RSET

RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

RSET VISION

To evolve into a premier technological and research institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

RSET MISSION

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

DEPARTMENT VISION

To evolve into a centre of excellence by imparting professional education in mechanical engineering with a unique academic and research ambience that fosters innovation, creativity and excellence.

DEPARTMENT MISSION

- *To have state-of-the-art infrastructure facilities.*
- *To have highly qualified and experienced faculty from academics, research organizations and industry.*
- *To develop students as socially committed professionals with sound engineering knowledge, creative minds, leadership qualities and practical skills.*

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Demonstrate the ability to analyse, formulate and solve/design engineering/real life problems based on his/her solid foundation in mathematics, science and engineering..

PEO 2: Showcase the ability to apply their knowledge and skills for a successful career in diverse domains viz., industry/technical, research and higher education/academia with creativity, commitment and social consciousness.

PEO 3: Exhibit professionalism, ethical attitude, communication skill, team work, multidisciplinary approach, professional development through continued education and an ability to relate engineering issues to broader social context.

PROGRAMME OUTCOMES

1) **Engineering Knowledge:** Apply the knowledge of Mathematics, Science, Engineering fundamentals, and Mechanical Engineering to the solution of complex engineering problems.
2) **Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.
3) **Design/development of solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4) **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
6) **The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.
7) **Environment and sustainability:** Understand the impact of the professional Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments.
8) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.
9) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10) **Communication:** Communicate effectively on complex Engineering activities with the Engineering Community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11) **Project management and finance:** Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
12) **Life -long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

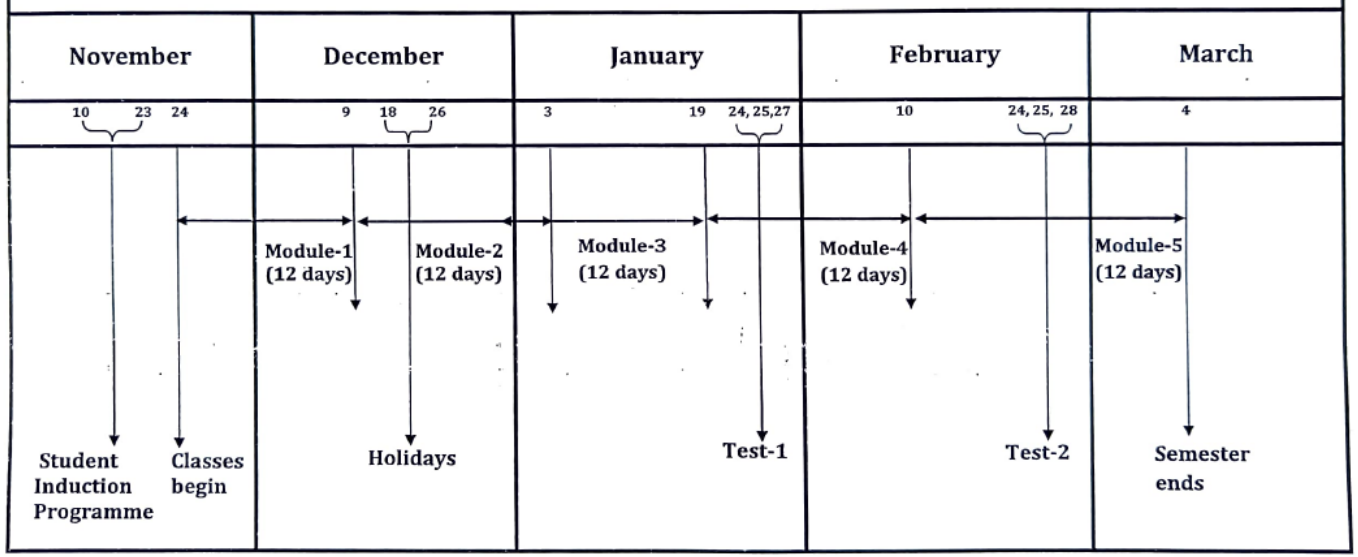
Mechanical Engineering Programme Students will be able to:

1) Apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.
2) Successfully apply the principles of design, analysis and implementation of mechanical systems/processes which have been learned as a part of the curriculum.
3) Develop and implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices.

1. SEMESTER PLAN

RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

SEMESTER PLAN – S1
November 2021 – March 2022



November: 15 December: 18 January: 20 February: 20 March: 3

Total no of working days:76

Total no of instructional days: 60

25/11/21

2. ASSIGNMENT SCHEDULE	
Week 4	**101908/MA100A Linear Algebra and Calculus**
Week 5	**101902/PH900B Engineering Physics B**
Week 5	**101908/CE900C Engineering Mechanics**
Week 6	**101908/CO900F Basics of Electrical and Electronics Engineering**
Week 7	**101908/EN100E Life Skills**
Week 8	**101908/MA100A Linear Algebra and Calculus**
Week 8	**101902/PH900B Engineering Physics B**
Week 9	**101908/CE900C Engineering Mechanics**
Week 9	**101908/CO900F Basics of Electrical and Electronics Engineering**

3. SCHEME

Code	Subject	Hours/week			Credits	Exam Slot
		L	T	P/D		
101908/MA100A	Linear Algebra and Calculus	3	1	0	4	A
101902/PH900B	Engineering Physics B	3	1	0	4	B
101908/CE900C	Engineering Mechanics	2	1	0	3	C
101908/CO900F	Basics of Electrical and Electronics Engineering	4	0	0	4	D
101908/EN100E	Life Skills	2	0	2	4	E
101908/PH922S	Engineering Physics Lab	0	0	2	2	T
101908/CO922U	Electrical and Electronics Workshop	0	0	2	2	T
	Total	**14**	**3**	**6**	**23**	

4. 101908/MA100A Linear Algebra and Calculus

4.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
COURSE: *Linear Algebra and Calculus*	**SEMESTER:** 1 **CREDITS:** 4
COURSE CODE: 101908/MA100A ***REGULATION:*** 2020	**COURSE TYPE:** CORE
COURSE AREA/DOMAIN: MATHEMATICS	**CONTACT HOURS:** 3+1 (Tutorial) Hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME:** NA

SYLLABUS:

UNIT	*DETAILS*	*HOURS*
I	Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix,fundamental theorem for linear systems (homogeneous and nonhomogeneous, without proof), Eigen values and eigen vectors. Diagonalization of matrices, orthogonal transformation, quadratic forms and their canonical forms.	10
II	Concept of limit and continuity of functions of two variables, partial derivatives, Differentials, Local Linear approximations, chain rule, total derivative, Relative maxima and minima	8
III	Double integrals (Cartesian), reversing the order of integration, Change of coordinates (Cartesian to polar), finding areas and volume using double integrals, Triple integrals, volume calculated as triple integral,triple integral in cylindrical And spherical coordinates	10
IV	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	8
V	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.	9
TOTAL HOURS		**45**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Anton, Bivens and Davis, Calculus, John Wiley and Sons.
R1	Thomas Jr., G. B., Weir, M. D. and Hass, J. R., Thomas' Calculus, Pearson.
R2	B.S Grewal-Higher Engineering Mathematics, Khanna publishers, New Delhi
R3	Jordan, D. W. and Smith, P., Mathematical Techniques, Oxford University Press.
R4	Kreyszig, E., Advanced Engineering Mathematics, Wiley India edition.

COURSE PRE-REQUISITES: (NIL)

C.CODE	COURSE NAME	DESCRIPTION	SEM

COURSE OBJECTIVES:

1	To enable the students to acquire knowledge on some basic mathematical ideas and tools which are at the core of any engineering course.
2	To familiarize students with some basic techniques in matrix theory which are essential for analysing linear systems.
3	To familiarize the students with topics like 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.

COURSE OUTCOMES:

S.NO.	DESCRIPTION
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
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

CO-PO AND CO-PSO MAPPING

	P01	PO2	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
CO 1	3	3	3	3	2	1	-	-	1	2	-	2	3	-	-
CO 2	3	3	3	3	2	1	-	-	1	2	-	2	2	-	-
CO 3	3	3	3	3	2	1	-	-	1	2	-	2	-	-	-
CO 4	3	2	3	2	2	1	-	-	1	2	-	2	-	-	-
CO 5	3	3	3	3	2	1	-	-	1	2	-	2	-	-	-

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/ MEDIUM/ HIGH	JUSTIFICATION
CO1-PO1	H	Matrix theory will give a thorough knowledge in the application problems.
CO1-PO2	H	Matrix theory analyses various methods to solve linear equations
CO1-PO3	H	Design solutions to engineering problems
CO1-PO4	H	Analyses and interpret different data using matrix theory.
CO1-PO5	M	Apply appropriate techniques in modelling various complex engineering activates.
CO1 -PO6	L	Fundamental knowledge in matrix theory help to assess various cultural issues relevant to the professional engineering practice.
CO1 -PO9	M	Matrix theory helps an individual to function effectively in multidisciplinary settings.
CO1 -PO10	M	Matrices are used in writing effective reports and design documentation
CO1 -PO12	M	Able to engage in independent and lifelong learning in the broadest context of technological change.
CO2 -PO1	H	Basic knowledge in differential calculus of functions of several variables helps in solving engineering problems
CO2 -PO2	H	Multivariable calculus can be applied to analyse deterministic systems that have multiple degrees of freedom

CO2 -PO3	H	Multivariable calculus is used in many fields of natural and social science and engineering to model and study high - dimensional systems.
CO2 -PO4	H	Most of the natural phenomenon is non -linear and that can be best described by using multivariable calculus and differential equation.
CO2 -PO5	M	Multivariable calculus can be used to optimise functions of two or more variables
CO2 -PO6	L	Helps to assess societal, health, safety legal and cultural issues.
CO2 -PO9	L	Engineers directly use calculus in their daily practice and some use computerprograms based on calculus that simplify engineering design.
CO2 -PO10	M	Effective communication helps the engineering community to give and receive clear instructions.
CO2 -PO12	M	Study, experience, and practice of multivariable calculus is applied with judgment to develop ways to utilize, economically.
CO3 -PO1	H	Basic knowledge of multiple integrals is used to create mathematical models in order to arrive into an optimal solution
CO3 -PO2	H	Multiple integration helps to analyse complex engineering problems to reach substantiated conclusions
CO3 -PO3	H	Application of the double integrals helps in designing solutions for engineering problems .
CO3 -PO4	H	The basic concepts of application integration develops and design a number of important issues in the research area.
CO3 -PO5	H	Integration is used to create and apply appropriate techniques in solving engineering problems.
CO3 -PO6	L	Integration helps us to find out the total cost function and total revenue function from the marginal cost.
CO3 -PO9	L	Integration is used effectively in multi - disciplinary settings
CO3 -PO10	M	Effective presentations and clear instructions can be done using integration.
CO3 -PO12	M	In the new era of technology, application of integration is used in independent and life -long learning.

CO4 -PO1	H	Infinite series is applied in finding the solution of complex engineering problems
CO4 -PO2	M	Infinite series can be used as a tool in formulating various research related activities.
CO4 -PO3	H	To meet the specified needs for the public health and safety, solutions of infinite series can be applied widely
CO4 -PO4	M	Various tests are used for interpreting and analysing the data in engineering field
CO4 -PO5	L	Different tests of infinite series can be applied to select and create IT tools in modelling complex engineering activities.
CO4 -PO6	L	Knowledge in various tests can be applied to assess societal, legal and cultural issues
CO4 -PO9	L	In multi -disciplinary settings, basic knowledge of infinite series and its related test helps to perform as a leader
CO4 -PO10	M	To write effective reports and make effective presentations, the idea related to infinite series work as a tool.
CO4-PO12	M	Various tests in infinite series will enable to engage in life-long learning.
CO5-PO1 3	H	Knowledge in Taylor series provides different techniques in solving engineering problems.
CO5-PO2	H	Identify and analyse the signals in electronics and communication using Taylor series
CO5-PO3	H	Fourier series can be used for designing system components
CO5-PO4	H	Valid conclusions can be drawn from the synthesis of information.
CO5-PO5	M	Modern techniques are used in understanding the problems in the society
CO5-PO6	L	Develop into a responsible engineer by assessing the knowledge in Taylor series
CO5-PO9	L	Mould an engineer with leadership quality in functioning effectively
CO5-PO10	M	Knowledge acquired in Fourier series is an important tool in digital communication
CO5-PO12	M	Expansion of the series helps in enabling an individual to cop-up with the technological change.

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*
CO1-PSO1	H	Students will use basic knowledge in mathematics in the domain of signals and processing to solve engineering problems utilizing advanced technology.
CO2-PSO1	M	Phenomena involving continuous change of variables are used in thermal sciences.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO\PSO*	*PROPOSED ACTIONS*
1	Basic concepts in limits and differential calculus	PO1 ,PSO1	Reading
2	Application of vector calculus	PO2, PSO1	Reading
3	Importance of double integrals and triple integrals	PO2, PSO2	Reading

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SNO	TOPIC	RELEVENCE TO PO\PSO
1	Application of vector calculus in Engineering	PO2 ,PO3
2	Application of multiple integrals in Engineering	PO2, P03,PSO1

WEB SOURCE REFERENCES:

1	www.nptel.ac.in
2	https://youtu.be/qNZxf0j41tw
3	https://youtu.be/4QFsiXfgbzM
4	https://youtu.be/ksS_yOK1vtk
5	https://youtu.be/vqJuFD0GdJA
6	https://tutorial.math.lamar.edu/
7	https://www.geogebra.org/3d?lang=en

Open source software packages such as gnuplot, maxima, scilab, geogebra may be used as appropriate for practice and assignment problems.

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES	☐ LCD/SMART BOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

✓ASSIGNMENTS	☐ STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

4.2 COURSE PLAN

DAY	*MODULE*	*TOPIC PLANNED*
1	I	Limit and continuity of functions of two variables
2	I	IntroductionMatrices
3	I	Linear Systems and Solutions
4	I	Elementary Row Operations and Row Echelon Form

5	I	Partial Derivatives
6	I	Partial Derivatives
7	I	Limit and continuity of functions of two variables
8	I	Introduction- Matrices
9	I	Linear Systems and Solutions
10	I	Elementary Row Operations and Row Echelon Form
11	I	Partial Derivatives
12	II	Partial Derivatives
13	II	Gaussian Elimination, Fundamental Theorem of linear systems, Problems
14	II	Differentials
15	II	Eigenvalues and Eigenvectors
16	II	Local Linear Approximations
17	II	Chain Rule
18	II	Problems
19	III	Eigenvalues and Eigenvectors-ctd.
20	III	Chain Rule
21	III	Introduction to Diagonalization
22	III	Total Derivative
23	III	Relative maxima and Minima
24	III	Relative maxima and Minima Problems
25	III	Integration- Introduction
26	III	Integration- Introduction
27	IV	Diagonalization
28	IV	Double Integrals
29	IV	Reversing the order of integration
30	IV	Problems
31	IV	Change of Coordinates
32	IV	Quadratic Forms
33	V	Finding area and volume using double integrals

34	V	Finding area and volume using double integrals
35	V	Orthogonal Transformations, Principal Axes Form of Quadratic Forms
36	V	Conic Sections,
37	V	Mass and Centre of Gravity using double integral
38	V	Triple Integrals
39	V	Triple Integrals
40	V	Volume Calculated as Triple Integral
41	V	Mass and Centre of Gravity using double integral
42	V	Triple Integrals
43	V	Triple Integrals
44	V	Volume Calculated as Triple Integral
45	V	Introduction to Sequences and Infinite Series
46	V	Geometric Series, p-Series
47	V	Volume Calculated as Triple Integral
48	V	Triple integral in cylindrical and spherical coordinates

4.3 MODULE WISE SAMPLE QUESTIONS

MODULE 1

1. Solve the following linear system given explicitly or by its augmented matrix by Gauss elimination method:
   a) $4x - 6y = -11$

   $-3x + 8y = 10$ Ans: $x = -2. y = \frac{1}{2}$

   b) $\begin{bmatrix} 13 & 12 & -6 \\ -4 & 7 & -73 \\ 11 & -13 & 157 \end{bmatrix}$ Ans: $x = 6, y = -7$

2. Find the rank of the matrix

   a) $\begin{bmatrix} 0 & 3 & 5 \\ 3 & 5 & 0 \\ 5 & 0 & 10 \end{bmatrix}$ b) $\begin{bmatrix} 2 & 4 & 8 & 16 \\ 16 & 8 & 4 & 2 \\ 4 & 8 & 16 & 2 \\ 2 & 16 & 8 & 4 \end{bmatrix}$ c) $\begin{bmatrix} 5 & -2 & 1 & 0 \\ -2 & 0 & -4 & 1 \\ 1 & -4 & -11 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$

3 a) Find the condition on a,b,c so that the linear system $x + y + z = a, 3x + 4y + 5z = b, 2x + 3y + 4z = c$ is consistent.

Ans: have many solutions if $a = \frac{b}{2} = c = 1$

b) Find the row-reduced echelon form of the following matrices and hence find the rank.

i) $\boldsymbol{A} = \begin{bmatrix} \mathbf{2} & \mathbf{3} & \mathbf{-1} & \mathbf{1} \\ \mathbf{1} & \mathbf{-1} & \mathbf{-2} & \mathbf{-4} \\ \mathbf{3} & \mathbf{1} & \mathbf{3} & \mathbf{-2} \\ \mathbf{6} & \mathbf{3} & \mathbf{0} & \mathbf{-7} \end{bmatrix}$ **ii)** $\boldsymbol{A} = \begin{bmatrix} \mathbf{0} & \mathbf{1} & \mathbf{-3} & \mathbf{-1} \\ \mathbf{1} & \mathbf{0} & \mathbf{1} & \mathbf{1} \\ \mathbf{3} & \mathbf{1} & \mathbf{0} & \mathbf{2} \\ \mathbf{1} & \mathbf{1} & \mathbf{-2} & \mathbf{0} \end{bmatrix}$ **Ans: i) Rank = 3 ii) Rank = 2**

c) Show that if $\lambda \neq -5$ the system of equations $x + 2y - 3z = -2, 6x + 5y + \lambda z = -3, 3x - y + 4z = 3$ have a unique solution. If $\lambda = -5$ show that the equations are consistent.

d) Test for consistency and solve $x + y - z = 0, 2x - y + z = 3, 4x + 2y - 2z = 2$ Ans: $x = 1, y = t - 1, z = t$

4 a) Find the sum and product of Eigen values of the matrix $\begin{bmatrix} -2 & 2 & 3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.

Ans: $\lambda = -3, -3, 5$

5 a) Find the Canonical form of the Quadratic form $3x^2 + 2xy + 3y^2$. Hence show that the equation $3x^2 + 2xy + 3y^2 - 8 = 0$ represents an ellipse in R^2

Ans: Canonical form is ${2y_1}^2 + 4{y_2}.^2$ Ellipse: $\frac{{y^2}_1}{4} + \frac{{y_2}^2}{2} = 1$

b) Find the orthogonal transformation which will transform the quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4xz$ into Canonical form Ans: $\lambda = 2, 2, 8,$

$$P = \begin{bmatrix} \frac{2}{\sqrt{6}} & 0 & \frac{1}{\sqrt{3}} \\ -\frac{1}{\sqrt{6}} & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{6}} & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{3}} \end{bmatrix}$$

MODULE 2

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

2.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 $\theta = \frac{\pi}{4}$.

3.Let $z = f(x, y)$where $x = r\cos\theta, y = r\sin\theta$.

Prove that $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial z}{\partial \theta}\right)^2$.

4.Locate all absolute maxima and minima, if any of $f(x,y) = 13 - 6x + x^2 + 2y + y^2$.

5.Find the point on the line $2x - 4y = 4$ that is closest to the origin.

MODULE 3

1. Evaluate the integral $\iint_R x\sqrt{1-x^2}\ dA$ where $R = \{(x, y): 0 \le x \le 1,\ 2 \le y \le 3\}$.
2. Evaluate $\iint_R xy\ dA$; R is the region enclosed by $y = \sqrt{x}, y = 6 - x, and\ y = 0$.
3. Evaluate $\int_0^{\pi} \int_0^{asin\theta} r^2 dr d\theta$.
4. Evaluate $\int_1^4 \int_z^2 \int_0^{\sqrt{3}y} \frac{y}{x^2+y^2} dx dy dz$.
5. Use cylindrical coordinates to find the volume of the solid enclosed by the paraboloid $z = x^2 + y^2$ and the plane $z = 16$.
6. Find the mass and center of gravity of the lamina with density $f(x, y) = xy$ in the first quadrant and bounded by the circle $x^2 + y^2 = a^2$ and the coordinate axes.

MODULE 4

1. Find the general term of the sequence, starting with n = 1, determine whether the sequence converges, and if so find its limit
   (a) $\frac{1}{3}, \frac{-1}{9}, \frac{1}{27}, \frac{-1}{81}, \ldots$ (b) $\left(1-\frac{1}{2}\right), \left(\frac{1}{3}-\frac{1}{2}\right), \left(\frac{1}{3}-\frac{1}{4}\right), \left(\frac{1}{5}-\frac{1}{4}\right), \ldots$ (c) $\frac{1}{3^5}, \frac{-1}{3^6}, \frac{1}{3^7}, \frac{-1}{3^8}, \ldots$
2. Determine whether the series converges, and if so find its sum.
   (a) $\sum_{k=1}^{\infty}(-1)^{k-1}\frac{7}{6^{k-1}}$ (b) $\sum_{k=1}^{\infty}(\frac{1}{2^k}-\frac{1}{2^{k+1}})$ (c) $\sum_{k=5}^{\infty}\left(\frac{e}{\pi}\right)^{k-1}$
3. Express the repeating decimal as a fraction.
   (a) 5.373737 ... (b) 0.451141414 ...
4. Use any method to determine whether the series converges.
   (a) $\sum_{k=1}^{\infty}\frac{k!10^k}{3^k}$ (b) $\sum_{k=1}^{\infty}\frac{2+\sqrt{k}}{(k+1)^3-1}$ (c) $\sum_{k=1}^{\infty}\left(\frac{k}{k+1}\right)^{k^2}$
5. Classify each series as absolutely convergent, conditionally convergent, or divergent.
   (a) $\sum_{k=1}^{\infty}(-1)^{k+1}\frac{1}{3k}$ (b) $\sum_{k=1}^{\infty}\frac{\sin k}{k^3}$ (c) $\sum_{k=2}^{\infty}\left(\frac{-1}{\ln k}\right)^k$

MODULE 5

1. Determine the Maclaurin series representation of the function $f(x) = \tan^{-1} x$.
2. Determine the Binomial series representation of the function $f(x) = \frac{1}{\sqrt{(2+x)^3}}$.
3. Find the Taylor series of $f(x) = x\sin x$ about the point $x = \frac{\pi}{2}$.
4. Find the Fourier series for $(x) = |x|, -\pi < x < \pi$ and hence deduce that $1 + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$.
5. Find the Fourier series for $f(x) = \begin{cases} 0, -\pi < x < 0 \\ \pi, 0 < x < \pi \end{cases}$ and deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots = \frac{\pi}{4}$.

Prepared by **Approved by**

RADHIKA DAS **Dr. Ramkumar P.B**
(Faculty) **(HOD)**

5. 101902/PH900B: ENGINEERING PHYSICS B

5.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
COURSE: *ENGINEERING PHYSICS B*	**SEMESTER: 1 CREDITS: 4**
COURSE CODE: 101902/PH900B ***REGULATION:*** 2020	**COURSE TYPE: BASIC**
COURSE AREA/DOMAIN: ENGINEERING PHYSICS	**CONTACT HOURS: 3+1 (Tutorial) Hours/Week.**
CORRESPONDING LAB COURSE CODE (IF ANY): 100908/PH922S	**LAB COURSE NAME: ENGINEERING PHYSICS LAB**

SYLLABUS:

UNIT	*DETAILS*	*HOURS*
I	***Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically dampedand 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 ofResonance, Electrical analogy of mechanical oscillators, Wave motion- Derivation of one dimensional wave equation and itssolution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves. Transversevibration in a stretched string, Statement of laws of vibration***	**9**
II	***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 thicknessand 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 Dispersivepower of a grating with expression (no derivation)***	**9**
III	***Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electronsinside 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 energyeigen values, Quantum Mechanical Tunnelling (Qualitative),***	10

	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, Nanowires and Quantum dots, Properties of nanomaterials-mechanical, electrical and opticalApplications of nanotechnology (qualitative ideas)	
IV	***Streamline and turbulent flow, Equation of continuity of fluid flow, Fluid Energy- Potential, Kinetic, pressure, Equations of fluid dynamics: Differential equations of mass, energy and momentum (Euler's equation-No derivation), Bernoulli's equation and applications- Magnus effect, airfoil, Navier-Stokes equations (without proof) in cartesian co-ordinates, 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.***	**9**
V	***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, workingprinciple, Construction and working of Ruby laser and Helium neon laser ,Construction and workingofsemiconductor 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***	9
TOTAL HOURS		45

TEXT/REFERENCE BOOKS:

T/R	*BOOK TITLE/AUTHORS/PUBLICATION*
T1	Aruldhas G, engineering Physics, PHI Ltd
T2	Beiser A, Concepts of Modern Physics, McGraw Hill India Ltd
T3	Bhattacharya and Tandon, Engineering Physics, Oxford India
T4	Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers
T5	Hecht. E, Optics, Pearson Education
T6	**Premlet B, Engineering Physics, McGraw Hill India Ltd**
R1	Mehta N, Applied Physics for Engineers, PHI Ltd
R2	Palais J C, Fiber Optic Communications, Pearson Education

R3	Pandey B K and Chathurvedi S, Engineering Physics, Cengage Learning
R4	**Philip J, A text book of Engineering Physics, Educational Publishers.**
R5	Brijlal and Subramanyam, A Text Book of Optics, S. Chand & Co.

COURSE PRE-REQUISITES:

C.CODE	*COURSE NAME*	*DESCRIPTION*	*SEM*
-	Higher secondary level physics	**To develop fundamental concepts of oscillations, waves, optics, electricity and acoustics**	-

COURSE OBJECTIVES:

1	
2	
3	
4	
5	

COURSE OUTCOMES:

S No.	Description
CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems. Identify appropriate seed idea for entrepreneurial realization.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments. Identify appropriate seed idea for entrepreneurial realization.
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. Identify appropriate seed idea for entrepreneurial realization.
CO 4	Apply the knowledge of ultrasonics in non-destructive testing and use the basic principles of Fluid dynamics to understand Bernoulli's, Euler and Navier-Stokes equations.Identify appropriate seed idea for entrepreneurial realization.
CO 5	Apply the comprehended knowledge about LASER and fibre optic communication system in various engineering application.Identify appropriate seed idea for entrepreneurial realization.

CO-PO AND CO-PSO MAPPING

	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				1	1	1	1		1
CO 2	3	2	1				1	1	1	1		1
CO 3	3	2	1				1	1	1	1		1
CO 4	3	2	1				1	1	1	1		1
CO 5	3	2	1				1	1	1	1		1

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*
CO1.PO1	H	**Compute the quantitative aspects of waves and oscillations in engineering systems** like natural frequency, damped frequency, forced frequency, resonant frequency, band-width, Q-factor, wavelength, wave-velocity, frequency etc.
CO1.PO2	H	Review research literature to identify physics behind current and relevant innovations in the respective branch by assignment.
CO1. PO3	M	Identification and realization of entrepreneur seed idea corresponding to the module
CO1. PO7	M	Identification and realization of entrepreneur seed idea corresponding to the module to meet societal needs
CO1.PO8	M	Professional punctuality and understanding professional ethics by self-reading.
CO1.PO9	M	Effectively function individually and as a team in various class presentations.
CO1.PO10	M	Identification and realization of entrepreneur seed idea and its powerful communication (pitching) in respective multiple intelligence of the student
CO1.PO12	L	Identification and realization of entrepreneur seed idea corresponding to the module and develop concepts on 21st century skills that make learners future-ready.
CO2.PO1	H	**Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments**.

		E.g.: measurement of fringe width, refractive index, path difference, phase difference, annihilation of reflection by interference, angle of diffraction, grating element: its dispersive power and resolving power
CO2.PO2	**H**	Review research literature to identify physics behind current and relevant innovations in the respective branch by assignment.
CO2. PO3	**M**	Identification and realization of entrepreneur seed idea corresponding to the module
CO2. PO7	**M**	Identification and realization of entrepreneur seed idea corresponding to the module to meet societal needs
CO2.PO8	**M**	Professional punctuality and understanding professional ethics by self-reading.
CO2.PO9	**L**	Effectively function individually and as a team in various class presentations.
CO2.PO10	**H**	Identification and realization of entrepreneur seed idea and its powerful communication (pitching) in respective multiple intelligence of the student
CO2.PO12	**H**	Identification and realization of entrepreneur seed idea corresponding to the module and develop concepts on 21st century skills that make learners future-ready.
CO3.PO1	**M**	**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.** E.g.: Wave-function and it's physical significance, Excitons, Schrodinger equations and application to particle in a one dimensional box, Energy Eigen values, tunneling, Quantum confinement, properties of nanomaterials.
CO3.PO2	**M**	Apply the knowledge of ultrasonic in non-destructive testing and use the basic principles of Fluid dynamics to understand Bernoulli's, Euler and Navier-Stokes equations.
CO3. PO3	**M**	Review research literature to identify physics behind current and relevant innovations in the respective branch by assignment.
CO3. PO7	**L**	Identification and realization of entrepreneur seed idea corresponding to the module
CO3.PO8	**M**	Identification and realization of entrepreneur seed idea corresponding to the module to meet societal needs.
CO3.PO9	**M**	Professional punctuality and understanding professional ethics by self-reading.

CO3.PO10	**M**	Effectively function individually and as a team in various class presentations.
CO3.PO12	**M**	Identification and realization of entrepreneur seed idea and its powerful communication (pitching) in respective multiple intelligence of the student.
CO4.PO1	**M**	Identification and realization of entrepreneur seed idea corresponding to the module and develop concepts on 21st century skills that make learners future-ready.
CO4.PO2	**L**	**Apply the comprehended knowledge about LASER and fibre optic communication system in various engineering application**
CO4. PO3	**M**	Review research literature to identify physics behind current and relevant innovations in the respective branch by assignment
CO4. PO7	**M**	Identification and realization of entrepreneur seed idea corresponding to the module
CO4.PO8	**M**	Identification and realization of entrepreneur seed idea corresponding to the module to meet societal needs.
CO4.PO9	**M**	Professional punctuality and understanding professional ethics by self-reading.
CO4.PO10	**M**	Effectively function individually and as a team in various class presentations.
CO1.PO12	**M**	Identification and realization of entrepreneur seed idea and its powerful communication (pitching) in respective multiple intelligence of the student
CO5.PO1	**M**	Identification and realization of entrepreneur seed idea corresponding to the module and develop concepts on 21st century skills that make learners future-ready.
CO5.PO2	**L**	**Physics the basis of all engineering subjects**
CO5. PO3	**H**	**Application of ultrasonics in various branches of engineering**
CO5. PO7	**H**	**Applying the theoretical knowledge of ultrasonics in designing and conducting experiments**
CO5.PO8	**H**	**Application of ultrasonics fundamentals in engineering design**
CO5.PO9	**H**	**Knowledge of ultrasonics fundamentals in advanced engineering**
CO5.PO10	**H**	**Knowledge of ultrasonics for characterizing materials**
CO5.PO12	**H**	**Helps to achieve the skills through regular class discussion/seminar/postop presentation**

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO\PSO*	*PROPOSED ACTIONS*
1	Nil Engineering Physics B is a basic course whose fundamentals are taught in higher secondary education, (Class XI & XII)		

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SINO:	TOPIC	RELEVENCE TO PO/PSO
1	**Applications of Underdamping in automobile shock-absorbers, tuned mass dampers and door stoppers.**	**PO1/PSO1**
2	**Interference Filter**	**PO1/PSO1**

WEB SOURCE REFERENCES:

1	**http://www.animations.physics.unsw.edu.au/jw/oscillations.htm**
2	**http://www.itp.uni-hannover.de/~zawischa/ITP/diffraction.html**
3	**http://science.howstuffworks.com/environmental/energy/superconductivity.htm**
4	**http://plato.stanford.edu/entries/qm/**
5	**http://www.damtp.cam.ac.uk/user/tong/statphys.html**
6	**http://www.coherent.com/products/?834/Lasers**

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓CHALK & TALK	✓ **STUD. ASSIGNMENT**	✓ **WEB RESOURCES**	☐**LCD/SMART BOARDS**
☐ STUD. SEMINARS	☐ **ADD-ON COURSES**		

ASSESSMENT METHODOLOGIES-DIRECT

✓ASSIGNMENTS	✓ **STUD. SEMINARS**	✓ **TESTS/MODEL EXAMS**	✓ **UNIV. EXAMINATION**
☐ STUD. LAB PRACTICES	☐ **STUD. VIVA**	☐ **MINI/MAJOR PROJECTS**	☐ **CERTIFICATIONS**

☐ ADD-ON COURSES	☐ **OTHERS**		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ **STUDENT FEEDBACK ON FACULTY (TWICE)**
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ **OTHERS**

5.2 COURSE PLAN

DAY	*MODULE*	*TOPIC PLANNED*
1	**I**	Introduction Harmonic Oscillator
2	**I**	Damped Harmonic Oscillator: Differential Eq.
3	**I**	Solution to the Differential Equation DHO
4	**I**	Special cases; Forced Harmonic Oscillator-Differential Equation
5	**I**	Solution to D. Eq. of Forced Harmonic Oscillator
6	**I**	Resonance
7	**I**	Electrical-Mechanical Oscillator Analogy: LCR
8	**I**	Q-Factor, Numerical Problems
9	**II**	Waves - Introduction
10	**II**	Wave Equation
11	**II**	Solution to the Wave Equation, Problem
12	**II**	Transverse Wave in a String, Law of Vibration
13	**II**	Numerical Problems on Module 1
14	**II**	Interference - General
15	**II**	Thin Film Interference
16	**II**	Air Wedge
17	**III**	Newtons Rings
18	**III**	Anti Reflection Coating, Numerical Problems
19	**III**	Diffraction
20	**III**	Plane Transmission Grating - Grating Equation
21	**III**	Resolving power & Dispersive power of Grating
22	**III**	Numerical Problems on Module 2
23	**III**	Quantum Mechanics -Introduction
24	**IV**	Heisenberg's Uncertainty Principle
25	**IV**	Applications of Heisenberg's Uncertainty Principle
26	**IV**	Wave Function
27	**IV**	Schrodinger Wave Equations

28	**IV**	Particle in a Box
29	**IV**	Quantum Mechanical Tunnelling
30	**IV**	Nanotechnology: Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials
31	**IV**	Quantum confinement in one dimension, two dimension and three dimension
32	**IV**	Nano sheets, Nanowires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical: Applications of nanotechnology
33	**IV**	Streamline and turbulent flow- Equation of continuity of fluid flow- Fluid Energy- Potential, Kinetic, pressure
34	**V**	Equations of fluid dynamics: Differential equations of mass, energy and momentum (Euler's equation-No derivation)
35	**V**	Bernoulli's equation and applications- Magnus effect, airfoil
36	**V**	Navier-Stokes equations (without proof) in cartesian co-ordinates
37	**V**	Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working
38	**V**	Detection of ultrasonic waves - Thermal and Piezoelectric methods:
39	**V**	Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid
40	**V**	Applications of ultrasonic waves -SONAR,NDT and Medical, Numerical Problems
41	**V**	LASER: Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission
42	**V**	Einstein's coefficients (no derivation), Population inversion, Metastable states
43	**V**	Basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle
44	**V**	Construction and working of Ruby LASER & He-Ne LASER
45	**V**	Construction and working of Semiconductor Laser. Applications
46	**V**	Holography, Recording of hologram and reconstruction of image, Applications
47	**V**	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres,
48	**V**	Numerical aperture –Derivation, Fibre optic communication system
49	**V**	Fibre optic sensors-Intensity Modulated and Phase modulated sensors

5.3 MODULE WISE SAMPLE QUESTIONS

MODULE 1

1. Obtain the differential equation of a damped Harmonic oscillator
2. Obtain the differential equation of a forced Harmonic oscillator
3. Explain the term Quality factor.On what factors does it depends
4. What is the physical significance of Q factor of a forced oscillator.
5. Is energy stored in a forced oscillator.? Explain
6. Justify the statement ”The lower the damping higher the Q-value”
7. Explain free ,damped and forced oscillations
8. What is amplitude resonance. Explain the condition for resonance
9. What is resonance. How is it applied in the tuning of a radio
10. What is the practical significance of resonance in the construction of machinery
11. What is resonance. Explain few examples of resonance.
12. Explain the term sharpness of resonance
13. Show a graph showing the variation of amplitude with time in case of heavily, lightlyand critically damped conditions.
14. Analyse the L.C.R circuit through which A.C.voltage is applied, as a forced oscilltor
15. Explain some practical cases of damping
16. Draw the frequency response curve of a forced harmonic oscillator indicating resonance
17. A damped oscillator of mass 1gm has a force constant 10N/m and damping factor $1s^{-}$ Calculate the angular frequenvcy without damping and with damping
18. Explain the theory of under damped harmonic oscillator
19. What is a forced harmonic oscillator. Obtain an experession for the displacement and amplitude of a forced oscillator.
20. What is Q factor of an oscillator. Obtain an expression for the Q-factor.

21. In a S.H.M. when the displacement is half the amplitude ,what fraction of the total energy are kinetic and potential. At what displacement will the energy be half kinetic and half potential
22. A condenser of capacity 3μF is discharged through an inductance of 3H . Calculate the quality factor and the time in which the amplitude of oscillations will be reduced to 10% of its initial value. The resistance is 2ohm.
23. After what time lapse oscillations decays to half amplitude if For a serirs LCR circuit L=10mH , C=1.0μF,R=0.2Ω .Calculate the frequency of the dmped oscillations

24. Find the natural frequencyof a circuit containing inductance of 144 μH and a capacity of 0.0025 μF . To which wavelength ,its response will be maximum
25. If the quality factor of an undamped tuning fork of frequency 256hertz is 10^3 . What is the time in which the energy is reduced to 1/e of its energy in the absence of damping.
26. Deduce the frequency and quality factor factor for a circuit with L=2mH, C= 5 μF and R=0.2 Ω
27. A forced harmonic oscillator shows equal amplitude of oscillations of frequencies p_1=300rad/secand p_2=400rad/sec.Find the resonant frequency for which amplitude becomes maximum .

Problem questions

1. A damped oscillator of mass 1gm has a force constant 10N/m and damping factor $1s^-$ Calculate the angular frequency without damping and with damping

2 In a S.H.M. when the displacement is half the amplitude ,what fraction of the total energy are kinetic and potential. At what displacement will the energy be half kinetic and half potential

3 Find the natural frequencyof a circuit containing inductance of 144 µH and a capacity of 0.002

5 µF . To which wavelength ,its response will be maximum

4 If the quality factor of an undamped tuning fork of frequency 256hertz is 10^3 . What is the time in which the energy is reduced to 1/e of its energy in the absence of damping

5. A forced harmonic oscillator shows equal amplitude of oscillations of frequencies p_1=300rad/secand p_2=400rad/sec.Find the resonant frequency for which amplitude becomes maximum .
6. For a circuit with L=2mH, C= 5 µF and R=0.2 Ω. Check wether the circuit is oscillatory or not
7. A 100Hz wave on a string has an amplitude of 0.100mm.How much energy exists in 100 gm of the string.Assume that one wavelength of the string has a mass much smaller than 100gm A wave of frequency 400Hz is travelling with 800m/s. How far are two points situated whose displacement differs in phase by π/4.

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MODULE 2

1. What is meant by coherence
2. Explain spatial and temporal coherence
3. What are the conditions required to get sustained interference.
4. Why two independent source of light of the same wavelength cannot produce interference fringes
5. Why does a soap bubble show beautiful colours when illuminated by white light
6. Explain path difference and phase difference
7. State and explain stokes law
8. Explain the fact that thecolour shown by a film in reflected and transmitted system are complimentary to each other
9. Obtain the cosine law
10. Explain interference filters
11. What is an anti reflection coating
12. Explain why newtons rings are circular
13. What will be the effect on the diameter of a ring if air is replaced with liquid in newtons ring
14. The centre of the newtons ring in reflected sysyem is dark. Why
15. What will happen if monochromatic light is replaced by white light in newtons ring
16. Why interference fringes are obseved in the case of thin films and not in the case of thick films
17. Obtain an expression for the thickness of a thin wire using air wedge
18. How will you teast the planeness of surface by forming an airwedge
19. Derive an expression for the wavelength of light using Newtons ring arrangement
20. In a newtons ring experiment the diameter of 4^{th} and 12^{th} dark rings are 0.400cm and 0.700cm respectively.Obtain the diameter of 20^{th} dark ring
21. Sodium light (5893A) strikes a film of oil on water at an angle300. The 8^{th} dark band is seen. .Compute the thickness of the oil film if the refractive index of the oil is 1.44

22. Light of wavelength 5893^0 is reflected at nearly normal incidence from a soap film of refractive index 1.42. What is the least thickness of the film that will appear (i) dark (ii) bright
23. In a newtons ring experiment the diameter of the 13^{th} dark ring was found to be 0.590cm and that of the third dark ring was 0.336cm. If the focal length of the plano-convex lens is 50cm, Calculate the wavelength of light used.
24. Light of wavelength 600 nm falls normally on a thin wedge shaped film of refractive index 1.4. forming fringes at 2mm apart. Find the angle of wedge.
25. The diameter of the tenth bright ring in a newtons ring appartus changes from 1.5 cm to 1.3cm when a liquid is introduced between the lens and the plate . Find the refractive index of the liquid
26. The diameter of the 20^{th} dark ring in a newton's rings system viewed normally is 0.6cm. Calculate the thickness of the corresponding air film. The wavelength of light used is 6×10^{-8}cm.

MODULE 3

1. What are matter waves. Obtain an expression for the wavelength of matter waves
2. Explain Heisenberg's uncertainity principle

3.What are the characteristics of a wave function

4. Explain the finite width of spectral lines on the basis of uncertainity principle
5. What is the significance of uncertainity principle for microscopic particles
6. Find the radius of Bohr's first orbit on the basis of uncertainity principle
7. " We cannot know future because we cannot know present" Justify the statement with uncertainity principle
8. What is meant by expectation value of a dynamical variable
9. What is meant by probability interpretation of a wave function
10 What is an eigen value equation
11 Why n=0 state is not allowed for particle confined to an infinite potential box

12 Explain the various quantum mechanical operators

13 What is the importance of normalising a wave function

14 Derive Schrod'inger's time dependent wave equation

15 . Obtain the expression for various energy values of a free particle in a one diamensional potential well.

16Explain quantum mechanical tunelling

17 Prove that an electron cannot remain inside the nucleus

18. Estimate the energy in eV of a helium atom having a de Broglie wavelength 0.1nm

19. Compare the uncertainities in the velocities of an electron and a proton confined to a box of width 10 A

20 Uncertainity in time of an excited atom is about 10^{-8}s. Calculate the uncertainities in energy and in frequency of the radiation

21. Find the energy of an electron moving in one dimensional infinitely high potential box ofwidth $1A^0$

22.Find the probability that aparticle trapped in a box 'l' wide can be found between 0.30l for the first excited state and 0.65l

23 . An electron in a metal encounters a barrier layer of height 6eV and thickness 0.5nm. If the electron energy of 5eV , what is the probability of tunneling through the barrier

24 Find the probabilitythat a particle in a box width " a" can be found between x=0 and x=a/n , when it is in nth state

25. Is it possible to observe the energy states of a ball of mass 10gms moving in a box along its length which is 10cm

26 An electron is confined to a one diamensional of side $1A^0$. Obtain the first four eigen values of energy in eV of the electron.

27. A nuclear particle is confined to a nucleus of diameter 5×10^{-4}m. Calculate the minimum uncertainity in the momentum of the nucleon. Also calculate the minimum kinetic energy of the nucleon

24 . Calculate the smallest possible uncertainty in the position of an electron moving with velocity 1.5×10^{7} m/s

25 . A bullet of mass 25 gms is moving with a speed of 400m/s. The speed is measured accurate upto 0.02%. Calculate the uncertainty with which the position of the bullet can be located

26 With what fundamental accuracy one can locate the position of an electron that has a spread of 10^{6}m/s accurate to 0.01%

MODULE 4

1. Are the Ultrasonics waves electromagnetic waves? Give proper reason.
2. Give the properties of Ultrasonics.
3. What are ultrasonics. Explain two methods of detecting ultrasonic waves
4. Explain NDT using ultrasonics,

4 Explain sonar. What are their applications

5. What is magnetostriction effect?
6. Explain the piezo electric method of producing ultrasonic waves
7. Explain the various applications of ultrasonic waves

8. Define the terms “piezo electric effect” and “inverse piezo electric effect”
9. What is cavitation? Mention its applications.
10. Name the methods to detect Ultrasonics.
11. List the industrial applications of Ultrasonics.
12. What is SONAR? Give its applications.
13. What is NDT? List the name of NDT techniques.
14. Compare destructive and non-destructive testing.
15. What is the principle of NDT by Ultrasonic? Name different scanning methods used in Ultrasonic NDT.
16. What is the principle of Ultrasonics flaw detector?
17. What are the medical applications of Ultrasonics?

18. What are the advantages of Ultrasonics in medical field over other technique?
19. Find the frequency of ultrasound from a nickel rod length 4 cm .For Ni Y= 203 G Pa and density 8900 kg/m^3.

MODULE 5

1 Explain the difference between photography and Holography

2 Explain holography. Whay are its merrits

3 What is popultion inversion . What is the need of it

4. Distinguish between spontaneous emission and stimulated emission

5. Define numerical aperature of an optical fiber. Derive an expression for it

6. Explain photo detector

7. Explain the working of a solar cell

8 Band gap energy of GaAs is 1.45eV .Calculate wavelength of the laser beam Emitted from thid laser diode

9. Explain the working of a Ruby Laser

10. Findthe intensity of Laser beamof 15 mW power and havinga diameterof 1.25mm.Assume the intensity to be uniform across the beam

11.Calculate the ratio of spontaneous emission to stimulated emission if λ of radiation is 600 nm at 2500K..h= 6.62X 10^{-34} J-S ,K_B= 1.38X 10^{-23}.Check whether laser production is possible or not

Prepared by

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DEEPTHI JAYAN K
SUJITH S
(Faculty)

Approved by

(HOD)

6. 100908/CE900C ENGINEERING MECHANICS

6.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
COURSE: ENGINEERING MECHANICS	**SEMESTER: 1 CREDITS: 3**
COURSE CODE: 100908/CE900C ***REGULATION:*** 2021	**COURSE TYPE: BASIC**
COURSE AREA/DOMAIN: ENGINEERING SCIENCE	**CONTACT HOURS: 4+1(tutorial)** **hours/Week**
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME: NA**

SYLLABUS:

MODULE	DETAILS	HOURS
I	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. Demonstration of parallelogram law.	7
II	Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simply supported, cantilevered and overhanging beams subjected to concentrated vertical load, uniformly distributed load and uniformly varying load. General coplanar force system - resultant and equilibrium equations. Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies – wedges. ladder- analysis of connected bodies. Demonstration of reactions in a simply supported beam and the determination of coefficient of friction.	7

III	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, Product of Inertia Theorem of Pappus Guldinus. Forces in space - vectorial representation of forces -moments and couples – resultant and equilibrium equations - concurrent forces in space .Demonstration of concept of moment of inertia of solid disc, solid cylinder and hollow cylinder by studying their rolling motion in an inclined plane. Demonstration and determination of centre of gravity of an irregular lamina.	7
IV	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 .	7
V	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. Simple harmonic motion – free vibration – degree of freedom- undamped free vibration of spring mass system.	7
TOTAL HOURS		**35**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	**Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers**
T2	**Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications, 14th edition, 2008**
R1	**Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley,5th edition, 2016**
R2	**Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers, 8th edition, 2021**
R3	**F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill**
R4	**Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd, 3rd edition, 2005**
R5	**Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India, 4th edition,2005**
R6	**R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education 11th edition, 2014**

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

Sl No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	***Recall*** principles and theorems related to rigid body mechanics														
	2	2											1		
2	***Identify*** and ***describe*** the components of system of forces acting on the rigid body														
	3	3											1		
3	***Apply*** the conditions of equilibrium to various practical problems involving different force system.														
	3	3											1	1	
4	***Choose*** appropriate theorems, principles or formulae to solve problems of mechanics.														
	3	3											1		
5	***Solve*** problems involving rigid bodies, applying the properties of distributed areas and masses														
	3	3											1	1	

CO-PO AND CO-PSO MAPPING

JUSTIFICATIONS FOR CO-PO MAPPING

CO	PO	MAPPING	JUSTIFICATION
CO1	PO1	2	Principles and theorems related to rigid body mechanics are applied to solve engineering problems
	PO2	2	Principles and theorems related to rigid body mechanics are usedto identify, formulate, and analyze complex engineering problems
	PSO1	1	Principles and theorems related to rigid body mechanics are applied to solve engineering problems
CO2	PO1	3	Components of system of forces acting on the rigid body are used to solve engineering problems
	PO2	3	Components of system of forces acting on the rigid body are used to identify, formulate, and analyze complex engineering problems
	PSO1	1	Components of system of forces acting on the rigid body are used to solve engineering problems
CO3	PO1	3	Conditions of equilibrium are important in solving engineering problems
	PO2	3	Conditions of equilibriumused toformulate and analyze complex engineering problems
	PSO1	1	Conditions of equilibrium are important in solving engineering problems
	PSO2	1	Conditions of equilibrium are utilised in design, analysis and implementation of mechanical systems/processes
	PO1	3	Theorems, principles or formulae should be appropriately usedto solve engineering problems
	PO2	3	Theorems, principles or formulae should be appropriately usedtoformulate, review research literature, and analyze complex engineering problems

	PSO1	**1**	**Theorems, principles or formulae should be appropriately used to solve engineering problems**
	PO1	**3**	**Knowledge in the properties of distributed areas and masses is necessary to solve engineering problems**
	PO2	**3**	**Properties of distributed areas and masses is usedto identify, formulate, and analyze complex engineering problems**
	PSO1	**1**	**Knowledge in the properties of distributed areas and masses is necessary to solve engineering problems**
	PSO2	**1**	**Properties of distributed areas and masses are crucial in design, analysis and implementation of mechanical systems/processes**

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

Sl No	DESCRIPTION	PROPOSED ACTIONS
1	Derivation of moment of inertia and centroid of planar surfaces	NPTEL
2	Numericals of Product of Inertia	NPTEL, Lecture Notes
3	Moment of Inertia about a rotated axis	NPTEL

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl No	DESCRIPTION
1	Principle of Virtual Work
2	Simple Pendulum

WEB SOURCE REFERENCES:

1	**http://nptel.ac.in/courses/112103019/**
2	**www.engineeringdrawing.org/category/projection_of_lines**

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓CHALK & TALK	✓ **STUD. ASSIGNMENT**	✓ **WEB RESOURCES**	✓**LCD/SMART BOARDS**
☐ STUD. SEMINARS	☐ **ADD-ON COURSES**		

ASSESSMENT METHODOLOGIES-DIRECT

✓ASSIGNMENTS	☐ **STUD. SEMINARS**	✓ **TESTS/MODEL EXAMS**	✓ **UNIV. EXAMINATION**
☐ STUD. LAB PRACTICES	☐ **STUD. VIVA**	☐ **MINI/MAJOR PROJECTS**	☐ **CERTIFICATIONS**
☐ ADD-ON COURSES	☐ **OTHERS**		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ **STUDENT FEEDBACK ON FACULTY (TWICE)**
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ **OTHERS**

6.2 COURSE PLAN

HOUR	MODULE	TOPICS PLANNED
HOUR 1	1	Introduction to CO PO attainment, Syllabus.Introduction to engineering mechanics
HOUR 2	1	introduction on statics and dynamics ,Basic principles of statics
HOUR 3	1	Parallelogram law, equilibrium law — Superposition and transmissibility, law of action and reaction
HOUR 4	1	Free body diagrams. Degree of freedom- types of supports and nature of reactions
HOUR 5	1	exercises for free body diagram preparation
HOUR 6	1	composition and resolution of forces, resultant and equilibrium equations
HOUR 7	1	equilibrium equation -numerical exercises for illustration

HOUR 8	1	equilibrium equation -numerical exercises for illustration
HOUR 9	1	Concurrent coplanar forces - analysis of concurrent forces
HOUR 10	1	methods of projections , illustrative numerical exercise
HOUR 11	1	Analysis of concurrent forces - methods of moment- Varignon's Theorem of Moments
HOUR 12	1	Varignon's Theorem -illustrative numerical exercise
HOUR 13	1	Analysis of concurrent force systems — extended problem solving
HOUR 14	1	Analysis of concurrent force systems — extended problem solving
HOUR 15	1	Analysis of concurrent force systems — extended problem solving
HOUR 16	2	Parallel coplanar forces
HOUR 17	2	Parallel coplanar forces — centre of parallel forces
HOUR 18	2	equilibrium of parallel forces — Simple beam subject to concentrated vertical loads
HOUR 19	2	equilibrium of parallel forces — overhanging and cantilever
		beam subject to concentrated vertical loads
HOUR 20	2	equilibrium of parallel forces — Simple beam subject to udl and uvl
HOUR 21	2	equilibrium of parallel forces — overhanging beam subject to udl and uvl
HOUR 22	2	equilibrium of parallel forces — cantilever beam subject to udl and uvl
HOUR 23	2	couple and resolution to force and couple
HOUR 24	2	Friction — sliding friction - Coulomb's laws of friction
HOUR 25	2	friction — analysis of single bodies
HOUR 26	2	illustrative examples on ladder
HOUR 27	2	illustrative examples on wedges
HOUR 28	2	illustrative examples on wedges
HOUR 29	2	Problems on friction- analysis of connected bodies

HOUR 30	2	Problems on friction- analysis of connected bodies
HOUR 31	2	Problems on friction- extended problem solving
HOUR 32	2	Problems on friction- extended problem solving
HOUR 33	3	Centroid of simple and regular geometrical shapes
HOUR 34	3	centroid of figures in combination
HOUR 35	3	composite areas- problems for illustration
HOUR 36	3	composite areas- problems for illustration
HOUR 37	3	Moment of inertia- parallel axis theorem-examples for illustration
HOUR 38	3	Moment of inertia-perpendicular axis theorem-examples for illustration
HOUR 39	3	Moment of inertia-perpendicular axis theorem-examples for illustration
HOUR 40	*3*	Solutions to practice problems — problems related to centroid and moment of inertia
HOUR 42	3	Solutions to practice problems — problems related to centroid and moment of inertia
HOUR 43	3	Solutions to practice problems — problems related to centroid
		and moment of inertia
HOUR 44	3	Polar moment of inertia, Radius of gyration
HOUR 45	3	Mass moment of inertia of ring, cylinder and uniform disc
HOUR 46	3	Theorem of Pappus Guldinus - Demonstration
HOUR 47	4	Introduction to dynamics — review of rectilinear translation - equations of kinematics
HOUR 48	4	equations of kinematics — problems to review the concepts
HOUR 49	4	equations of kinematics — problems to review the concepts
HOUR 50	4	introduction to kinetics — equation of motion
HOUR 51	4	D'Alembert's principle — illustrative exercise from motion on horizontal surfaces
HOUR 52	4	Analysis of lift motion

HOUR 53	4	D'AIembert's principle — illustrative exercise from motion on inclined surfaces
HOUR 54	4	Motion of connected bodies
HOUR 55	4	Motion of connected bodies-extended problem solving
HOUR 56	4	Curvilinear translation - Review of kinematics
HOUR 57	4	projectile motion — simple problems to review the concepts
HOUR 58	4	Concepts on Impulse momentum equation and work energy equation
HOUR 59	5	Rotation — kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis
HOUR 60	5	Rotation under a constant moment
HOUR 61	5	Rotation under a constant moment - extended problem solving.
HOUR 62	5	Plane motion of rigid body- instantaneous centre of rotation
HOUR 63	5	Introduction to harmonic oscillation
HOUR 64	5	free vibrations - simple harmonic motion — differential equation and solution.
HOUR 65	5	Degree of freedom — examples of single degree of freedom (SDOF) systems
HOUR 66	5	Idealisation of mechanical systems as spring-mass systems
HOUR 67	5	SHM -extended problem solving
HOUR 68	5	SHM -extended problem solving

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
T2	Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications, 14th edition, 2008
R1	Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley,5th edition, 2016
R2	Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers, 8th edition, 2021
R3	F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill
R4	Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd, 3rd edition, 2005
R5	Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India, 4th edition,2005
R6	R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education 11th edition, 2014

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEMESTER
	NIL		

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

Sl No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	***Recall*** principles and theorems related to rigid body mechanics														
	2	2											1		
2	***Identify*** and ***describe*** the components of system of forces acting on the rigid body														
	3	3											1		
3	***Apply*** the conditions of equilibrium to various practical problems involving different force system.														
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4	***Choose*** appropriate theorems, principles or formulae to solve problems of mechanics.														
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5	***Solve*** problems involving rigid bodies, applying the properties of distributed areas and masses														
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JUSTIFICATION FOR CO-PO MAPPING:

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CO 2	PO 1	3	Components of system of forces acting on the rigid body are used to solve engineering problems
	PO 2	3	Components of system of forces acting on the rigid body are used to identify, formulate, and analyze complex engineering problems
	PSO 1	1	Components of system of forces acting on the rigid body are used to solve engineering problems
	PO 1	3	Conditions of equilibrium are important in solving engineering problems

CO 3	PO 2	3	Conditions of equilibriumused toformulate and analyze complex engineering problems
	PSO 1	1	Conditions of equilibrium are important in solving engineering problems

CO	***PO***	***MAPPING***	***JUSTIFICATION***
	PSO 2	1	Conditions of equilibrium are utilised in design, analysis and implementation of mechanical systems/processes
CO 4	PO 1	3	Theorems, principles or formulae should be appropriately usedto solve engineering problems
	PO 2	3	Theorems, principles or formulae should be appropriately usedtoformulate, review research literature, and analyze complex engineering problems
	PSO 1	1	Theorems, principles or formulae should be appropriately used to solve engineering problems
CO 5	PO 1	3	Knowledge in the properties of distributed areas and masses is necessary to solve engineering problems
	PO 2	3	Properties of distributed areas and masses is usedto identify, formulate, and analyze complex engineering problems
	PSO 1	1	Knowledge in the properties of distributed areas and masses is necessary to solve engineering problems
	PSO 2	1	Properties of distributed areas and masses are crucial in design, analysis and implementation of mechanical systems/processes

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

Sl No	***DESCRIPTION***	***PROPOSED ACTIONS***
1	Derivation of moment of inertia and centroid of planar surfaces	NPTEL
2	Numericals of Product of Inertia	NPTEL, Lecture Notes
3	Moment of Inertia about a rotated axis	NPTEL

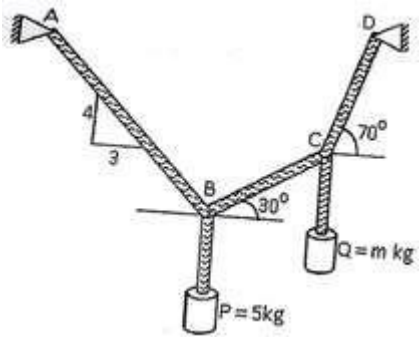
TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

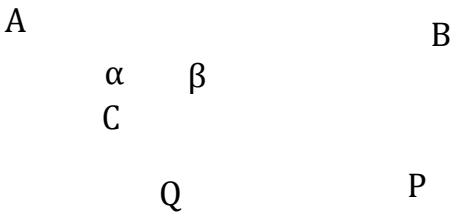
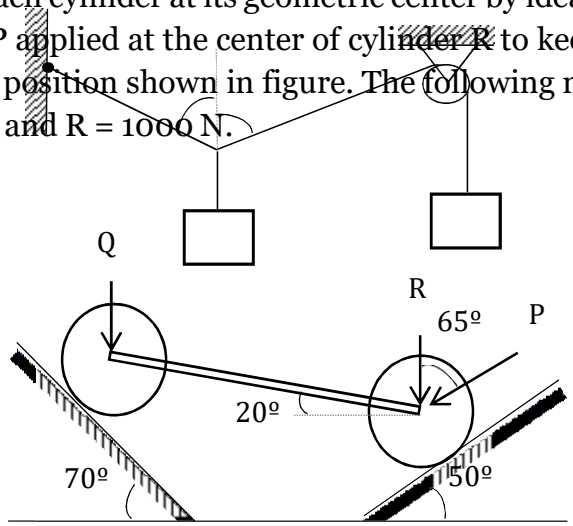
Sl No	DESCRIPTION
1	Principle of Virtual Work
2	Simple Pendulum

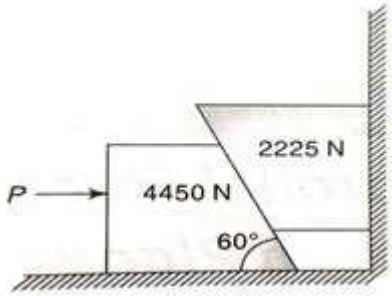
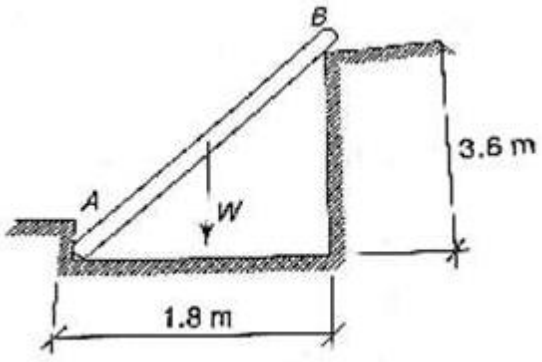
WEB SOURCE REFERENCES:

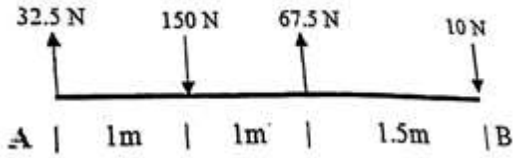
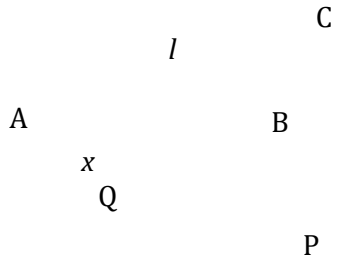
Sl No	DESCRIPTION
1	www.nptel.ac.in/courses/112/106/112106286/
2	https://nptel.ac.in/courses/122/104/122104014/
3	https://nptel.ac.in/courses/112/103/112103108/

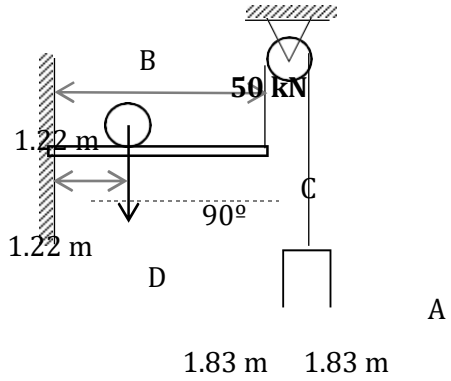
	UNIT WISE QUESTION BANK	
Module I		
Sl.No.	**Questions**	**DL**
1	State parallelogram law	A1
2	State and prove Varignon's theorem of moments.	A2
3	Define a couple and explain its characteristics. With the help of a sketch, explain how a force can be resolved into a force and a couple.	A3

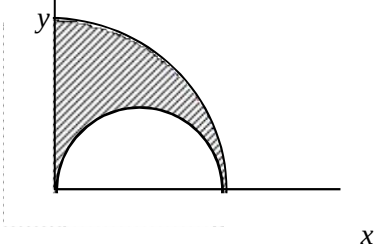
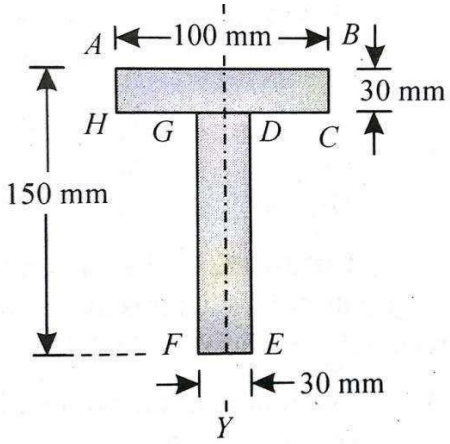
4	Determine the magnitude and direction of the resultant of the forces acting on the ring as shown in Figure.	B1
5	F1 and F2 are two collinear forces. When they act in opposite directions, their resultant is 34N, when they act at right angles to each other, their resultant is 50N. Find F1 and F2.	B2
6	Two smooth circular cylinders, each of weight W = 445 N and radius r = 152 mm, are connected at their centres by a string AB of length l = 406 mm and rest upon a horizontal plane, supporting above them a third cylinder of weight Q = 890 N and radius r = 152 mm. Find the forces T in the string and the pressures produced on the floor at the points of contact D and E.	B3
7	Block P=5kg and block Q of mass "m" kg are suspended through a cord which is in equilibrium as shown in figure. Determine the mass of block Q. 	C1

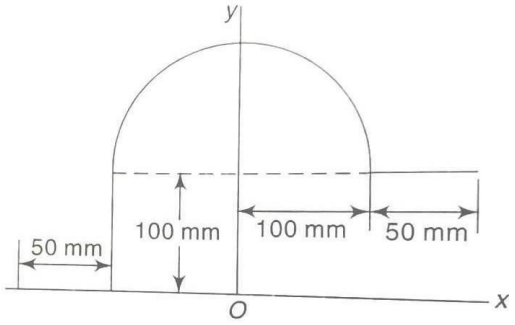
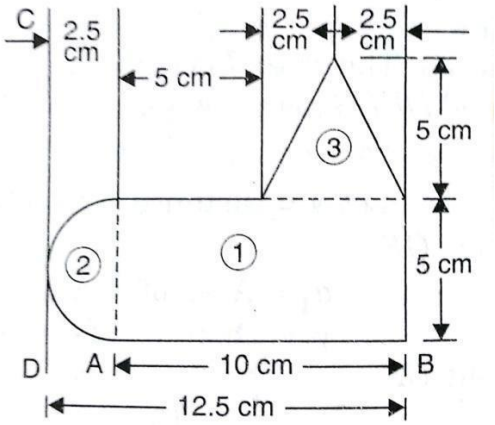
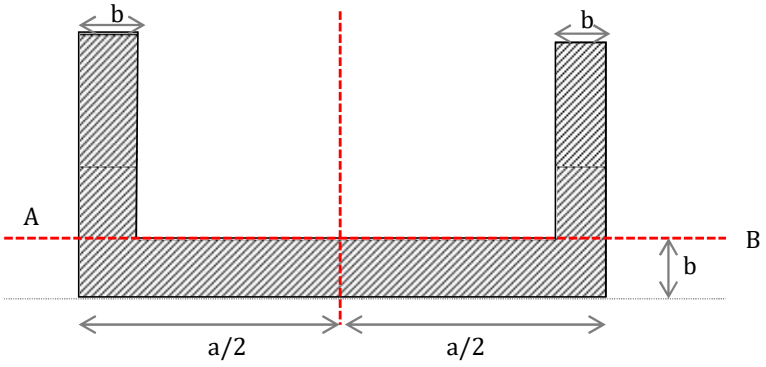
8	A weight Q is suspended from a small ring C, supported by two ords AC and BC. The cord AC is fastened at A while the cord BC passes over a frictionless pulley at B and carries the weight P as shown. If P = Q and α = 500, find the value of the angle β.  	C2
9	Two cylinders of weights Q and R are interconnected by a bar of negligible weight hinged to each cylinder at its geometric center by ideal pins. Determine the magnitude of P applied at the center of cylinder R to keep the cylinders in equilibrium in the position shown in figure. The following numerical data are given: Q = 2000 N and R = 1000 N.  	C3

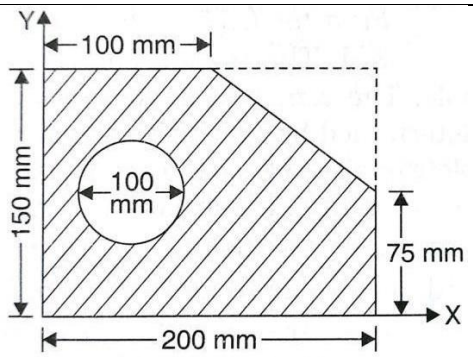
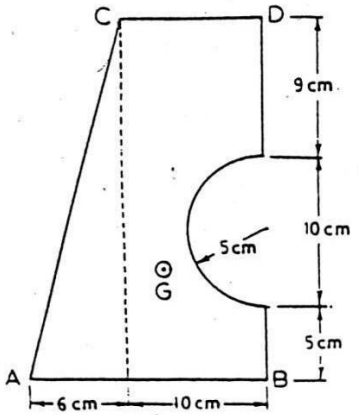
Module II		
Sl.No.	**Questions**	**DL**
1	State the laws of friction	A1
2	Sketch the free body diagram of a ladder inclined at 30° to the horizontal floor.Considering friction at wall and the floor	A2
3	Distinguish between the terms 1.Coefficient of friction, 2.Angle of friction, 3.Angle of repose and derive relationship between these terms if any.	A3
4	A uniform ladder of 4m length rests against a wall at an angle of 45° with the vertical. The coefficient of friction between the ladder and the wall is 0.4 and that between the ladder and the floor is 0.5. If a man whose weight is one half of that of ladder ascends it, how high will he be when the ladder slips.	B1
5	Referring to the Figure , the coefficients of friction are as follow : 0.25 at the floor, 0.30 at the wall, and 0.20 between blocks. Find the minimum value for a horizontal force P applied to the lower block that will hold the system in equilibrium. 	C1
6	A man with weight 667.5 N stands on the middle rung of a 227.5 N ladder, as shown in Figure . Assuming the end B rests on the corner of a wall and a stop at A to prevent slipping, find the reactions at A and B. 	B3

7	A system of parallel forces is acting on a rigid bar as shown in Figure . Reduce this system into a)a single force b)a force and a couple at A.  	B2
8	The beam AB is hinged at A and supported at B by a vertical cord which passes over a frictionless pulley at C and carries at its end a load P as shown in the figure. Determine the distance x from A at which a load Q must be placed on the beam if it is to remain in equilibrium in a horizontal position. Neglect the weight of the beam  	C2

9	A bar AB hinged to the foundation at A and supported by a strut CD is subjected to a horizontal 50kN load at B, as shown in Figure . Find the tensile force S in the strut and the reaction R_A.  	C3

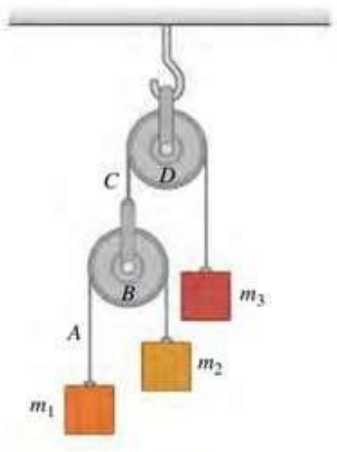
Module III		
Sl.No.	**Questions**	**DL**
1	Define the terms Centroid and Centre of Gravity.	A1
2	Find the moment about the point C(-2,3,5) of the force F=4i+4j-k passing through the points A(1,-2,4) and B(5,2,3)	A1
3	Locate the centroid C of the shaded area obtained by cutting a semicircle of diameter 'a' from the quadrant of a circle of radius 'a' as shown in the Figure 	A2
	Determine the moment of inertia about the base for the figure shown 	A3
5	A tripod supports a load of 2kN as shown in the figure. The ends A, B, C are in the X-Z plane. Find the force in the three legs of the tripod 	B1

6	Referring to the Figure, locate the centroid of length of the mean centre line of the stirrup with the dimensions shown 	B2
7	Locate the centroid of the of a plane uniform lamina shown in Figure 	B3
8	If the dimensions a and b of the plane figure are fixed, find what the dimension c must be in order that the centroid of the area will lie on the line AB 	C1
9	Determine the coordinates of the centroid of the circular hole having 100 mm diameter to be cut in thin plate so that this point will be the centroid of the remaining shaded as shown in Figure and determine the centroidal moment of inertia	C2

		
10	A plane lamina ABCD is hung freely from point D. Find the angle made by DB with the vertical. 	C3

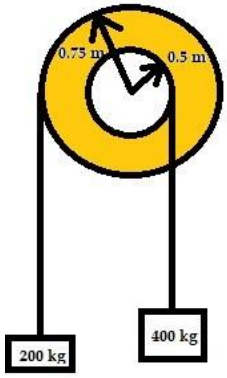
Module IV

Sl.No.	Questions	DL
1	State D 'Alemberts principle	A1
2	Derive the expression for the tension in the cables supporting a lift of weight, *W*, when the lift is moving upward with an acceleration, *a*.	A2
3	An athlete whirls a circular discus in a circle of radius 80 cm. At a certain instant the athlete is rotating at 10 rad/s and the angular acceleration is 50 rad/s^2. Find the tangential and centripetal components of acceleration of the discus.	A3
4	A stone is thrown vertically upwards with a velocity of 20 m/s from the top of the tower 30 m height. Calculate the time required for the stone to reach the ground.	B1

5	A body of weight 200 N is initially stationary on a 45 degree inclined plane. What distance along the inclined plane must the body slide, before it reaches a speed of 2 m/s. The coefficient of friction between the body and the plane is 0.1.	B2
6	A projectile is fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of 30 degrees with horizontal. Find (a) horizontal distance from the gun to the point where the projectile strikes the ground (b) greatest deviation above the ground reached by the projectile.	B3
7	A cage carrying 10 men each weighing 500 N starts moving downwards from rest in a mine vertical shaft. The cage attains a speed of 12 m/s in 20 metres. Find the pressure exerted by each man on the floor of the cage.	C1
8	Two blocks of masses, connected by a string passing over a small, frictionless pulley rest on planes as shown. Assume the surfaces to be smooth. (a) Which way will the system move when the blocks are released from rest? (b) What is the acceleration of the blocks? (c) What is the tension in the string?	C2
9	The masses m_1 and m_2 are connected by a light string A over a light, frictionless pulley B. The axle of pulley B is connected by a light string C over a light, frictionless pulley D to a mass m_3. m_1= 50 kg; m_2 = 40, m_3 = 100 kg. Find the acceleration of the masses and the tension in the strings A and C. 	C3

Module V		
Sl.No.	**Questions**	**DL**
1	Define instantaneous centre.	A1

2	A wheel is rotating about its axis with a constant angular acceleration of 1 rad/s^2. If the initial and final angular velocities are 5.25 rad/s and 10.5 rad/s, find the total angle turned through during the time interval this change of angular velocity took place	A2
3	Find the velocity and acceleration after 0.5 seconds from the extreme position of a body moving with simple harmonic motion with an amplitude of 0.8 m and period of complete oscillation of 1.8 seconds.	A3
4	Two blocks of masses 10 kg and 25 kg are attached to the two ends of a flexible rope. The rope passes over a pulley of diameter 500 mm. The mass of the pulley is 7.5 kg and its radius of gyration is 200 mm. Determine the acceleration of the masses and the tension on either side of the rope.	B1
5	The radius of gyration of a flywheel, which weighs 6 kN is 50 c.m. If the wheel starts from rest and attains a speed of 200 r.p.m in 2 minutes, determine the average torque exerted on the flywheel.	B2
6	A helical spring with negligible mass extends 0.3mm under a mass of 1.5kg and is made to support a mass of 50kg. The spring and the mass system is displaced vertically through 13mm and released. Determine the frequency of natural vibration of system. Find also the velocity of the mass, when it is 6mm below its rest position	B3
7	A particle with SHM,performs 10 complete oscillations per minute and its speed is 60 % of the maximum speed when it is at a distance of 8 cm from the centre of oscillation. Determine the amplitude,maximum acceleration and also the speed of the particle when it is 6 cm far from the centre of oscillation	C2
8	A wheel is uniformly accelerated from 10 rev/s to 18 rev/s in 4 seconds. The wheel continues to accelerate at this rate for the next 8 seconds. There after the wheel rotates with a uniform angular velocity. Determine the total time to complete 400 revolutions.	C1
9	A rotor of an electric motor is uniformly accelerated to a speed of 1800 rpm from rest for5 seconds and then immediately power is switched off and the motor decelerates uniformly. If the total time elapsed from start to stop is 12.5 sec, determine the number of revolutions made while (a) acceleration (b) deceleration. Also find the value of deceleration.	C2

10	Composite pulley weighs 800 N and has a radius of gyration of 0.6 m. The 200 kg and 400 kg blocks are attached to the pulley by strings. Determine the tension in the string and angular acceleration of the pulley 	C3

Prepared by **Approved by**

Irine Raju

7. 101908/CO900F Basics of Electrical and Electronics Engineering

7.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
COURSE: *Basics of Electrical and Electronics Engineering*	**SEMESTER:** 1 **CREDITS:** 4
COURSE CODE: 101908/CO900F ***REGULATION:*** 2020	**COURSE TYPE:** CORE
COURSE AREA/DOMAIN: ELECTRICAL AND ELECTRONICS	**CONTACT HOURS:** 3+1 (Tutorial) Hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): 101908/CO922U	**LAB COURSE NAME:** ELECTRICAL AND ELECTRONICS WORKSHOP

SYLLABUS:

UNIT	*DETAILS*	*HOURS*
I	Evolution of Electronics, Impact of Electronics in industry and in society. Resistors, Capacitors: types, specifications. Standard values, marking, colour coding. Inductors and Transformers: types, specifications, Principle of working. Electro mechanical components: relays and contactors.	8
II	PN Junction diode: Intrinsic and extrinsic semiconductors, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration (NPN only)	9
III	Rectifiers and power supplies: Block diagram description of a dc power supply, half wave and full wave (including bridge) rectifier, capacitor filter, working of simple Zener voltage regulator. Amplifiers and Oscillators: Circuit diagram and working of common emitter amplifier, Block diagram of Public Address system, concepts of feedback, working principles of oscillators, circuit diagram & working of RC phase shift oscillator	7
IV	Evolution of electronics – Vacuum tubes to nano electronics (in evolutional perspective only), Resistors, Capacitors and Inductors: Types, Specifications, Standard Values, Color coding (No constructional features), PN Junction diode: Principles 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	8

V	Rectifiers and power supplies: Block diagram of a dc power supply, working of a Half wave rectifier & 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	9
VI	Evolution of communication systems – Telegraphy to 5G Radio communication- Principles of AM and FM, frequency bands for various communication systems, block diagram of super heterodyne receiver. Mobile Communication – Basic principle of cellular communications, principles and block diagram of GSM	7
TOTAL HOURS		**48**

TEXT/REFERENCE BOOKS:

T/R	*BOOK TITLE/AUTHORS/PUBLICATION*
T1	S. Chinmoy Saha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018
T2	Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010
R1	Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
R2	Bernard Grob, Ba sic Electronics, McGraw Hill
R3	A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition

COURSE PRE-REQUISITES: (NIL)

C.CODE	*COURSE NAME*	*DESCRIPTION*	*SEM*

COURSE OBJECTIVES:

1.	To get basic idea about types, specification and common values of passive and active components.
2.	To familiarize the working of diodes and transistors
3.	To get a fundamental idea of basic communication systems and entertainment electronics

COURSE OUTCOMES:

SL. NO.	DESCRIPTION	Blooms' Taxonomy Level

C0.4	To identify the different passive & active components used in electronic industry for common application and to ***familiarize*** with the working of PN junction diode & BJT and to ***describe*** working of a voltage amplifier	Remember and Understand (level 1, 2)
C0.5	To ***analyze*** simple circuits using diodes like rectifiers and voltage regulators and to ***understand*** the working principle electronic instrumentation systems.	Remember and Understand (Level 1, 2)
C0.6	To ***understand*** the basic principle of radio and cellular communication systems.	Understand (level 2)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C0 1	1	2	2	1	2	-	-	2	1	-	-	2	3	-	2
C0 2	2	-	2	-	-	2	1	2	-	-	2	-	2	-	2
C0 3	2	3	-	2	-	-	-	-	2	-	-	-	2	-	-
C0 4	2	-	1	-	-	-	-	2	-	-	2	-	-	2	3
C0 5	-	-	-	-	-	2	2	-	-	3	2	-	2	-	-
C0 6	2	-	2	-	-	-	-	2	-	1	2	-	-	-	2

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO.4-PO1	M	Students will learn passive electronic components, working of PN junction diode and Bipolar Junction Transistor.
CO.5-PO1	M	Students will learn working of different diode circuits and the basic principle of electronic instrumentation system
CO.6-PO1	M	Students will get a fundamental idea of basic communication systems.
CO.5-PO12	M	Students will be able the idea about voltage regulator
CO.6-PO12	M	Students will get the concept of cellular communication
CO.4-PSO1	H	Students will learn passive electronic components, diode and working of different types of Transistors.

CO.5-PSO1	H	Students will learn working of different diode circuits and electronic instrumentation system.
CO.6-PSO1	H	Students will learn working of radio and mobile communication system

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO.4-PO1	M	Students will learn passive electronic components, working of PN junction diode and Bipolar Junction Transistor.
CO.5-PO1	M	Students will learn working of different diode circuits and the basic principle of electronic instrumentation system
CO.6-PO1	M	Students will get a fundamental idea of basic communication systems.
CO.5-PO12	M	Students will be able the idea about voltage regulator
CO.6-PO12	M	Students will get the concept of cellular communication
CO.4-PSO1	H	Students will learn passive electronic components, diode and working of different types of Transistors.
CO.5-PSO1	H	Students will learn working of different diode circuits and electronic instrumentation system.
CO.6-PSO1	H	Students will learn working of radio and mobile communication system

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO\PSO*	*PROPOSED ACTIONS*
1	Zener diode & Characteristic	PO1, PO2	Reading

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SNO	TOPIC	RELEVENCE TO PO\PSO
1	FET biasing circuits and amplifiers	PO1, PO2

WEB SOURCE REFERENCES:

1	http://nptel.ac.in/courses/117106087
2	http://www.electronics-tutorials.ws/design
3	https://nptel.ac.in/courses/108101091
4	https://nptel.ac.in/courses/117103063

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES	☐ LCD/SMART BOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

✓ASSIGNMENTS	☐ STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

7.2 COURSE PLAN

DAY	*MODULE*	*TOPIC PLANNED*
1	I	Fundamental Concepts of Circuit Elements and Circuit variables: Electromotive force, potential and voltage. Resistors, Capacitors, Inductors- terminal V-I relations
2	I	Electromagnetic Induction: Faraday's laws, Lenz's law,
3	I	statically and dynamically induced EMF, self and mutual inductance,
4	I	coupling coefficient-energy stored in inductance
5	I	PReal and Ideal independent voltage and current sources,
6	I	V-I relations. Passive sign convention.

7	I	Numerical Problems
8	I	Basic Circuit Laws: Kirchhoff's current and voltage laws, analysis of resistive circuitsmesh analysis –
9	I	super mesh analysis, Node analysis-super node analysis,
10	I	star delta transformation, Numerical problems
11	I	Magnetic Circuits: Magneto motive force, flux, reluctance, permeability -
12	II	comparison of electric and magnetic circuits, analysis of series magnetic circuits
13	II	Parallel magnetic circuits, magnetic circuits with air-gaps.
14	II	Numerical problems
15	II	Eigenvalues and Eigenvectors
16	II	Local Linear Approximations
17	II	Chain Rule
18	II	Problems
19	III	Alternating current fundamentals:-Generation of Alternating voltages-waveforms, Frequency, Period, RMS
20	III	peak factor and form factor of periodic waveforms (pure sinusoidal) and composite waveforms Phasor Concepts,
21	III	Complex representation (exponential, polar and rectangular forms) of sinusoidal voltages and currents phasor diagrams
22	III	Complex impedance - series and parallel impedances and admittances,
23	III	Phasor analysis of RL, , Numerical problems
24	III	RC, RLC circuits
25	III	Revision
26	III	Practice
27	IV	Evolution of electronics – Vacuum tubes to nano electronics.
28	IV	Resistors, Capacitors and Inductors (constructional features not required): Types, specifications. Standard values, color coding.
29	IV	Resistors, Capacitors and Inductors: Standard values, color coding.
30	IV	PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown.
31	IV	PN Junction diode: Principle of avalanche breakdown.
32	IV	Bipolar Junction Transistors: PNP and NPN structures.

33	V	Bipolar Junction Transistors: Principle of operation.
34	V	Bipolar Junction Transistors: Input and output characteristics of common emitter configuration.
35	V	Rectifiers and power supplies: Block diagram description of a dc power supply.
36	V	Working of a half wave rectifier, capacitor filter (no analysis).
37	V	Working of full wave bridge rectifier, capacitor filter (no analysis).
38	V	Working of simple zener voltage regulator.
39	V	Amplifiers: Block diagram of Public Address system.
40	V	Amplifiers: Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response.
41	V	Amplifiers: Concept of voltage divider biasing.
42	V	Electronic Instrumentation: Block diagram of an electronic instrumentation system.
43	V	Evolution of communication systems – Telegraphy to 5G.
44	VI	Radio communication: Principle of AM.
45	VI	Radio communication: Principle of FM.
46	VI	Radio communication: Frequency bands used for various communication systems
47	VI	Radio communication: Block diagram of super heterodyne receiver
48	VI	Mobile communication
49	VI	Mobile communication: Basic principles of cellular communications
50	VI	Mobile communication: Principle and block diagram of GSM.

7.3 MODULE WISE SAMPLE QUESTIONS

MODULE 1

1. An iron ring of 200 mm mean diameter is made of 30 mm round iron of permeability 900, has an air gap 10 mm wide.
It has 800 turns. If the current flowing through this winding is 6.8A, determine
(i) m.m.f. (ii) total reluctance of the circuit (iii) flux in the ring (iv) flux density in the ring.
2. A magnetic circuit consists of an iron ring of mean circumference 80 cm with c.s.a of 12 cm2
throughout. A current of
1A in the magnetizing coil of 200 turns produces a total flux of 1.2 mWb in the iron.
Calculate (i) flux density in the iron
(ii) the absolute and relative permeability of iron (iii) reluctance of the circuit.
3. An iron ring 100 cm mean circumference is made from cast iron of c.s.a. 10 cm2
. Its relative permeability is 500. If it is
wound with 200 turns, what current will be required to produce a flux of 0.1x 10-2 Wb.
4. A flux density of 1.2 Wb/m2

is required in the 1mm air gap of an electromagnet having an iron path of 1.5m long. Calculate the m.m.f. required. μr of iron = 1600. Neglect leakage.

5. A coil is wound uniformly over a wooden ring having a c.s.a of 600 mm2 and a mean circumference of 750 mm. If the current through the coil is 5A and the no. of turns of the coil is 250 turns, calculate the magnetizing force, the flux density and the total flux.

6. A magnetic circuit comprises three parts in series, each of different c.s.a. They are
(a) a length of 80 mm & c.s.a. 50 mm2
(b) a length of 60 mm & c.s.a. 90 mm2
(c) an airgap of length 0.5 mm & c.s.a. 150 mm2
A coil of 4000 turns is wound on part (b) and the flux density in the airgap is 0.3 T. Assuming that all the flux passes through the given circuit and that the relative permeability is 1300, estimate the coil current to produce such a flux density

MODULE 2

1. An Iron ring 30 cm mean diameter is made up of square iron of 2cm x 2cm cross section and is uniformly wound with 400 turns of wire of 2 mm2 cross section. Calculate the value of self inductance of the coil. μr = 800.

66

2. Coils A and B having 100 and 150 turns respectively are wound side by side on a closed iron circuit of c.s.a 125 cm2 and mean length 2m. Determine (i) L of each coil (ii) M between them (iii) e.m.f induced in coil B when current changes from 0 to 5A in coil A in 0.02sec. μr = 2000.

3. Two coils A and B each with 100 turns, are mounted so that part of the flux set up by one links the other. When the current through coil A is changed from +2A to -2A in 0.5 sec, an e.m.f of 8mV is induced in coil B. Calculate (i) the mutual inductance between the coils (ii) flux produced in coil B due to 2A in coil A.

4. Two coils A of 11,450 turns and B of 14,500 turns lie in parallel planes so that 65% of flux produced in A links coil B. It is found that a current of 6A in A produces a flux of 0.7mWb, while the same current in B produces 0.9mWb. Determine
(i) Mutual Inductance (ii) Coupling coefficient.

5. An air cored solenoid has a length of 60 cm and a diameter of of 4 cm. Calculate its inductance, if it has 1000 turns
and also find the energy stored if the current rises from zero to 6A.
6. The no: of turns in a coil is 300. When a current of 2A flows in this coil, flux in the coil is 0.3 mWb. When this
current is reduced to zero in 1 ms, the voltage induced in a coil lying in the vicinity of coil is 70 Volts. If the coefficient of
coupling between the two coils is 0.75, find self inductances of the two coils, mutual inductance and the no: of turns in the
second coil.
7. Two long single layer solenoids have the same length and the same no. of turns, but are placed co-axially one
within the other. The diameter of the inner core is 60 mm and that of the other coil is 75 mm. Calculate the coefficient of
coupling between the coils.
8. Two coils A and B are wound side by side on a paper tube former. An e.m.f. of 0.25V is induced in coil A, when the
flux linking it changes at the rate of 1 mWb/sec. A current of 2A in coil B causes a flux of 10μWb to link coil A. Calculate the
Mutual Inductance between the coils.

MODULE 3

1. Find the total current i1 + i 2 where i1 = 100 sin(100πt –(π/6)) A and i 2 = 100 cos (100πt –(π/3)) A. Also
calculate the r.m.s. value and average value.
2. A pure inductive coil allows a current of 12A to flow from a 220V, 50 Hz supply. Find (i) inductive
reactance (ii) inductance of the coil (iii) power absorbed (iv) voltage and current equations.
3. A 36 μF capacitor is connected across a 400V, 50 Hz supply. Calculate (i) reactance of the capacitor (ii)
the circuit current.
4. A 120V a.c. circuit contains 10 Ω resistance and 30 Ω inductive reactance in series. What would be the
average power in the circuit?
5. A voltage v = 200 sin(100πt) is applied to a coil having R = 200 Ω and L = 0.38 H. Find the expression for
the current, p.f. and power taken by the coil.
6. In a circuit containing a resistance of 5000 Ω and an inductance of 1H in series, a voltage of 150 V r.m.s.

at 400 Hz is applied. Determine the magnitude and phase of the current, the voltage across the
resistance and voltage across the inductance. Calculate the power taken from the supply.
7. A series circuit consists of a non-inductive resistance of 5 Ω and inductive reactance of 10 Ω. When
connected to a single phase supply, it draws a current i = 27.89 sin (628.3t – 450
) A. Find (i) the voltage
applied to the series circuit (ii) inductance (iii) power drawn by the circuit.

Module 4

1. List different types of resistors.
2. List various applications of diodes.
3. Determine the capacitance and tolerance of the following specifications.
   i. 472M ii. 0.0027Z
4. The colour bands marked on a resistor are Blue, Grey, Yellow and Gold. What is the minimum and maximum resistance values expected from that resistance?
5. Explain with diagram the principle of operation of an NPN transistor.

Module 5

1. Draw the block diagram of the Public Address (PA) system.
2. What is the need for biasing in amplifiers?
3. Draw the circuit diagram of RC Coupled Amplifier and explain the role of the different capacitors.
4. Explain the need of using smoothing circuits in a power supply.
5. Explain the working of bridge rectifier with necessary waveforms.

Module 6

1. What is the need for modulation?
2. What is meant by Intermediate frequency and specify its values for AM and FM.
3. Define frequency modulation.
4. Differentiate between AM and FM.

Derive the expression for a conventional AM signal

8. 101908/EN100E LIFE SKILLS

8.1 COURSE INFORMATION SHEET

PROGRAMME: ALL PROGRAMMES	DEGREE: BTECH
PROGRAMME: ALL PROGRAMMES	DEGREE: B.TECH UNIVERSITY: A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY
COURSE: LIFE SKILLS	SEMESTER: I CREDITS: ---
COURSE CODE: 101908/EN100E REGULATION: 2021	COURSE TYPE: MANDATORY NON-CREDIT
COURSE AREA/DOMAIN: HUMANITIES	CONTACT HOURS: 4) hours/Week. (2L + 2P)

SYLLABUS:

UNIT	DETAILS	HOURS
I	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	5
	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:	

II	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, Cooperation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.	9
III	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.	7
IV	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. Cognitive Dissonance, Group Think, Conflict spiral and resolution, Managing team performance and managing conflicts, Intrapreneurship.	8
V	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.	4

LAB	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, kinesthetic, 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.	
LAB	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.	
TOTAL HOURS		33

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
R	Shiv Khera, "*You Can Win"*, Macmillan Books, New York, 2003
R	Barun K. Mitra, *"Personality Development & Soft Skills*", First Edition; Oxford Publishers, 2011
R	ICT Academy of Kerala, "*Life Skills for Engineers*", McGraw Hill Education (India) Private Ltd., 2016
R	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

R	Kalyana, "*Soft Skill for Managers*"; First Edition; Wiley Publishing Ltd., 2015
R	Larry James , "*The First Book of Life Skills*"; First Edition; Embassy Books, 2016
R	Shalini Verma, *"Development of Life Skills and Professional Practice"*; First Edition; Sultan Chand (G/L) & Company, 2014
R	Daniel Goleman, "*Emotional Intelligence*"; Bantam, 2006
R	Remesh S., Vishnu R.G., "*Life Skills for Engineers*", Ridhima Publications, First Edition, 2016
R	Jeff Butterfield, "*Soft Skills for Everyone*", Cengage Learning India Pvt Ltd; 1 edition, 2011
R	Stephen P. Robbins, Phillip L. Hunsaker*, "Training in Interpersonal Skills: Tips for Managing People at Work"*, Pearson Education, India; 6 edition, 2015
R	Gopalaswamy Ramesh, Mahadevan Ramesh*, "The Ace of Soft Skills: Attitude, Communication and Etiquette for Success"*, Pearson Education; 1 edition, 2013

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
NIL	NIL	NIL	

COURSE OBJECTIVES:

1	Enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success
2	Help the students acquire the skills needed to apply the principles of personal and professional success in their lives and careers

COURSE OUTCOMES:

SNO	DESCRIPTION	Bloom's Taxonomy Level
CO1	Define and identify different life skills required in personal and professional life	
CO2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress	
CO3	Explain the basic mechanics of effective communication and demonstrate these through presentations	
CO4	Take part in group discussions	
CO5	Use appropriate thinking and problem-solving techniques to solve new problems	
CO6	Understand the basics of teamwork and leadership	

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2		1	2	2	1	3			1
CO2									3			2			1
CO3						1			1	3					1
CO4										3		1			1
CO5		3	2	1											1
CO6						1			3						1

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO1-PO6	M	Knowledge and mastery of life skills will enable the student to effectively function at both the professional and personal levels
CO1-PO8	L	The skills of analysis, logical reasoning and problem-solving will enable the student to make the right decision when faced with moral dilemmas in personal and professional life
CO1-PO9	M	Developing an awareness of the self, learning to work in groups and teams, and learning about leadership enables the student to effectively carry out his responsibilities at both the individual and team level
CO1-PO10	M	Developing an understanding of oneself, and learning the tools of effective communication enables the student to become a successful communicator
CO1-PO11	L	Learning about problem-solving and decision making, and individual and team work enables the student to become efficient leaders and managers
CO1-PO12	H	Understanding the importance of engaging in continuous personal and professional development motivates the student to become a lifelong learner
CO2-PO9	H	Gaining an insight into the self and learning to cope with emotions and stress will help the student to be more effective at the individual level and as a team player

CO2-PO12	M	Understanding one's priorities and learning to set clear goals will motivate the student to engage in lifelong learning
CO3-PO6	L	Learning about and practising effective communication strategies will make the student successful in interacting with others in both professional and personal life
CO3-PO9	L	Effective communication strategies will help the student to be more successful at the individual level and in groups: as a leader and as a team player
CO3-PO10	H	Mastering the theoretical and practical aspects of communication will lay the foundation for effective personal and professional communication
CO4-PO10	H	Taking part in group discussions and developing the skills of listening and responding to others' opinions helps the student to learn the rudiments of effective group communication
CO4-PO12	L	By engaging in group discussions on contemporary topics the student will realize the need to keep oneself abreast of current developments thereby engaging in lifelong learning
CO5-PO2	H	The exposure to effective thinking and problem-solving techniques enables the student to learn the rudiments of problem analysis
CO5-PO3	M	Having gained an insight into creative and critical thinking techniques, the student will be better equipped to design and develop solutions

CO5-PO4	L	The student will learn how to apply logical and creative thinking as the situation demands while encountering complex problems
CO6-PO6	L	Learning about teamwork and leadership will help the student in both professional and personal life
CO6-PO9	H	The theoretical framework and practical exposure provided will enhance the efficiency of the student in individual and team contexts

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO1-PSO 3	L	The best manufacturing practices can only be built on a foundation of basic life skills.
CO2-PSO 3	L	In order to remain creative and develop new ideas depending on real-world issues, one must first introspect to improve their own creativity and break their own limits.
CO3-PSO 3	L	The product development cycle would involve presenting the various processes and prototypes to the stakeholders involved via presentations.
CO4-PSO 3	L	The product development cycle involves constant communication and feedback from multiple departments via formal meetings and group discussions.
CO5-PSO 3	L	Product design requires absorbing the requirements and creating a plan utilising the resources available through basic problem-solving skills.

CO6-PSO 3	L	The product development cycle requires cooperation and communication between team members and management to run effectively and without wastage of resources.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	DESCRIPTION	RELEVANCE TO PO\PSO	PROPOSED ACTIONS
1	Nil		

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SINO:	TOPIC	RELEVANCE TO PO\PSO
1	Existential, Teaching/Pedagogical, Moral Intelligences	PO7. PO8, PO10, PO12, PSO3
2	Polya's Problem Solving Method	PO2, PO4, PO6, PO7, PSO3
3	Multicultural awareness	PO6, PO7, PO9, PO10, PO12, PSO3
4	Benjamin Franklin's List of Virtues	PO8, PSO3

WEB SOURCE REFERENCES:

1	https://swayam.gov.in/nd2_cec19_hs05/ - Swayam – Developing Life Skills
2	https://www.skillsyouneed.com/general/life-skills.html

3	https://ethicsunwrapped.utexas.edu/
4	Stress management strategies: Ways to Unwind - https://www.youtube.com/watch?v=0fL-pn80s-c
5	Signs of Stress https://www.youtube.com/watch?v=n3G0n7HoTr4
6	What is Civic Virtue? - YouTube https://www.youtube.com › watch?v=ANl4MqtHBxg
7	What Is Six Thinking Hats? - YouTube https://www.youtube.com › watch?v=UZ8vF8HRWE4
8	https://www.verywellmind.com/gardners-theory-of-multiple-intelligences-2795161
9	https://www.youtube.com/watch?v=IHMv6ALNfcs (Levels of Leadership)
10	https://www.youtube.com/watch?v=j6FSaHVufZc (Styles of Leadership)
11	https://www.mayoclinic.org/healthy-lifestyle/stress-management/in-depth/stress-relief/art-20044476
12	https://www.mhanational.org/helpful-vs-harmful-ways-manage-emotions
13	https://www.inc.com/justin-bariso/7-simple-strategies-that-will-help-you-manage-your-emotions.html
14	https://nickwignall.com/self-awareness/
15	http://www.debonogroup.com/six_thinking_hats.php
16	https://www.youtube.com/watch?v=UZ8vF8HRWE4
17	https://icebreakerideas.com/problem-solving-activities/
18	https://www.verywellmind.com/left-brain-vs-right-brain-2795005
19	https://ideadrop.co/creative-vs-strategic-thinking-whats-difference/

20	https://www.youtube.com/watch?v=bEusrD8g-dM
21	https://activecollab.com/blog/collaboration/group-vs-team
22	https://www.youtube.com/watch?v=uG-FLOi4OOU
23	https://www.managementstudyguide.com/virtual-team.htm
24	https://www.youtube.com/watch?v=AcxeMU0I1b4
25	https://www.forbes.com/sites/deeppatel/2017/03/22/11-powerful-traits-of-successful-leaders/
26	https://www.youtube.com/watch?v=eG16EmA2Fe0
27	https://www.investopedia.com/terms/l/leadership-grid.asp
28	https://www.inc.com/peter-economy/44-inspiring-john-c-maxwell-quotes-that-will-take-you-to-leadership-success.html
29	http://psychologyformarketers.com/5-levels-leadership-john-maxwell/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☐ LCD/SMART BOARDS
☑ STUD. SEMINARS	☐ ADD-ON COURSES	☐ OTHERS	

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

8.2 COURSE PLAN

DAY	MODULE	TOPIC PLANNED
1	1	Overview of the Life Skills syllabus
2	1	Overview of the Life Skills assignments and marking
3	1	The 10 Life Skills identified by WHO
4	1	The multiple life skills required by professionals in a work environment
5	1	IQ, EQ, and SQ
7	2	Introduction to self awareness. How can we be self aware? Self awareness test.
6	2	Results of implicit bias test. How you can be self aware: journaling, reflective questions, meditation, mindfulness, feedback.
8	2	What is stress? Are you stressed? When do you experience stress?
9	2	Stress in a professional setting. (optional given time) 4 As of Stress Management
10	2	Stress and emotion - difference.

		How to NOT deal with emotion PATH method
11	2	Result of stress journaling
12	2	Goal setting, SMART goals, Pomodoro technique
13	2	Morals, Values and Ethics, Basic human values
14	2	Basic human values continued
15	3	Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making
16	3	Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity
17	3	Steps in problem solving, Six Thinking Hats,
18	3	Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking,
19	3	8(10) Multiple Intelligences
20	3	Mind Mapping
21	3	Myths of creativity
22	4	Introduction to Groups and Teams, Team Composition, Managing Team Performance, Importance of Group
23	4	Stages of Group, Group Cycle, Group thinking, Group Problem Solving
24	4	Group vs Team
25	4	Groupthink and examples
26	4	Managing Team Performance & Managing Conflict in Teams
27	4	Team Decision-Making

28	4	Cognitive Dissonance
29	4	Virtual Teams
30	5	Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions.
31	5	Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management.
32	5	Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership
33	5	Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.
34		Assignments
35		Assignments
36		Revision
37		Revision
38		Revision
39		Revision

8.3 MODULE WISE SAMPLE QUESTIONS

MODULE 1

1. Which are the core life skills identified by WHO?
2. Which are the 5 c's of effective communication?
3. Every goal must ideally be S.M.A.R.T. What is its full form?
4. What is the difference between sympathy and empathy? Give an example each
5. What happens if we are oblivious of the changes in our inner world (ourselves)?
6. How do emotions influence our behaviour?
7. Why is it said that understanding emotion and intention is imperative for good communication?

8. Lack of life skills can lead to mental strain and in extreme cases to depression. Explain.
9. A person needs to be conscious of his/her inner states. Explain.
10. How is paying ‘attention to details’ and ‘seeing the big picture’ interconnected?
11. Effective communication exceeds the mere exchange of information. Explain
12. Explain why the three Q’s (IQ, EQ, and SQ) are important for the making of an ideal personality?
13. Describe a situation in your life where you employed problem-solving skills and techniques to tackle a difficult situation?
14. How will you help your classmate who is suffering from anxiety and tension arising out of academic works?
15. How is critical thinking different from creative thinking?
16. How does decision making involve the process of choosing alternatives based on the values, preferences and beliefs?
17. How can the goal you have set, prove and improve yourself?
18. Attitude is nothing but a frame of mind. Do you agree with this statement? Why?
19. Is it possible to stay confident and positive even amidst difficult circumstances?
20. To what extent can a stress journal help a person in identifying various stressors in his/her life?
21. Write a sample stress journal (academic context) involving its four steps.
22. How would you go about in researching a topic that you are interested in?

MODULE II

1. How can you improve your self-awareness?
2. What is cognitive reframing?
3. Which all are the different relaxation techniques?
4. What does a typical stress diary record?
5. How can you be an impartial observer of yourself? Describe a situation from your own life.
6. Is it important for a person to be always conscious of oneself? Give your reasons.
7. What are the cognitive, emotional, and physical symptoms of stress?
8. How does meditation contribute to self-awareness?
9. Explain the four A’s of stress management.
10. What is a stress diary and how can it help in regulating your stress?
11. Self-awareness is nothing but having a feeling of knowledge about yourself. Explain.
12. Acting on feelings right away is not always advisable. How can the PATH method of emotion management help a person here?
13. How can time management and planning help you in managing stress?
14. What are feelings and actions, how are they both interconnected?
15. How can denial lead to bottling up of problematic feelings?
16. How can relaxation techniques help a person in managing his emotions?

17. Do you think that self-awareness is a prerequisite for self-esteem? Give reasons
18. Stress is the body's way of responding to any demand or threat that it faces. Evaluate this statement.
19. Create a 5-step action plan to help your friend manage and overcome academic stress.

MODULE III

1. Who coined the term lateral thinking?
2. Which type of thinking depends on proven, well-ordered series of steps to reach a solution?
3. What are the two main aspects of lateral thinking?
4. Name the different set of skills to be developed by students in the 21st century?
5. Explain how imagination is associated with creativity?
6. "Creativity doesn't wait for that perfect moment. It fashions its own perfect moments out of ordinary ones." Explain.
7. Critical thinkers rigorously question ideas and assumptions rather than accepting them at face value. Explain.
8. What is the breed myth? Give an example that proves it.
9. Why do people having a wide range of experience tend to be more creative?
10. Recall a situation in your life where you solved a problem using critical thinking
11. How is a left-brain dominant person different from that of a right-brain dominant person? Do you personally believe in a theory like that? Give your reasons.
12. How is experience connected with intuition?
13. Give reasons why intuition is considered as a type of non-linear thinking?
14. Do you think that offering incentives can make a person sincere and conscientious? Give your reasons.
15. Do you think that the dominant side of your brain can affect your personality and behaviour? Give reasons
16. What is your personal opinion on the relation between incentives and creativity?
17. How can creativity help in self-actualisation?
18. Using six-thinking hats generate a solution to solve the habit of people throwing wastes in water bodies?
19. Create a mind-map on the topic of multiple intelligence
20. How can you utilize your critical thinking to identify fake news?

MODULE IV

1. List the different types of groups.
2. How is team effectiveness evaluated?
3. What is the difference between entrepreneurship and intrapreneurship?
4. What is groupthink?

5. List the differences between groups and teams.
6. List the different types of groups.
7. Describe the stages in team formation.
8. Describe the stages in group formation.
9. What is cognitive dissonance?
10. Describe Tuckman's Model of Group Development.
11. Which are the different steps in group problem-solving?
12. Which are the different types of teams?
13. How can conflict be effectively managed in groups and teams?
14. Explain Brainstorming, Nominal Group Technique and Multi-voting.
15. What is a virtual team? What are its advantages and disadvantages?
16. Would political parties come under the category of teams or groups? Explain.
17. What is the importance of Team Performance Management?
18. What is the importance of intrapreneurship?
19. Explain groupthink in the context of education.
20. Explain the team problem-solving technique with an example.
21. What are the consequences of cognitive dissonance?
22. Why do people form groups?
23. How does intrapreneurship help the organization?
24. What are the advantages of using the nominal group technique over democratic processes?
25. What are the advantages and disadvantages of using virtual teams in a country like India?
26. Give an example of an event where groupthink led to a poor outcome.
27. How has the implementation of virtual teams affected Indian youth?

MODULE V

1. Explain multicultural leadership.
2. What is turnaround leadership?
3. What skills are required by a leader to manage a crisis?
4. Differentiate between transformational and transactional leadership with examples.
5. What is VUCA leadership?
6. Describe the 6 different types of leadership with examples.
7. What are the leadership traits required for an engineer?
8. Describe the leadership grid. Give examples for all the types of leadership across the leadership grid.
9. What are the levels of leadership as per John Maxwell? Explain with examples.
10. Does the education system require transactional leadership or transformational leadership? Give reasons for your answer
11. Do you think that ideal leadership is not practical in the context of the leadership grid? Give reasons for your answer

12. Why is VUCA leadership not always the preferred style of leadership?
13. Differentiate between middle-of-the-road leadership and impoverished leadership?
14. What are the advantages of transformational leadership over transactional leadership?
15. Give an example where transactional leadership is more applicable than transformational leadership and why?
16. What are the disadvantages of using the leadership grid to analyse the type of management?
17. What are some drawbacks of multicultural leadership?
18. What are the instances where VUCA leadership is required?
19. Are Indians capable of multicultural leadership? Explain your reasons
20. Explain a real-world example of VUCA leadership that solved a crisis.
21. What type of leadership level applies to the following as per John Maxwell:
    a. Elon Musk
    b. Your local police constable
    c. Coaching centres in Kota
    d. Shri Shri Ravishankar
22. How does turnaround leadership help solve a national crisis?
23. What are the characteristics an engineer must acquire to become a better leader?
24. Which would work better in a classroom in India: transactional or transformational leadership. Justify your answer.
25. Why do some people generally obsess over celebrities? Explain with Maxwell's levels of leadership.

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9. 101908/PH922S Engineering Physics Lab

9.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
COURSE: ENGINEERING PHYSICS LAB	**SEMESTER:** 1 **CREDITS:** 1
COURSE CODE: 101908/PH922S ***REGULATION:*** 2020	**COURSE TYPE:** CORE
COURSE AREA/DOMAIN: BASIC SCIENCE	**CONTACT HOURS:** 3 (Practical) Hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME:** NA

LIST OF EXERCISES / EXPERIMENTS (MINIMUM OF 8 MANDATORY)

SL.NO.	*EXPERIMENTS*
1	Application of CRO for amplitude and frequency measurement.
2	Temperature measurement- thermocouple
3	Measurement of strain using strain gauge and Wheatstone's bridge.
4	Measurement of wavelength and velocity of ultrasonic waves in a liquid using diffractometer
5	Forced and damped harmonic oscillations of LCR circuits
6	Measurement of frequency in the transverse and longitudinal mode using Melde's string apparatus.
7	Wavelength measurement of a monochromatic source of light using Newton's rings method.
8	Determination of refractive index of a liquid using Newton's rings apparatus
9	Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method
10	Determination of slit or pin hole width.
11	Measurement of wavelength using millimeter scale as a grating.
12	Determination of wavelength of He-Ne laser or any standard laser using diffraction grating
13	Determination of wavelength of monochromatic source using grating
14	Determination of dispersive power and resolving power of a plane transmission grating
15	Demonstration of Kerr effect in nitrobenzene solution
16	Measurement of light intensity of a plane polarized light as a function of analyzer position
17	Determination of concentration of optically active benzene solution using Laurents Half Shade Polari meter

18	Determination of speed of light in air using laser
19	Calculation of numerical aperture of an optical fiber
20	Determination of particle size of lycopodium powder
21	I-V Characteristics of a solar cell
22	Measurement of Planck's constant using photo electric cell
23	Measurement of wavelength of laser using grating

TEXT/REFERENCE BOOKS:

T/R	*BOOK TITLE/AUTHORS/PUBLICATION*
T1	Gupta S.K., Engineering Physics Practicals, Krishna Prakashan Pvt Ltd
R1	Avadhanuulu M.N., Dani A. A and Pokley P.M., Experiments in engineering Physics, S.Chand & Co.
R2	Koser A.A., practical Engineering Physics, Nakoda Publishers and Printers India Ltd
R3	Rao B.S. and Krishna K. V., Engineering Physics Practicals, Lakshmi Publications
R4	Sasikumar P.R., Practical Physics, PHI

COURSE PRE-REQUISITES:

C.CODE	*COURSE NAME*	*DESCRIPTION*	*SEM*
-	Higher secondary level Physics	To develop basic ideas on oscillations, waves, interference, diffraction, polarization, acoustics, lasers, photonics etc.	-

COURSE OBJECTIVES:

COURSE OUTCOMES:

S.NO.	*DESCRIPTION*	*Bloom's Taxonomy Level*
CO1	An ability to gain knowledge about different types of oscillations and resonant electrical circuits	
CO 2	An ability to understand, explain and use instrumental techniques for intensity pattern analysis	
CO 3	To apply and demonstrate the theoretical concepts of Engineering Physics and to develop scientific attitude	

CO 4	An ability to analyze the behaviour of quantum particles and Bose-Einstein condensates	
CO 5	An ability to measure chemical parameters to solve problems in Physical sciences both individually and in teams by analysing and interpreting data from a range of sources	
CO6	To acquire the skill for the preparation of engineering materials like ultrasonic generators and detectors	
CO 7	To apply the theoretical concepts of laser, numerical aperture and photodetectors	

CO-PO AND CO-PSO MAPPING

	PO1	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***	***PO11***	***PO12***	***PSO1***	***PSO2***	***PSO3***
CO 1	3	3	-	-	-	2	2	2	2	-	2	3			
CO2	3	3	-	-	2	-	2	-	2	-	-	3			
CO 3	3	3	-	-	-	-	2	-	2	-	2	3			
CO 4	2	2	-	-	2	-	2	-	2	-	-	2			
CO5	2	2	2	-	2	-	2	-	2	2	-	2			
CO 6	3	3	3	-	3	3	3	-	3	-	-	3			
CO 7	2	2	1	-	1	1	2	-	3	-	2	2			

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	***LOW/MEDIUM/ HIGH***	***JUSTIFICATION***
CO 1-PO1	H	Designing of instruments, structures and analysis using tools requires fundamentals of oscillations, resonance and waves (EXP1,2)
CO 1-PO2	H	Applying the theoretical knowledge of resonance and waves to design and conduct experiments for data interpretation
CO 1-PO6	M	Selection of quality components for engineering design
CO 1-PO7	M	Helps to achieve the skills through regular class discussion/seminar/poster presentation
CO 1-PO8	M	Applying the theoretical knowledge of resonance and waves to design and conduct experiments for data interpretation

CO 1-PO9	M	Helps to achieve the skills through poster presentation thereby stimulating them for lifelong learning
CO 1-P11	M	Enhanced through lab questions experiments and creative questions
CO 1-P12	H	
CO 2-PO1	H	Designing of instruments, structures and analysis tools require fundamentals of interference and diffraction engineering problems (EXP- 3- 8)
CO 2-PO2	H	Applying the theoretical knowledge of interference and diffraction to design and conduct experiments for data interpretation
CO 2-PO5	M	Knowledge of interference and diffraction for characterizing materials
CO 2-PO7	M	Helps to achieve the skills through regular class discussion/seminar /poster presentation
CO2-PO9	M	Helps to achieve the skills through poster presentation thereby stimulating them for lifelong learning
CO 2-P12	H	
CO 3-PO1	H	Designing of polaroids and analysis require fundamentals of polarisation
CO 3-PO2	H	Applying the theoretical knowledge of polarisation to design and conduct experiments for data interpretation
CO 3-PO7	M	Helps to achieve the skills through regular class discussion/seminar/poster presentation
CO 3-PO9	M	Helps to achieve the skills through poster presentation thereby stimulating them for lifelong learning
CO 3-PO11	M	Enhanced through lab experiments and creative questions
CO 3-P12	H	
CO 4-PO1	M	Applications of superconductivity in various branches of engineering
CO 4-PO2	M	Applying the theoretical knowledge of superconductivity for data interpretation
CO 4-PO5	M	Knowledge of superconductors for characterizing materials
CO 4-PO7	M	Helps to achieve the skills through regular class discussion/seminar/poster presentation
CO 4-PO9	M	Helps to achieve the skills through poster presentation thereby stimulating them for lifelong learning
CO 4-P12	M	
CO 5-PO1	M	Application of quantum and statistical mechanics fundamentals in various branches of engineering
CO 5-PO2	M	Applying the theoretical knowledge of quantum mechanics and statistical mechanics for data interpretation
CO 5-PO3	M	Application of quantum and statistical mechanics fundamentals in engineering design
CO 5-PO5	M	Knowledge of quantum and statistical mechanics fundamentals in advanced engineering

CO 5-PO7	M	Helps to achieve the skills through regular class discussion/seminar/poster presentation
CO 5-PO9	M	Helps to achieve the skills through poster presentation thereby stimulating them for lifelong learning
CO 5-P10	M	Application of quantum mechanics in advanced engineering fields
CO5-P12	M	
CO 6-PO1	H	Application of ultrasonic in various branches of engineering
CO 6-PO2	H	Applying the theoretical knowledge of ultrasonics for data interpretation
CO 6-PO3	H	Application of quantum and statistical mechanics fundamentals in engineering design
CO 6-PO5	H	Knowledge of ultrasonics in advanced engineering
CO 6-PO6	H	Knowledge of ultrasonics for characterizing materials
CO 6-PO7	H	Helps to achieve the skills through regular class discussion/seminar/poster presentation
CO 6-PO9	H	Helps to achieve the skills through poster presentation thereby stimulating them for lifelong learning
CO 6-P12	H	
CO 7-PO1	M	Application of laser, photonics and fiber optics in various branches of engineering
CO 7-PO2	M	Applying the theoretical knowledge of laser, photonics and fiber optics for data interpretation
CO 7-PO3	L	Application of laser, photonics and fiber optics fundamentals in engineering design
CO 7-PO5	L	Knowledge of laser, photonics and fiber optics in advanced engineering
CO 7-PO6	L	Knowledge of laser, photonics and fiber optics for various applications (following standards)
CO 7-PO7	M	Helps to achieve the skills through regular class discussion/seminar/poster presentation
CO 7-PO9	H	Helps to achieve the skills through poster presentation thereby stimulating them for lifelong learning
CO 7-P11	M	Applications of laser, photonics and fiber optics in advanced engineering fields

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO\PSO*	*PROPOSED ACTIONS*

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SNO	TOPIC	RELEVENCE TO PO\PSO

WEB SOURCE REFERENCES:

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐ CHALK & TALK	☐ STUD. ASSIGNMENT	☐ WEB RESOURCES	☐ LCD/SMART BOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☐ ASSIGNMENTS	☐ STUD. SEMINARS	☐ TESTS/MODEL EXAMS	☐ UNIV. EXAMINATION □
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☐ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☐ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

9.2 COURSE PLAN

DAY	*MODULE*	*TOPIC PLANNED*
1		

9.3 SAMPLE QUESTIONS

OPEN QUESTIONS

1. How does a microwave cavity work as resonant circuit like an RLC circuit?
2. How can the brightness of the pattern on the screen of the cathode ray tube be changed?
3. How does a cathode ray tube in an LCD screen turn so bright?
4. Why does the fringes in Newton's rings crowd together as the radius of the fringe increases?
5. Why Newton's are rings circular?
6. How Newton does explain Newton's rings with corpuscular theory of light?
7. What happens when white or colored light is used for air wedge experiment?
8. What happens to the fringes in air wedge experiment when we apply stress?
9. What are the differences between wavelength division multiplexing and time division multiplexing?
10. Do gravity waves have different lengths or frequencies like electromagnetic waves?
11. A team of international researchers are working on developing a camera that can identify cancerous tissue. Which property of Mantis shrimp has inspired them?
12. Bats use echolocation to identify pray. But how do they navigate?
13. At densities greater than that supported by degeneracy, the material inside a black hole convert from fermions to bosons. What type of boson is it?
14. Why at high temperature and low density, all statistics predict equivalently?
15. Why does quantum particles lose their distinguishability?
16. Will human teleportation ever possible?
17. Why are standing waves formed only when the medium is vibrated at specific frequencies?
18. Why nodes are alone formed at walls or boundaries?
19. Why are only antinodes formed at the open ends of a pipe?
20. When we see an object, is it the diffracted image? If so, why we are not seeing more than one image at a time?
21. How can a photon having no mass and still travel?
22. What type of electrical current I produced by solar panels. AC or DC?
23. Can we use solar panels to power a DC electric motor? How?
24. What happens when the numerical aperture of a fiber is zero?
25. How does the numerical aperture of a camera affect its resolution?

ADVANCED QUESTIONS

1. Why do we have equivalence between mechanical and electrical oscillators?
2. Why do we prefer phosphors for the production of photons in a CRT?

3. What is the difference between a spectrum analyzer and a cathode ray oscilloscope?
4. How do some smart phones enable us to see all of the emission spectra of light sources?
5. How certain wavelengths of light are used in forensic applications?
6. Which wavelength of light may fight fatigue round the clock?
7. Why do interference fringes due to air wedge have equal thickness?
8. Can gravitational waves from two or many events interact and cause constructive or destructive interference?
9. Why do radio waves and gamma rays pass through walls but visible light does not?
10. Do sound waves exhibit polarization?
11. Does Higg's Boson undergo Bose-Einstein condensation?
12. Does quantum entanglement provide communication at a velocity faster than that of light?
13. Can you connect two computers with a laser data link?
14. How can solar cells bring a paradigm shift in the next generation energy production?
15. How is it possible to send a forward and backward message along the same cable?

Prepared by

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10. 101908/CO922U Electrical and Electronics Workshop

10.1 COURSE INFORMATION SHEET

PROGRAMME: **CS/ME**	DEGREE: **B. Tech**
COURSE: **ELECTRONICS WORKSHOP**	SEMESTER: **1** CREDITS: **1**
COURSE CODE: **101908/CO922U** REGULATION: **2021**	COURSE TYPE: **LAB**
COURSE AREA/DOMAIN: Basics of Electrical and Electronics Engineering	CONTACT HOURS: 2 hours /Week.
CORRESPONDING LAB COURSE CODE (IF ANY): N.A	LAB COURSE NAME: N.A

SYLLABUS:

UNIT	DETAILS
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, Desoldering 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.

TEXT/REFERENCE BOOKS:

T/R	AUTHORS "BOOK TITLE", PUBLICATION
1.	Bell. D. A , "Electronic Devices and Circuits", Oxford University Press
2.	Boylested, R.L Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education
3.	Kal. S "Basic Electronic Devices, Circuits and Fundamentals", PHI Learning
4.	Millman J, Hawkins C and Parikhu C D "Integrated Electronics", Tata McGraw Hill
5.	Neeman D.A "Electronics Circuit Analysis and Design", Tata McGraw Hill
6.	S M Dhir "Electronic Components and Materials", Tata McGraw Hills publishing company Ltd.
7.	Charles A. Harper, "Handbook of Components for Electronics", Laxmi Enterprise

COURSE PRE-REQUISITES: NIL

COURSE OBJECTIVES:

1	To identify various electronic components
2	To get hands-on assembling, dismantling, testing, fabrication and repairing systems by utilizing the tools available in the workshop
3	Familiarization with software tools for drawing circuits

COURSE OUTCOMES:

Sl. No.	DESCRIPTION
CO 1	Identify and test various electronics components
CO 2	Draw schematics with EDA tools
CO 3	Assemble and test electronic circuits on boards
CO 4	Work in a team with good interpersonal skills

CO-PO-PSO MAPPING:

	Programme Outcomes (POs)												Programme-specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	-	-	-	-	-	-	-	-	-	-	2	2		2
CO 2	3	-	-	-	2	-	-	-	-	-	-	2	1	3	
CO 3	3	-	-	-	2	-	-	-	-	-	-	1	3		
CO 4	-	-	-	-	-	-	-	-	3	2	-	1			3
ESL 130	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**2**	**-**	**1.5**	**2**	**3**	**3**

JUSTIFICATION FOR CO-PO-PSO CORRELATION:

	PO1	PO5	PO9	PO10	PO12	PSO1	PSO2	PSO3
CO1	Application of knowledge of basic passive and active components				Basics of components and connection and understanding DSO will help in life-long learning	Understand the fundamentals of passive and active components		Understanding of basic components can lead to the development of innovative products.
CO2	Application of knowledge of basic passive and active components	Familiarization with latest EDA tools			Team work can be a mandate for life-long learning	Application of basic knowledge of electronic components	Application of knowledge of EDA tools	
CO3	Application of knowledge of basic passive and active components	Usage of DSO and other testing instruments are involved in analyzing and testing circuits			Motivate the students to further explore their knowledge in conducting independent experiments	Knowledge and application of various fundamental laws in electronics		
CO4			Carrying out experiments require coordinating as a group	Interpersonal skills can be improved by working together as a team	Working as groups motivates the students to further explore their knowledge	Group work is essential for all the activities	Group work is essential for all the activities	Group work is essential for all the activities

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS
1	Diode characteristic	Theory

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

1	Transistor common emitter configuration.
2	Hobby circuits to practice “https://www.circuitstoday.com/simple-electronics-projects-and-circuits”

WEB SOURCE REFERENCES:

1.	*https://www.instructables.com/The-Ultimate-Guide-to-Desoldering/*
2.	*www.electronics-tutorials.ws › RC Networks*

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐ CHALK & TALK	☐ STUD. ASSIGNMENT	☐ WEB RESOURCES	
☐ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☐ ~~ASSIGNMENTS~~	☐ ~~STUD. SEMINARS~~	☐ TESTS/MODEL EXAMS	☐ ~~UNIV. EXAMINATION~~
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ ~~MINI/MAJOR PROJECTS~~	☐ ~~CERTIFICATIONS~~
☐ ~~ADD-ON COURSES~~	☐ ~~OTHERS~~		

ASSESSMENT METHODOLOGIES-INDIRECT

☐ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☐ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ~~ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS~~	☐ ~~OTHERS~~

Prepared by **Approved by HOD (ECE)**

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