode of action.
2. What is Bioterrorism?
3. Write in detail about the Toxicants generated during food processing and packaging.

Course Outcome 3 (CO3):

1. Describe the mechanisms of allergic-type reactions caused by food.
2. Summarize the types of food allergens.

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3. Discuss the Food disorders associated with its metabolism.

Course Outcome 4 (CO4):

1. How Biological determination of toxicants in food can be done?
2. Assess the Quantitative and qualitative analysis of toxicants in foods.
3. Elaborate on the various laws and regulation of safety assessment of foods.

Course Outcome 5 (CO5):

1. How Food additives results as toxicants in food and explain its mechanism.
2. What you mean by Maillard reaction?
3. Explain the toxicity implications of nanotechnology in food.

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(R&S)

Course Code: FTT464

Course Name: FOOD TOXICOLOGY (FT)

Max. Marks: 100 **Duration:3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Define food toxicology and give its scope.
2. List out the factors affecting the toxicity of compounds.
3. Write a note on Mycotoxins?
4. Mention the different toxicants from plants and animals.
5. Write short notes on food allergens.
6. Differentiate between Risk and Hazard.
7. Write a detailed account of quantitative analysis of toxicants in food.
8. Write short notes on Risk assessment.
9. Explain the various aspects of Maillard reaction.
10. Explain the various mechanisms by which toxicants act.

PART-B

Answer any 5 questions, each question carries 14 marks

11.(a)Discuss the principles of Toxicology.

(b)Explain in detail about the classification of food toxicants.

12.Write in detail about mechanisms by which toxic chemicals causes diseases in humans.

13.(a)Elaborate on different types of toxins and their mode of action.

(b)What is Bioterrorism?

14.Write in detail about the Toxicants generated during food processing and packaging.

15.(a)Describe mechanisms of allergic-type reactions caused by food.

(b) Summarize the types of food allergens.

16.Discuss the Food disorders associated with its metabolism.

17.(a)How Biological determination of toxicants in food can be done?

(b)Assess the Quantitative and qualitative analysis of toxicants in foods.

18.(a) Elaborate on the various laws and regulation of safety assessment of foods.

(b) What is the importance of risk assessment in foods and explain in detail.

19.(a) How Food additives results as toxicants in food and explain its mechanism.

20.(a) Justify the risk of genetically modified food.

(b) Explain the toxicity implications of nanotechnology in food.

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Syllabus:

Module 1: Introduction to food toxicology (7 hours)

Definition, scope, Principles of toxicology, General mechanisms by which toxic chemicals causes disease in humans - Absorption, distribution, metabolism and excretion of toxic chemicals, Classification of food toxicants, factors affecting toxicity of compounds.

Module 2: Natural and Derived Food toxicants (7 hours)

Toxicants and allergens derived from plants, animals, marine algae, mushrooms etc. Microbial toxins –Mycotoxins Impacting Food Production and Manufacturing-,Guidance and regulations on mycotoxins in food ,Toxicants generated during food processing and packaging such as nitrosamines, acrylamide, benzene, dioxins, furans etc. , persistent organic pollutants, food carcinogen and mutagens and their mode of action, Transgenic approaches-Bioterrorism.

Module 3: Food allergens (7 hours)

Types, Chemistry of food allergens, Food allergy and hypersensitivity, mechanisms of allergic-type reactions and allergenic components in foods. Food disorders associated with metabolism, lactose intolerance, and asthma, handle of food allergies.

Module 4: Determination of toxins and risk assessment (7 hours)

Quantitative and qualitative analysis of toxicants in foods; Biological determination of toxicants, Assessment of food safety – Risk assessment and risk benefit indices of human exposure, acute toxicity, mutagencity and carcinogenicity, reproductive and developmental toxicity, neurotoxicity and behavioural effect, immunotoxicity. Laws and regulation of safety assessment of foods .

Module 5: Food additives as toxicants (7 hours)

Food additives as toxicants: artificial colors, preservatives, sweeteners; toxicants formed during food processing such as nitrosamines, maillard reaction products acrylamide, benzene, heterocyclic amines and aromatic hydrocarbons and irradiation; risk of genetically modified food, food supplements, persistent organic pollutants, toxicity implications of nanotechnology in food.

Text Books:

1. Concon JM.1988. Food Toxicology - Principles & Concepts. Marcel Dekker.
2. Steven T. 1989. Food Toxicology: A Perspective on Relative Risks
3. Helferich, William and Carl K.Winter "Food Toxicology" CRC Press, 2001
4. Shibamoto, Taka yuki and Leonard F.Bjeldanzes "Introduction to Food Toxicology" 2nd Edition.Academic Press, 2009.

Reference Books:

1. Shibamato T. and Bjeldanes L., Introduction to Food Toxicology, Academic Press, Inc. San Diego, CA. ISBN 0-12640025-3 2. Deshpande, S.S. (2002).

2. Handbook of Food Toxicology, Marcel Dekker Inc. NY ISBN 0- 8247-0760-5

3. Stine, K. and Brown, T. 1996. Principles of Toxicology. CRC Press, Inc. Boca Raton, FL.
4. Püssa, Tönu. 2007. Principles of Food Toxicology. CRC Press, LLC. Boca Raton, FL.
5. Watson, David. 1998. Natural Toxicants in Food. CRC Press, LLC. Boca Raton, FL.

Course Contents and Lecture Schedule:

No	Topic	No. of Lectures
1	**Module 1 – Introduction to food toxicology**:	**7**
1.1	Introduction,Definition, scope, Principles of toxicology	2
1.2	General mechanisms by which toxic chemicals causes disease in humans.	2
1.3	Classification of food toxicants	2
1.4	Factors affecting toxicity of compounds.	1
2	**Module 2- Natural and Derived Food toxicants:**	**7**
2.1	Natural Food toxicants	2
2.2	Derived Food toxicants	2
2.3	Food carcinogen and mutagens and their mode of action	1
2.4	Transgenic approaches	1
2.5	Mycotoxins	1
3	**Module 3- Food allergens:**	**7**
3.1	Types, Chemistry of food allergens	1
3.2	Mechanisms of allergic-type reactions	2
3.3	Food allergy and hypersensitivity ,	2
3.4	Food disorders associated with metabolism	1
3.5	Handle of food allergies	1
4	**Module 4- Determination of toxins and risk assessment:**	**8**
4.1	Quantitative and qualitative analysis of toxicants in foods	2

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4.2	Biological determination of toxicants	1
4.3	Assessment of food safety	2
4.4	Risk assessment and risk benefit indices of human exposure	1
4.5	laws and regulation of safety assessment of foods	1
5	**Module 5- Food additives as toxicants:**	**7**
5.1	Food additives as toxicants: artificial colors, preservatives, sweeteners	2
5.2	Toxicants formed during food processing	2
5.3	Risk of genetically modified food, food supplements, persistent organic pollutants	2
5.4	Toxicity implications of nanotechnology in food.	1

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FTT 474	BEVERAGE PROCESSING	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: Goal of this course is to develop the knowledge of students on various concepts, procedures and manufacturing of different beverages and its quality control measures.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	To study the basic ingredients of beverages and classification
CO 2	To study the process techniques and equipment used for the beer and wine manufacture
CO 3	To study the process techniques and equipment used for the manufacture of distilled fermented beverages
CO 4	To study the process techniques and equipment used for carbonated beverages
CO 5	To study the process techniques and equipment used for non- carbonated beverages
CO 6	To study the quality parameters of beverages

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2	3										
CO 2	3	3	2	2								
CO 3	3	3	2	2								
CO 4	3	3	2	2								
CO 5	3	3	2	2								
CO 6	1	2	3									

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define chlorination and UV light treatment for filtration of water

2. Describe the classification of beverages with a neat flow chart

3. Explain coagulation and membrane filtration process with neat sketch

Course Outcome 2 (CO2)

1. Explain beer manufacturing process in detail.

2. Explain the red wine processing steps in detail

3. Describe the spoilage of beer in detail.

Course Outcome 3(CO3):

1. Explain the manufacturing process of malt whisky with a flow chart.

2. List out the principle behind alcoholic distillation and the importance of distillation.

3. Explain wash still and spirit still.

Course Outcome 4 (CO4):

1. Summarize syrup preparation and carbonation process.

2. List out the principle behind filling of carbonated beverage.

3. Explain the processing steps in the production of any two RTS beverages

Course Outcome 5 (CO5):

1. Explain manufacturing process of drinking water

2. Explain the sanitation and hygiene procedure in beverage industry

3. Describe the titrable acidity measurement of beverage

Model Question paper

QP CODE: **PAGES: 2**

Reg No: _______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 474

Course Name: BEVERAGE PROCESSING

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Define beverage and its ingredients
2. Differentiate between water miscible and water dispersible flavouring agents
3. Define malt and its ingredients
4. Explain different types of wine
5. Explain types of whisky in detail
6. Describe the process of spirit still distillation
7. Write short notes on carbonation process
8. Describe different types of tea
9. Explain the types of packaged drinking water
10. Explain the importance of sanitation in beverage industry

PART B

Answer any one Question from each module.Each Question carries 14 Marks

11. Describe the classification of beverages with a neat flow chart

(14)

OR

12. Describe artificial and natural colours used in beverages in detail

(14)

13. Explain the beer manufacturing process in detail (14)

OR

14. Explain the different types of wine and its fermentation process in detail (14)

(

15. Explain the design and operation of grain whisky stills (14)

OR

16. List out the principle behind alcoholic distillation and the importance of distillation. (14)

17. Explain the processing steps involved in coffee .

(14)

OR

18. Explain Flash Pasteurization, Canning and Aseptic packaging of beverages (14)

19. Write a note on importance of quality controls in beverage industry (14)

OR

20. Describe the food safety regulations to be followed in beverage industries (14)

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Syllabus

Module 1 (7 hours)

Basic Ingredients in Beverages

Beverage definition-ingredients-water, CO_2, Bulk and Intense Sweeteners, Water Miscible and Water dispersible flavouring agents, Colours-natural and artificial, micro and nano emulsions of flavours and colours in beverages, Preservatives, Emulsifiers and Stabilizers

Module 2 (7 hours)

Beer and Wine Manufacture

Ingredients-Malt, Hops-adjuncts-water, yeast. Beer manufacturing process-malting, preparation of sweet wort, brewing, fermentation, pasteurization and packaging. Beer defects and spoilage. Wine fermentation-types-red and white. Wine defects and spoilage

Module 3 (7 hours)

Manufacture of Distilled Fermented Beverages

Malt and Grain, Whisky-types, raw materials and processing. Design-wash still operation-spirit still operation-continuous distillation-design and operation of grain whisky stills-maturation and blending- co products. Whiskies of the world and their regulations.

Module 4 (7 hours)

Carbonated and Non carbonated Beverages

Procedures - Carbonation equipment - ingredients, preparation of syrups - filling systems - packaging - containers and closures. Coffee bean preparation-processing-brewing-decaffeination-Instant Coffee-Tea-types-Black, Green and oolong. Dairy based beverages. Fruit juices, Nectar, Squash, RTS beverages and Isotonic Beverages. Flash Pasteurization, Canning and Aseptic packaging of beverages

Module 5 (7 hours)

Quality Control

Packaged drinking water- definition, types, manufacturing processes, Effective application of quality controls-Sanitation and hygiene in beverage Industry-quality of water used in beverages-threshold limits of various ingredients –Food safety regulations-Requirements of Soluble Solids and Titrable Acidity in Beverages

Text Books

1.Ashurst,P.R ,"Chemistry and Technology of Soft Drinks and Fruit Juices",2nd Edition, Blackwell Publishing, 2005.

2. Steen,D.P and Ashurst,P.R,"Carbonated soft drinks-Formulation and Manufacture", Blackwell Publishing, 2000.

3. Shahkunthala Manay,V and Shadakdharaswamy,M, "Food-Facts and Principles", New Age International Pvt. Ltd, 3rd Revised Edition,2000.

Reference Books

1. Amalendu Chakraverty et al, "Handbook of post harvest technology", Ed: Marcel Dekker Inc, (Special Indian Edition), 2000.
2. Robert W Hukins, "Microbiology and Technology of fermented Foods", IFT Press, Blackwell Publishing Ltd. 2006.
3. Charles,W, Bamforth, "Food, Fermentation and Microorganisms," Blackwell Science Publishing Ltd., 2005

4. Inge Russel, Graham Stewart and Charlie Bamforth, "Whisky-Technology, production and marketing", Elsevier.2003

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Basic Ingredients in Beverages**	**7**
1.1	Beverage definition-ingredients-water, CO_2	1
1.2	Bulk and Intense Sweeteners, Water Miscible and Water dispersible flavouring agents	2
1.3	Colours-natural and artificial, micro and nano emulsions of flavours and colours in beverages,	2
1.4	Preservatives, Emulsifiers and Stabilizers	2
2	**Beer and Wine Manufacture**	**7**
2.1	Ingredients-Malt, Hops-adjuncts-water, yeast.	1
2.2	Beer manufacturing process-malting, preparation of sweet wort, brewing, fermentation, pasteurization and packaging.	3
2.3	Beer defects and spoilage. Wine fermentation-types-red and white. Wine defects and spoilage	3
3	**Manufacture of Distilled Fermented Beverages**	**7**
3.1	Malt and Grain Whisky-types, raw materials and processing.	2
3.2	Design-wash still operation-spirit still operation-continuous	2

	distillation	
3.3	Design and operation of grain whisky stills-maturation and blending- co products. Whiskies of the world and their regulations.	3
4	**Carbonated and Non carbonated Beverages**	**7**
4.1	Procedures - Carbonation equipment - ingredients.	1
4.2	Preparation of syrups - filling systems - packaging - containers and closures	2
4.3	Coffee bean preparation-processing-brewing-decaffeination-Instant Coffee-Tea-types-Black, Green and oolong.	2
4.4	Dairy based beverages. Fruit juices, Nectar, Squash, RTS beverages and Isotonic Beverages.	1
4.5	Flash Pasteurization, Canning and Aseptic packaging of beverages	1
5	**Quality Control**	**7**
5.1	Packaged drinking water- definition, types, manufacturing processes	2
5.2	Effective application of quality controls-Sanitation and hygiene in beverage Industry-quality of water used in beverages-threshold limits of various ingredients	3
5.3	Food safety regulations-Requirements of Soluble Solids and Titrable Acidity in Beverages	2

CODE FTT416	FOOD QUALITY, SAFETY AND REGULATIONS	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course will deal with the food safety, quality and regulations practiced in food industry. This course gives understanding about safety and hygienic practices to be adopted and followed in food industry. The course will focus on providing graduate students with a detailed knowledge of quality control and quality assurance system in food industry. This course also gives understanding on various rules and regulations for ensuring safety and quality of food

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Recall the principles that make a food product safe for consumption
CO 2	Analyse hazard and formulate hazard analysis critical control point as part of food safety and quality management
CO 3	Apply the principles of food Science and food analysis in ensuring quality control
CO 4	Emphasize on the importance of food safety, food quality, food laws and regulations in food industry

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	3										
CO 2	3	2	2									
CO 3	2	3		3		2	2					
CO 4	2	2	3			2	2					

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

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Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe underlying principle behind food safety?
2. Give an account of significance of SOP and SSOP in ensuring food safety?
3. What are the different methods available for pest control in food industry?

Course Outcome 2 (CO2)

1. Define hazard and explain the types of hazards with example?
2. Illustrate the steps involved in HACCP?
3. Explain the process of risk assessment?

Course Outcome 3(CO3):

1. Differentiate quality control and quality assurance?
2. Identify different quality control tools and its applications?
3. Describe the methods available for food quality authentication?

Course Outcome 4 (CO4):

1. Mention the salient features of FSSA 2006?
2. Explain the role of BRC in food regulation
3. Discuss the role of Codex in ensuring food standards?

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MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION (R&S), MONTH & YEAR
Course Code: FTT416

Course Name: FOOD QUALITY, SAFETY AND REGULATIONS

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Explain the significance of food safety?
2. What are the factors to be considered while designing the layout of food industry?
3. Differentiate hazard and risk with example?
4. Give an account of steps involved in risk analysis?
5. What do you mean by quality control tool?
6. Explain quality assurance systems in food industry?
7. What is meant by food authentication?
8. Mention the functions of FSSAI?
9. Enumerate the role of Codex in harmonising food standards?
10. What do you mean by PRP in food safety?

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Explain the significance of Schedule 4 of Food Safety and Standards Act in ensuring food safety in food business.

(OR)

12. Discuss the GMP and GHP to be followed in food industry for ensuring food safety?

13. Detail on the process of food recall plan and allergen control plan in food industry?

(OR)

14. How will you conduct risk analysis in food industry with example?

15. Write an essay on intrinsic and extrinsic factors affecting food quality .

(OR)

16. How can you apply quality control tools in food industry ?

17. Describe the process of HACCP implementation in food industry?

(OR)

18. Explain the different methods used in evaluating food authentication?

19. Examine the various regulations prevailing for export and import of food?

(OR)

20. Detail on the initiatives by FSSAI in ensuring quality and safety of food product ?

Syllabus

Module 1 (7 hours)

Food Safety

Principles of food safety, need for food safety culture, consequences of unsafe food, challenges in food safety, recent statistics of food borne illness, Design and construction of food premises, cleaning and disinfection facilities, Control of rats and rodents, insects and microbes, Personal hygiene,SOP,SSOP

Module 2 (7 hours)

Hazard and Risk Analysis

Hazard, types, risk, risk analysis, risk assessment, food recall -significance food recall plan, allergen control plan, food traceability, significance, methods available

Module 3 (7 hours)

Quality Control

Definition of food quality- ways for describing food quality ,factors affecting food quality, Quality aspect in food supply chain and food processing industry Different quality control tools, Food authentication – significance ,methods available for food authentication

Module 4 (7 hours)

Quality Assurance

HACCP – History, introduction and significance, Principles of HACCP and steps in HACCP, HACCP worksheet – preparation with case study Significance, CCP determination, ISO, FSMS, TQM

Module 5 (7 hours)

Regulations

Food Standards and Specification –Global Food Safety Initiative, CODEX, CODEX INDIA, National Codex Committee of India, ToR, Shadow Committee FSSA 2006- its origin, Salient features of Act,Regulations,FSSAI ,its activities for ensuring food safety in India, BIS,BRC,FAO, AGMARK,Other agencies involved in regulating food business

Text Books

1. Andres Vasconcellos J. 2005. Quality Assurance for the Food industry - A practical approach. CRC press.
2. Inteaz Alli. 2004. Food quality assurance - Principles & practices. CRC Press. New York.
3. Sara Mortimore and Carol Wallace. 2013. HACCP - A practical approach. Third edition. Chapman and Hall, London.
4. Pomeraz Y and MeLoari C E 1996 Food Analysis ; Theory and Practice,CBS Publishers and Distributor, New Delhi

Reference Books

1. Food Safety and Standards Act 2006, Rules 2011, Regulations, 2011,10 th Edition, ILBCO India, Indian Law Book Company 2013
2. Early R 1995 Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London
3. Gould W A and Gould R W 1998 Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore
4. Bryan F L 1992 Hazard Analysis Critical Control Point Evaluations A Guide to Identifying hazards and Assessing Risks Associated with Food World Health Organisation, Geneva
5. FSSAI, FSIS,CDC,EU and FAO website for updates

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Food Safety**	**7**
1.1	Principles of food safety, need for food safety culture, consequences of unsafe food, challenges in food safety, recent statistics of food borne illness	2
1.2	Design and construction of food premises, cleaning and disinfection facilities	2
1.3	Control of rats and rodents, insects and microbes, Personal hygiene, SOP, SSOP	3
2	**Hazard and Risk Analysis**	**7**
2.1	Definition of hazards ,types of hazards with examples, Risk and Risk Analysis – significance and methods	3
2.2	Food Recall plan, Allergen Control Plan	2
2.3	Food traceability – significance, application, methods available	2
3	**Quality Control**	**7**
3.1	Definition of food quality- ways for describing food quality ,factors affecting food quality	3
3.2	Quality aspect in food supply chain and food processing industry Different quality control tools	2
3.3	Food authentication – significance ,methods available for food authentication	2
4	**Quality Assurance**	**7**
4.1	HACCP – History, introduction and significance, Principles of HACCP and steps in HACCP,	2
4.2	HACCP worksheet – preparation with case study Significance, CCP determination	2
4.3	ISO, FSMS, TQM	3
5	**Regulations**	**7**
5.1	Food Standards and Specification –Global Food Safety Initiative, CODEX, CODEX INDIA, National Codex Committee of India	2
5.2	FSSA 2006- its origin, Salient features of Act,Regulations,FSSAI ,its activities for ensuring food safety in India,	3
5.3	BIS,BRC,FAO, AGMARK,Other agencies involved in regulating food business	2

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FTT 426	ENTREPRENEURSHIP DEVELOPMENT IN FOOD TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: The objective of the course is to provide insight to students and encouragement to become entrepreneur infood processing sector

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Motivation for entrepreneurial career
CO 2	Have the ability to discern distinct entrepreneurial traits
CO 3	Conducting feasibility analysis
CO 4	Preparation of business plan

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2					2	2	2				
CO 2	2											
CO 3	2	2	2	2			2	2		2	2	2
CO 4	3	2					2	2	2	2	2	

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	50	100	3 hours

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Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Define entrepreneur?
2. What is the significance of entrepreneurship

Course Outcome 2 (CO2) :

1. Write a note on skills for business entrepreneur?
2. What are traits required for business entrepreneur?

Course Outcome 3(CO3):

1. Explain about feasibility report.
2. List out the factors to be considered for feasibility report.

Course Outcome 4 (CO4):

1. Write a detailed account of development of food business plan
2. Give a brief on break even analysis?

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION (R&S), MONTH & YEAR
Course Code: FTT 426

Course Name: Entrepreneurship Development in Food Technology

Max. Marks: 100 **Duration: 3hours**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

PART A
(Answer all questions; each question carries 3 marks)

1. Differentiate between Entrepreneur and Manager.
2. What are the problems faced by women entrepreneurs?
3. Briefly explain the theories of Entrepreneurial motivation.
4. Define a small scale industry. What are its chief characteristics?
5. What is the interrelationship between enterprise and society?
6. What are the salient features of New Small Enterprise Policy?
7. What are the important factors to be considered during the selection of project?
8. What you meant by Project appraisal?
9. Differentiate between Management and Administration.
10. Explain the terms Shares, Debentures and Bonds.

.

PART-B

Answer any 5 questions, each question carries 14 marks

11. Explain about growth of entrepreneurship in India

(OR)

12. Discuss Government of India policy measures to promote entrepreneurship in Food Processing sector in India.

13. Explain the factors to be considered while developing a feasibility report for food business plan.

(OR)

14. Discuss the major principles of food business Management

15. Write a note on fundamental of operation and supply chain management?

(OR)

16. What are the marketing challenges and approaches for new products and services sustain in a competitive environment?

17. What do you know about decision making processes and tools?

(OR)

18. Explain in detail about break even analysis

19. .Explain about the contents and formulation of project report.

(OR)

20. Prepare a techno-economic feasibility report on bakery

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SYLLABUS

MODULE 1

Entrepreneur & entrepreneurial flair

Classification of small, medium and large scale manufacturing industries; Opportunities of food processing industries in Kerala compared to other states Agencies for promotion of food processing industries; Source of machine and equipment. Entrepreneurship
Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations

MODULE 2

Marketing Principles:
Fundamentals of marketing principles and marketing mix, Sales and distribution management, Costing and cost management, pricing methods, fundamentals of operations and supply chain management, organization structure and human resource management , Trade license and registration marks

MODULE 3 Analysis:

Opportunity identification and feasibility studies, financial analysis,technical entrepreneurship, Project sizing , fund management and enterprise management issues Problem solving, decision making processes and tools, conflict and change management in a new industrial enterprise, Systems approach and consideration in an entrepreneurial venture. Management reporting and information system for monitoring and control of the new enterprise

MODULE 4 Monitoring and decision making

Problem solving, decision making processes and tools, conflict andchange management in a new industrial enterprise, Systems approach and consideration in an entrepreneurial venture. Management reporting and information system for monitoring and control of the new enterprise, managing Innovation. Marketing challenges and approaches for new products and services sustaining in competitive environment

MODULE 5- Reports:

Preparation of project report; Market feasibility reports; Break even Analysis Techno- economic feasibility report on an identified opportunity-any food processing; bakery and confectionary , fruit and vegetable processing, oil and fat ,milk and milk products etc

Text Books:

1.C.B. Gupta and N.P. Srinivasan. 2012. Entrepreneurship Development. S. Chand & Sons, New Delhi.
2. Anil Kumar, S., Poornima, S.C., Mini, K., Abraham and Jayashree, K. 2003. Entrepreneurship Development. New Age International Publishers, New Delhi.
3. Gupta, C.B. 2001. Management: Theory and Practice. Sultan Chand & Sons, New Delhi.
4. Vasant Desai. 2000. Dynamics of Entrepreneurial Development and Management. Himalaya Publishing House, New Delhi.

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5. K.P. Sudheer and V.Indira.2018. Entrepreneurship and skill development in Horticultural Processing. New India Publishing Agency, New Delhi.

Reference Books:

1. Couger C – Creativity and Innovation (IPP 1990)
2. Nina Jcaob – Creativity in Organisations Wheeler 1998
3. Jonne and Ceserani – Innovation and Creativity Crest 2001
4. Bridge S et al – Understanding Enterprise : Entrepreneurship and Small Business Palgrave 200
5. Holt – Entrepreneurship : New Venture Creation Prentice Hall 1998

Course Contents and Lecture Schedule :

No	Topic	No. of Lectures
1	**Entrepreneur & entrepreneurial flair**	**7**
1.1	Classification of small, medium and large scale manufacturing industries	2
1.2	Opportunities of food processing industries in Kerala	1
1.3	Agencies for promotion of food processing industries; Source of machine and equipment	2
1.4	Entrepreneurship Development Training and Other Support Organisational Services	1
1.5	Central and State Government Industrial Policies and Regulations	1
2	**Marketing Principles**	**7**
2.1	Fundamentals of marketing principles and marketing mix,	1
2.2	Sales and distribution management	1
2.3	Costing and cost management	2
2.4	pricing methods, fundamentals of operations and supply chain management	1
2.5	organization structure and human resource management , Trade license and registration marks	2
3	**Analysis**	**7**
3.1	Opportunity identification and feasibility studies, financial analysis,technical entrepreneurship	1
3.2	Project sizing , fund management and enterprise management	2
3.3	Problem solving, decision making processes and tools,	2
3.4	Systems approach and consideration in an entrepreneurial venture.	1
3.5	Management reporting and information system for monitoring and control of the new enterprise	1
4	**Monitoring and decision making**	**7**
4.1	Problem solving, decision making processes and tools	2
4.2	Systems approach and consideration in an entrepreneurial venture.	2
4.3	Management reporting and information system for monitoring and control of the new enterprise	1
4.4	Managing Innovation.	1
4.5	Marketing challenges and approaches for new products and services sustaining in competitive environment	1
5	**Reports**	**7**
5.1	Preparation of project report	1

5.2	Market feasibility reports	2
5.3	Break even Analysis	2
5.4	Techno- economic feasibility report on an identified opportunity	2
5.5	Preparation of project report	1
5.6	Visit a successful agribusiness organization or co-operative and understand its operations	1

FTT436	BYE-PRODUCT UTILIZATION IN FOOD INDUSTRY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course is designed to know about by-products obtained from various food process operations and their utilization. To introduce the basic concepts of food waste recycling.
Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Identify and distinguish types of waste generated from food industries and find suitable application based on its properties
CO 2	Plan effective methods for energy recovery from waste products and thereby to improve economic efficiency
CO 3	Develop various value-added products from food industry waste
CO 4	Assess and control environmental impacts associated with food industry waste disposal by using appropriate waste management techniques
CO 5	Apply the principles of waste water recycling to restore water supply and to control pollution

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2											
CO 2			2				3					
CO 3	2											
CO 4		3	3			3	3					
CO 5	3					3	3	2				

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. **Explain the waste treatment from rice mill.**
2. **Why is it necessary to proper waste disposal?**
3. **Define pyrolysis and importance of gasification?**

Course Outcome 2 (CO2)

1. **How will you determine the economic efficiency of waste management?**
2. **What is the significance of effective methods of waste disposal**
3. **Explain the by-product utilisation of coconut.**

Course Outcome 3(CO3):

1. **Explain the by-products obtained from tuber crops.**
2. **Illustrate the processing of dairy waste.**
3. **Explain coconut husk processing?**

Course Outcome 4 (CO4):

1. **Explain the importance of waste treatment in wheat milling.**
2. **Describe the environmental impact of proper waste management.**
3. **How does separation of wastes carry out in food industries?**

Course Outcome 5 (CO5):

1. **Illustrate the procedure for waste water treatment.**
2. **How will you carry out waste water recycling?**
3. **Explain the methods used for analysing the pollution of water.**

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT436
BYE-PRODUCT UTILIZATION IN FOOD INDUSTRY

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Write a short note on the different sources of waste from food industries.
2. Define pyrolysis. What is meant by the term, ‘gasification’?
3. What is distillation?
4. Write a short note on citric acid production?
5. What do you mean by fish silage?
6. Explain fish protein concentrate.
7. How is the dairy waste water treatment
8. Write on the by-product utilisation of plantain.
9. Differentiate between effluent and affluent.
10. What is sludge treatment?

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Give an account of pyrolysis and gasification of rice husk.

(OR)

12. Explain the role of cement preparation and different thermal applications.

13. Detail on the waste management in sugar mills.

(OR)

14. Explain distillation for production of alcohol.

15. Write an essay on fish protein concentrate and fish protein hydrolysate.

(OR)

16. How can you employ production of chitin, chitosan?

17. Write on dairy waste recycling-waste water treatment.

(OR)

18. Explain the processing of jackfruit and its by-product utilisation.

19. What is effluent treatment? How will you carry out sludge disposal?

(OR)

20. Detail on the physical and chemical methods of waste water treatment.

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Syllabus

Module 1 (7 hours)

By-product utilization from Cereals

Importance of bye-product utilization. Different sources of wastes from food industries and their availability in India-nature of different waste - Thermal and biotechnological uses of rice husk - pyrolysis and gasification of rice husk -cement preparation and different thermal applications - utilisation of rice bran - stabilization - defatted bran utilisation. By products of wheat milling – germs and bran – by products of pulse milling –husk, germs and broken.

Module 2 (7 hours)

Fruit and vegetable Bye-products

Processes for waste utilization from fruit and vegetable industries- Distillation for production of alcohol – oil extraction from waste - waste management in sugar mills - citric acid production from fruit waste.

Module 3 (7 hours)

Fish, Meat and Poultry

Fish industry by products and waste utilisation - Fish by-products - production of fish meal, fish protein concentrate, fish protein hydrolysate fish liver oil and fish silage; Production of chitin, chitosan; Production of non-food items from fish processing wastes. meat and poultry waste recycling.

Module 4 (7 hours)

Utilization Of milk and milk products

Dairy industry by-products and utilisation – dairy by-products – dairy waste recycling-waste water treatment in dairy industry, Tuber crops, plantation crops, plantain, jackfruit

Module 5 (7 hours)

Waste water Recycling:

Effluent safe disposal- effluent treatment plant- waste water treatment- physical and chemical methods, sludge disposal

Text Books

1. Bor S. Luh , Rice: Vol.1 Production, Vol.2. Utilisation, Springer, 1991
2. Scholarly articles in Agricultural Waste and By Product Utilisation

Reference Books

1. A Chakravarthy & De, "Agricultural Waste and By Product Utilisation
2.Green A H and A Kramer, Food processing waste management, AVI Pub. Co.1979
3. *Culp and Wisner, Handbook of advanced wastewater treatment***.** Van Nostrand Reinhold Company, 1978

4. *Scholarly articles in By*-products from food industries: utilization and disposal
5. *E. Beagle, "Rice Husk Conversion to Energy*"

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**By-product utilization from Cereals:**	**7**
1.1	Importance of bye-product utilization. Different sources of wastes from food industries and their availability in India-nature of different waste	3
1.2	Thermal and biotechnological uses of rice husk - pyrolysis and gasification of rice husk Cement preparation and different thermal applications - utilisation of rice bran - stabilization - defatted bran utilisation.	2
1.3	By products of wheat milling – germs and bran – by products of pulse milling –husk, germs and broken.	2
2	**Fruit and vegetable Bye-products**	**7**
2.1	Processes for waste utilization from fruit and vegetable industries- - waste management in sugar mills -	3
2.2	Distillation for production of alcohol – oil extraction from waste	2
2.3	Citric acid production from fruit waste.	2
3	**Fish, Meat and Poultry**	**7**
3.1	Fish industry by products and waste utilisation - Fish by-products	3
3.2	Production of fish meal, fish protein concentrate, fish protein hydrolysate fish liver oil and fish silage; Production of chitin, chitosan	2
3.3	Production of non-food items from fish processing wastes. meat and poultry waste recycling.	2
4	**Utilization Of milk and milk products**	**7**
4.1	Dairy industry by-products and utilisation – dairy by-products	3
4.2	Dairy waste recycling-waste water treatment in dairy industry.	2
4.3	**Other crops** Tuber crops, plantation crops, plantain, jackfruit	2
5	**Waste water Recycling**	**7**
5.1	Effluent safe disposal- effluent treatment plant	2
5.2	Waste water treatment- physical and chemical methods	3
5.3	Sludge disposal	2

FTT 446	FOOD PLANT UTILITIES, MAINTENANCE AND SAFETY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: The objective of the course is to provide insight to give ideas on food plant utilities, maintenance, safety and sanitation.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Identify and distinguish food plant utilities, maintenance programs ,sanitation and understand their significance
CO 2	Apply the principles of steam generation and working of boilers in food industry
CO 3	Ensure safe and quality food to the public by applying food quality sanitation and quality control tools
CO 4	Identify various causes of environmental pollution and choose appropriate control methods

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3					3		2				
CO 3	3					3						2
CO 4	3	2				3						

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Define sanitation
2. What is the significance of hygiene in food industry

Course Outcome 2 (CO2) :

1. Write a note on SOP ?
2. What is an accident investigation report?

Course Outcome 3(CO3):

1. Explain GHP followed in food industry
2. List out the test for food safety

Course Outcome 4 (CO4):

1. Write a note on CIP ?
2. Give a brief on BOD?

MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION (R&S), MONTH & YEAR

Course Code: FTT 446

Course Name: Food Plant Utilities, Maintenance and Safety

Max. Marks: 100 **Duration: 3hours**

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PART A

(Answer all questions; each question carries 3 marks)

1. Define sanitation.
2. With neat sketch explain the working and construction of any water tube boiler
3. What is pollution? Explain the methods to control water pollution from food industries.
4. Differentiate Preventive maintenance and Reactive maintenance
5. Explain i) GMP ii) GHP iii) GAP?
6. What is an accident investigation report?
7. Define sludge volume index and the methods for determine it.
8. Differentiate hazard and risk
9. What are different types of Preventive maintenance?.
10. Differentiate COD and BOD

.

PART-B

Answer any 5 questions, each question carries 14 marks

11. Explain the challenges for the maintenance in the food industry.

(OR)

12. Explain the role of staff and operators for the maintenance in food industry.

13 Explain the direct method to calculate the efficiency of boilers.

(OR)

14. Explain the factors to maintain for ensuring the sanitation at food storage area

15. Explain the different principles for maintaining the food safety at food industries.

(OR)

16. Discuss the sections in the Indian factories Act, 1948 for the ensuring the safety at food industries

17. Explain the sanitation design consideration of food processing equipment in food industries.

(OR)

18 Elaborate different types of sanitizing agents at food industries

19. Explain in detail pre-treatment and secondary treatment of solid waste in food industry

(OR)

20. Illustrate the process flowchart of waste utilization in food industries

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SYLLABUS

MODULE 1 (7 hours)

Introduction

Foot plant utilities and their importance; Estimation of utilities and utility load diagram; Plant maintenance program, role of maintenance staff and plant operators Preventive maintenance, Guidelines for good maintenance and safety precautions, Importance of food plant sanitation; Sanitation standards and their implementation

MODULE 2(7 hours)

Steam Generation

Properties of steam and steam generation process: steam generation equipment (boiler); Boiler type and their characteristics: Boiler accessories; Selection of boiler for food processing operations; Performance of boilers and its evaluation; Energy conservation in boiler operation; Treatment of boiler feed water

MODULE 3 (7 hours)

Food Safety

Principles of food safety, indicators of risk analysis, risk management clothing and personal hygiene , hygienic and sanitation requirement in different food processing units, pest control in food processing ,storage and service area source of contamination -test for food safety

MODULE 4 (7 hours)

Sanitization:

Sanitary design of food process equipment, for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation. The need for cleaning; Frequency of cleaning: Methods of cleaning and cleaning equipment: Standards for clean surfaces; Sanitizing agents and agents and sanitization processes

MODULE 5 (7 hours)

Waste management:

Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water, pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated bio-filtration, Flow process chart of food plant Waste utilization processes, various treatment for waste disposal
analysis of cleaners & sanitizers, CIP Cleaning

Text books:

1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981, Applied Science Pub Ltd.
2. Water & Wastewater Engineering; Fair GM, Geyer JC & Okun DA; 1986, John Wiley & Sons, Inc.
3. Wastewater Treatment; Bartlett RE; Applied Science Pub Ltd. 4. Symposium: Processing Agricultural & Municipal Wastes; Inglett GE; 1973, AVI.

Reference books:

1. Food Processing Waste Management; Green JH & Kramer A; 1979, AVI.
2. Environmental Biotechnology: Principles and Applications; Rittmann BE & McCarty PL; 2001, Mc-Grow-Hill International editions.
3. Environmental Biotechnology; Bhattacharyya B C & Banerjee R; Oxford University Press.

Course Contents and Lecture Schedule:

No	Topic	No. of Lectures
1	**Introduction**	**7**
1.1	Foot plant utilities and their importance; Estimation of utilities and utility load diagram	2
1.2	Plant maintenance program, role of maintenance staff and plant operators	2
1.3	Preventive maintenance, Guidelines for good maintenance and safety precautions	2
1.4	Importance of food plant sanitation; Sanitation standards and their implementation	1
2	**Steam Generation**	**7**
2.1	Properties of steam and steam generation process	1
2.2	Steam generation equipment (boiler)	1
2.3	Boiler type and their characteristics: Boiler accessories	1
2.4	Selection of boiler for food processing operations; Performance of boilers and its evaluation	2
2.5	Energy conservation in boiler operation; Treatment of boiler feed water	2
3	**Food Safety**	**7**
3.1	Principles of food safety	1
3.2	Indicators of risk analysis	1
3.3	Risk management clothing and personal hygiene , hygienic and sanitation requirement indifferent food processing units	2
3.4	Pest control in food processing ,storage and service area source of contamination -test for food safety	2
3.5	Storage and service area source of contamination -test for food safety	1
4	**Food Safety**	**7**
4.1	Sanitary design of food process equipment, for cleaning, packaging sanitation	2
4.2	Food storage sanitation, transport sanitation and water sanitation.	2
4.3	The need for cleaning; Frequency of cleaning	1

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4.4	Methodsof cleaning and cleaning equipment: Standards for clean surfaces; Sanitizing agents and agents and sanitization processes	1
4.5	Sanitizing agents and agents and sanitization processes	1
5	**Waste management**	**7**
5.1	Characterization of food industry wastes e.g., BOD, COD and total organic content	2
5.2	Floatable and suspended solids in water, pretreatment,	1
5.3	Secondary treatments of solid waste, sludge volume index,	1
5.4	Advanced techniques activated bio-filtration, Flow process chart of food plant	1
5.5	Waste utilization processes, various treatment for waste disposal analysis of cleaners & sanitizers, CIP Cleaning	1
5.6	CIP Cleaning	1

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FTT456	FERMENTATION AND ENZYME TECHNOLOGY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: The objective of the course is to provide a deeper insight into the fundamentals of enzyme structure, functions, kinetics of soluble and immobilized enzymes and also to empower the students with various designs of fermenter and fermentation processes.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Describe structure, functions and the mechanisms of action of enzymes.
CO 2	Learn kinetics of enzyme catalyzed reactions, enzyme inhibitory and regulatory process.
CO 3	Analyse different types of enzyme immobilization and also get exposure of applications of enzymes and their future potential.
CO 4	Gain knowledge on types of fermentation processes, media compositions and its role.
CO 5	Acquire insight on the design, parts of fermenters and its applications in various food industries.

Mapping of course outcomes with program outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2											
CO 2	2				3							
CO 3	2		2		2							
CO 4	3	2										
CO 5	3	2										

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Assessment Pattern:

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Define collision theory.
2. Differentiate Isozymes and Abzymes.

Course Outcome 2 (CO2) :

1. Write a note on turnover number?
2. What are multisubstrate reaction mechanisms?

Course Outcome 3(CO3):

1. Explain about thermophilic enzymes.
2. List out the enzymes used in various fermentation processes.

Course Outcome 4 (CO4):

1. Write a detailed account of fermentation medium composition with its functions.
2. Give a brief on lactic acid fermentation.

Course Outcome 5 (CO5):

1. List out the different parts of a fermenter.
2. Explain the various mechanisms of recovery and purifications in fermentation.

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION (R&S), MONTH &YEAR
Course Code: FTT456

Course Name: FERMENTATION AND ENZYME TECHNOLOGY

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. What are the functional classes of enzymes?
2. Discuss allosterism.
3. Write a note on types of inhibitors?
4. Mention the effect of ph and temperature on enzymes.
5. Write short notes on thermophilic enzymes.
6. Differentiate between entrapment and encapsulation.
7. Write a detailed account of fermentation medium composition.
8. Write short notes on Media formulation.
9. Explain the factors involved in the Design of fermenter.
10. Give a brief on the applications of fermentations in food industries.

PART-B

Answer any 5 questions, each question carries 14 marks

11. Explain the different classification of enzymes with its mode of action.

(OR)

12. Give a brief on the principles of catalysis.
13. Derive the Michaelis- Menten equation explaining its parameters.

(OR)

14. Elaborate on the process of Enzyme inhibition and the various types of inhibitors.
15. Write in detail about the Physical and chemical techniques for enzyme immobilization.

(OR)

16. Explain briefly about the enzymes used in various fermentation processes.
17. Give notes on the general requirements for fermentation processes.

(OR)

18. Describe the types of fermentation with examples.
19. With neat sketch, explain the types of fermenter.

(OR)

20. Summarize on the applications of fermentation in various food industries.

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SYLLABUS

MODULE 1-INTRODUCTION TO ENZYMES:

Classification of enzymes, Mechanisms of enzyme action; concept of active site and energetics of enzyme-substrate complex formation; specificity of enzyme action; principles of catalysis – collision theory, transition state theory, Coenzymes and Cofactors- Prosthetic group, coenzymes involved in different metabolic pathways. Classification of coenzymes. Isozymes, Abzymes, Synzyme.

MODULE 2- KINETICS OF ENZYME ACTION:

Kinetics of single substrate reactions; estimation of Michaelis- Menten parameters, multisubstrate reaction mechanisms and kinetics; Allosteric enzymes:The Monad – Changeux – Wyman model (MCW) and The Koshland – Nemethy – Filmer (KNF) model, Enzyme inhibition - types of inhibitors - competitive, non-competitive and uncompetitive, their mode of action , turnover number; ph and temperature effect on enzymes.

MODULE 3-ENZYME IMMOBILIZATION & APPLIED ENZYMOLOGY:

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages. Industrial Enzymes- Thermophilic enzymes, amylases, lipases, proteolytic enzymes in meat industry, enzymes used in various fermentation processes.

MODULE 4- INTRODUCTION TO FERMENTATION PROCESSES:

General requirements and Microbial culture selection for fermentation processes, Media formulation, inoculum development and process optimization- medium composition, energy, CO_2, nitrogen and other growth factors, buffering and foam agents. Types of fermentation- ethanolic fermentation – mixed alcoholic and acid fermentation – lactic acid fermentation.

MODULE 5-OVERVIEW OF FERMENTATION TECHNOLOGY & INDUSTRIAL IMPORTANCE:

Design of fermenter - types of fermenter -different parts-agitator, impellers, aerator, baffles, mode of configurations, process control, functions of various parts of fermenter. Recovery and purifications of food products. Selection of industrially important microorganisms; Fermentation in foods; application in baking, sauces, sauerkraut, sausages, pickle, beer and wine fermentation.

Text Books:

1. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals", 2nd Edition, McGraw-Hill, 1986.
2. Blanch, H.W. and D.S. Clark "Biochemical Engineering", Marcal Dekker, Inc., 1997.
3. Lee, James M. "Biochemical Engineering", Prentice – Hall, 1992.

Reference Books:

1. Hartmeier,Winfried "Immobilized Biocatalysts : An Introduction", Springer – Verlag, 1986
2. Palmer, Trevor "Enzymes : Biochemistry, Biotechnology, Clinical Chemistry", Affiliated East-West Press Pvt. Ltd., 2004.
3. Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation Technology", 2nd Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.
4. Wiseman, Alan "Handbook of Enzyme Biotechnology", 3rd Edition, Ellis Harwood Publications, 1999.

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Course Contents and Lecture Schedule:

No	Topic	No. of Lectures
1	**Introduction to enzymes:**	**7**
1.1	Classification of enzymes, Mechanisms of enzyme action	1
1.2	concept of active site, enzyme-substrate complex formation	1
1.3	specificity of enzyme action	1
1.4	principles of catalysis	1
1.5	Coenzymes and Cofactors	1
1.6	Classification of coenzymes	1
1.7	Isozymes, Abzymes, Synzyme	1
2	**Kinetics of enzyme action:**	**8**
2.1	Kinetics of single substrate reactions	1
2.2	Michaelis- Menten equation	1
2.3	multisubstrate reaction mechanisms and kinetics	1
2.4	Allosteric enzymes	1
2.5	The Monad – Changeux – Wyman model (MCW)	1
2.6	Koshland – Nemethy – Filmer (KNF) model	1
2.7	types of inhibitors	1
2.8	turnover number; ph and temperature effect on enzymes.	1
3	**Enzyme immobilization & applied enzymology:**	**7**
3.1	Techniques for enzyme immobilization	1
3.2	Advantages ,disadvantages and applications	2
3.3	Thermophilic enzymes	2
3.4	enzymes used in various fermentation processes	2

4	**Introduction to fermentation processes:**	**7**
4.1	Introduction and General requirements	2
4.2	Microbial culture selection	2
4.3	Media formulation, inoculum development and process optimization	2
4.4	Types of fermentation	1
4.5	lactic acid fermentation.	1
5	**Overview of fermentation technology & industrial importance:**	**7**
5.1	Design of fermenter	1
5.2	Types of fermenter	2
5.3	different parts of fermenter	1
5.4	Recovery and purifications of food products	2
5.5	Fermentation in foods	1
5.6	Applications	1

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Estd.
2014

CODE FTT466	BIOPROCESS ENGINEERING	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The students will be able to gain knowledge on industrial fermentation and to design the fermenter. It also helps to analyse the Engineering problems associated with the manufacture of products using bioreactors.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	To understand industrial fermentation and design of industrial fermenter.
CO 2	To distinguish between primary and secondary metabolites.
CO 3	To know the process technologies for commercial production of products.
CO 4	To identify the Engineering problems associated with the manufacture of products using bioreactors.
CO 5	To summarize the application of enzymes in industries and to explain the role of microorganisms in bioremediation and biopesticides.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2		3	1								
CO 2		3										
CO 3		2	2	2				2				
CO 4	2	3	1									
CO 5	1											

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	40
Analyse	5	5	10

Evaluate	5	5	10
Create			10

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List out the industrially useful microorganisms.

2. Give the detailed overview of industrial fermentation process.

3. Mention the medium requirements for fermentation process.

Course Outcome 2 (CO2)

1. Explain the Industrial processes for the manufacture of the following products :Organic acids

2. List out the commercially important amino acids.

3. Explain the Industrial production processes for various classes of secondary metabolites.

Course Outcome 3(CO3):

1. Describe the production and purification of enzymes and otherby-products.

2. List the commercially important vitamins and steroids.

3. Mention the Production of Ethanol, Acetone and Butanol.

Course Outcome 4 (CO4):

1. Explain the Production of biofertilizers.

2. Give examples for biofertilizers.

3. Describe the manufacture of biopesticides.

Course Outcome 5 (CO5):

1. Mention the production of baker's yeast.

2. What are enzymes and specify the applications of enzymes in industry?

3. Demonstrate the Isolation and purification of commercially important enzymes.

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FT466
BIOPROCESS ENGINEERING

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. What is fermentation?
2. List out the commonly used micro organisms
3. Why amino acids are called the building blocks of life?
4. What are primary metabolites?
5. What are vitamins and steroids?
6. Mention the various classes of secondary metabolites.
7. What are bio pesticides ? Give examples
8. What are the applications of Bioprocess Engineering?
9. Define enzyme.
10. Name any three polymers used for enzyme immobilization.

PART B
(Answer one full question from each module, each question carries 14 marks)

11. With neat sketch, Explain about the process and design of fermenter.

(OR)

12. Explain briefly about the medium requirements for industrial fermentation.

13. Explain the production of Ethanol with neat block diagram.

(OR)

14. Explain the Industrial processes for the manufacture of any two Organic acids.

15. Give the Industrial production processes for antibiotics.

(OR)

16. Explain the Industrial processes for the manufacture of streptomycin with flow sheet.

17. Explain the Microbial production of any two industrial enzymes.

(OR)

18. Explain the Production of Bio fertilizers.

19. Explain the Production of baker's yeast with neat sketch.

(OR)

20. How will you develop the production monoclonal antibodies ?

Syllabus

Module 1 (7 hours)

A historical overview of industrial fermentation process – traditional and modern biotechnology - industrially useful microorganisms . Process flow sheeting – block diagrams with industrial pictorial representation for various equipments, Isolation, preservation and improvement of industrial micro-organisms for overproduction of primary and secondary metabolites, medium requirements for fermentation process, Basic design of the fermenter

Module 2 (7 hours)

Production and purification of primary metabolites: Industrial processes for the manufacture of the following products: Organic acids-citric acid, lactic acid itaconic acid and acetic acid, Production of amino acids - commercially important amino acids; alcohols: ethanol, acetone

Module 3 (7 hours)

Production of secondary metabolites: - Industrial production processes for various classes of secondary metabolites: antibiotics: beta-lactams- penicillin and cephalosporin, aminoglycosides-streptomycin, quinines, commercially important vitamins and steroids.

Module 4 (7 hours)

Production and purification of enzymes and otherby-products: Microbial production of industrial enzymes: proteases, amylases, lipases and cellulases, Production of biofertilizers- manufacture, formulation and utilization, biopesticides:-Important biopesticides- Bt-toxin, Kasugamycin, Beauverin, Devine.

Module 5 (7 hours)

Biopreservatives, biopolymers- Xanthan gum and PHB, Beverages:- production of beverages, production of baker's yeast. Bioremediation- microbes in mining, ore leaching, oil recovery, waste water treatment, biodegradation of non cellulose and cellulosic wastes for environmental conservation, production of vaccines, production of monoclonal antibodies. Extraction and preparation of crude enzymes, purification and characterization of enzymes from plant, application of enzymes in industry, analytical purposes and medical therapy.

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Text Books

1. James E Bailey, “Biochemical Engineering Fundamentals”, McGraw Hill Edu, second edition, 2017.
2. Michael L Shuler, “Bioprocess Engineering ”, Pearson Education India, second edition, 2015.

Reference Books

1. Jackson, A.T, Process engineering in biotechnology, Prentice Hall.
2. Murrey Moo and Young, Comprehensive Biotechnology, Pergamon.
3. 3. Wulf Cruger and Anneliese Crueger, Biotechnology: A Textbook of Industrial Microbiology, Panima Publishing Corporation
4. Palmer T, Enzymes: Biochemistry, Biotechnology, Clinical chemistry, Horwood publishing, Colphon

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Fermentation design**	**7**
	Industrially useful microorganisms	3
1.2	Overview of industrial fermentation process	2
1.3	Medium requirements for fermentation process.	2
2	**Primary and secondary metabolites**	**7**
2.1	Industrial processes for the manufacture of the following products :Organic acids	3
2.2	Commercially important amino acids	2
2.3	Industrial production processes for various classes of secondary metabolites	2
3	**Process technologies**	**7**
3.1	Production and purification of enzymes and other byproducts	3
3.2	commercially important vitamins and steroids	2
3.3	production of ethanol, acetone and butanol	2
4	**Application of enzymes in industries**	**7**
4.1	Production of biofertilizers	3
4.2	The manufacture of biopesticides	2
4.3	Examples for biofertilizers	2
5	**Role of microorganisms**	**7**
5.1	Production of baker's yeast.	3
5.2	Isolation and purification of commercially important enzymes	2
5.3	Production of monoclonal antibodies	2

FTT 476	MEMBRANE TECHNOLOGY IN FOOD ENGINEERING	CATEGORY	L	T	P	CREDIT
			2	1	0	3

Preamble:

This course will enable students to understand membrane-based separation by acquiring in-depth knowledge in the area of membrane separation mechanisms, transport models, membrane materials and modules etc. The focus will be particularly on various applications of membrane science and technology in food engineering.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply transport mechanism, membrane preparation and characterization techniques for food processes
CO 2	Identify proper membrane materials, mode of operation and modules for any separation process
CO 3	Suggest a method to reduce fouling and identify cleaning /disinfection procedure
CO 4	Interpret the various membrane separation processes
CO 5	Evaluate the application of membrane separation processes in food industries

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2			3							
CO 2	2											
CO 3	3	2				3						
CO 4	3	2										
CO 5	2	3				3						

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	10	10	20
Apply	20	20	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

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Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define membrane and classify the membrane separation processes.
2. List out the various membrane preparation methods and explain the preparation of ceramic membranes

Course Outcome 2 (CO2)

1. Explain in detail about the different membrane materials used in the membrane processes.
2. Write down the general requirements of the membrane material.

Course Outcome 3(CO3):

1. Explain the concept of concentration polarisation.
2. Does fouling affect the efficiency of separation process? Justify

Course Outcome 4 (CO4):

1. Describe the theory, design and working of per evaporation.
2. Differentiate electro dialysis and reverse osmosis.

Course Outcome 5 (CO5):

1. Mention the separation process used in the dairy processing industries. Comment on its significance compared to conventional preservation processes.
2. Illustrate the application of membrane technology in fermented beverages processing.

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MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT476

MEMBRANE TECHNOLOGY IN FOOD ENGINERING

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Discuss the concept of driving force for membrane processes.
2. Write the principle of membrane process.
3. Differentiate dead end membrane process and cross flow membrane process
4. Enlist different types of membrane modules
5. Discuss the concept of membrane fouling.
6. Mention the cleaning procedure to reduce fouling
7. Draw neat sketch of electro-dialysis.
8. Differentiate ultra filtration and microfiltration
9. Write scope of membrane technology in food industries.
10. Write any two application of food industry.

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Explain in detail the transport mechanism involved in membrane separation process. . (14)

[OR]

12. Describe in detail about any two technique used in the membrane preparation process. (14)
13. Classify the membrane materials and explain the importance of application of each of them (14)

[OR]

14. Draw a neat sketch of the different types of membrane modules used in the membrane separation process and explain its mechanism. (14)
15. Enlist the theories involved in concentration polarisation of liquid separation process and explain any one theory in detail. (14)

[OR]

16. Explain the concept of fouling in membrane separation processes and mention the preventive control measures to overcome it. . (14)
17. Describe construction and working of ultra filtration with neat sketch. (14)

[OR]

18. Compare the working principle of dialysis and electro dialysis with neat sketch. (14)

19. Explain the application of membrane separation process in dairy processing industry. (14)

[OR]

20. Explain the application of membrane separation process in nutraceutical and functional foods. (14)

Syllabus

Module 1 (7 hours)

Introduction to membrane technology: Definition of a membrane, General characteristics of membrane processes, transport mechanism, advantages, classification of membrane processes, Preparation and characterization of membranes, Melt pressing, Film stretching, Sol-gel peptization, Interfacial polymerization etc.

Module 2 (7 hours)

Membrane materials and configurations: Requirements of membrane materials, Membrane materials: Organic polymers, Inorganic polymers, ceramic membranes, composite membrane, modes of operation: dead end flow, cross flow, direct flow, membrane modules: spiral-wound modules, tubular modules, capillary modules, hollow fiber modules, and flat-sheet plate-and-frame/cassette modules.

Module 3 (7 hours)

Concentration polarisation and fouling: Concentration polarisation in liquid separation process, fouling: fouling mechanism, prevention and control, cleaning: cleaning factors, cleaning procedures, chemicals used and recovery, disinfection

Module 4 (7 hours)

Membrane separation processes: Theory, system design and application: Reverse osmosis, Microfiltration, Ultra-filtration, Nano-filtration, Electro-dialysis, Dialysis, Per-evaporation, Gas separation, Membrane distillation, and Liquid membrane technology.

Module 5 (7 hours)

Application in food processing: Membrane application: water treatment, Dairy processing, nutraceuticals and functional foods, fruit juice and beverage production, fermented beverage production

Text Books

1. A.Y. Tamime, "Membrane processing, Dairy and beverage applications" Wiley Blackwell Publications
2. Richard W. Baker, "Membrane Technology and Applications", 3 rd edition, John Wiley & Sons, Ltd, United Kingdom, 2012
3. Membrane Handbook Eds. By W. S. W. Ho and K. K.Sirkar

Reference Books

1. Robert Field et al "Engineering Aspects of Membrane Separation and Application in Food Processing" CRC Press.
2. Amaresh et al, Book chapter, Applications of membrane separation technology in food industry

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Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to membrane technology**	**7**
1.1	Definition of a membrane, General characteristics of membrane processes, transport mechanism, advantages, classification of membrane processes	4
1.2	Preparation and characterization of membranes, Melt pressing, Film stretching, Sol-gel peptization, Interfacial polymerization etc.	3
2	**Membrane materials and configurations**	**7**
2.1	Requirements of membrane materials, Membrane materials: Organic polymers, Inorganic polymers, ceramic membranes, composite membrane	2
2.2	modes of operation: dead end flow, cross flow, direct flow	2
2.3	Membrane modules: spiral-wound modules, tubular modules, capillary modules, hollow fiber modules, and flat-sheet plate-and-frame/cassette modules.	3
3	**Concentration polarisation and fouling**	**7**
3.1	Concentration polarisation in liquid separation process	3
3.2	fouling: fouling mechanism, prevention and control	2
3.3	cleaning: cleaning factors, cleaning procedures, chemicals used and recovery, disinfection	2
4	**Membrane separation processes**	**7**
4.1	Theory, system design and application: Reverse osmosis, Microfiltration, Ultra-filtration, Nano-filtration	3
4.2	Electro-dialysis, Dialysis, Per-evaporation, Gas separation, Membrane distillation, and Liquid membrane technology.	4
5	**Application in food processing**	**7**
5.1	Membrane application: water treatment, Dairy processing, nutraceuticals and functional foods	4
5.2	fruit juice and beverage production, fermented beverage production	3

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd. 2014

FTT418	FOOD LAWS AND REGULATIONS	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course is designed to introduce the basic food standards, laws and legislative bodies**.** This course gives understanding of the safety regulations and food acts for food standardization.

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Recognize the concept of food safety and standards and rules established to enforce safety and purity of food products
CO 2	Summarize different types of food hazards and contaminations and know about food safety aspects of novel methods of food processing
CO 3	To gain knowledge of the food safety aspects of novel methods of food processing
CO 4	Distinguish various food safety regulations, risk assessment and voluntary quality standards and certification
CO 5	Relate different types of food acts and food standardization

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3					3						
CO 2	3					3						
CO 3	3					3		2				
CO 4	3	2				3						
CO 5	3					3						

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	60
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. **What is the function of FPO?**
2. **What are the responsibilities of Various Authorities under PFA?**
3. **Explain the Important features and Definitions of IMS act**
4. **Give details of laws related to permitted additives like colours**

Course Outcome 2 (CO2)

1. **Enumerate the sources of microbial contamination**
2. **Elaborate on Pesticide residues in food**
3. **Classify food hazards with examples**

Course Outcome 3(CO3):

1. **Explain the principle of HPP with its application in food processing**
2. **What are the advantages of food irradiation?**
3. **Elaborate on food safety aspects of PEF**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY KTU Estd 2014

Course Outcome 4 (CO4):

1. **Write a note on CODEX Alimentarius commission and its functions**
2. **Explain the important features of GMP**
3. **What are the different elements of effective risk communication ?**

Course Outcome 5 (CO5):

1. **Outline the benefits and principles of BRC/IOP packaging standard**
2. **What are the steps involved in ISO 14000 certification process?**
3. **Differentiate between SQF 1000 and SQF 2000**

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Estd.
2014

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT418
FOOD LAWS AND REGULATIONS

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Demonstrate the different strategies of food safety
2. Describe the important features and definitions of IMS act
3. Consider one food industry of your choice and analyse different types of hazards with examples
4. What are pesticide residues and why do they turn up in your food?
5. What do you mean by JECFA?
6. Explain the role of FSSAI
7. Give a detailed description on functions of OIE
8. What are the similarities between SPS and TBT agreements?
9. Write about GAHP with special emphasis on benefits.
10. Enumerate the salient features of ISO 17025

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Give an account of Prevention of Food Adulteration Act 1954 and its important features
(OR)
12. Elaborate on important features of 'The vegetable oil products (Regulation) order' 1998 and laws pertaining to vegetable oils
13. Explain in detail on the hazards in foods

(OR)

14. Discuss the construction details of Pulsed Electric Field with its advantages and disadvantages
15. Elaborate on Essential Commodities Act, 1955 with special emphasis on important features and various sections

(OR)

16. Give a detailed description on WHO/FAO expert bodies and their functions
17. Describe the important features of 'Export Act 1963'

(OR)

18. Explain WTO agreements

19. Consider one food industry of your choice and elaborate on application of HACCP principles through the analysis of a case study

(OR)

20. Elaborate on management and technical requirements specific to food testing laboratories in terms of physical and chemical parameters

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Syllabus

Module 1 (7 hours)

Introduction: Introduction, concept of food safety and standards, food safety strategies. Prevention of Food Adulteration Act 1954 & 1955, rules established in India to enforce safety and purity of food products; Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment; Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants etc.

Module 2 (7 hours)

Food hazards and contaminations: Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical factors. Food safety aspects of novel methods of food processing such as PEF, high pressure processing, thermal and non thermal processing, irradiation of foods

Module 3 (7 hours)

Food Safety Regulation: Indian and Food Regulatory Regime (Existing and new), PFA Act and Rules, Food Safety and Standards Act, 2006, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.

Module 4 (7 hours)

Food Acts: Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Customs Act and Import Control Regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK.

Module 5 (7 hours)

Risk Assessment and Food Standardization: Risk assessment studies: Risk management, risk characterization and communication. Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices. An Overview and structure of 9001:2000/2008, ISO 9001:2000, ISO 22000:2005, ISO 9000, ISO 22000, ISO 14000, ISO 17025, FSSC 22000, BRC, BRC IOP, IFS, SQF 1000, SQF 2000.

Text Books

1. Jacob MB (1999). The chemical analysis of foods and food products. CBS Publ. New Delhi
2. Pomeranze Y (2004). Food analysis - Theory and Practice CBS Publications, New Delhi.
3. Rees, Naomi and David Watson —International Standards for Food Safety, Aspen Publication, 2000.
4. Shapton DA (1994). Principles and practices of safe processing of foods. Butterworth Publication, London.
5. Winton AL (1999) Techniques of food analysis, Allied Science Publications New Delhi.

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Reference Books

1. Mehta, Rajesh and J. George —Food Safety Regulations, Concerns and Trade : The Developing Country Perspective^, Macmillan, 2005.

2. Schmidt, Ronald H. and Rodrick, G.E. —Food Safety Handbooks, Wiley Interscience, UK, 2005.

3. Singal RS (1997). Handbook of indices of food quality and authenticity. Woodhead Publ. Cambridge, UK.

4. The Prevention of Food Adulteration Act, 1954D, Commercial Law Publishers India) Pvt. Ltd.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**7**
1.1	Introduction, concept of food safety and standards, food safety strategies.	1
1.2	Prevention of Food Adulteration Act 1954 & 1955, rules established in India to enforce safety and purity of food products	2
1.3	Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment	2
1.4	Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants etc.	2
2	**Food hazards and contaminations**	**7**
2.1	Food hazards and contaminations - biological	1
2.2	Food hazards and contaminations - chemical	1
2.3	Food hazards and contaminations - physical	1
2.4	Food safety aspects of novel methods of food processing	2
2.5	Irradiation of foods	2
3	**Food Safety Regulation**	**7**
3.1	Indian and Food Regulatory Regime (Existing and new), Global Scenario	2
3.2	PFA Act and Rules	1
3.3	Food Safety and Standards Act, 2006	1
3.4	Essential Commodities Act, 1955, Codex Alimentarius	2
3.5	WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.	1
4	**Food Acts**	**7**
4.1	Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc).	2
4.2	WTO: Introduction to WTO Agreements: SPS and TBT Agreement	2
4.3	Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Customs Act and Import Control Regulations	2
4.4	Other Voluntary National Food Standards: BIS, AGMARK.	1
5	**Risk Assessment and Food Standardization**	**7**
5.1	Risk assessment studies: Risk management, risk characterization and	2

	communication.	
5.2	Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices	2
5.3	An Overview and structure of 9001:2000/2008, ISO 9001:2000, ISO 22000:2005, ISO 9000, ISO 22000	1
5.5	ISO 14000, ISO 17025, FSSC 22000, BRC, BRC IOP	1
5.6	IFS, SQF 1000, SQF 2000	1

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FTT428	ICT APPLICATIONS IN FOOD INDUSTRY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course is designed to understand the importance of computerization in food industry and the applications of ICT in food industries.

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the importance of computerization in food industry
CO 2	Gain knowledge about the use of MATLAB in food industry
CO 3	Have an understanding about different toolboxes used in food industry andcomputational fluid dynamics.
CO 4	Attain knowledge about different software used in the food industry.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2		3	2	-	2	-	-		2	2
CO 2	3	-		2		-		-	-	-	-	2
CO 3	2	-				-		-	-	-	2	
CO 4	1	2	3	3	3	-	2	-	-	-	-	

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	60
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration

150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. **Mention the need for computerization in food industry**
2. **List out the different types of computer platform used in food industry.**
3. **Explain the application of networking and spreadsheet in data handling and interpretations.**

Course Outcome 2 (CO2)

1. **Write the general procedure to develop a program using MATLAB.**
2. **Develop a MATLAB program applicable to food processing system.**
3. **Enlist the different applications of MATLAB in food industries.**

Course Outcome 3(CO3):

1. **Mention any three toolboxes and its application in food industry.**
2. **Write a note on importance of CFD studies in food processing.**
3. **Describe the different steps involved in the CFD studies.**

Course Outcome 4 (CO4):

1. **Mention the different features of the CFD software**
2. **What are the advantages of Lab view software**
3. **Explain the process involved in collection and analysis of data using Data Acquisition system.**

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT428
ICT APPLICATIONS IN FOOD INDUSTRY

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. List the different operating environment used in food industry.
2. Mention the application of spreadsheet in food processing sector.
3. Write a note on webpage design.
4. Write a MATLAB program for solving food process.
5. Write the application of neural network tool box.
6. Explain the significance of CFD studies.
7. List out the features of fluent software.
8. How does data acquisition system works
9. What is cloud computing? Mention its significance
10. Mention the use of robots in food industry.

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Explain in detail about the SCADA system and its features.

(OR)

12. Detail any three computer tools and its application in solving food engineering problems.

13. Describe the process involved in on-line food process control from centralized server system in processing plant

(OR)

14. Develop a MATLAB program to solve drying related problem.

15. Explain in detail about image processing toolbox and statistical toolbox.

(OR)

16. Demonstrate the application of CFD studies in fruit and beverage processing.

17. Describe the different aspects of FLUENT software and its application in food processing sector.

(OR)

18. Explain the various components of data acquisition system and its usage in food industry
19. Consider one food industry of your choice and elaborate on application of automation and robotics

(OR)

20. Elaborate on machine learning technologies and their algorithms.

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Syllabus

Module 1(7 hours)

Importance of computerization in food industry, operating environments and information systems for various types of food industries, Supervisory control and data acquisition (SCADA); SCADA systems hardware, firmware, software and protocols, landlines, local area network systems, modems; Spreadsheet applications: Data interpretation and solving problems, preparation of charts, use of macros to solve engineering problems, use of add-ins, use of solver

Module 2 (7 hours)

Web hosting and webpage design; file transfer protocol (FTP), on-line food process control from centralized server system in processing plant;Use of MATLAB in food industry; computing with MATLAB, script files and editor/debugger, MATLAB help system, problem solving methodologies, numeric, cell,arrays, matrix operations, user defined functions, programming using MATLAB

Module 3 (7 hours)

Introduction to toolboxes useful to food industry, curve fitting toolbox, fuzzy logic toolbox, neural network toolbox, image processing toolbox, statistical toolbox; Introduction to computational fluid dynamics (CFD), governing equations of fluid dynamics; Models of flow, substantial derivative, divergence of velocity, continuity, momentum and energy equations;Physical boundary conditions, discretization; Applications of CFD in food and beverage industry

Module 4 (7 hours)

Introduction to CFD software, GAMBIT and FLUENT software; LabVIEW –LabVIEW environment: Getting data into computer, data acquisition devices, NI-DAQ, simulated data acquisition, sound card, front panel/block diagram, toolbar/tools palette

Module 5 (7 hours)

ICT applications for the food industry, Robots in food industries, Components of information and communication technologies, Collection of data, Wireless sensors in data collection, Processes involved in information and communication technologies, Data processing technologies: Big data analysis, Machine learning, Machine learning technologies and their learning algorithms, Cloud computing, Image processing, Data communication devices and applications in the food industry

Text Books

1.National Instruments Corporation. 2005. Introduction to LabVIEW: 3-Hour Hands-On.NI, Austin,Texas.
2..David Bailey and Edwin Wright. 2003. Practical SCADA for Industry. Elsevier,Burlington, MA
3. Future Foods Global Trends, Opportunities, and Sustainability Challenges ,Edited byRajeev Bhat

Reference Books

1.R. Paul Singh. 2014. Computer Applications in Food Technology: Use of Spreadsheetsin Graphical,Statistical and Process Analysis. Academic Press, London.
2.William J. Palm III. 2011. Introduction to MATLAB for Engineers, 3rd Ed. McGraw-Hill Companies, Inc., NY, USA.
3.Nigel Chapman and Jenny Chapman. 2006. Web Design: A Complete Introduction.John Wiley & Sons, USA.

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KTU
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Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1**	**7**
1.1	Importance of computerization in food industry	1
1.2	Operating environments and information systems for various types of food industries	2
1.3	Supervisory control and data acquisition (SCADA); SCADA systems hardware	2
1.4	Spreadsheet applications Data interpretation and solving problems, preparation of charts, use of macros to solve engineering problems, use of add-ins, use of solver	2
2	**Module 2**	**7**
2.1	Web hosting and webpage design; file transfer protocol (FTP	2
2.2	On-line food process control from centralized server system in processing plant	1
2.3	Use of MATLAB in food industry; computing with MATLAB	2
2.4	Script files and editor/debugger, MATLAB help system, problem solving methodologies	1
2.5	Numeric, cell,arrays, matrix operations, user defined functions, programming using MATLAB	1
3	**Module 3**	**7**
3.1	Introduction to toolboxes useful to food industry	2
3.2	Curve fitting toolbox, fuzzy logic toolbox	1
3.3	Neural network toolbox, image processing toolbox	1
3.4	Introduction to computational fluid dynamics (CFD), governing equations of fluid dynamics	2
3.5	Models of flow, substantial derivative, divergence of velocity, continuity, momentum and energy equations Physical boundary conditions, discretization; Applications of CFD in food and beverage industry	1
4	**Module 4**	**7**
4.1	Introduction to CFD software	1
4.2	GAMBIT and FLUENT software	2
4.3	LabVIEW –LabVIEW environment	2
4.4	Getting data into computer, data acquisition devices, NI-DAQ, simulated data acquisition, sound card, front panel/block diagram, toolbar/tools palette	2
5	**Module 5**	**7**
5.1	ICT applications for the food industry	1
5.2	Robots in food industries, Components of information and communication technologies	2
5.3	Collection of data, Wireless sensors in data collection	1

5.5	Data processing technologies: Big data analysis, Machine learning, Machine learning technologies and their learning algorithms	2
5.6	Cloud computing, Image processing, Data communication devices and applications in the food industry	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
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Estd.
2014

FTT438	FOOD INDUSTRY WASTE MANAGEMENT	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble: This course is designed to introduce various strategies for food industry waste management and also gives understanding of waste utilization in food industries.

Prerequisite:

Course Outcomes: After the completion of the course the student will be able to

CO 1	To enable the student, understand the extent of wastes produced in a food industry
CO 2	Recognize the concept of waste disposal in food industries and different methods of waste disposal
CO 3	Summarize different methods for treatment of food industry wastes
CO 4	To gain knowledge on solid waste disposal in food industries
CO 5	Distinguish various waste water treatment methods in food industries

Mapping of course outcomes with program outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3					3						
CO 2	3					3						
CO 3	3					3		2				
CO 4	3	2				3						
CO 5	3					3						

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	60
Analyse			
Evaluate			
Create			

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Estd.
2014

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. **What is the function of Food industry waste management?**
2. **What are the different types of wastes from fish processing industry?**
3. **What are the different types of wastes from sugar industry?**

Course Outcome 2 (CO2)

1. **Enumerate the methods of waste disposal**
2. **Feasibility report for food industries using food waste and by products**
3. **Classify biological methods of waste disposal**

Course Outcome 3(CO3):

1. **Explain the principle of trickling filter**
2. **What are the advantages of biogas plant?**
3. **Elaborate on rotating biological contactors**

Course Outcome 4 (CO4):

1. **Write a note on advantages of biological composting**
2. **Explain the important features of landfill digester**

3. What are the different elements of vermicomposting pit?

Course Outcome 5 (CO5):

1. **Outline the benefits and principle of bioclarifiers**
2. **What are the steps involved in drinking water treatment process?**
3. **What are the steps involved in effluent treatment?**

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MODEL QUESTION PAPER

QP CODE:

Reg No.:_______________

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: FTT438

FOOD INDUSTRY WASTE MANAGEMENT

Max. Marks: 100 **Duration: 3 hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Demonstrate the sources of food industry waste
2. Classify food industry wastes
3. Classify food industry waste disposal methods
4. What are the physical methods employed to dispose food industry waste?
5. What do you mean by UASB?
6. Explain the role of Trickling filters
7. Give a detailed description on biological composting
8. What are the differences between drying and incineration?
9. Write about biofilters.
10. Enumerate the salient features of bioclarifiers

PART B

(Answer one full question from each module, each question carries 14 marks)

11. Give an account of Classification and characterization of food industrial wastes from fruit and vegetable processing industry

(OR)

12. Elaborate on food industrial wastes from dairy industry

13. Explain in detail on economic aspects of waste treatment and disposal

(OR)

14. Discuss the waste disposal methods with special emphasis on chemical and biological methods

15. Elaborate on activated sludge process

(OR)

16. Give a detailed description on biogas plant

17. Describe the important features of biological composting

(OR)

18. Explain vermicomposting

19. Explain in detail on Ion exchange treatment of waste water

(OR)

20. Elaborate on drinking water treatment methods

Syllabus

Module 1 (7 hours)

Introduction: Sources of Food Industry Wastes Introduction. Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry

Module 2 (7 hours)

Waste disposal methods: Physical, chemical and biological; Economical aspects of waste treatment and disposal. Energy efficiency and conservation Feasibility report for food industries using food waste and by products

Module 3 (7 hours)

Waste Treatment Methods: Treatment methods for liquid wastes from food process industries; Design of activated sludge process, rotating biological contactors, Trickling filters, UASB, Biogas plant.

Module 4 (7 hours)

Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester, Vermicomposting pit.

Module 5 (7 hours)

Treatment of waste water: Biofilters and bioclarifiers, Ion exchange treatment of waste water, Drinking-water treatment, Recovery of useful materials from effluents by different methods

Text books:

1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981, Applied Science Pub Ltd.
2. Water & Wastewater Engineering; Fair GM, Geyer JC & Okun DA; 1986, John Wiley & Sons, Inc.
3. Wastewater Treatment; Bartlett RE; Applied Science Pub Ltd. 4. Symposium: Processing Agricultural & Municipal Wastes; Inglett GE; 1973, AVI.

Reference books:

1. Food Processing Waste Management; Green JH & Kramer A; 1979, AVI.
2. Environmental Biotechnology: Principles and Applications; Rittmann BE & McCarty PL; 2001, Mc-Grow-Hill International editions.
3. Environmental Biotechnology; Bhattacharyya B C & Banerjee R; Oxford University Press.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**7**
1.1	Sources of Food Industry Wastes Introduction.	1
1.2	Classification and characterization of food industrial wastes from beverage industry, fish, meat and poultry industry	2
1.3	Classification and characterization of food industrial wastes from fruit and vegetable processing industry	2
1.4	Classification and characterization of food industrial wastes from sugar industry and dairy industry	2
2	**Waste disposal methods**	**7**
2.1	Physical	1
2.2	Chemical	1
2.3	Biological	1
2.4	Economical aspects of waste treatment and disposal.	2
2.5	Feasibility report for food industries using food waste and by products	2
3	**Waste Treatment Methods**	**7**
3.1	Treatment methods for liquid wastes from food process industries	2
3.2	Design of activated sludge process,	1
3.3	Rotating biological contactors,	1
3.4	Trickling filters,	2
3.5	UASB, Biogas plant.	1
4	**Treatment methods of solid wastes**	**7**
4.1	Biological composting	2
4.2	drying and incineration	2
4.3	Design of solid waste management system	1
4.4	Landfill digester, Vermicomposting pit.	2
5	**Treatment of waste water**	**7**
5.1	Biofilters	2
5.2	Bioclarifiers	2

5.3	Ion exchange treatment of waste water,	1
5.5	Drinking-water treatment	1
5.6	Recovery of useful materials from effluents by different methods	1

FTT 448	PHYTOCHEMICALS IN FOOD	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The students will able to know about the role of different phytochemicals in food, their mode of action and health benefits

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Learn the methods used to study phytochemicals and health.
CO 2	Gain knowledge on different sugars, organic acids and soluble fibres.
CO 3	Gain knowledge about different alkaloids and their mode of action.
CO 4	Gain knowledge on quality control of herbal drugs as per WHO guidelines

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2						2	2				
CO 2	2											
CO 3	2	2	2	2				2			2	2
CO 4	3	2					2	2	2	2	2	

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1)

1. List out the methods used to study connections between phytochemicals and health.

2. Write a note on ROS.

3. List out different antioxidant activity assays.

4. Discuss antioxidant hypothesis.

Course Outcome 2 (CO2)

1. What are amino acids and their health benefits?

2. Write a note on organic acids.

3. Explain Flavonoids and the role in health.

4. Describe condensed tannins and tea phenolics?

Course Outcome 3 (CO3)

1. Write a note on essential amino acids.

2. Discuss on seed storage proteins.

3. Explain plant-animal interactions.

4. What are the important alkaloids which have heath benefits?

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Course Outcome 5 (CO5)

1. Discuss on the quality control of herbal drugs as per WHO guidelines.

2. Write a note on biological analysis of herbal drugs.

3. Methods to identify adulteration of drugs.

4. List out important herbal drugs and their mode of action.

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MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION (R&S), MONTH & YEAR

Course Code: FTT 448

Course Name: Phytochemicals in Food

Max. Marks: 100 **Duration: 3hours**

PART A

(Answer all questions; each question carries 3 marks)

1. Discuss on health benefits of phytochemicals.

2. List out different anti-oxidant activity assays.

3. Discuss on health benefits of amino acids.

4. Comment on flavonoids role in health.

5. What are organic acids.

6. Explain seed storage proteins.

7. Mention the analogues of Morphine.

8. Discuss on the mode of action of different alkaloids.

9. Mode of action of herbal drugs.

10. Discuss on the strategies adopted for adulteration of foods?

Part B

(Answer one full question from each module, each question carries 14 Marks)

11. Describe different antioxidant assays.

OR

12. Mention the different strategies adopted to study antioxidant properties of phytochemicals.

13. Describe flavonoids biosynthetic pathways.

OR

14. Explain the important health benefits of soluble fibres.

15. Write a note on seed oils and explain its important health benefits.

OR

16. Discuss on the important seed storage proteins.

17. Describe semi-synthetic derivatives of different alkaloids.

OR

18. Explain the different alkaloids and their semi-synthetic derivatives.

19. List out the mode of action of five herbal drugs.

OR

20. Discuss on the different methods used for analysis of herbal drugs..

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SYLLABUS

MODULE 1 (7 hours)

Introduction

Methods used to study connections between phytochemicals and health, Introduction to a variety of food plants & health promotion, ROS and Antioxidant hypothesis, Total antioxidant activity assays, Methods to study phytochemicals and health promotion.

MODULE 2 (7 hours)

Sugars, soluble fibres and organic acids

Sugars, Soluble fibres, Ascorbic acid, Other organic acids, Amino acids. Flavonoids, anthocyanins and polyphenolics - Flavonoid biosynthesis, Anthocyanins, Condensed tannins, Tea polyphenolics

MODULE 3 (7 hours)

Fats and oils

Carotenoids, Seed oils, Terpenoids, Glucosinalates Alkaloids and Seed storage proteins- Alkaloids – Capsaicinoids, Alkaloids – Caffeine, Essential amino acids, Seed storage proteins, Plant-Animal interactions

MODULE 4 (7 hours)

Alkaloids

Morphine and a brief account of its derivatives and analogues, Ergot alkaloids and semisynthetic derivatives, Caffeine and Theophylline, Reserpine, Quinine and Quinidine, Atropine, Hyoscyamine and Scopolamine, Structure and use of Homatropine. Vincristine and Vinblastine, Taxol, Camptothecin, Podophyllotoxin and Semisynthetic derivatives of these compounds.

MODULE 5 (7 hours)

Quality control Guidelines and evaluation methods

Quality control of herbal drugs as per WHO Guidelines- Adulteration of crude drugs and their detection by evaluation methods. Introduction, morphological, microscopical, physical, chemical, biological analysis of herbal drugs

Text Books:

1. Harborne JB 1998. Phytochemical methods. Chapman and Hall. Lea PJ, Leegood RC 1993.
2. Plant Biochemistry and molecular biology. Wiley. Biochemistry & Molecular Biology of Plants, Second edition, print or electronic version, 2015, Wiley Blackwell (Available on Google Play
3. https://play.google.com/store/books/details/Bob_B_Buchanan_Biochemistry_and_Molecular_Biology?id=9YAZCgAAQBAJ for $93.59) 2 Heldt, HW. 2005.

Reference Books:

1. Plant Biochemistry and Molecular Biology. Oxford University Press, 3rd Ed. Campbell, TC and Campbell II, TM.. 2006. The China Study: The most comprehensive study of nutrition ever conducted and the startling implications for diet, weight loss and long-term health. Benbella Books, Dallas, TX.

2. Organic chemistry – Morrison & Boyd – 11th edition along with the study guide. Spectroscopic methods of identification of organic compounds – Silverstein and Basler

Course Contents and Lecture Schedule :

No.	Topic	No. of Lectures
1.	**Introduction**	**7**
1.1.	Methods used to study connections between phytochemicals and health	3
1.2.	Introduction to a variety of food plants & health promotion, ROS and Antioxidant hypothesis	2
1.3.	Total antioxidant activity assays, Methods to study phytochemicals and health promotion	2
2.	**Sugars, soluble fibres and organic acids**	**7**
2.1.	Sugars, Soluble fibres, Ascorbic acid, - Flavonoid biosynthesis, Anthocyanins,	2
2.2.	Other organic acids, Amino acids. Flavonoids, anthocyanins and polyphenolics	2
2.3.	Condensed tannins, Tea polyphenolics	3
3.	**Fats and oils**	**7**
3.1.	Carotenoids, Seed oils, Terpenoids, Alkaloids – Capsaicinoids, Alkaloids	2
3.2.	Glucosinalates Alkaloids and Seed storage proteins-	2
3.3.	Caffeine, Essential amino acids, Seed storage proteins, Plant-Animal interactions	3
4.	**Alkaloids**	**7**
4.1.	Morphine and a brief account of its derivatives and analogues, Ergot alkaloids and semisynthetic derivatives	2
4.2.	Caffeine and Theophylline, Reserpine, Quinine and Quinidine, Atropine, Hyoscyamine and Scopolamine	3

4.3.	Structure and use of Homatropine. Vincristine and Vinblastine, Taxol, Camptothecin, Podophyllotoxin and Semisynthetic derivatives of these compounds	2
5.	**Quality control Guidelines and evaluation methods**	**7**
5.1.	Quality control of herbal drugs as per WHO Guidelines	2
5.2.	Adulteration of crude drugs and their detection by evaluation methods	2
5.3.	Introduction, morphological, microscopical, physical, chemical, biological analysis of herbal drugs	3

FTT458	Food Informatics	CATEGORY	L	T	P	CREDIT
		PEC	3	0	0	3

Preamble: Goal of this course is to develop the knowledge of students to design different equipments and programs used in food industries. This course will give students a clear vision about the basic considerations of chemical and instrumental methods of food analysis, spectroscopic techniques and data optimization in food industry.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	To understand the principles behind analytical techniques in food analysis
CO 2	To know the methods of selecting appropriate techniques in the analysis of food products
CO 3	To understand the principles and operation of different instrumentation techniques
CO 4	To Understand the different molecular spectroscopic techniques and their analytical applications
CO 5	To understand the concepts applied in databases, their significance and application.

Mapping of course outcomes with program outcomes

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	3									
CO 2	1	2	3	2	2							
CO 3	1	3	2	1	2							
CO 4	1	3	3	3	2							
CO 5	1	2	3	1	1							

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	20	20	70
Analyse			

Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define different concepts related to measurement system configuration

2. Describe the theories and types of instruments

3. Explain the transmitting and teleporting devices of the food industry

Course Outcome 2 (CO2)

1. Explain zero, first and second order instrument systems

2. Explain the Specification and testing of dynamic response

3. Explain the different types of measuring instruments

4. Explain the properties of different types of measuring instruments

Course Outcome 3(CO3):

1. Explain different chromatography techniques

2. Explain different Spectrophotometry techniques

3. Explain the applications of Spectrophotometry, chromatography in food industries

Course Outcome 4 (CO4):

1. Explain the instrumental and Experimental Considerations of NMR spectra

2. Explain the application of NMR to Food analysis

3. Explain the Application of GC/MS, LC/MS / FAB/MS / MS/MS and Linked scan techniques. FTIR, XRF, Differential Scanning Calorimeter, XRD, SEM, TEM

Course Outcome 5 (CO5):

1. Explain Role of Computer in Data Optimization

2. Explain the independent and dependent parameters in artificial network

3. Explain the optimization matrix representation

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Model Question paper

QP CODE **Reg No: _______________**

Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: FTT 458

Course Name: FOOD INFORMATICS

Max.Marks:100 **Duration:3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Define accuracy and precision
2. Write down the Dynamic Characteristics for the differential equation
3. Define Speed of Response and Response Time
4. Explain Concept of Mechanical Loading
5. Explain the theory and applications of HPLC.
6. How protein molecules are separated using ion exchange chromatography?
7. Define fundamental frequency and finger print region in FT-IR
8. List the NMR spectral parameters and explain their importance
9. List the Types of Real-World Data and Machine Learning Techniques
10. Explain Cluster Analysis

PART B

Answer any one Question from each module.Each Question carries 14 Marks

11. Write briefly on the IR detectors and their function. (14)

OR

12. Explain any Name four important characteristics of emr associated with an analyte and the associated instrumentation methods of analysis. (14)

13. What are the classical methods used for separation, identification and quantification of different chemical components in a mixture? (14)

OR

14. How instrumental noises are classified? Expalin briefly the various hard and software techniques used to improve signal to noise ratio (14)

15. Explain the theory and applications of HPLC. (14)

OR

16. What are the carrier gases used in GC? What is the function of a carrier gas? (14)

17. Explain the theory, instrumentation and uses of GC-MS (14)

OR

18. Write briefly the qualitative and quantitative applications of FT-IR spectroscopy (14)

19. Define effectiveness of screen. Explain design of air screen cleaners (14)

OR

20. Describe the working principle of disc and spiral separator (14)

Syllabus

Module 1

Introduction

Informatics; definition, Basic concepts of measurement system configuration. Concept of accuracy precision error, resolution repeatability bias, calibration, range. Error analysis, Instrument types; Indicating and recording type instruments, digital displays, transmitting and telemetering devices, static and dynamic characteristics

Module 2

Basic instrument systems

Zero, first and second order instrument systems and their response to different input signals (step, ramp etc) Specification and testing of dynamic response. Different types of measuring instruments, their working principles, construction features, measurement of level, flow, temperature, pressure, vacuum, force, torque, power, displacement, vibration, acceleration, pH, colour, viscosity, surface tension and composition.

Module 3

Chromatography and spectrometry

Paper chromatography, thin layer chromatography, HPLC (High performance liquid chromatography), Gas chromatography. Application in food analysis. Spectrophotometry - Atomic absorption spectroscopy -Introduction to AAS – Components of an AA spectrometer – Overview, Light sources, Nebuliser / Atomiser assemblies, Nebulisers, flames, optics, detectors, support gases, AAS measurements - Application in food analysis.

Module 4

Electromagnetic spectrum and analytical equipments

The NMR Phenomenon – Types of information provided by NMR spectra – Instrumental and Experimental Considerations – Solid state NMR –application of NMR to Food analysis. –Application of GC/MS, LC/MS / FAB/MS / MS/MS and Linked scan techniques. FTIR, XRF, Differential Scanning Calorimeter, XRD, SEM, TEM, water activity meter, textural analyser, e –sensors, biosensors, Nitrogen analyzers instrumentation, operating procedure and application in analysis of foods.

Module 5

Role of Computer

Role of Computer in Data Optimization: Developing predictive model between independent and dependent parameters by using Artificial neural network –optimization matrix representation

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Text Books

1. Eckman, D.P., Industrial Instrumentation, Wiley Eastern Ltd., New York 1990. House, New Delhi 2004.
2. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers.
3. Sharma, B.K, “Instrumental Methods of Chemical Analysis”. Goel Publishing

Reference Books

1. Doeblin, D.O. "Measurement Systems; Application and Design". McGraw Hill, 1984.
2. Fribance, A.E. "Industrial Instrumentation Fundamentals", McGraw Hill, 1962
3. Liptak, V.G. "Instrumentation in the Processing Industry", Chilton Book Company, 1973.
4. Nakra B C & Chaudhury K K , Instrumentation, Measurement and Analysis;; Tata McGraw Hill, 1985
5. Nielsen, S.S, “Introduction to the chemical analysis of foods”. Jones and Bartlett Publishers, Boston, London 2004.
6. Patranabis. D. "Principles of Industrial Instrumentation", Tata McGraw Hill, 1995

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	
1.1	Informatics; definition, Basic concepts of measurement system configuration.	2
1.2	Concept of accuracy precision error, resolution repeatability bias, calibration, range.	2
1.3	Error analysis, Instrument types; Indicating and recording type instruments, digital displays, transmitting and telemetering devices, static and dynamic characteristics	3
2	**Basic instrument systems**	
2.1	Zero, first and second order instrument systems and their response to different input signals (step, ramp etc) Specification and testing of dynamic response	2
2.2	Different types of measuring instruments, their working principles, construction features	2
2.3	measurement of level, flow, temperature, pressure, vacuum, force, torque, power, displacement, vibration, acceleration, pH, colour, viscosity, surface tension and composition	3
3	**Chromatography and spectrometry**	
3.1	Paper chromatography, thin layer chromatography, HPLC (High performance liquid chromatography), Gas chromatography. Application in food analysis	3
3.2	. Spectrophotometry - Atomic absorption spectroscopy - Introduction to AAS – Components of an AA spectrometer – Overview, Light sources, Nebuliser / Atomiser assemblies, Nebulisers, flames, optics, detectors, support gases, AAS measurements	3
3.3	Application in food analysis	1
4	**Electromagnetic spectrum**	

4.1	The NMR Phenomenon – Types of information provided by NMR spectra Instrumental and Experimental Considerations	2
4.2	Solid state NMR –application of NMR to Food analysis	1
4.3	Application of GC/MS, LC/MS / FAB/MS / MS/MS and Linked scan techniques	1
4.4	FTIR, XRF, Differential Scanning Calorimeter	2
4.5	XRD, SEM, TEM, water activity meter, textural analyser, e – sensors, biosensors	2
4.5	Nitrogen analyzers instrumentation, operating procedure and application in analysis of foods	1
5	**Role of Computer**	
5.1	Role of Computer in Data Optimization	2
5.2	Developing predictive model between independent and dependent parameters by using Artificial neural network	3
5.3	optimization matrix representation	2

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FTT 468	AUTOMATION IN FOOD INDUSTRY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

This course will enable students to understand the basics of process control and its application in food manufacturing process. Moreover, course mainly focuses on sensors and modeling techniques helpful in the automation in food processing equipments and systems.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Recommend the appropriate measurement device for food industry
CO 2	Apply the control system in food process equipment and system
CO 3	Apply the different types of sensors for specific function
CO 4	Recognize the robots and its components
CO 5	Evaluate the application of automation in food industries

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3	3										
CO 3	3	2			3							
CO 4	3				3							
CO 5	3											

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	10	10	20
Apply	20	20	40
Analyse	5	5	10
Evaluate	5	5	10
Create			10

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Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Mention the type of equipment used for measuring pressure, temperature and pH.
2. Which type of devices is used to store the data? Mention its importance.

Course Outcome 2 (CO2)

1. Which type of controller is suitable for temperature control in thermal processing? Mention its transfer function.
2. Does PLC control system is necessary in industry? If "Yes or No" justify your answer.

Course Outcome 3(CO3):

1. Mention the application of online spectroscopy in food processing.
2. What type of sensing technology is suitable for identifying the colour? Explain its working principle.

Course Outcome 4 (CO4):

1. Differentiate the features of various generation robots.
2. Which types of robotic system are commonly used in the food industry?

Course Outcome 5 (CO5):

1. Explain about the automation process involved in the meat and poultry processing.
2. Illustrate the application of automation in storage and transport system.

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: FTT 468
AUTOMATION IN FOOD INDUSTRY

Max. Marks: 100 **Duration: 3 hours**

PART A
(Answer all questions; each question carries 3 marks)

1. Differentiate the accuracy and precision of an instrument.
2. List out the different types of heat measurement devices.
3. Draw the control diagram for feedback and fed forward control system.
4. Define control variable, manipulated variable and load variable.
5. Write down the significance of automation in food industry.
6. Mention the different types of sensors used in the food industry with its application.
7. Differentiate black box model and grey box model.
8. Enlist the basic components of robots and mention its function.
9. Write down the automatic components used in the cleaning and grading process.
10. Mention the type of sensors used in the food packaging equipment and its principle.

PART B
(Answer one full question from each module, each question carries 14 marks)

11. Explain the types of manometers with neat sketch. (14)

[OR]

12. Describe in detail about the colour and viscosity measuring devices. (14)
13. List out and explain the different types of controllers along with its principle and transfer function (14)

[OR]

14. Explain the principle and working of pneumatic control system and mention its application in food processing sector (14)
15. Describe the theory behind machine vision system and enlist its significance in food processing. (14)

[OR]

16. Write in detail about data acquisition (SCADA) systems. (14)
17. Enumerate the modeling strategy by intelligent control system using fuzzy logic. (14)

[OR]

18. Discuss in detail about the components of robots. (14)
19. Explain the application of automation in chilling and freezing process. (14)

[OR]

20. Explain the application of Automation in packaging of food products (14)

Syllabus

Module 1 (7 hours)

Measurement system: Measurement system and error analysis, measurement of level, flow, temperature, strain pressure, vacuum, force, torque, power, displacement, vibration, acceleration, pH, colour viscosity, surface tension and composition. Recording instruments, digital displays, transmitting and telemetering devices.

Module 2 (7 hours)

Process Control: Introduction to control system- Feedback and feed forward control strategies, block diagrams, Mode of control and generation of control action; P. PI and PID control elements. PLC system, ladder diagram, Electronic, pneumatic and hydraulic control systems and their application in food processing industry.

Module 3 (7 hours)

Sensors for automation: Automatic process control and robotics in the food industry, sensors for automated quality and safety control. Machine vision systems. Optical sensors and online spectroscopy, gripper technologies, wireless sensor networks (WSN) and supervisory control and data acquisition (SCADA) systems

Module 4 (7 hours)

Modelling and Robotics: Modeling strategy, ANN, null hypothesis, Intelligent control system using fuzzy logic, Robotics, Application of robotics and basic components of robotics, Features of I, II, III and IV generation robots

Module 5 (7 hours)

Automation in food processing: Automation in sorting, thermal processing, Automation in food chilling and freezing; in storage, transport, retail systems , Automation in fruit vegetable processing; cleaning, grading, canning etc. Automation in meat, poultry and fish processing, Automation in packaging of food prodcuts.

Text Books

4. *Robotics and Automation in the Food Industry by D Caldwell, Elsevier Science, Woodhead Publishing, 2012*
5. George Stephanopolous, "Chemical Process Control", Prentice Hall of India, 1990
6. *Industrial Instrumentation* by Eckman, Donald P, CBS publishers and distributors New Delhi.

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Reference Books

1. *Process Modeling, Simulation and Control for Chemical Engineers Luyben, W. L,, McGraw hill, 1973.*
2. *Thermal Processing of Foods: Control and Automation by K. P. Sandeep March 2011, Wiley-Blackwell*
3. Process system analysis and control by Coughanewr *McGraw hill*
4. *Mechanical and Industrial by Jain R K, Khanna Publishers*

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Measurement systems**	**7**
1.1	Measurement system and error analysis, measurement of level, flow, temperature, strain pressure, vacuum, force, torque, power, displacement, vibration, acceleration	3
1.2	Measurement of pH, colour viscosity, surface tension and composition. Recording instruments, digital displays, transmitting and telemetering devices.	4
2	**Process Control**	**7**
2.1	Introduction to control system- Feedback and feed forward control strategies, block diagrams,	2
2.2	Mode of control and generation of control action; P. PI and PID control elements. PLC system, ladder diagram,	2
2.3	Electronic, pneumatic and hydraulic control systems and their application in food processing industry.	3
3	**Sensors for automation**	**7**
3.1	Automatic process control and robotics in the food industry, sensors for automated quality and safety control.	2
3.2	Machine vision systems. Optical sensors and online spectroscopy, gripper technologies,	2
3.3	Wireless sensor networks (WSN) and supervisory control and data acquisition (SCADA) systems	3
4	**Modelling and Robotics**	**7**
4.1	Modeling strategy, ANN, null hypothesis, Intelligent control system using fuzzy logic,	4
4.2	Robotics, Application of robotics and basic components of robotics, Features of I, II, III and IV generation robots	3
5	**Automation in food processing**	**7**
5.1	Automation in sorting, thermal processing, Automation in food chilling and freezing; in storage, transport, retail systems ,	3
5.2	Automation in fruit vegetable processing; cleaning, grading, canning etc. Automation in meat, poultry and fish processing, Automation in packaging of food prodcuts.	4

FTT 478	MANAGEMENT OF FOOD PROCESSING INDUSTRY	CATEGORY	L	T	P	CREDIT
		PEC	2	1	0	3

Preamble:

The objective of the course is to provide insight to students and encouragement to become entrepreneur infood processing sector

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to:

CO 1	Acquire knowledge regarding management concepts
CO 2	Knowledge on financial and marketing management techniques
CO 3	Understand about the market strategy, selection of market for product launching, consumer testing by market survey.
CO 4	Knowledge on patent and its significance

Mapping of course outcomes with program outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2					2	2	2				
CO 2	2											
CO 3	2	2	2	2			2	2		2	2	2
CO 4	3	2					2	2	2	2	2	

Assessment Pattern:

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Define batch production?
2. What are the factors to be considered before launching a new product?

Course Outcome 2 (CO2) :

1. Give a brief on break even analysis?
2. What do you mean by financial ratio analysis?

Course Outcome 3(CO3):

1. How will you conduct consumer survey for new product development?.
2. What are the factors affecting purchasing behaviour pattern of consumers?

Course Outcome 4 (CO4):

1. Define Patent?
2. Mention the significance of patent in food product development?

MODEL QUESTION PAPER

QP CODE:
Reg No.:_______________
Name: _______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION (R&S), MONTH & YEAR

Course Code: FTT 478

Course Name: MANAGEMENT OF FOOD PROCESSING INDUSTRY

Max. Marks: 100 **Duration: 3hours**

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PART A

(Answer all questions; each question carries 3 marks)

1 Differentiate batch and continuous production in food industry?
2. Define inventory control? Give an account of inventory control technique?
3. Explain the financial ratio analysis?
4. Mention the factors affecting new product development in food industry?
5. Give an account of factors affecting consumer buying behaviour??
6. Explain the Sanitary and phytosanitary agreement?
7. Explain the role of WTO in establishing rules for international trade?
8. Explain the role of GATT in promoting international trade?
9. Define Patent?

10. Mention the significance of patent in food product development

PART-B

Answer any 5 questions, each question carries 14 marks

11.Discuss ABC analysis with respect to inventory management?

(OR)

12. Discuss in detail the process planning concept in food processing.

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13. Explain PDCA cycle and its significance in food business management?.

(OR)

14. Explain assessing, acquiring and allocating funds in a food industry? Give an account of various government schemes available for food industry

15. Describe the application of breakeven analysis in food industry.

(OR)

16. Describe the factors affecting consumer buying behaviour with respect to food products?

17. What do you know about decision making processes and tools?

(OR)

18. Explain in detail about break even analysis

19. Describe the importance and Intellectual property rights

(OR)

20. Explain the process of patent application for food processing industry?

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SYLLABUS

MODULE 1 (7 hours)

Production and Inventory Management

Introduction to Food Industry Management- nature of processing industry, production, planning – Batch and continuous production, process planning, definition and concepts, inventory control- classification, economic ordering, inventory models, ABC Analysis

MODULE 2 (7 hours)

Financial Management

Assessing, acquiring and allocating funds, cash flow statement- balance sheet, financial ratio, break even analysis, concept, application in food industry – project appraisal

MODULE 3 (7 hours)

Market Management

Concepts- consumer market, business market, marketing environment- market segmentation- market measurement and forecasting- advertisement- publicity market information system- market research- management of distribution channel, Consumer buying behaviour, factors influencing consumer buying behaviour. Export trade- Government regulations, GAIT, WTO regulation

MODULE 4 (7 hours)

Intellectual Property Rights and Patent

Kind of patents- Indian patent law, meanings scope objectives- Kind of patent applications- Procedure for obtaining patent – Patent applications- Drafting, claims, patent oppositions, enforcement and revocation – Fee structure – Source of patent information – Patent databases, IP- Licencing and Technology transfer

MODULE 5 (7 hours)

Business Plan Reports

Preparation of project report; Market feasibility reports; Break even Analysis Techno- economic feasibility report on an identified opportunity-any food processing; bakery and confectionary , fruit and vegetable processing, oil and fat ,milk and milk products etc

Reference Books:

1. Philip Kotler, 1985, Marketing management, Prentice Hall of India
2. Brigham, Eugene F, 1989, Fundamentals of Financial Mangement, The Dryden Press
3. Sherilaker, 1985, Marketing Mangement, Himalaya Publishing Company
4. Mehta P. L, Management Economics- Analysis, problems and cases, Sultan Chand and Sons, New Delhi

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5. K.P. Sudheer and V.Indira.2018. Entrepreneurship and skill development in Horticultural Processing. New India Publishing Agency, New Delhi

Course Contents and Lecture Schedule:

No	Topic	No. of Lectures
1	**Production and Inventory Management**	**7**
1.1	Introduction to Food Industry Management- nature of processing industry	2
1.2	Batch and continuous production	1
1.3	process planning, definition and concepts, inventory control	1
1.4	economic ordering, inventory models	1
1.5	ABC Analysis	2
2	**Financial Management**	**7**
2.1	Assessing, acquiring and allocating funds,	2
2.2	cash flow statement- balance sheet,	2
2.3	break even analysis – concept and significance	2
2.4	project appraisal	1
3	**Market Management**	**7**
3.1	Concepts- consumer market, business market,.	1
3.2	Marketing environment- market segmentation	2
3.3	Market measurement and forecasting- advertisement- publicity market information system	1
3.4	Consumer buying behaviour, factors influencing consumer buying behaviour	2
3.5	Export trade- Government regulations, GAIT, WTO regulation	1
4	**Intellectual Property Rights and Patent**	**7**
4.1	Kind of patents- Indian patent law, meanings scope objectives	1
4.2	Kind of patent applications- Procedure for obtaining patent	2
4.3	Patent applications- Drafting, claims, patent oppositions, enforcement and revocation	2
4.4	Source of patent information – Patent databases	1
4.5	IP- Licencing and Technology transfer	1
5	**Business Plan Reports**	**7**
5.1	Preparation of project report	1
5.2	Market feasibility reports	2

5.3	Break even Analysis	1
5.4	Techno- economic feasibility report on an identified opportunity	2
5.5	Preparation of project report	1

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FTT404	COMPREHENSIVE COURSE VIVA	CATEGORY	L	T	P	CREDIT
		PCC	1	0	0	1

Preamble:

The objective of this Course viva is to ensure the basic knowledge of each student in the most fundamental core courses in the curriculum. The viva voce shall be conducted based on the core subjects studied from third to eighth semester. This course helps the learner to become competent in placement tests and other competitive examinations.

Guidelines

1. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum.
2. The viva voce will be conducted by the same three member committee assigned for final project phase II evaluation. It comprises of Project coordinator, expert from Industry/research Institute and a senior faculty from a sister department.
3. The pass minimum for this course is 25.
4. The mark will be treated as internal and should be uploaded along with internal marks of other courses.
5. Comprehensive Viva should be conducted along with final project evaluation by the three member committee.

Mark Distribution

Total marks: 50, only CIE, minimum required to pass : 25 Marks

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FTD 416	PROJECT PHASE II	CATEGORY	L	T	P	CREDIT
		PWS	0	0	12	4

Preamble:

The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

1. To apply engineering knowledge in practical problem solving.
2. To foster innovation in design of products, processes or systems.
3. To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs]: After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: **Apply**).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: **Apply**).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: **Apply**).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: **Apply**).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: **Analyze**).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: **Apply**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1

CO4					2			3	2	2	3	2
CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1

Abstract POs defined by National Board of Accreditation			
PO #	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO0	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

PROJECT PHASE II

Phase 2 Targets

1. In depth study of the topic assigned in the light of the report prepared under Phase - I;
2. Review and finalization of the approach to the problem relating to the assigned topic.
3. Preparing a detailed action plan for conducting the investigation, including teamwork.
4. Detailed Analysis/ Modeling / Simulation/ Design/ Problem Solving/Experiment as needed.
5. Final development of product/ process, testing, results, conclusions and future directions.
6. Preparing a paper for Conference Presentation/ Publication in Journals, if possible.
7. Presenting projects in Project Expos conducted by the University at the cluster level and/ or state level as well as others conducted in India and abroad.
8. Filing Intellectual Property Rights (IPR) if applicable.
9. Preparing a report in the standard format for being evaluated by the Department Assessment Board.
10. Final project presentation and viva voce by the assessment board including the external expert.

Evaluation Guidelines & Rubrics

Total: 150 marks (Minimum required to pass: 75 marks).

1. Project progress evaluation by guide: 30 Marks.
2. Two interim evaluations by the Evaluation Committee: 50 Marks (25 marks for each evaluation).
3. Final evaluation by the Final Evaluation committee: 40 Marks
4. Quality of the report evaluated by the evaluation committee: 30 Marks

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor. The final evaluation committee comprises of Project coordinator, expert from Industry/research/academic Institute and a senior faculty from a sister department).

Evaluation by the Guide

The guide/supervisor must monitor the progress being carried out by the project groups on regular basis. In case it is found that progress is unsatisfactory it should be reported to the Department Evaluation Committee for necessary action. The presence of each student in the group and their involvement in all stages of execution of the project shall be ensured by the guide. Project evaluation by the guide: 30 Marks. This mark shall be awarded to the students in his/her group by considering the following aspects:

Project Scheduling & Distribution of Work among Team members: Detailed and extensive Scheduling with timelines provided for each phase of project. Work breakdown structure well defined. (5)

Literature survey: Outstanding investigation in all aspects. (4)

Student's Diary/ Daily Log: The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily/weekly activity diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily/weekly activity diary shall be signed after every day/week by the guide. (7)

Individual Contribution: The contribution of each student at various stages. (9)

Completion of the project: The students should demonstrate the project to their respective guide. The guide shall verify the results and see that the objectives are met. (5)

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EVALUATION RUBRICS for PROJECT Phase II: Interim Evaluation - 1

No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
2-a	Novelty of idea, and Implementation scope [CO5] [Group Evaluation]	**5**	The project is not addressing any useful requirement. The idea is evolved into a non-implementable one. The work presented so far is lacking any amount of original work by the team.	Some of the aspects of the proposed idea can be implemented. There is still lack of originality in the work done so far by the team. The project is a regularly done theme/topic without any freshness in terms of specifications, features, and/or improvements.	Good evidence of an implementable project. There is some evidence for the originality of the work done by the team . There is fresh specifications/ features/improvements suggested by the team. The team is doing a design from fundamental principles, and there is some independent learning and engineering ingenuity.	The project has evolved into incorporating an outstandingly novel idea. Original work which is not yet reported anywhere else. Evidence for ingenious way of innovation which is also Implementable. Could be a patentable / publishable work.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
2-b	Effectiveness of task distribution among team members. [CO3] [Group Evaluation]	**5**	No task distribution of any kind. Members are still having no clue on what to do.	Task allocation done, but not effectively, some members do not have any idea of the tasks assigned. Some of the tasks were identified but not followed individually well.	Good evidence of task allocation being done, supported by project journal entries, identification of tasks through discussion etc. However, the task distribution seems to be skewed, and depends a few members heavily than others. Mostly the tasks are being followed by the individual members.	Excellent display of task identification and distribution backed by documentary evidence of team brainstorming, and project journal entries. All members are allocated tasks according to their capabilities, and as much as possible in an equal manner. The individual members are following the tasks in an excellent manner.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
2-c	Adherence to project schedule. [CO4] [Group Evaluation]	**5**	Little or no evidence of continued planning or scheduling of the project. The students did not stick to the plan what they were going to build nor plan on what materials / resources to use in the project. The students do not have any idea on the budget required even after the end of phase - I. No project journal kept or the journal.	There is some improvement in the primary plan prepared during phase I. There were some ideas on the materials /resources required, but not really thought out. The students have some idea on the finances required, but they have not formalized a budget plan. Schedules were not prepared. The project journal has no useful details on the project.	Good evidence of planning done and being followed up to a good extent after phase I. Materials were listed and thought out, but the plan wasn't followed completely. Schedules were prepared, but not detailed, and needs improvement. Project journal is presented but it is neither complete nor updated regularly.	Excellent evidence of enterprising and extensive project planning and follow-up since phase I. Continued use of project management/version control tool to track the project. Material procurement if applicable is progressing well. Tasks are updated and incorporated in the schedule. A well-kept project journal showed evidence for all the above, in addition to the interaction with the project guide.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)

2-d	Interim Results. [CO6] [Group assessment]	**5**	There are no interim results to show.	The team showed some interim results, but they are not complete / consistent to the current stage, Some corrections are needed.	The interim results showed were good and mostly consistent/correct with respect to the current stage. There is room for improvement.	There were significant interim results presented which clearly shows the progress.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-e	Presentation [Individual assessment]	**5**	Very poor presentation and there is no interim results. The student has no idea about the project proposal.	Presentation is average, and the student has only a feeble idea about the team work.	Good presentation. Student has good idea about the team's project. The overall presentation quality is good.	Exceptionally good presentation. Student has excellent grasp of the project. The quality of presentation is outstanding.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
Phase-II Interim Evaluation - 1 Total Marks: 25						

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EVALUATION RUBRICS for PROJECT Phase II: Interim Evaluation – 2						
No	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
2-f	Application of engineering knowledge [CO1] [Individual Assessment]	**10**	The student does not show any evidence of applying engineering knowledge on the design and the methodology adopted. The student's contribution in application of engineering knowledge in the project is poor.	The student appears to apply some basic knowledge, but not able to show the design procedure and the methodologies adopted in a comprehensive manner.	The student is able to show some evidence of application of engineering knowledge in the design and development of the project to good extent.	Excellent knowledge in design procedure and its adaptation. The student is able to apply knowledge from engineering domains to the problem and develop solutions.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
2-g	Involvement of individual members [CO3] [Individual Assessment]	**5**	No evidence of any Individual participation in the project work.	There is evidence for some amount of individual contribution, but is limited to some of the superficial tasks.	The individual contribution is evident. The student has good amount of involvement in core activities of the project.	Evidence available for the student acting as the core technical lead and has excellent contribution to the project.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-h	Results and inferences upon execution [CO5] [Group Assessment]	**5**	None of the expected outcomes are achieved yet. The team is unable to derive any inferences on the failures/ issues observed. Any kind o f observations or studies are not made.	Only a few of the expected outcomes are achieved. A few inferences are made on the observed failures/issues. No further work suggested.	Many of the expected outcomes are achieved. Many observations and inferences are made, and attempts to identify the issues are done. Some suggestions are made for further work.	Most of the stated outcomes are met. Extensive studies are done and inferences drawn. Most of the failures are addressed and solutions suggested. Clear and valid suggestions made for further work.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-i	Documentation and presentation. .[CO6] [Individual assessment]	**5**	The individual student has no idea on the presentation of his/her part. The presentation is of poor quality.	Presentation's overall quality needs to be improved.	The individual's presentation performance is satisfactory.	The individual's presentation is done professionally and with great clarity. The individual's performance is excellent.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
Phase-II Interim Evaluation - 2 Total Marks: 25						

EVALUATION RUBRICS for PROJECT Phase II: Final Evaluation						
No	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
2-j	Engineering knowledge. [CO1] [Group Assessment]	10	The team does not show any evidence of applying engineering knowledge on the design and the methodology adopted.	The team is able to show some of the design procedure and the methodologies adopted, but not in a comprehensive manner.	The team is able to show evidence of application of engineering knowledge in the design and development of the project to good extent. There is scope for improvement.	Excellent knowledge in design procedure and its adaptation. The team is able to apply knowledge from engineering domains to the problem and develop an excellent solution.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
2-k	Relevance of the project with respect to societal and/or industrial needs. [Group Assessment] [CO2]	5	The project as a whole do not have any societal / industrial relevance at all.	The project has some relevance with respect to social and/or industrial application. The team has however made not much effort to explore further and make it better.	The project is relevant to the society and/or industry. The team is mostly successful in translating the problem into an engineering specification and managed to solve much of it.	The project is exceptionally relevant to society and/or industry. The team has made outstanding contribution while solving the problem in a professional and/ or ethical manner.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-i	Innovation / novelty / Creativity [CO5] [Group Assessment]	5	The project is not addressing any useful requirement. The idea is evolved into a non-implementable one. The work presented so far is lacking any amount of original work by the team.	Some of the aspects of the proposed idea appears to be practical. There is still lack of originality in the work done. The project is a regularly done theme/topic without any freshness in terms of specifications, features, and/ or improvements.	Good evidence of an implementable project. There is some evidence for the originality of the work done by the team. There is fresh specifications/ features/improvements suggested by the team. The team is doing a design from fundamental principles, and there is some independent learning and engineering ingenuity. Could be translated into a product / process if more work is done.	The project has evolved into incorporating an outstandingly novel idea. Original work which is not yet reported anywhere else. Evidence for ingenious way of innovation which is also Implementable. Could be a patentable publishable work.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
2-m	Quality of results / conclusions / solutions. [CO1] [Group Assessment]	10	None of the expected outcomes are achieved. The team is unable to derive any inferences on the failures/issues observed. Any kind of observations or studies is not made.	Only a few of the expected outcomes are achieved. A few inferences are made on the observed failures/issues. No further work suggested.	Many of the expected outcomes are achieved. Many observations and inferences are made, and attempts to identify the issues are done. Some suggestions are made for further work.	Most of the stated outcomes are met. Extensive studies are done and inferences drawn. Most of the failures are addressed and solutions suggested. Clear and valid suggestions made for further work.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)

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2-n	Presentation - Part I Preparation of slides. [CO6] [Group Assessment].	5	The presentation slides are shallow and in a clumsy format. It does not follow proper organization.	Presentation slides follow professional style formats to some extent. However, its organization is not very good. Language needs to be improved. All references are not cited properly, or acknowledged. Presentation slides needs to be more professional.	Presentation slides follow a good style format and there are only a few issues. Organization of the slides is good. Most of references are cited properly. The flow is good and team presentation is neatly organized. Some of the results are not clearly shown. There is room for improvement.	The presentation slides are exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and equations are properly numbered, and l i s ted. Results/ inferences clearly highlighted and readable.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
	Presentation - Part II: Individual Communication [CO6] [Individual Assessment].	5	The student is not communicating properly. Poor response to questions.	The student is able to explain some of the content. The student requires a lot of prompts to get to the idea. There are language issues.	Good presentation/ communication by the student. The student is able to explain most of the content very well. There are however, a few areas where the student shows lack of preparation. Language is better.	Clear and concise communication exhibited by the student. The presentation is outstanding. Very confident and tackles all the questions without hesitation. Exceptional traits of communicator.
			(0 - 1 Marks)	(2 - 3 Marks)	(4 Marks)	(5 Marks)
Phase-II Final Evaluation, Marks: 40						

EVALUATION RUBRICS for PROJECT Phase II: Report Evaluation						
Sl. No.	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
2-o	Report [CO6]	30	The prepared report is shallow and not as per standard format. It does not follow proper organization. Contains mostly unacknowledged content. Lack of effort in preparation is evident. References are not cited. Unprofessional and inconsistent formatting.	Project report follows the standard format to some extent. However, its organization is not very good. Language needs to be improved. All references are not cited properly in the report. There is lack of formatting consistency.	Project report shows evidence of systematic documentation. Report is mostly following the standard style format and there are only a few issues. Organization of the report is good. Mostly consistently formatted. Most of references/sources are cited/ acknowledged properly.	The report is exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and equations are properly numbered, and listed and clearly shown. Language is excellent and follows professional styles. Consistent formatting and exceptional readability.
			(0 - 11 Marks)	(12 - 18 Marks)	(19 - 28 Marks)	(29 - 30 Marks)
Phase - II Project Report Marks: 30						

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FTD482	MINI PROJECT	CATEGORY	L	T	P	CREDIT
		PWS	0	0	3	4

Preamble:

Mini Project Phase I: A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The object of Project Work I is to enable the student to take up investigative study in the broad field of Food Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on a group of three/four students, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Preparing an Action Plan for conducting the investigation, including team work;
3. Working out a preliminary Approach to the Problem relating to the assigned topic;
4. Block level design documentation
5. Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility;
6. Preparing a Written Report on the Study conducted for presentation to the Department;

CO1	Identify and synthesize problems and propose solutions to them.
CO2	Prepare work plan and liaison with the team in completing as per schedule.
CO3	Validate the above solutions by theoretical calculations and through experimental
CO4	Write technical reports and develop proper communication skills.
CO5	Present the data and defend ideas.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3					3	3		2
CO2	3			3				3	3	3	3	
CO3	3	3	3	3	3					3		
CO4					3			3	3	3		1
CO5	3	3	3	3				3		3	3	1

*1-slight/low mapping, 2- moderate/medium mapping, 3-substantial/high mapping

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the mini project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systms under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution. The review committee should assess the extent to which the implementation reflects the proposed design. A well coded, assembled and completely functional product is the expected output at this stage. The final CIE mark is the average of 1st and 2nd review marks.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for innovative ideas. Zeroth review will not be a part of the CIE evaluation process.

Marks Distribution

Total Marks	CIE	ESE
150	75	75

Continuous Internal Evaluation Pattern:
Attendance : 10 marks
Marks awarded by Guide : 15 marks
Project Report : 10 marks
Evaluation by the Committee : 40 Marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks.
(a) Demonstration : 50 Marks
(b) Project report : 10 Marks
(d) Viva voce : 15marks

Course Plan

In this course, each group consisting of three/four members is expected to design and develop a moderately complex software/hardware system with practical applications. This should be a working model. The basic concept of product design may be taken into consideration.

Students should identify a topic of interest in consultation with Faculty-in-charge of miniproject/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews**.**

The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight.

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FTD496	MINI PROJECT	CATEGORY	L	T	P	CREDIT
		PWS	0	0	3	4

Preamble:

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2. Preparing an Action Plan for conducting the investigation, including team work;
3. Working out a preliminary Approach to the Problem relating to the assigned topic;
4. Block level design documentation
5. Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility;
6. Preparing a Written Report on the Study conducted for presentation to the Department;

CO1	Identify and synthesize problems and propose solutions to them.
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Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3					3	3		2
CO2	3			3				3	3	3	3	
CO3	3	3	3	3	3					3		
CO4					3			3	3	3		1
CO5	3	3	3	3				3		3	3	1

*1-slight/low mapping, 2- moderate/medium mapping, 3-substantial/high mapping

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