COURSE STRUCTURE
AND
DETAILED SYLLABUS
(Up to II Year)

B.Tech

in

MECHANICAL ENGINEERING

Academic Regulation – R24

Applicable for the batches admitted from 2024-2025

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
(Approved by A.I.C.T.E., NewDelhi,& Permanently Affiliated to J.N.T.U-GV, Vizianagaram)
NAAC"A+" Accredited Institute
Cherukupally (Village), Near Tagarapuvalasa Bridge, Vizianagaram(Dist), A.P- 531162.
www.aietta.ac.in,principal@aietta.ac.in

DEPARTMENT OF MECHANICAL ENGINEERING

Course Structure

Program– B. Tech in Mechanical Engineering

Regulation-R24

Induction Programme

S.No	Course Title	Category	L-T-P-C
1	Physical Activities--Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counseling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

DEPARTMENT OF MECHANICAL ENGINEERING

Program: B. Tech in Mechanical Engineering Regulation: R24

I Year I Semester- Course Structure

S.No.	Category	Course Code	Course Name	Hours per Week			
				L	T	P	Credits
1.	BS	R24BS01	Linear Algebra & Calculus	3	0	0	3
2.	BS	R24BS07	Engineering Chemistry	3	0	0	3
3.	ES	R24ES02	Problem solving and programming with C	3	0	0	3
4.	ES	R24ES06	Engineering Graphics	1	0	4	3
5.	ES	R24ES05	Basic Electrical & Electronics Engineering	3	0	0	3
6.	BS	R24BS08	Engineering Chemistry Lab	0	0	2	1
7.	ES	R24ES03	Problem solving and programming with C Lab	0	0	3	1.5
8.	ES	R24ES07	Basic Electrical & Electronics Engineering Lab	0	0	3	1.5
9.	ES	R24ES08	Engineering Workshop	0	0	3	1.5
10.	MC	R24MC01	Health and Wellness, Yoga and Sports	0	0	1	0.5
			Total	**13**	**0**	**16**	**21**

Category	Courses	Credits
BS- Basic Sciences Course	3	7
ES- Engineering Science Courses	6	13.5
MC- Mandatory Course	1	0.5
Total	10	21

DEPARTMENT OF MECHANICAL ENGINEERING

Program: B. Tech in Mechanical Engineering Regulation: R24

I Year II Semester- Course Structure

S.No.	Category	Course Code	Course Name	Hours per Week			
				L	T	P	Credits
1.	BS	R24BS04	Differential Equations and Vector Calculus	3	0	0	3
2.	BS	R24BS02	Engineering Physics	3	0	0	3
3.	HS	R24HS01	Communicative English	2	0	0	2
4.	ES	R24ES01	Basic Civil & Mechanical Engineering	3	0	0	3
5.	PC	R24MEPC01	Engineering Mechanics	3	0	0	3
6.	HS	R24HS02	Communicative English Lab	0	0	2	1
7.	BS	R24BS03	Engineering Physics Lab	0	0	2	1
8.	ES	R24ES04	IT workshop	0	0	2	1
9.	PC	R24MEPC02	Engineering Mechanics Lab	0	0	3	1.5
10.	MC	R24MC02	NSS/NCC/Scouts & Guides/ Community Service	0	0	1	0.5
			Total	**14**	**0**	**10**	**19**

Category	Courses	Credits
BS- Basic Sciences Course	3	7
PC- Professional Core Courses	2	4.5
HS- Humanities and Social Science including Management	2	3
ES- Engineering Sciences	2	4
MC- Mandatory Course	1	0.5
Total	10	19

Chairperson
Board of Studies (ME)

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DEPARTMENT OF MECHANICAL ENGINEERING

Program: B.Tech- Mechanical Engineering **Regulation- R24**

II Year I Semester- Course Structure

S.No	Category	Course Code	Course Name	Hours per Week			
				L	T	P	Credits
1	BS	R24BS10	Numerical Methods and Transform Techniques	3	0	0	3
2	PC	R24MEPC03	Thermodynamics	3	0	0	3
3	PC	R24MEPC04	Mechanics of Solids	3	0	0	3
4	PC	R24MEPC05	Engineering Materials & Manufacturing Processes	3	0	0	3
5	PC	R24MEPC06	CAD/CAM	3	0	0	3
6	PC	R24MEPC07	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7	SC	R24MESC01	Computer-Aided Modeling Lab	0	0	3	1.5
8	PC	R24MEPC08	Manufacturing processes Lab	0	0	3	1.5
9	HS	R24HS04	Logical Reasoning and Corporate Communication Skills	0	0	2	1
10	MC	R24MC03	Environmental Science	2	0	0	0
			Total	**17**	**0**	**11**	**20.5**

Category	Courses	Credits
BS- Basic Sciences Course	1	3
PC- Professional Core Courses	6	15
HS- Humanities and Social Science including Management	1	1
SC- Skill Enhancement Courses	1	1.5
MC- Mandatory Course	1	0
Total	10	20.5

DEPARTMENT OF MECHANICAL ENGINEERING

Program: B.Tech- Mechanical Engineering **Regulation- R24**

II Year II Semester- Course Structure

S.No	Category	Course Code	Course Name	Hours per Week			
				L	T	P	Credits
1	BS	R24BS09	Complex Variables and Statistical Methods	3	0	0	3
2	PC	R24MEPC09	Fluid Mechanics & Hydraulic Machines	3	0	0	3
3	PC	R24MEPC10	Theory of Machines	3	0	0	3
4	PC	R24MEPC11	Machine Tools & Metrology	3	0	0	3
5	HS	R24HS03	Universal Human Values–Understanding Harmony & Ethical human conduct	2	0	0	2
6	PC	R24MEPC12	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	PC	R24MEPC13	Theory of Machines Lab	0	0	3	1.5
8	SC	R24MESC02	Drones & Digital Fabrication Lab	0	0	3	1.5
9	HS	R24HS05	Numerical Ability & Professional Communication Skills	0	0	2	1
10	MC	R24MC05	Design Thinking & Innovation	0	1	2	2
			Total	**14**	**1**	**13**	**21.5**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation							

Category	Courses	Credits
BS- Basic Sciences Course	1	3
PC- Professional Core Courses	5	12
HS- Humanities and Social Science including Management	2	3
SC- Skill Enhancement Courses	1	1.5
ES- Engineering Sciences	1	2
Total	10	21.5

Chairperson
Board of Studies (ME)

24BS01 **Linear Algebra and Calculus** **3 0 0 3**
(Common to all Branches)

Course Objectives:

1. To equip the students with standard concepts and tools of mathematics to handle various real- world problems and their applications.
2. To enable the students to apply linear algebra to solve engineering problems.
3. To enable the students to apply calculus to solve engineering problems.

Course Code	Course Outcomes	Mapping with POs			Dok
		PO1	PO2	PO12	
R24BS01.1	Develop matrix algebra techniques that are needed by engineers for practical applications.	3	2	1	L1,L2,L3
R24BS01.2	To find the eigen values and eigen vectors and solve the problems by using linear transformation.	3	2	1	L1,L2,L3
R24BS01.3	Apply the knowledge of mean value theorems, solve inequality.	3	2	1	L1,L2,L3
R24BS01.4	Familiarize with functions of several variables which is useful in optimization.	3	2	1	L3,L4
R24BS01.5	Familiarize with double and triple integrals of functions of several variables in two and three dimensions.	3	2	1	L4,L5

SYLLABUS

UNIT-I: Matrices and Linear System of Equations **10 Hours**

Matrices: Vector Space, Linear independent, dependent (only definitions).

Rank of a matrix by echelon form, normal form. Cauchy-Binet formulae (without proof). Inverse of Non- singular matrices by Gauss- Jordan method.

System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method. **COs-CO1**

Self-Learning Topic: Encoding and Decoding messages by using matrices

UNIT- II: Linear Transformation and Orthogonal Transformation **10 Hours**

Eigen values and Eigen vectors and their properties(without proof), Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley–Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation. **COs-CO2**

Self-Learning Topic: Google's page rank Algorithm.

UNIT–III: Calculus **10 Hours**

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), problems on the above theorems. **COs-CO3**

Self-Learning Topic: Application of mean value theorems

UNIT- IV: Partial differentiation and Applications **10 Hours**

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers. **COs-CO4**

Self-Learning Topic: Jacobian of implicit functions.

UNIT-V: Multiple Integrals **10 Hours**

Double integrals - change of variables (Cartesian and Polar coordinates), change of order of integration, Cylindrical and Spherical coordinates, triple integrals. Finding areas (by double integrals) and volumes (by double integrals and triple integrals). **COs-CO5**

Self-Learning topic: Calculating Centers of Mass and Moment of inertia

Board of Studies : Mathematics-Basic Science and Humanities
Approved in BOS No:01, August, 2024
Approved in ACM No: 01, August, 2024

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Reference Books:

1. Dennis G. Zill and Warren S. Wright , Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Green berg, Advanced Engineering Mathematics, 9th edition, Pearson edn.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science
5. International Ltd., 2021 (9th reprint).
6. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017.

Web References:

1. http://onlinecourses.nptel.ac.in
2. https://nptel.ac.in/courses/111105121
3. https://onlinecourses.nptel.ac.in/noc24_ma91/course
4. https://onlinecourses.nptel.ac.in/noc24_ma53/course
5. https://onlinecourses.nptel.ac.in/noc24_ma11/course

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	10
L2	30	10
L3	40	30
L4	--	25
L5	--	25
Total (%)	100	100

Sample Short and Long Answers questions of Various Cognitive Levels

UNIT-I

1. State Cauchy-Binet formulae (L1)
2. Define Echelon form of a matrix(L1)
3. Test for consistency and solve $2x+3y+7z=5;3x+y-3z=12;2x+19y-47z=32(L2)$
4. Discuss for what value of λ,μ the simultaneous equations

$x+y+z=6, x+2y+3z=10, x+2y+\lambda z=10$ have (i)no solution(ii) a unique solution (iii) an infinite number of solutions.(L2)

5. Reduce the matrix $\begin{bmatrix} 8 & 1 & 3 & 6 \\ 0 & 3 & 2 & 2 \\ -8 & -1 & -3 & 4 \end{bmatrix}$ into its normal form and hence find its rank.(L2)
6. Find the value of k such that the rank of $\begin{bmatrix} 1 & 2 & 3 \\ 2 & k & 7 \\ 3 & 6 & 10 \end{bmatrix}$ is 2. (L2)

UNIT-II

1. State Cayley-Hamilton theorem (L1)
2. Find the sum and product of the eigen values of $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ (L1)
3. Find the latent roots and latent vectors of $A=\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ (L2)
4. Use Cayley-Hamilton theorem to express $A^5-4A^4-7A^3+11A^2-A-10I$ as a linear polynomial in A. where $A=\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ (L3)

UNIT-III

1. State Lagrange's mean value theorem(L1)
2. Verify Rolle's theorem for the function $f(x)=(x-a)^m(y-b)^n$ where m.n are positive integers in $[a,b]$ (L2)
3. Calculate approximately $\sqrt[5]{245}$ by using Lagrange's mean value theorem (L3)

UNIT-IV

1. Find the maximum and minimum values of $3x^4-2x^3-6x^2+6x+1$ in $(0,2)$ (L4)
2. If $x+y+z, uv=y+z, uvw=z$, show that $\frac{\partial(x,y,z}{\partial(u,v,w)}=u^2v$ (L4)
3. In plane triangle, finds the maximum value of $\cos A\cos B\cos C$ (L4)

UNIT-V

1. $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dxdy$ (L5)
2. Evaluate $\iint(x^2+y^2)dxdy$ over the area bounded by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ (L5)

Chairperson
Board of Studies (Mathematics)

R24BS07 **ENGINEERING CHEMISTRY** **3 0 0 3**

(Mechanical Engineering)

Course objectives:

1. To familiarize engineering chemistry and its applications.
2. To impart the concept of soft and hard waters, softening methods of hard water.
3. To train the students on the principles and applications of electrochemistry, polymers, surface chemistry and cement.
4. To impart basic concepts of fuels.
5. To introduce Refractories.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs		Dok
		PO1	PO12	
R24BS07.1	Assessment of the quality of water, Specifications for drinking water	3	1	L1,L2, L5
R24BS07.2	Demonstrate the corrosion prevention methods and factors affecting corrosion.	3	1	L1, L2
R24BS07.3	Explain the Preparation, Properties and applications of thermo plastics & thermo setting plastics, Explain calorific values, octane number, refining of petroleum and cracking of oils.	3	1	L1, L2
R24BS07.4	Explain the setting and hardening of cement.	3	1	L2,L3, L4
R24BS07.5	Summarize the concepts of colloids, micelle and nano materials.	3	1	L1, L2,L5

SYLLABUS

UNIT-I: Water Technology **10 Hours**

Soft and hard water, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen – Boiler troubles **–**Priming, foaming**,** scale and sludge, Caustic embrittlement, Industrial Water treatment–Specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, Ion-exchange processes – desalination of brackish water, reverse osmosis (RO) and electro dialysis. **COs-CO1**

Self-Learning Topics: Parameters of drinking water.

UNIT-II: Electro chemistry and Applications: **10 Hours**

Electrodes–electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni-Cd), and lithium ion batteries-working principle of the batteries including cell reactions;

Fuel cells-Basic Concepts, the principle and working of hydrogen -oxygen Fuel cell.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel), Paints (Constituents and Functions) **. COs-CO2**

Self-Learning Topics: Pb-Acid battery, Methods of Coatings for Controlling Corrosion.

UNIT- III: Polymers and Fuel Chemistry **10 Hours**

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization (Free radical).

Plastic: Thermoplastics and Thermo-setting plastics, Preparation, properties and applications of polystyrene, PVC, Nylon 6,6 and Bakelite.

Elastomers– Preparation, properties and applications of Buna S Buna N and Thiokol rubbers.

Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number, Gaseous Fuels **,** liquefied petroleum gas, Flue gas analysis by orsat apparatus. **COs-CO3**

Self-Learning Topics: Differences between Thermoplastics and Thermo-setting plastics, Gaseous Fuels.

UNIT-IV Modern Engineering Materials **10 Hours**

Composites- Definition, Constituents, Classification- Particle, Fiber and Structural reinforced composites, properties and Engineering applications.
Refractories- Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants- Definition, mechanism, properties and importance of lubricants, Viscosity, Viscosity Index. Building materials-Portland Cement, constituents, Setting and Hardening of cement.

COs-CO4

Self-Learning Topics: Characterization of Nano Materials.

UNIT- V: Surface Chemistry and Nano materials **10 Hours**

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (Braggs Method), chemical and electrochemical methods, preparation of nano metals and metal oxides, Stabilization of colloids and nano materials by Stabilizing agents, characterization of surface by physic chemical methods (TEM,SEM) applications of colloids and nano materials – catalysis, medicine, Sensors, etc. **COs-CO5**

Self-Learning Topics: Characterization of Nano Materials.

Board of Studies : Basic Science and Humanities (Chemistry)
Approved in BOS No: 01, August, 2024
Approved in ACM No: 01

Textbooks:

1. Jain and Jain, Engineering Chemistry,16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio dePaula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J.Shaw, Introduction to Colloids and Surface Chemistry, Butterworth – Heineman, 1992.
3. Text book of Polymer Science, FredW.Billmayer Jr, 3rd Edition

Web References:

1. https://swayam.gov.in/nc_details/NPTEL
2. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-cy50

Internal Assessment Pattern

Cognitive Level	Internal Assessment#1(%)	Internal Assessment#2(%)

L1	20	20
L2	30	30
L3	30	30
L4	10	10
L5	10	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

UNIT -I

1. Determine the Hardness of Water by EDTA Method.(L5)
2. Discuss Ion-Exchange Process (L2)
3. Describe Reverse Osmosis Method. (L1)

UNIT-II

1. Write the Construction and working of Zinc-Air battery.(L1)
2. Discuss Electro Chemical Theory of Corrosion.(L2)
3. Describe the Factors Influencing rate of Corrosion.(L1)
4. Write a short note on Cathodic and Anodic Protection (L1)

UNIT-III

1. Write the Differences between Thermo Plastics and Thermo Setting Plastics.(L1)
2. Explain the Functionality of Monomers.(L2)
3. Write the mechanism of Chain growth Polymerization.(L1)
4. Write Preparation, properties & applications of Bakelite.(L1)
5. Explain Proximate Analysis of Coal.(L2)

UNIT-IV

1. Discuss Fiber Reinforced Composites (L2)
2. Classify Refractories. (L3)
3. Explain the Mechanism of Lubrication. (L2)
4. Describe the preparation of Portland cement by Rotary Kiln Method (L1)

UNIT-V

1. Explain Sol-Gel method. (L2)
2. Write the Synthesis of Colloids by Braggs Method.(L1)
3. Importance of Nanomaterials in various fields (L5)
4. Write the applications of Colloids. (L1)

Chairperson
Board of Studies (Chemistry)

R24ES02 **Problem Solving & Programming with C** **3 0 0 3**
(Common to all Branches)

Course Objectives:

1. To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
2. To express algorithms and draw flowcharts in a language independent manner.
3. To enable effective usage of Operators &Control Structures.
4. To learn about the design concept of Arrays, Strings and Functions.
5. To understand Structures and Unions and their usage.
6. To assimilate about Pointers, Dynamic Memory Allocation and know the significance of Pre-processors, perform operations on files.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs					Dok
		PO1	PO2	PO3	PS01	PS02	
R24ES02.1	Illustrate the fundamental concepts of computers and basic computer programming and problem-solving approach.	3	3	2	3	2	L1, L2
R24ES02.2	Understand the Control structures, Branching and Looping.	3	3	3	3	2	L1, L2 L3
R24ES02.3	Make use of Arrays and Develop Programs on modular programming using functions and strings.	3	3	3	2	3	L1, L2, L3
R24ES02.4	Demonstrate the ability to write programs using Structures and Unions.	3	3	3	3	2	L4
R24ES02.5	Apply File handling operations.	3	3	3	3	3	L4, L5

SYLLABUS

UNIT-I: Introduction to Programming and Algorithm for Problem Solving: 10 Hours

Introduction to Programming: The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages, Compilation, Linking and Loading, Testing and Debugging, Documentation,

Algorithm for Problem Solving: Exchanging values of two variables, summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers, Test whether a number is prime, Organize numbers in ascending order, Find square root of a number, factorial computation, Fibonacci sequence, Evaluate 'sin x' as sum of a series, Reverse order of elements of an array, Find largest number in an array, Print elements of upper triangular matrix, multiplication of two matrices, Evaluate a Polynomial

COs–CO1

Self-Learning Topics: Compilation and Interpretation

UNIT- II: Introduction to the 'C' Programming **15 Hours**

Introduction: Character set, Variables and Identifiers, Built-in Data Types, Input/output statements, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Type Casting and Type def Simple 'C' programs

Conditional Statements and Loops: Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, Break statement, Go to statement. **COs-CO2**

Self-Learning Topics: Escape Sequences

UNIT – III: Arrays, Strings and Functions **15 Hours**

Arrays: One dimensional array: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; two dimensional arrays with examples.

Strings: Concepts, String Types, String Input / Output functions, String manipulation functions, Null terminated strings as array of characters, Standard library string functions.

Functions: Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, passing arguments to a Function: call by reference; call by value, Recursive Functions, arrays as function arguments. **COs–CO3**

Self-Learning Topics: String Pattern Matching

UNIT- IV: Structures and Unions **10 Hours**

Structures and Unions: Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions, Enumeration.

Storage Classes**:** Scope and extent, Storage Classes in a single source file: auto, extern and static, register, Storage Classes in multiple source files: extern and static **COs–CO4**

Self-Learning Topics: How do you pass a structure to a function?

UNIT-V: Pointers & File Processing **10 Hours**

Pointers: Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation.

File Processing: Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input/output functions (standard library input/output functions for files), file status functions (error handling), Positioning functions

COs-CO5

Self-Learning Topics: Binary Files and operations on Binary files

Board of Studies : Computer Science and Engineering

Approved in BOS No: 01, 30th July, 2024

Approved in ACM No: 01, 30th July, 2024

Expert Talk (To be Delivered by SMEs from Industries) COs POs / PSOs

1. Logic Develop using C Programming CO1–CO5, PO1,PO2,PO3,PO12,PSO1,PSO2
2. Real Time Applications of C Programming CO1–CO5, PO1, PO2,PO3,PO12,PSO1,PSO2

TEXT BOOKS:

1. Byron S Gottfried "Programming with C" Second edition, Tata McGrawhill, 2007 (Paperback)
2. R.G. Dromey, "How to solve it by Computer", Pearson Education, 2008.
3. Kanetkar Y, "Let us C", BPB Publications, 2007.
4. 4. Hanly J R & Koffman E.B, "Problem Solving and Program design in C", Pearson Education, 2009.

REFERENCE BOOKS:

1. E. Balaguruswamy, "Programming with ANSI-C", Fourth Edition, 2008, Tata McGraw Hill.
2. Venugopal K. R and Prasad S. R, "Mastering 'C'", Third Edition, 2008, Tata McGraw Hill.
3. B.W. Kernighan & D. M. Ritchie, "The C Programming Language", Second Edition, 2001, Pearson Education
4. ISRD Group, "Programming and Problem-solving Using C", Tata McGraw Hill, 2008.
5. Pradip Dey, Manas Ghosh, "Programming in C", Oxford University Press, 2007.

Web References:

1. http://www.c4learn.com/
2. http://www.geeksforgeeks.org/c/
3. http://nptel.ac.in/courses/122104019/
4. http://www.learn-c.org/
5. https://www.tutorialspoint.com/c programming/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	40
L4	--	35
L5	--	25
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What are the five key features of the C programming language?
2. What are the top 5 applications of C programming language?
3. What do you mean by reserved words in C programming language?
4. What do you mean by library functions?
5. List the name of the tokens

6. What is static() function in C programming?
7. What is the difference between operators = and ==?
8. What are 3 main drawbacks of C language?
9. What is the difference between R-value and L-value?
10. How does const char*p differ from the char const* p

L2: Understand

1. What is the importance of function?
2. Explain the function prototype with an example.
3. What do you mean by error? Discuss types of errors() in C language.
4. What do you mean by function pointer?
5. What is a header file in the C programming language?
6. How can you implement decision-making processes in C language?
7. What are the 4 primary sections to define a function in C language?
8. What are modifiers? List the C programming modifiers?
9. What is an array, and why does it play a major role in C programming?
10. Is sizeof( ) a function or operator?

L3: Apply

1. Program to find Factorial of number?
2. Fibonacci Series Program?
3. Palindrome Program?
4. Program to reverse a String?
5. Find a given number is Armstrong Number?
6. Print first n Prime Numbers?
7. Find Largest among n Numbers?
8. LCM of Two Numbers?
9. GCD of Two Numbers?
10. Reverse a String?

L4: Analysing

1. Swapping Two Numbers using Bitwise operators?
2. Copy File to another File?
3. C program to get and set system current system date and time?
4. C program to run DOS command?

L5: Evaluating

1. C program to find two smallest elements in a one-dimensional array?
2. C program to find odd or even numbers using Bit masking?
3. Swapping two bits of byte using C program?

Chairperson
Board of Studies (CSE)

R24ES06 **ENGINEERING GRAPHICS** **1 0 4 3**

(Common To All Branches)

Course Objectives:

1. Understand the fundamentals of engineering drawing, including lines, lettering, and dimensioning.
2. Develop skills in geometrical constructions, including regular polygons and curves.
3. Learn orthographic projection techniques, including projections of points, lines, and planes.
4. Understand how to project solids in simple positions and create sectional views.
5. Develop skills in converting isometric views to orthographic views and vice versa.
6. Apply computer-aided design (CAD) techniques using AutoCAD to create 2D and 3D drawings.
7. Understand the importance of reference planes and reference lines in orthographic projection.
8. Develop problem-solving skills in engineering drawing, including creating and interpreting drawings.

Course Code	Course Outcomes	Mapping with POs and PSOs					Dok
		PO1	PO2	PO3	PO5	PO10	
R24ES06.1	Understand the basics of Engineering Graphics to construct the polygon, curves, and scales.	3	2	2	1	1	L1, L2, L3
R24ES06.2	Draw the orthographic projections of points and straight lines inclined to both the planes.	3	2	2	1	1	L2, L3
R24ES06.3	Draw the projections of planes in various conditions.	3	2	2	1	1	L2, L3
R24ES06.4	Draw the projections of regular solids, with its axis inclined to one plane and sections of solids.	3	2	2	1	1	L3,
R24ES06.5	Visualize the 3D isometric views from 2D orthographic views and vice versa along with basic introduction to CAD.	3	2	3	1	1	L2, L4

SYLLABUS

UNIT-1 **12 Hours**

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general method.

Curves: construction of ellipse, parabola, and hyperbola by general method, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales. **COs: CO1**

UNIT-2 **16 Hours**

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes. **COs: CO2**

UNIT-3 **10 Hours**

Projections of Planes: Regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes. **COs: CO3**

UNIT-4 **16 Hours**

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of sections for simple position only. **COs: CO4**

UNIT-5 **12 Hours**

Conversion of Views: Conversion of isometric views to orthographic views and Conversion of orthographic views to isometric views for simple objects only.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination). **COs: CO5**

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc.
3. Engineering Drawing with an Introduction to AutoCAD, DhananjayJolhe, Tata McGraw Hill.

Board of Studies: Mechanical Engineering
Approved in BOS No: 01, 31st July, 2024
Approved in ACM No: 01

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	30	40
L3	40	40
Total (%)	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Draw an octagon given the length of side 25mm.
2. Construct a regular hexagon of 40mm side. Using general method?
3. Construct a regular pentagon inscribed in a circle of diameter 80 mm?
4. Construct a pentagon of side 50mm with one side vertical. Attach a non-overlapping hexagon of same side length with common vertical side.

L2: Understand

1. A fixed-point F is 7.5cm from a fixed straight line. Draw the locus of a point P moving in such a way that its distance from the fixed straight line is 2/3 times its distance from F. Plot at least 9 points. Name the curves. Also draw a normal and a tangent to the curve at a point on it 6cm from F.
2. Construct a parabola whose focus is at a distance of 40mm from the directrix. Draw a tangent and a normal to the parabola at point 50mm away from the principal axis. Determine the double ordinate through a point 90mm from the directrix.
3. Construct an ellipse when the distance between the locus and the directrix is 30mm and the eccentricity is 3/4. Draw the tangent and normal at any point P on the curve using directrix.
4. Construct a hyperbola when the distance between the focus and the directrix is 40mm and the eccentricity is 4/3. Draw a tangent and normal at any point on the hyperbola.
5. Draw the involute of hexagon of side 25mm A disc is in the form of a square of side 30mm surmounted by a semi-circle on one of the sides of the square and a half hexagon on the opposite side. Draw the path of the end of a string which is unwound from the circumference of the disc.
6. Draw a vernier scale of R.F = 1/25 to read centimetres up to 4 metres and on it, show lengths representing 3.14m, 2.39 m and 0.91 m.
7. Construct a vernier scale to read distance correct to decimetre on a map in which the actual distances are reduced in the ratio of 1:40000. The scale should be long enough to measure up to 6km. Mark on the scale a length of 3034km and 0.59km.
8. The front view of a line, inclined at 30^0 to the VP is 65mm long. Draw the projections of the line, when it is parallel to and 40 mm above the HP, its one end being 30mm in front of the VP.
9. Mark the projections of the following points on a common reference line, keeping the projectors 35mm apart.
   (i) A, 25mm above H.P and 35mm in front of V.P
   (ii) B, 25mm above H.P and 40 mm behind V.P
   (iii) C, 30mm below H.P and 45 mm behind V.P
   (iv) D, 30 mm below H.P and 40 mm in front V.P
10. Draw the FV, TV of the following points:
    (i) Point P lies in the HP and 20mm behind the VP
    (ii)Point Q lies in the VP and 30mm below the HP
    (iii)Point R lies 35mm below the HP and 25mm behind the VP
11. Draw the involute of hexagon of side 25mm.
12. A 100 mm long line is parallel to and 40mm above the HP. Its two ends are 25 mm and 50 mm in front of the VP respectively. Draw the projections and find its inclination with the VP.
13. Draw the projections of a straight-line AB of 60mm long, in the following positions
    (i)Perpendicular to the HP and in the VP and one end on the HP
    (ii)Parallel to and 30 mm in front of the VP and on the HP

(iii)Inclined at 30^0 to the VP, in the HP and one end on the VP

14. Draw an involute of the circle of 40mm diameter. Also draw a normal and tangent at a point 100mm from the centre of the circle.
15. A rectangular plot of 100sq.km. is represented on a certain map by a similar rectangular area of 4sq.cm. Draw a scale to show km and mark a distance of 43km on it.

L3: Apply

1. A truck is moving at the rate of 1.2 km per min. Construct a diagonal scale with RF value of 1/25000, showing minutes and seconds. Mark the distance moved by the truck in 4 minutes and 27 seconds?
2. A tunnel on the Konkan railway route has a size of 640m × 10m × 10m. It is represented on a model by the volume of 27 cm^3 Find RF. Devise a diagonal scale of this RF to read up to 300 meters. Show the distances of 299 meters, 171 meters and 9 meters on it.
3. A car is running at a speed of 50 km/hour. Construct a diagonal scale to show 1 km by 3 cm and to measure up to 6 km. Mark also on the scale the distance covered by the car in 5 min 28 seconds.

L4: Analyze

1. Analyze the importance of orthographic projection in CAD and explain how it aids in the visualization of 3D objects from 2D views. Provide examples and diagrams to support your answer.
2. Compare and contrast 2D orthographic views and 3D isometric views. How do they differ in terms of representation and application? Explain with examples and illustrations.
3. Explain the process of creating a 3D isometric view from 2D orthographic views. Use a simple object (e.g., a cube or a cylinder) as an example and provide step-by-step diagrams to illustrate the process.
4. Discuss the advantages and limitations of using CAD software for creating 2D orthographic views and 3D isometric views. How does CAD improve the design process, and what are its limitations?
5. Analyze a given 2D orthographic view (front, top, and side views) and create a 3D isometric view from it. Explain the process and provide diagrams. Then, reverse-engineer the process by creating 2D orthographic views from the 3D isometric view.
6. Explain the concept of dimensioning and annotation in CAD. How are dimensions and annotations added to 2D orthographic views and 3D isometric views? Provide examples and illustrations.

Chairperson
Board of Studies (ME)

R24ES05 Basic Electrical and Electronics Engineering 3 0 0 3

Course Objectives:

1. To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering
2. To acquire fundamental knowledge in the relevant field.
3. To teach the fundamentals of semiconductor devices and its applications.
4. To teach the working process and analysis of different rectifying and Amplifying Circuits.
5. To teach the fundamental principles and rules of digital electronic circuits like gates, Sequential and Combinational Circuits.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs							
		PO1	PO2	PO3	PO6	PO7	PO8	PO12	Dok
R24ES05.1	Understand the problem-solving concepts associated to AC and DC circuits	2	2	1	-	-	-	1	L1, L2,L3
R24ES05.2	Remember the fundamental laws, construction and operation of AC and DC machines, instruments.	2	2	1	-	-	-	1	L2,L3
R24ES05.3	Understand different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.	3	1	2	3	2	1	1	L1,L2
R24ES05.4	Understand the fundamental principles of electronic devices, analyzing the different rectifying and Amplifying Circuits.	1	2	3	-	-	-	1	L1, L2,L3
R24ES05.5	analyze and design different digital electronic circuits like gates, Sequential and Combinational Circuits	1	2	3	-	-	-	2	L1, L3,L4

SYLLABUS

Part A-Electrical Engineering

UNIT- I: DC & AC Circuits 10 Hours

DC Circuits: Electrical circuit elements (R, Land C), Ohm's Law and its limitations, KCL& KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems). **COs–CO1**

Self-Learning Topics: Circuit elements

UNIT-II: Machines and Measuring Instruments **10 Hours**

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge. **COs–CO2**

Self-Learning Topics: Magnetic materials

UNIT- III: Energy Resources, Electricity Bill & Safety Measures **10 Hours**

Energy Resources: Conventional and non-conventional energy resources; Layout and operation o various Power Generation systems: Hydal, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of ―unit‖ used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock. **COs– CO3**

Part B: Electronics Engineering

UNIT-IV: Semiconductor Devices and Basic Electronic Circuits **15 Hours**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier. Rectifiers and power supplies: Block diagram description of a dc power supply, Half-Wave Rectifiers, Full-Wave Rectifiers, capacitor filter (no analysis). Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. **COs –CO4**

Self-Learning Topics: Electronic components and characteristics, Design Amplifier circuit at different R, C Values

UNIT -V: DIGITAL ELECTRONICS and INSTRUMENTTAION **15 Hours**

Overview of Number Systems, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits– Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only), Electronic Instrumentation: Block diagram of an electronic instrumentation system **COs–CO5**

Self-Learning Topics: Develop digital circuits using minimum no. of gates, design principles of electronic instruments.

Board of Studies : Electrical and Electronics Engineering
Approved in BoS No: 01, 3rd August, 2024
Approved in ACM No: 01

Text Books: Electrical Engineering

1. Basic Electrical Engineering, D. C. Kulshreshtha, TataMcGrawHill,2019, First Edition
2. Power System Engineering, P.V. Gupta,M.L.Soni,U.S.BhatnagarandA.Chakrabarti,Dhanpat Rai & Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Text Books: Electronics Engineering

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books: Electrical Engineering

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019,FourthEdition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S.Sukhija, Oxford University Press,2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Pearson Publications, 2018,Second Edition.

Reference Books: Electronics Engineering

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall,India, 2002.
3. R.T.Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version,Pearson Education,2009

Web References: (Electrical Engineering)

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

Web References: (Electronics Engineering)

1. https://archive.nptel.ac.in/courses/117/102/117102059
2. https://www.tutorialspoint.com/principles_of_communication
3. https://www.geeksforgeeks.org/electronics-and-communication-engineering

Internal Assessment Pattern (Electrical Engineering)

Cognitive Level	Internal Assessment #1(%)
L1	30
L2	30
L3	40
Total (%)	**100**

Internal Assessment Pattern (Electronics Engineering)

Cognitive Level	Internal Assessment #2(%)
L1	30
L2	30
L3	40
Total (%)	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

Part-A: Electrical Engineering

L1: Remember

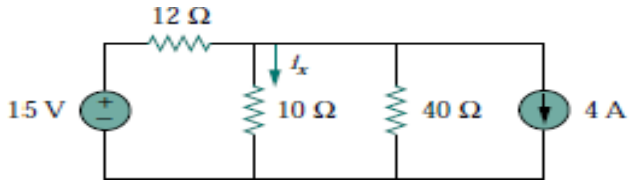
1. State Ohm's law?
2. Define Superposition theorem?
3. Define Active power?
4. Define Reactive power?
5. Define the term tariff?
6. Define form factor?
7. Define RMS value?

L2: Understand

1. Explain the principle and operation of DC Motor?
2. Explain the construction of Alternator?
3. Explain the principle and operation of Moving Iron instruments?
4. What is meant by Earthing and explain about process of earthing?
5. Draw the layout of wind power generating plant?

L3: Apply

1. For the circuit shown below in calculate Ix and the power dissipated by the 10-Ω resistor using superposition.



2. An alternating voltage is given by V=230sin314t.Calculate i)frequency, i)maximum value, iii)average value ,iv)RMS value
3. A Consumer has Maximum demand of 200 KW at 40% load factor. If the tariff is Rs.200per KW of maximum demand plus 10paise per KWH, find the annual charges?

Part-B: Electronics Engineering

L1: Remember

1. Draw the symbol of pn junction of diode
2. What is meant by BJT?
3. Define Avalanche and Zener break down voltages?
4. Draw the symbol of Zener diode.
5. Define Amplifier?
6. Define Rectifier?
7. What is the Zener voltage regulator?
8. Define latch and flip flop?
9. Symbol of JK flip flop?
10. Draw the logic symbols of OR, AND, NOT gate?

L2: Understand

1. Write the Differences between Avalanche and Zener break down voltages?
2. Draw the diagram and explain single input and dual input op-amps?
3. Compare BJT, CB, CE, CC transistor configuration characteristics?
4. Write the notes of PN junction diode?
5. Draw the block diagram of public address system and explain?
6. Discuss the working principal of zener voltage regulator?
7. Draw the block diagram of electronic instrumentation system and explain?

L3: Apply

1. What is doping? Describe P and N type semiconductors with Qualitative theory?
2. Draw the diagram and explain single input and dual input op-amps and design?
3. Design operational amplifier?
4. Explain the block diagram of DC power supply?
5. Explain the circuit diagram and working of RC coupled amplifier?
6. Operation of center tap full-wave rectifier?
7. Explain the operation of full –wave rectifier with capacitor?
8. Explain the JK, SR, D,T flip flops ?
9. Simplify the Boolean expressions to minimum number of literals i) A+B+A'B'C ii) AB + A (B +C) + B'(B+D).

Chairperson
Board of Studies (EEE& ECE)

R24BS08 **ENGINEERING CHEMISTRY LAB** **0 0 2 1**
(Mechanical Engineering)

Course Objectives:

1. Verify the fundamental concepts with experiments.
2. Learn and carry out some of the important experiments related to batteries and their properties.
3. Learn the preparation of engineering polymer materials like Bakelite
4. Know the fundamental principles of chemistry lab experiments which include volumetric analysis, dichrometry, PH metry

At the end of the course, the students will be able to

Course Code	Course Outcomes	Mapping with POs		
		PO1	PO2	Dok
R24BS08.1	Conductometric titration of strong acid vs. strong base, P^H metric titration, Dissolved Oxygen, ferrous iron, Calcium in port land Cement, Moisture content in a coal sample the cell constant and conductance of solutions.	1	3	L1,L2
R24BS08.2	Prepare advanced polymer Bakelite materials, nano materials by precipitation method, Adsorption of acetic acid by charcoal.	1	3	L1,L3
R24BS08.3	Determine the physical properties like surface tension, adsorption and viscosity, Strength of an acid in Pb-Acid battery, Calculation of hardness of water.	1	3	L1,L4

Board of Studies : Basic Science and Humanities (Chemistry)
Approved in BOS No: 01, 5th August, 2024
Approved in ACM No: 01

List of Experiments

Week-1
1. Determination of Hardness of a groundwater sample **COs:CO3**

Week-2
2. Estimation of Dissolved Oxygen by Winkler's method **COs:CO1**

Week-3
3. Determination of Strength of an acid in Pb-Acid battery **COs:CO3**

Week-4
4. Estimation of ferrous iron by Dichrometry **COs:CO1**

Week-5
5. Estimation of Calcium in port land Cement **COs:CO1**

Week-6
6. Preparation of nano materials by precipitation method **COs:CO2**

Week-7
7. Adsorption of acetic acid by charcoal **COs:CO2**

Week-8
8. Determination of percentage Moisture content in a coal sample **COs:CO1**

Week-9

9. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
10. Conductometric titration of strong acid vs. strong base
11. PH metric. titration of strong acid vs. strong base **COs:CO1**

Week-10

9. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
10. Conductometric titration of strong acid vs. strong base
11. PH metric. titration of strong acid vs. strong base **COs:CO1**

Week-11

12. Determination of Surface tension of liquids **COs:CO3**

Week-12

13. Preparation of a polymer (Bakelite) (Demo) **COs:CO2**

Additional Experiments

1. Determination of Sodium carbonate by using Hydrochloric acid **COs:CO4**
2. Determination of alkalinity of a sample containing Na2CO3 and NaOH **COs:CO4**

Reference:

1. "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar
2. Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

Chairperson
Board of Studies (Chemistry)

R24ES03 Problem Solving &Programming with C Lab 0 0 3 1.5
(Common to all Branches)

Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C-programming language.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs			
		PO1	PO2	PO3	Dok
R24ES03.1	Read, understand, and trace the execution of programs written in C language.	2	2	2	L1, L2
R24ES03.2	Select the right control structure for solving the problems .and demonstrate the application of arrays functions and strings	3	3	3	L2,L3
R24ES03.3	Develop Debug and Execute programs to demonstrate the applications of Pointers, Structures& Unions, and Files.	3	3	3	L2, L3

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01, 30th July, 2024

Developing the following programs:

Week 1:

1. Write a C program using printf() and Scanf(). COs:CO1
2. Write a C program on swapping of two nos. COs:CO1
3. Write a C program using arithmetic Expressions. COs:CO1

Week 2:

4. Simple interest calculation COs:CO2
5. Finding compound interest COs:CO2
6. Area of a triangle using heron's formulae COs:CO2
7. Distance travelled by an object COs:CO2

Week 3:

8. Find the maximum of three numbers using conditional operator COs:CO2
9. Take marks of 5 subjects in integers, and find the total, average in float COs:CO2
10. Write a C program to shift/rotate using bit fields. COs:CO2
11. Finding the square root of a given number COs:CO2
12. Write a C program using if-else statement. COs:CO2

Week 4:

13. Write a C program to find the max and min of four numbers using if-else. COs:CO2
14. Write a C program to generate electricity bill. COs:CO2
15. Find the roots of the quadratic equation. ` COs:CO2

16. Write a C program to find the given year is a leap year or not. COs:CO2
17. Write a C program to simulate a calculator using switch case. COs:CO2

Week 5:

18. Find the factorial of given number using any loop. COs:CO2
19. Find the given number is a prime or not. COs:CO2
20. Compute sine and cos series. COs:CO2
21. Checking a number palindrome. COs:CO2
22. Construct a pyramid of numbers. COs:CO2

Week 6:

23. Write a C program on Linear Search. COs:CO3
24. Find the min and max of a 1-D integer array. COs:CO3
25. Perform linear search on1D array. COs:CO3
26. The reverse of a 1D integer array. COs:CO3

Week 7:

27. Find 2's complement of the given binary number. COs:CO3
28. Eliminate duplicate elements in an array. COs:CO3
29. Sort array elements using bubble sort. COs:CO3
30. Addition of two matrices. COs:CO3

Week 8:

31. Multiplication two matrices. COs:CO3
32. Write a C program using call by reference. COs:CO3
33. Write a C program to find factorial of n using recursion. COs:CO3
34. Write a C function to calculate NCR value COs:CO3
35. Concatenate two strings without built-in functions. COs:CO3

Week 9:

36. Write a C function to transpose of a matrix. COs:CO3
37. Write a C function to find the length of a string. COs:CO3
38. Reverse a string using built-in and without built-in string functions. COs:CO3
39. Write a C program to find the sum of a 1D array using malloc ( ). COs:CO3

Week 10:

40. Write a recursive function to find the lcm of two numbers. COs:CO3
41. Write a recursive function to find the sum of series. COs:CO3
42. Write a C program to swap two numbers using call by reference. COs:CO3
43. Write a C program using Pointers, Structures and Unions. COs:CO4
44. Write a C program to find the total, average of n students using structures. COs:CO4

Week 11:

45. Enter n students data using calloc() and display failed students list. COs:CO4
46. Read student name and marks from the command line and display the student details along with the total. COs:CO4
47. Write a C program to implement realloc(). COs:CO4
48. Write a C program to copy one structure variable to another structure of the same type. COs: CO4

Week 12:

49. Demonstrate Dangling pointer problem using a C program. COs: CO4
50. Write a C program to copy one string into another using pointer. COs: CO4

51. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers. COs: CO4

Week 13:

52. Write a C program using Files operations. COs:CO5
    a. Sum and average of 3 numbers
    b. Conversion of Fahrenheit to Celsius and vice versa.
53. Write a C program to write and read text into a file. COs:CO5

Week 14:

54. Write a C program to write and read text into a binary file using fread() and fwrite() COs:CO5
55. Copy the contents of one file to another file. COs:CO5
56. Write a C program to merge two files into the third file using command-line arguments. COs: CO5

Week 15:

57. Find no. of lines, words and characters in a file. COs:CO5
58. Write a C program to print last n characters of a given file. COs:CO5

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Chairperson
Board of Studies (CSE)

R24ES07 Basic Electrical and Electronics Engineering Lab 0 0 3 1.5
(Common to all branches of Engineering)

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs							
		PO1	PO2	PO3	PO4	PO5	PO11	PS01	Dok
R24ES07.1	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.	1	1		3	1			L1, L2, L3
R24ES07.2	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor and design suitable circuits for measurement of electrical parameters	1	1		3	1	2	2	L2, L3
R24ES07.3	Plot and discuss the characteristics of various electron devices/instruments.	1	1		3	1	2		L1, L2, L3

Board of Studies : Electrical and Electronics Engineering
Approved in BOS No: 01, 3rd August, 2024
Approved in ACM No: 01

Developing the following programs:

List of Experiments

1. Verification of KCL and KVL **COs: CO2**
2. Verification of Superposition theorem **COs: CO2**
3. Measurement of Resistance using Wheatstone bridge **COs: CO2**
4. Magnetization Characteristics of DC shunt Generator **COs: CO2**
5. Measurement of Power and Power factor using Single-phase wattmeter **COs: CO2**
6. Measurement of Earth Resistance using Megger **COs: CO2**
7. Calculation of Electrical Energy for Domestic Premises **COs: CO2**

Reference Books:

1. Basic Electrical Engineering, D.C.Kulshreshtha,TataMcGrawHill,2019, First Edition
2. Power System Engineering, P.V.Gupta, M.L.Soni, U.S.Bhatnagar and A. Chakrabarti,

DhanpatRai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.

Web References:

1. https://www.jntumaterials.co.in/2015/06/jntuk-btech-lab-manuals
2. www.jntumaterials.in

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	20
L2	30	40
L3	40	40
Total (%)	**100**	**100**

Sample Lab Experiments of Various Cognitive Levels:

Experiments

1. Verification of KCL and KVL **COs: CO2**
2. Verification of Superposition theorem **COs: CO2**
3. Measurement of Resistance using Wheatstone bridge **COs: CO2**
4. Magnetization Characteristics of DC shunt Generator **COs: CO2**
5. Measurement of Power and Power factor using Single-phase wattmeter **COs: CO2**
6. Measurement of Earth Resistance using Megger **COs: CO2**
7. Calculation of Electrical Energy for Domestic Premises **COs: CO2**

S. No.	Title	Cognitive Level
1	Verification of KCL and KVL	L1, L2,L3
2	Verification of Superposition theorem	L1, L2,L3
3	Measurement of Resistance using Wheatstone bridge	L2,L3,
4	Magnetization Characteristics of DC shunt Generator	L1, L2,L3
5	Measurement of Power and Power factor using Single-phase wattmeter	L1, L2,L3
6	Measurement of Earth Resistance using Megger	L1,L3
7	Calculation of Electrical Energy for Domestic Premises	L1, L2

Note: Minimum Six Experiments to be performed.

PART B: Electronics Engineering Workshop

Course Objectives:

To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias. **COs: CO3**
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator. **COs: CO3**
3. Implementation of half wave and full wave rectifiers **COs: CO3**
4. Plot Input & Output characteristics of BJT in CE and CB configurations **COs: CO3**
5. Frequency response of CE amplifier. **COs: CO3**
6. Simulation of RC coupled amplifier with the design supplied **COs: CO3**

7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs. **COs: CO2**
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. **COs: CO2**

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using bothHardware and Software.

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	20
L2	30	40
L3	40	40
Total (%)	**100**	**100**

Web References:

1. https://www.jntumaterials.co.in/2015/06/jntuk-btech-lab-manuals
2. www.jntumaterials.in

Experiments of Various Cognitive Levels:

S. No.	Title	Cognitive Level
1	Plot V-I characteristics of PN Junction diode A)Forward bias B) Reverse bias.	L1, L2, L3
2	Plot V – I characteristics of Zener Diode and its application as voltage Regulator.	L1, L2, L3
3	Implementation of half wave and full waverectifiers	L2,L3,L4
4	Plot Input & Output characteristics of BJT in CEand CB configurations	L1, L2,L3
5	Frequency response of CE amplifier.	L1, L2,L3
6	Simulation of RC coupled amplifier with the designsupplied	L1,L3,L4
7	Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates	L1, L4
8	Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.	L1,L3,L4

Note: Minimum Six Experiments to be performed.

Chairperson
Board of Studies (EEE&ECE)

R24ES08 **ENGINEERING WORKSHOP** **0 0 3 1.5**
(Common to all Branches)

Course Objectives:

- Describe how different tools are used in home wiring, tin smiting, blacksmithing, carpentry, and fitting.

Course Code	Course Outcomes	Mapping with Pos					
		PO1	PO2	PO3	PO4	PO6	PO9
R24ES08.1	Identify workshop tools and their operational capabilities. Practice on manufacturing of components using workshop trades including carpentry, fitting, sheet metal	3	2	1	1	1	1
R24ES08.2	Practice on manufacturing of components using workshop trades including foundry and welding.	3	2	1	1	2	3
R24ES08.3	Apply fitting operations in various applications and engineering knowledge for Plumbing, House Wiring Practice, and Making square rod and L-bend from the round rod in black smithy	3	2	1	1	2	3

List of Experiments

1. **Wood Working:** **COs: CO1**
   a) Half – Lap joint
   b) Mortise and Tenon joint
   c) Corner Dovetail joint or Bridle joint
2. **Sheet Metal Working:** **COs: CO1**
   a) Tapered tray
   b) Conical funnel
   c) Elbow pipe
   d) Brazing
3. **Fitting:** **COs: CO1**
   a) V-fit
   b) Dovetail fit
   c) Semi-circular fit
   d) Bicycle tire puncture and change oftwo-wheeler tyre
4. **Foundry Trade:** Preparation of Green Sand Moulds **COs: CO2**
   a) Single piece pattern
   b) Double piece pattern
5. **Welding Shop: Arc welding Practice** **COs: CO2**
   a) Lap joint
   b) Butt joint

6. **Electrical Wiring**: **COs: CO3**
   a) Parallel and series connection
   b) Two-way switch connection
   c) Tube light connection
   d) Soldering of wires

7. **Plumbing:** **COs: CO3**
   a) Prepare Pipe joint with coupling for 1 inch diameter
   b) Prepare Pipe joint with coupling for 1.5 inch diameter

8. **Black smithy:** **COs: CO3**
   a) Round rod to Square
   b) Round rod to S-Hook

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 &2017

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan 2021-22

Board of Studies: Mechanical Engineering
Approved in BOS No: 01, 31st July, 2024
Approved in ACM No: 01

Sample Experiments

1. Prepare Half – Lap joint
2. Prepare Mortise and Tenon joint
3. Prepare Corner Dovetail joint or Bridle joint
4. Prepare Tapered tray
5. Prepare Conical funnel
6. Prepare Elbow pipe
7. Do Brazing operation
8. Prepare V-fit
9. Prepare Dovetail fit
10. Prepare Semi-circular fit
11. Do Bicycle tire puncture andchange of two-wheeler tyre
12. Prepare Parallel and series
13. Prepare Two-way switch
14. Prepare Tube light
15. Do Soldering of wires
16. Prepare Green Sand Moulds for single piece Pattern

17. Prepare Green Sand Moulds for double piece Patterns
18. Prepare Lap joint using arc welding
19. Prepare Butt joint using arc welding
20. Prepare Pipe joint with coupling for same diameter(10mm)
21. Prepare Pipe joint with coupling for same diameter(12mm)
22. Prepare Round rod to Square rod
23. Prepare Round rod to S-Hook

Chairperson
Board of Studies (ME)

R24MC01 Health and Wellness, Yoga and Sports 0 0 1 0.5
(Common to all Branches)

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

At the end of the course, students will be able:

Course Code	Course Outcomes	Mapping with POs				
		PO3	PO6	PO7	PO9	PO12
R24MC01.1	Understand the importance of yoga and sports for Physical fitness and sound health.	2	1	1	1	1
R24MC01.2	Demonstrate an understanding of health-related fitness components.	1	2	1	1	1
R24MC01.3	Compare and contrast various activities that help enhance their health	2	1	2	2	1
R24MC01.4	Assess current personal fitness levels.		1	1		1
R24MC01.5	Develop Positive Personality	1	1	2	1	1

SYLLABUS

UNIT-I: **3 Hours**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

1. Organizing health awareness programmes in community.
2. Preparation of health profile.
3. Preparation of chart for balance diet for all age groups **COs-CO1**

UNIT- II: **3 Hours**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities: Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar. **COs-CO2**

UNIT–III: **3 Hours**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

1. Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
2. Practicing general and specific warm up, aerobics
3. Practicing cardio respiratory fitness, treadmill, run test, 9 min walk, skipping and running.

COs-CO3

Board of Studies : BS&H
Approved in BoS No: 01, August, 2024
Approved in ACM No: 01

Text Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Assessment Pattern:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva
4. voce on the subject.

Chairperson
Board of Studies (Mathematics)

24BS04 **Differential Equations and Vector Calculus (Common to all Branches)** **3 0 0 3**

Course Objectives:

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. To furnish the learners with basic concept and techniques at plus two level to lead them in to advanced level by handling various real-world applications.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs			Dok
		PO1	PO2	PO12	
R24BS04.1	Solve the first order differential equations related to various engineering fields.	3	2	1	L1,L2,L3
R24BS04.2	Model engineering problems as higher order differential equations and solve analytically.	3	2	1	L1,L2,L3
R24BS04.3	Identify solution methods for partial differential equations that model physical processes.	3	2	1	L1,L2,L3
R24BS04.4	Interpret the physical meaning of different operators such as gradient, curl and divergence.	3	2	1	L3,L4
R24BS04.5	Estimate the work done against a field, circulation and flux using vector calculus.	3	2	1	L4,L5

SYLLABUS

UNIT- I: Differential equations of first order and first degree **10 Hours**

Formation of differential equations, order, degree, separation of variables (only Review). Linear differential equations-Bernoulli's equations-Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay, Electrical circuits (RL and LC). **COs-CO1**

Self-Learning Topic: Mixed tank problems

UNIT- II: Higher order Linear differential equations with Constant Coefficients **10 Hours**

Definitions, homogenous and non-homogenous, complimentary function, particular integral $\left(e^{ax}, \sin ax, \cos ax, \text{Polynomial in } x, e^{ax}V(x), xV(x)\right)$, general solution, Wronskian, method of variation of parameters. **COs-CO2**

Applications: L-C-R Circuit problems

Self-Learning Topic: Simple Harmonic motion

UNIT–III: Partial Differential Equations **10 Hours**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solution of first order linear equations using Lagrange's method. Homogenous Linear Partial differential equations with constant coefficients. **COs-CO3**

Self-Learning Topic: Method of Separation of Variables

UNIT- IV: Vector differentiation **10 Hours**

Vector, Scalar, dot product, cross product, unit vector, equation of a line passing through two points (Review only)

Scalar and vector point functions, vector operator del, del applies to scalar point function-Gradient, del applied to vector point function – Divergence and Curl, Vector Identities **COs-CO4**

Application: Scalar Potential

Self-Learning Topic: Equation of tangent plane and Normal plane.

UNIT-V: Vector integration **10 Hour**

Line integral – circulation – work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof). **COs-CO5**

Self-Learning Topic: Application of above theorems.

Board of Studies: Basic Science and Humanities
Approved in BOS No: 01, 2nd August, 2024
Approved in ACM No: 01

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Green berg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science
5. International Ltd., 2021 (9th reprint).
6. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017.

Web References:

1. http://onlinecourses.nptel.ac.in
2. https://nptel.ac.in/courses/111105121
3. https://onlinecourses.nptel.ac.in/noc24_ma86/course

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	10
L2	30	10
L3	40	30
L4	--	25
L5	--	25
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

UNIT-I

1. Define Leibnitz's linear differential equation(L1)
2. State Newton's law of cooling(L1)
3. Write differential equation of L-R series circuit (L1)
4. solve the differential equation $\left(1+x^2\right)\frac{dy}{dx}+2xy=4x^2$ (L2)
5. If the temperature of the air is 30^0C and the substance cools from 100^0C to 70^0C in 15 minutes, find when the temperature will be 40^0C (L3)
6. The rate at which bacteria multiply is proportional to the instantaneous number present. If the original number doubles in two hours, then it will triple after ….hours (L3)

UNIT-II

1. Define Wronskian (L1)
2. solve the differential equation $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+13y=8e^{3x}\sin 2x$ (L2)
3. An inductance of 2 henries and a resistance of 20 ohms are connected in series with e.n.f. E volts. If the current is zero when $t=0$. Find the current at the end of 0.01 seconds if E=100 volts. (L3)

UNIT-III

1. State Lagrange's Linear equation (L1)
2. form a partial differential equation by eliminating the arbitrary function φ from $lx+my+nz=\varphi\left(x^2+y^2+z^2\right)$ (L2)
3. solve $\frac{\partial^3 z}{\partial x^3}-2\frac{\partial^3 z}{\partial x^2\partial y}=2e^{3x}+3x^2y$ (L2)
4. Solve $\left(mz-ny\right)\frac{\partial z}{\partial x}+\left(nx-lz\right)\frac{\partial z}{\partial y}=ly-mx$ (L3)

UNIT-IV

1. The temperature of points in space is given by $T\left(x,y,z\right)=x^2+y^2-z.$ A mosquito located at $\left(1,1,2\right)$ desires to fly in such a direction that it will get warm as soon as possible. In what direction should it move? (L3)
2. Show that $\nabla^2\left(r^n\right)=n\left(n+1\right)r^{n-2}$ (L4)

UNIT-V

1. Evaluate $\iiint_v \nabla.\vec{F}dV$, where $\vec{F}=4x\hat{i}-2y^2\,j+z^2k$ and V is bounded by $x^2+y^2=4, z=0$ and $z=3$ (L4)
2. Evaluate $\int_C\left(3x^2-8y^2\right)dx+\left(4y-6xy\right)dy$ where C is the curve bounded by $y=\sqrt{x}$ and $y=x^2$ (L5)

Chairperson
Board of Studies (Mathematics)

R24BS02 **Engineering Physics** **3 0 0 3**
(Common to all Branches)

Course Objectives:

1. To bridge the gap between the physics in school at 10+2 level and UG level engineering courses.
2. To identify the importance of the optical phenomenon i.e. interference and diffraction related to its engineering applications.
3. To understand the mechanism of emission of light, utilization of lasers as coherent light sources for low and high energy applications.
4. To enlightening the periodic arrangement of atoms in crystalline solids and classify various crystal systems.
5. To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
6. To enlightenment of the concepts of quantum mechanics and to provide fundamentals of de-Broglie matter waves and the importance of free electron theory for metals.
7. To understand the physics of semiconductors and identify the type of semiconductor using Hall Effect.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with Pos			Dok
		PO1	PO2	PO12	
R24BS02.1	Analyze the intensity variation of light due to interference, diffraction and classify various types of lasers.	3	2	1	L1 ,L2, L3
R24BS02.2	Identify various crystal systems and analyze the crystalline structure.	3	2	1	L1, L2, L3
R24BS02.3	Summarize various types of polarization of dielectrics and classify the magnetic materials.	2	2	1	L2, L3
R24BS02.4	Explain fundamentals of quantum mechanics and apply to one dimensional motion of particles.	3	2	2	L1, L4
R24BS02.5	Outline the properties of charge carriers in semiconductors	3	2	1	L2, L5

SYLLABUS

UNIT-I: Wave Optics and Lasers **14 Hours**

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit- Fraunhofer diffraction due to N-Slits -Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Lasers: Introduction - Characteristics of laser - Spontaneous and Stimulated emissions of radiation - Population inversion - Lasing action - Pumping mechanisms - Ruby laser - He-Ne laser- Applications of lasers. **COs–CO1**

Self-Learning Topics: Interference in thin films due to Transmission of light

UNIT-II: Crystallography and X-ray diffraction **10 Hours**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters - Bravais Lattices - crystal systems (3D) - coordination number - packing fraction of SC, BCC & FCC - Miller indices - separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffraction - Crystal structure determination by Laue's and Powder methods. **COs–CO2**

Self-Learning Topics: Effect of crystallite size on diffracted X-Ray intensity

UNIT-III: Magnetic and Dielectric Materials **12 Hours**

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro& Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector - Relation between the electric vectors - Types of polarization- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - dielectric loss. **COs–CO3**

Self-Learning Topics: Frequency dependence of polarization.

UNIT-IV: Quantum Mechanics and Free electron theory **12 Hours**

Quantum Mechanics: Dual nature of matter - Heisenberg's Uncertainty Principle - Significance and properties of wave function - Schrodinger's time independent and dependent wave equations - Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) - Quantum free electron theory - electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Fermi energy. **COs– CO4**

Self-Learning Topics: Density of states, Origin of energy bands in solids

UNIT-V: Semiconductors **8 Hours**

Semiconductors: Formation of energy bands - classification of crystalline solids - Intrinsic semiconductors: - Fermi level - Extrinsic semiconductors- P-Type semiconductors- N-Type semiconductors- Principle of operation and Characteristics of P-N Junction diode - Drift and diffusion currents - Einstein's equation - Hall Effect and its applications. **COs-CO5**

Self-Learning Topics: Zener diode, Solar cells

Board of Studies : Department of Physics
Approved in BOS No: 01, 5th August, 2024
Approved in ACM No: 01

Textbooks:

1. A Text book of Engineering Physics - M. N. Avadhanulu, P.G. Kshirsagar& TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Introduction to Quantum Mechanics, David J. Griffiths, Pearson Education India Learning Private Limited (2015).
3. Laser Fundamentals, William T. Silfvast, 2nd edn, Cambridge University press, New York (2004).
4. Introduction to Solid State Physics, 8 th Edition, Charles Kittel, John Wiley & Sons, NJ,

USA (2005).
5. Engineering Physics - D.K. Bhattacharya and Poonam Tandon, Oxford press (2015).
6. Semiconductor Physics and Devices:Basic principle, Donald A. Neamen 4th ed,, McGraw-Hill, New York (2012).

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning.
2. The Principles of Quantum Mechanics, P. A. M. Dirac, fourth Edition (Oxford University Press, Oxford, 1958).
3. Physics-Resnick, Halliday, Krane, Fifth edison, Volume-1, Wiley student edition.
4. Engineering Physics - Dr.R. Swapna, Scientific International Publishing House.
5. Concepts of Modern Physics. Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).
6. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
7. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web References:

1. https://www.ebooksdirectory.com/
2. http://www.sciencedirect.com/Science
3. https://onlinecourses.nptel.ac.in/
4. https://www.link.springer.com/physics/
5. https://www.loc.gov/rr/scitech/selected-internet/physics.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	40	20
L2	30	30
L3	30	--
L4	--	30
L5	--	20
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

UNIT-1

1. Define interference? What are the necessary conditions for obtaining interference of light? (L1)
2. Explain interference in thin films due to reflected light. What are the conditions to obtain the maximum and minimum intensities in the reflected light? (L2)
3. Describe the principle and formation of Newton's rings and give a method to determine the radius of nth dark ring, radius of curvature (R) of plano convex lens and radius of nth dark ring. (L1,L3)
4. What is meant by diffraction? Distinguish between Fresnel and Fraunhofer diffraction. (L1)
5. Discuss Fraunhofer diffraction due to single slit and derive an expression for width of the central maxima? (L2,L3)
6. What is meant by stimulated emission. Describe Lasing action. (L1,L2)
7. Describe the construction and working of He-Ne Laser. (L1)

UNIT-2

1. Define the terms space lattice, basis, unit Cell, lattice parameters, bravais Lattice, atomic radius and coordination number. (L1)

2. Illustrate the SC, BCC and FCC crystal structures. (L3).
3. Explain body centered cubic (BCC) and determine the packing fraction of BCC. (L2,L3)
4. Explain body centered cubic (FCC) and determine the packing fraction of FCC. (L2,L3)
5. Classify the seven crystal systems and write the relationship between lattice parameters in various crystal systems. (L2)
6. What are the Miller indices? How are they obtained? (L1)
7. What are the important features of Miller indices? Draw the planes (100), (101) (110) (010) and (111), (123). (L1)
8. State and explain Bragg's law. (L2)
9. Describe the LAUE method for determination of crystal structure. (L2)

.UNIT-3

1. Define the terms magnetic dipole moment and magnetic susceptibility, magnetization, permeability, dielectric flux density and magnetic field intensity. (L1)
2. Summarize various types of polarization of dielectrics. (L2)
3. Show that $\mu r = 1 + \chi$. (L3)
4. Describe the origin of magnetic moment of an atom. (L1)
5. Explain the domain concept of ferromagnetism based on Hysteresis loop (B-H Curve). (L2)
6. Describe soft and hard magnetic materials? (L1)
7. What is meant by internal field or local field or Lorentz field? Derive an expression for internal field. (L1, L3)
8. Derive Clausius-Mosotti relation in dielectrics subjected to static fields. (L3)

UNIT-4

1. Discuss the de-Broglie's hypothesis. Show that $\lambda = h / \sqrt{2mE}$ (L1, L4)
2. Show that the wavelength of an electron accelerated by potential differences $\lambda = \frac{1.227}{\sqrt{V}} nm$. (L3)
3. What are the matter waves? Explain the properties of matter waves. (L1)
4. What is the physical significance of wave function ψ.(L4)
5. Derive the time independent and dependent Schrodinger wave equation. (L4)
6. Describe the particle in 1 dimensional infinite potential box. (L1)
7. Explain Heisenberg uncertainty principle? (L4)
8. Find the energy required to jump an electron from ground state to the second excited state in a metal.(L1),
9. Define the terms (i) mean free path (ii) drift velocity (iii) relaxation time. (L1)
10. What are the success and draw backs of classical free electron theory of metals. (L1)
11. Derive an expression for electrical conductivity on the basis of quantum free electron theory of metals. (L3)
12. What is Fermi level? Explain Fermi-Dirac distribution function (FDD) of the electrons. (L1, L4)

UNIT-5

1. Explain the classification of solids (conductors, semiconductors and insulators (L5).
2. What are the differences between intrinsic and extrinsic semiconductors? (L2)
3. Explain N-Type and P-Type semiconductors. Indicate on an energy level diagram the donor and acceptor level for intrinsic and extrinsic semiconductors. (L5)
4. Explain the characteristics of P-N Junction diode. (L5)

5. Describe the diffusion current and drift current in a semiconductor. (L2)
6. Derive an expression for Einstein's equation by using drift and diffusion currents. (L5)

7. What is Hall Effect? Identify the type of semiconductor using Hall effect and derive an expression for Hall coefficient. (L2, L3).
8. Write the applications of Hall Effect. (L1)

Chairperson
Board of studies (Physics)

R24HS01 COMMUNICATIVE ENGLISH 2 0 0 2

(Common to CSE, CSE-AI & ML, CSD Branches in Semester-I)

(Common to EEE, MECH & ECE in Semester-II)

Course Objectives:

1. To identify the English Communication Skills among the first year B.Tech students and to initiate measures to bridge the gap.
2. To enlighten the students on the necessity of cultivating good language habits through practising LSRW skills.
3 To explain them various topics of grammar and the importance of being grammatically correct in speech and writing.
4 To make them practise Phonetics and impart the nuances of fine speech.
5 To instruct them about the various types of format related to writing letters, paragraph, emails, essays and reports.
6 To make them appreciate English text and deepen their comprehension through reading of textual and non-detailed topics.

At the end of the course, students will be able:

Course Code	Course Outcomes	Mapping with POs			Dok
		PO9	PO10	PO12	
R24HS01.1	To utilize the text, online resources, and other social, and real time situations with an aim to practice Communicative English	1	3	2	L2, L4
R24HS01.2	To apply grammatical knowledge for speaking, and writing purposes	2	3	1	L3, L6
R24HS01.3	To analyze and practice various devices of speech for effective conversation and presentations	2	3	1	L4, L6
R24HS01.4	Appraising the language competence of the learners and suggesting remedial action	2	3	1	L3,L5
R24HS01.5	To make the learners practice writing tasks which are relevant for job training and academic purposes.	1	2	3	L3,L6

SYLLABUS

UNIT-I **12 Hours**

Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short story)

Listening: Identifying the topic, the context and specific pieces of information

By listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words. **COs-C01**

Self learning topics : The Great Indian Scientists-Biography of CV Raman

UNIT-II **10 Hours**

Lesson: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices-linkers, use of articles and zero article prepositions.

Vocabulary: Homonyms, Homophones, Homographs. **COs-C02**

Self learning Topics : Seven Ages of Man by William Shakespeare.

UNIT-III **12 Hours**

Lesson: BIOGRAPHY: Steve Jobs

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs-tenses; Subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations **COs-C03**

Self learning topics: Elon Musk

UNIT-IV **8 Hours**

Lesson: INSPIRATION: The Knowledge Society by APJ Abdul Kalam (Ignited minds)

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/ patterns / relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters and Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons **COs-C04**

Self learning Topics: The writings of Sudha Murthy- "The day I stopped drinking milk"

UNIT-V **10 Hours**

Lesson: MOTIVATION: The Power of Intra personal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal Oral Presentation topics from academic contexts

Reading: Reading comprehension.

Writing: Writings structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)

Vocabulary: Technical Jargons **COs-C05**

Self learning Topics: Body Language (Allan Pease)

Board of Studies : ENGLISH
Approved in BOS No: 6th August, 2024
Approved in ACM No: 01

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1stEdition,Orient BlackSwan, 2023 (Units 1,2,3 &5)
2. Empowering English by Cengage Publications, 2023
3. The Great Indian Scientists-Cengage Publications
4. English Essentials- Maruthi Publications.(Unit 4)

Reference Books:

1. P. Elian : A Hand book of English for Engineers and Technologists,
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy Raymond English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. English for Engineers by Shyam Ji Dubey- Vikas Publishing House

Web References:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx
7. https://www.youtube.com/c/DailyVideoVocabulary/videos
8. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	25	25
L2	25	25
L3	15	15
L4	15	15
L5	10	10
L6	10	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of various cognitive levels

UNIT-I

1. List the major characters in the story.
2. How did the family financial circumstances affect narrator's behaviour and relationship with her family and students?
3. What are the different types of reading?
4. How to avoid errors in spellings and enlist few steps for vocabulary development?
5. What are the different parts of speech?

UNIT-II

1. Write the summary of the poem Night of the Scorpion?
2. How does the ruler setting serve as a perfect background for the programme?
3. Describe the superstitious beliefs and practices mentioned by writer Nissim Ezekiel in his poem.
4. Write a paragraph on Artificial intelligence
5. Write about Definite and In-definite articles with examples?

UNIT-III

1. How did informal jobs and formal education influence his career?
2. Sketch the biography of Elon Musk.
3. List three steps to effective note making.
4. Can technological advancements address the pressing human problems like climate change and disease prevention?
5. Can you come up with creative ideas to match the technological vision of Elon Musk for our humanity?

UNIT-IV

1. What are the various resources of knowledge that Abdul Kalam points out in the knowledge society?
2. What are three main objectives which need to be realized for India to become a Super Power?
3. How ancient Indian knowledge systems have informed the world over centuries?
4. What does it take according to Dr.Kalam for India to become a Knowledge Society?
5. What message can students import from Knowledge Society?

UNIT-V

1. Write the difference between Inter personal communication and Intra personal communication?
2. Mention the different ways through which Intra personal communication helps to improve every day's life.
3. What do you mean by non-verbal communication? Discuss the various types of non-verbal communication.
4. What is the most important type of non-verbal communication, justify your answer?
5. How to make an effective presentation?

Chairperson
Board of Studies (English)

R24ES01 BASIC CIVIL AND MECHANICAL ENGINEERING 3 0 0 3
(COMMON TO ALL BRANCHES)

Course Objectives:

1. **Understand the Role of Civil Engineers**: Familiarize students with the roles and responsibilities of civil engineers in society and the various sub-disciplines within civil engineering.
2. **Construction Materials**: Provide knowledge about different construction materials such as cement, aggregates, bricks, concrete, steel, soil, stones and their applications in building construction.
3. **Transportation Engineering**: Offer insights into the importance of transportation engineering for national economic development and the fundamentals of highway pavements, harbor, tunnel airport and railway engineering.
4. **Water Resources and Environmental Engineering**: Cover the basics of water sources, water quality specifications, hydrology, rainwater harvesting, and water storage structures, emphasizing their importance in environmental sustainability.
5. **Scope and Importance of Mechanical Engineering**: Familiarize students with the scope and significance of mechanical engineering in various sectors, including energy, manufacturing, automotive, aerospace and marine industries.
6. **Engineering Materials and Manufacturing Processes**: Explain different engineering materials and various manufacturing processes and computational manufacturing.
7. **Thermal Engineering**: Provide an overview of thermal engineering principles, including the working of boilers, IC engines, and power plants, and introduce concepts related to electric and hybrid vehicles.
8. **Mechanical Power Transmission Systems**: Describe different mechanical power transmission systems such as belt drives, chain drives, gear drives, and their applications.
9. **Basics of Robotics**: Introduce the basics of robotics, including joints, links, configurations, and applications, along with advancements in robotics technology.

Course Code	Course Outcomes	Mapping with POs and PSOs						Dok
		PO1	PO2	PO3	PO5	PO9	PO12	
R24ES01.1	Understand the role of civil engineers in various disciplines, the scope of each discipline, and the materials used in building construction and principles of surveying.	3	-	1	-	2	1	L1
R24ES01.2	Describe the fundamentals of transportation engineering, water resources, and environmental engineering, including highway pavements, water quality, hydrology, and water storage structures.	3	1	1	1	1	-	L2, L3
R24ES01.3	Understand and apply different manufacturing processes and engineering materials, including	3	2	1	2	2	2	L1

	their applications, and basic mechanical design principles.							
R24ES01.4	Explain the basics of thermal engineering, including working principles of engines, power plants, and related thermal cycles, along with their applications.	3	1	1	2	2	2	L1,L2
R24ES01.5	Describe the working of different mechanical power transmission systems and the basics of robotics and their applications.	3	1	1	2	1	2	L2, L3

SYLLABUS

UNIT I **10 Hours**

Role of Civil Engineers in Society, Various Disciplines of Civil Engineering, Structural Engineering, Geo-technical Engineering, Transportation Engineering, Hydraulics and Water Resources Engineering, Environmental Engineering, Scope of Each Discipline, Building Construction and Planning, Construction Materials Cement, Aggregate, Bricks, Cement Concrete-Steel, soils and stones. Introduction to Prefabricated construction Techniques.

Surveying: Objectives of Surveying, Horizontal Measurements, Angular Measurements, Introduction to Bearings Simple problems on bearings-Contour mapping.

Self-Learning Topic: Advancements in Prefabricated Construction Techniques **COs: CO1**

UNIT II **15 Hours**

Transportation Engineering: Importance of Transportation in Nation's economic development, Types of Highway Pavements, Flexible Pavements and Rigid Pavements, Simple Differences. Basics of Harbor, Tunnel, Airport, and Railway Engineering

Water Resources and Environmental Engineering: Introduction, Sources of water, Quality of water, Specifications, Introduction to Hydrology, Rainwater Harvesting, Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Self-Learning Topic: Sustainable Transportation Engineering **COs: CO2**

UNIT-III: **12 Hours**

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Basic Mechanical Design Principles: Fundamentals of Mechanical Design- Introduction to the design process, understanding design requirements, and conceptual design, Design of Simple Machine Components - Design considerations for basic machine components like shafts, bearings, gears, and fasteners.

Engineering Materials – Metals - Ferrous and Non-ferrous, Ceramics, Composites, Smart materials**.**

Self-Learning Topics: Sustainable Engineering Practices, Advancements in Smart Materials.

COs: CO3

UNIT- IV: **12 Hours**

Thermal Engineering– Working principle of Boilers

Cycles- Otto cycle, Diesel cycle, Refrigeration and air conditioning cycles,

Engines- IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines,

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants, Introduction to Electric and Hybrid Vehicles.

Self-Learning Topics: Advanced Engine Technologies, Thermodynamics in Renewable Energy Systems. **COs: CO4**

UNIT – V: 12 Hours

Manufacturing Processes: Principles of Casting, Forming, joining processes,

Computational Manufacturing: Introduction to CNC machines, 3D printing, and Smart manufacturing.

Machining – Conventional & Non-Conventional,

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

Self-Learning Topics: Additive Manufacturing Technologies, Innovations in Mechanical Power Transmission **COs: CO5**

Text Books:

1. Basic Civil and Mechanical Engineering, by Ommi Srikanth, M. Sreenivasa Reddy S. Chand Publications
2. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
3. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
4. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd.

Reference Books:

1. AppuuKuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata Mcgraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata Mcgraw Hill publications (India) Pvt. Ltd.

Board of Studies: Mechanical Engineering
Approved in BOS No: 01, 31st July, 2024
Approved in ACM No: 01

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	30
L2	30	50
L3	20	20
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

Basic Civil Engineering

L1: Remember

1. List out components of building.
2. Steps in preparation of bricks cement.
3. Explain various requirements of building
4. Write various principles in building planning
5. Write qualities of goods bricks
6. Write uses of concrete
7. What are types in soils.
8. Write about pre-fabricated structures.
9. What are the uses of surveying
10. What are types in surveying
11. Write about closed traverse and open traverse
12. Write about bearings and meridian.
13. What is contour mapping.
14. Write about flexible and rigid pavements.
15. What is runway
16. Write about dams and reservoirs
17. Write the sources of water

1. What are the main roles of mechanical engineering in different industries?
2. Define basic mechanical design principles.
3. List the types of engineering materials covered in this unit.
4. What are the key differences between ferrous and non-ferrous metals?
5. Name three applications of smart materials.
6. What is the working principle of a boiler?
7. Define the Otto cycle and Diesel cycle.
8. What are the key differences between 2-Stroke and 4-Stroke engines?
9. List the types of power plants covered in this unit.
10. Name a major advantage of electric vehicles over conventional vehicles.
11. What are the basic principles of casting in manufacturing processes?
12. Define CNC machining and its basic applications.
13. List the types of mechanical power transmission systems discussed in this unit.
14. What are the key differences between conventional and non-conventional machining?
15. Name the main components of a robotic system.

L2: Understand

1. Explain the process of designing a simple machine component like a shaft.
2. Describe the role of mechanical engineering in the aerospace sector.
3. Compare the properties of ceramics and composites used in engineering.
4. Discuss the importance of understanding material properties in mechanical design.
5. Summarize the technological advancements in smart materials.
6. Explain the basic operation of an IC engine.
7. Describe the differences between refrigeration and air conditioning cycles.
8. Compare the working principles of steam and hydro power plants.
9. Discuss the role of hybrid vehicles in reducing energy consumption.

10. Summarize the working principles of the Diesel cycle and its applications.
11. Explain the process of CNC machining and its advantages.
12. Describe the principles of gear drives and their applications in mechanical systems.

L3: Apply

1. Analyze the role of civil engineering in society.
2. Understanding the various disciplines of civil engineering.
3. Evaluate the use of materials in construction.
4. Create a case study on a recent innovation in civil engineering like prefabricated structures.
5. Apply the principles of the surveying to determine different measurements.
6. Solve problems related to bearings
7. Compare the flexible pavement and rigid pavements.
8. Evaluate the benefits water supply system.
9. Evaluate the benefits of dams.
10. Design a rain water harvesting.
11. Apply the basic mechanical design principles to design a simple gear system.
12. Using the properties of different engineering materials, suggest a suitable material for a specific mechanical component.
13. Design a basic component considering the design requirements and material properties.
14. Analyze how advancements in smart materials can impact the design of mechanical components.
15. Apply knowledge of engineering materials to solve a problem in a real-world mechanical system.
16. Apply the principles of thermal engineering to analyze the efficiency of a steam power plant.
17. Using the Otto cycle, calculate the performance parameters for a given engine setup.
18. Design a basic model of a hybrid vehicle considering its power source and energy efficiency.
19. Apply the knowledge of refrigeration cycles to improve the efficiency of a cooling system.
20. Analyze the impact of different thermal cycles on the performance of an IC engine.
21. Apply the principles of CNC machining to design a simple component.
22. Design a mechanical power transmission system for a specific application, considering the required drives and components.

Chairperson
Board of Studies (ME)

R24MEPC01 ENGINEERING MECHANICS 3 0 0 3

Course Objectives:

1. To get familiarized with different types of force systems.
2. To draw accurate free body diagrams representing forces and moments acting on a body to analyze the equilibrium of system of forces.
3. To teach the basic principles of center of gravity, centroid and moment of inertia and determine them for different simple and composite bodies.
4. To apply the Work-Energy method to particle motion
5. To understand the kinematics and kinetics of translational and rotational motion of rigid bodies.
6. Able to analysis of frames and trusses, different types of motion, friction and application of work - energy method.

Course Code	Course Outcomes	Mapping with POs and PSOs					DoK
		PO1	PO2	PO3	PO4	PSO1	
R24MEPC01.1	Understand the fundamental concepts in mechanics and determine the frictional forces for bodies in contact.	3	1	2	2	2	L1, L2
R24MEPC01.2	Analyze different force systems such as concurrent non concurrent systems and calculate their resultant forces and moments.	3	1	2	1	2	L1, L2, L3
R24MEPC01.3	Calculate the Centroids, Centre of gravity and moment of inertia of different geometrical shapes.	3	1	3	2	2	L1, L2
R24MEPC01.4	Determine the displacement, velocity & acceleration relations in dynamic systems.	3	1	2	2	2	L1, L2
R24MEPC01.5	Analyze the motion of the bodies with (or) without the application of force.	3	1	1	1	2	L1, L2, L3

SYLLABUS

Unit- I: Introduction to Engineering Mechanics **9 Hours**

Introduction to Engineering Mechanics – Basic Concepts and Applications

Systems of Forces: Coplanar Concurrent Forces– Components in Space– Resultant–Moment of Force and its Application –Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction.

Self learning topic: Newton's law of motion and gravitation **COs: CO1**

Unit- II: Equilibrium of Systems of Forces **9 Hours**

Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses. Principle of virtual work with simple examples

Self learning topic: Distribution of forces in a plane **COs: CO2**

Unit- III Centroid, Centre of Gravity and Area moments of Inertia 9 Hours

Centroid: Centroids of simple figures (from basic principles)–Centroids of Composite Fig

Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.

Area Moments of Inertia: Definition–Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Self learning topic: Centroid for two dimensional bodies **COs: CO3**

Unit- IV: Kinematics, Kinetics 9 Hours

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle – Work Energy method and applications to particle motion-Impulse Momentum method

Self learning topic: Cylindrical and spherical coordinates **COs: CO4**

Unit -V: Work – Energy Method 9 Hours

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method

Self learning topic: Potential energy and equilibrium **COs: CO5**

Text Books:

1. Timoshenko S. and Young D.H.," Engineering Mechanics",5th Edition, Mc Graw Hill Publications,2013
2. Bavakatti S. S.," Engineering Mechanics Statics",4th Edition, New Age International Publications,2012
3. Tayal. A. K., "Engineering Mechanics Statics and Dynamics",6th Edition, Umesh Publications,2006

Reference Books:

1. Kurmi R.S.,"Engineering Mechanics Statics",10thEdition, S.Chand Publications,2005
2. Vijay Kumar Reddy K. and Suresh KumarJ.," Mechanics: Statics and Dynamics",3rd Edition, B S Publications,2010
3. Ferdinand P. Beer, Russell Johnston Jr .E.," Vector Mechanics for Engineers Static sand Dynamics",9th Edition, McGraw Hill Publications,2011

Web References:

1. https://www.iitg.ac.in/rkbc/me101/Presentation/L01-03.pdf

Board of Studies: Mechanical Engineering
Approved in BOS No: 01, 31st July, 2024
Approved in ACM No: 01

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	30
L2	40	40
L3	20	30
Total (%)	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

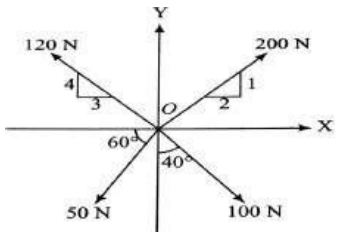
1. State the conditions for equilibrium of a rigid body in three dimensions
2. What is the principle of transmissibility?
3. State the Parallel axis theorem
4. Define centroid and centre of gravity
5. State triangular law of forces. What is the use of this law?

L2: Understand

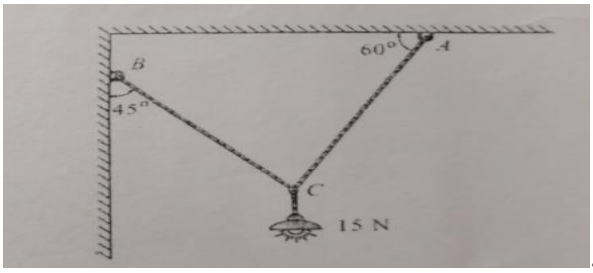
1. Explain Pappus theorem I&II
2. Differentiate between polar moment of inertia and product of inertia
3. Write impulse momentum equation
4. What is a rolling body? Explain its importance
5. Explain work-energy method for a plane motion

L3: Apply

1. Two forces of magnitude 50N and 30N are acting at a point. If the angle between the two forces is 60^0, determine the magnitude and direction of the resultant force
2. A system of four forces acting on a body is shown in figure. Determine the resultant force and its direction



3. An electric light weighing 15N hangs from a point C by the two strings AC and BC as shown in Figure3. AC is inclined at 60^0 to the horizontal and BC at 45^0 to the vertical shown in figure. Using Lami's theorem find the forces in strings AC and BC



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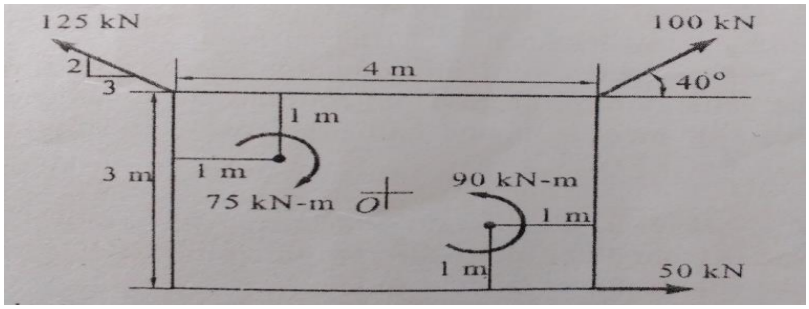
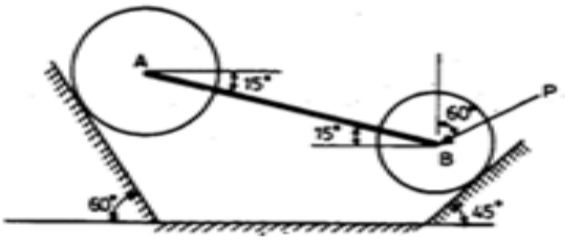
4. Find the sum of moment about center O of the force and couple acting on the rectangle plate shown in **Figure**



5. Two cylinders, A of weight 4000 N and B of weight 2000 N rest on smooth inclines as shown in **Figure** They are connected by a bar of negligible weight hinged to each cylinder at its geometric centre by smooth pins. Find the force P to be applied as show in the figure such that it will hold the system in the given position



Chairperson
Board of Studies (ME)

R24HS02 COMMUNICATIVE ENGLISH LAB 0 0 2 1
(Common to CSE, CSE-AI & ML, CSD Branches in Semester-I)
(Common to EEE, MECH & ECE in Semester-II)

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. Students undergo training in basic communication skills to make them into confident communicators in all situations.

At the end of the course, students will be able:

Course Code	Course Outcomes	Mapping with POs			
		PO9	PO10	PO12	Dok
R24HS02.1	Understand and recognize the various facets of English language ability with a focus on the four basic skills- namely -LSRW abilities.	1	3	2	L1
R24HS02.2	Implement various activities for language learners to practise communication skills.	1	2	3	L2
R24HS02.3	To enhance listening and speaking comprehension, analyze the sounds, stress, rhythm, intonation, and syllable division of English speech.	1	3	2	L3
R24HS02.4	Assess the professionalism of students when taking part in group discussions, debates, JAM sessions, Presentations and Interviews.	3	1	2	L4
R24HS02.5	Equipping oneself with Interview Skills and a range of Soft Skills for life and career.	1	3	2	L5

Board of Studies : BS&H- English

Approved in BOS No: 6th August, 2024

Approved in ACM No: 01

SYLLABUS

Week1:

1. To explain and guide the students in decoding the sounds of English.
2. List all the consonant sounds and vowel sounds in English

Week2:

1. What is a syllable and describe the syllable structure.
2. Define stress, functional stress and various rules of stress.
3. What is connected speech?

Week3:

1. What is Intonation and mention the various pitch movements like rise, fall, fall-rise or rise-fall?
2. What is connected speech?

Week4:

1. To equip students to speak in English language confidently without any inhibitions.
2. Why are majority of the companies conducting JAM session as a preliminary interview?

3. What are the key skills tested in JAM round?

Week5:

1. To help students learn and understand different functions of language like greeting, asking
2. For information, giving information, meetings, requests, exchanging dialogues in formal and informal contexts.
3. Introduce yourself and others, give instructions and directions

Week 6:

1. To help the students understand and work on the digital age connector for personal correspondence, business communication, etc.
2. Write about email etiquette.
3. Draft an email to the HR Manager of Wipro Technologies requesting to consider your application for the post of Software Engineer.

Week 7:

1. To update students about the importance of Resume, the various types and the essentials of an effective resume
2. Draft a resume for a software post in reputed organization.

Week 8:

1. To educate students about the various styles of writing formal letters.
2. What is a cover letter? What are the different types of cover letters?
3. Write a job application letter for any post of your choice in a reputed company?

Week 9:

1. To help students know the importance of an SOP in their professional advancements?
2. What is an SOP and what are the different kinds and parts of an SOP?
3. Prepare an SOP to apply for a Master's Programme in any University of your choice.

Week 10:

1. To educate and guide the students about presentation skills and its importance in the technical evolving world.
2. To inform explain students about the importance of body language in various personal and professional forums
3. To help students to present papers, PPT's in seminars, workshops, conferences, research projects, interviews, etc.

Week 11:

1. To help students to give effective PPT's in various academic and professional platforms.
2. Describe various aspects that make PPT more effective.
3. Make a PPT on any topic of your choice and present it to the class.

Week 12:

1. To foster, creative, critical thinking skills, analytical skills and problem solving skills.
2. Suggest a few tips for preparing a poster.
3. Prepare posters from or outside your curriculum.

List of Activities:

1. Sounds of English (Vowels and Consonants) **COs: CO1,CO2**
2. Neutralization and Accent Rules **COs: CO1,CO2**
3. Improving communication skills /JAM. **COs: CO3,CO4**

4. Letter Writing and E-mail Writing **COs: CO1,CO2**
5. Cover letters and Resume Writing **COs: CO1,CO2**
6. Statement of Purpose. **COs: CO1,CO2**
7. Debates **COs: CO4:CO5**
8. Presentation skills- PPT and Poster **COs: CO4:CO5**
9. Group Discussions , types and practice **COs: CO4,CO5**
10. Interview skills – Mock interviews **COs: CO4,CO5**

Reference Books:

1. Prof. M. Hari Prasad, Prof. Vijaya Babu, Prof. Padmaja Kalapala, Skill Craft – A Communicative English Laboratory Workbook, Maruthi Publications first Edition, 2023
2. Meenakshi Ramana, Sangeeta-Sharma, 4thEdition, Technical Communication, Oxford Press, 2022.
3. Grant Taylor: English Conversation Practice, 1st Edition, Tata ,Mc Graw-Hill Education India, 2001.
4. Hewing,s, Martin, Cambridge Academic English(B2), Cambridge University Press,2012.
5. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students, 3rd Edition, Trinity, 2022.
6. Dr. ShaliniSharma's Body Language Your Success Mantra, S. Chand publications 2010.
7. Sunitha Mishra and C.Murali Krishna's Communication Skills for Engineers Pearson Education Edition 2009.

Suggested software:

- English Wordsworth –Language Lab- Wordsworth Software

Web References for:

Spoken English

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. . https://www.youtube.com/c/ArnelsEverydayEnglish/featured
7. https://www.youtube.com/c/engvidAdam/featured
8. . https://www.youtube.com/c/EnglishClass101/featured
9. https://www.ted.com/watch/ted-ed
10. http://www.edest.org/

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Chairperson
Board of Studies (English)

R24BS03 **Engineering Physics Lab** **0 0 2 1**
(Common to all Branches)

Course Objectives:

1. To study the concepts of optical phenomenon like interference, diffraction etc.,
2. To recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors
3. To study the parameters and applications of dielectric and magnetic materials by conducting experiments.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs					Dok
		PO1	P02	P04	PO9	PO12	
R24BS03.1	Demonstrate the modern engineering physics techniques and tools in real times applications in engineering studies.	3	1	2	1	2	L1
R24BS03.2	Develop the laboratory skills in handling of electrical and optical instruments.	2	1	1	2	1	L3
R24BS03.3	Conduct experiment independently and in team to record the measurements	2	1	2	2	1	L2

Board of Studies : Department of Physics
Approved in BOS No: 01, 5th August, 2024
Approved in ACM No: 01

Developing the following programs:

List of Experiments

1. Determination of radius of curvature of a given plano convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Determination of thickness of thin object by air wedge method.
4. Determination of wavelength of Laser Source by diffraction grating.
5. Determination of rigidity modulus of the material of the given wire using Torsional Pendulum.
6. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method.
7. Determination of dispersive power of the prism.
8. Determination of acceleration due to gravity and radius of Gyration by using Compound Pendulum.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Determination of dielectric constant using charging and discharging method.
11. Sonometer: Verification of laws of stretched string.
12. Estimation of Planck's constant using photoelectric effect.
13. Study the variation of B versus H by magnetization of the magnetic material (B-H curve).
14. Determination of frequency of electrically maintained tuning fork by Melde's experiment.
15. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall

effect.

16. Determination of the resistivity of semiconductor by four probe method.
17. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method.
18. Determination of velocity of sound by Kundt's tube method.

Note: Any **TEN** of the listed experiments are to be conducted. Out of which any **TWO** experiments may be conducted in virtual mode.

Week 1:

1. What is the basic principle of newton's rings experiment?
2. Define Interference phenomena?.
3. Why the rings are circular?
4. What are Newton's Rings?
5. Why it is necessary for the light to fall normally on plano convex lens?
6. What is constructive interference and destructive interference?
7. What is the purpose of glass plate incline at 450 in this experiment?
8. Why the centre of the rings is dark?
9. Which light does u use in this experiment?
10. What will happen if we use White light in this experiment?
11. If u replace yellow light with green light, is there any difference in the formation of rings ?

Week 2:

1. What is diode?
2. What is energy gap?
3. What is valency band?
4. What is conduction band?
5. How many types of solid materials are there and what are those materials?
6. What is a conductor?
7. What is insulator?
8. What are Semi conductors?
9. What are the types of semi conductors are there?
10. What is intrinsic and extrinsic semi conductor?
11. What u meant by Fermi energy level?

Week 3:

1. What is the full form of laser?
2. How laser light is different from the ordinary light?
3. What is population inversion?
4. What is pumping?
5. What is laser?
6. What is meant by the term coherency?
7. What is diffraction?
8. Define Grating
9. What is active medium?
10. What is the action of the optical resonator?

Week 4:

1. What is the magnetic induction formula at a point x, away from the center of the circular

coil?

2. What will be the Magnetic field value at the center of a current-carrying coil?
3. Does earth's horizontal magnetic field value remain the same everywhere or it fluctuates?
4. What is Commutator and what its role in an experiment?
5. What is the relation between Gauss and Tesla?
6. Why do you put apparatus (Wooden Frame along with circular coil) in East-West Direction?
7. What are Tan A and Tan B Positions?
8. What is the unit of magnetic field intensity H?
9. Can you perform the experiment by using the Alternating Current?
10. What are the magnetic elements?

Week 5:

1. What is the purpose of Capacitors ?
2. What the resistor will do ?
3. What is the purpose of Inductors?
4. What is Time constant?
5. What you meant by capacity of a conductor.
6. Define potential.
7. What is capacitance.
8. Define dielectric Constant?
9. What is the significance of finding the dielectric strength of a material?
10. Give some examples of dielectric materials used in electric devices?

Week 6:

1. What is plane transmission diffraction grating?
2. In our experiment, what type of diffraction does occur and how?
3. What is meant by dispersive power of grating?
4. How the commercial gratings can be made?
5. Define grating element
6. Among Prism and grating which gives more intense spectrum and why?
7. Define diffraction grating?
8. What are the essential parts of the spectrometer?
9. Which colour in the spectrum is having more refractive index?
10. How many types of spectra are available?
11. Define grating element.

Week 7:

1. What is the significance of the beam splitter in this experiment?
2. How do you form a wedge shaped air film?
3. Why the fringes are straight?
4. Why the fringes are formed equally spaced?
5. What type of light source is required for this experiment?
6. Why the fringes are formed parallel and why not circular like Newton Ring's experiment?
7. What is the principle involved in this experiment?
8. What is meant by constructive and destructive interference?

Week 8:

1. What is prism?
2. What u meant by Angular Dispersion?

3. Dispersive power of the prism?
4. What is Refractive index?
5. What is Spectrometer?
6. What is the function of Collimator?
7. What u meant by Angle of Prism?
8. What is Dispersion of Light?
9. What is the main optical action of the prism?
10. What type of prism do u use in this experiment?
11. What are the units of Dispersive power?
12. What type of light do u use in this experiment?
13. Which colour in the spectrum is having more refractive index?

Week 9:

1. .Define Rigidity of modulus?
2. Define Moment Of Inertia?
3. What is the meaning in calling this a pendulum?
4. Difference between simple pendulum and torsional pendulum?
5. What is S.H.M ?
6. What is Young's modulus?
7. Define Time Period?
8. Mention the factors on which the rigidity modulus of a material depends?
9. What is meant by mechanical deformation?
10. Define restoring force?
11. Define stress and mention its units?
12. Define strain and mention its units?
13. If we increase the diameter of the wire, what happened to rigidity modulus?
14. Differentiate simple pendulum and torsional pendulum?

Week 10:

1. What does u mean by Frequency?
2. Define Resonance?
3. What u meant by Progressive wave?
4. How many types of progressive waves are there?
5. Difference between transverse wave and longitudinal wave?
6. What u meant by standing wave?
7. In our experiment which type of wave passing along the thread?
8. In our experiment which type of wave passing along the thread?

Week 11:

1. What is the purpose of Capacitors ?
2. What the resistor will do?
3. What is the purpose of Inductors?
4. What is Time constant?
5. What is capacitance?
6. Define potential?
7. What u meant by capacity of a conductor?
8. What is the relation between charge "Q" and capacitor?

References:

1. S. Balasubramanian, M.N.Srinivasan "A Text Book of Practical Physics"-S Chand Publishers, 2017.
2. R.K. Shukla, Anchal Srivastava, Practical Physics, New age international (2011).
3. H.G.Jerrad and D.B. Mc Neil -Theoretical and Experimental Physics.
4. Roman Kezerashvili, Physics laboratory experiments: electricity, magnetism, optics, New York: Gurami Pub., (2003).
5. Y. Aparna and K. Venkateswararao, Engineering Physics–I and II, VGS Techno series.
6. J.R.G. Patnaik, "Physics Laboratory Manual, "Paramount book distributors.
7. S. Panigrahi and B. Mallick, Engineering Practical Physics, Cengage leaning, Delhi, 2015.

Weblinks:

1. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype
2. http:/www./iitk.vlab.co.in

Chairperson
Board of studies (Physics)

R24ES04 **IT Workshop Lab** **0 0 2 1**

(Common to All Branches)

Course Objectives:

1. To assemble and disassemble a computer.
2. To solve hardware and software problems.
3. To learn about Networking of computers and use Internet facility for Browsing and Searching.
4. To develop project documentation using MS word
5. To work with various productivity tools including Excel, PowerPoint.
6. To work with different online repositories such as GITHUB, AI CHATBOT.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs					Dok
		PO1	PO2	PO3	PS01	PS02	
R24ES04.1	Perform Hardware troubleshooting and Perform Hardware troubleshooting	2	3	3	3	2	L2, L3
R24ES04.2	Apply different way of hooking the PC on to the internet from home and Workplace.	3	2	2	2	3	L1, L2 L3
R24ES04.3	Design word documents by learning word processing and Create presentations by using different styles and using AI Tools-Chat GPT and GITHUB	2	3	3	2	3	L2, L3, L4

SYLLABUS

PC Hardware & Software Installation **9 Hours**

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the Block diagram of the CPU along with the configuration of each peripheral and submit it to your Instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab Instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab Instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. Lab instructor should verify the installation and follow it up with a Viva. **COs-CO1**

Internet &World Wide Web **6 Hours**

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students Should demonstrate to the instructor, how to access the websites and email. If there is no internet Connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN Proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to Use the search engines. A few topics would be given to the students for which they need to search On Google. This should be demonstrated to the instructors by the student. **COs-CO2**

MS WORD **6 Hours**

Task 1: Creating project abstract Features to be covered: -Formatting Styles, Inserting table, Bullets And Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 2: Creating a Newsletter: Features to be covered: - Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL **6 Hours**

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool; give the details of the four tasks and features that would be covered in Each. Using Excel – Accessing, overview of toolbars, saving excel files, using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, and auto Fill, Formatting Text**.**

Task 2: Calculating GPA -. Features to be covered: - Cell Referencing, Formulae in excel – Average, std. deviation, Charts, Renaming and Inserting worksheets, hyper linking, Count Function

POWER POINT **6 Hours**

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.**COs-CO3**

AI TOOLS – Chat GPT **6 Hours**

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model Responds. Try asking questions, starting conversations, or even providing incomplete sentences to See how the model completes them. Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to Brainstorm creative ideas Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Explore – GITHUB **6 Hours**

Task 1: Students should understand GITHUB and should possess accounts in it.

Task 2: Students should explore different repositories available in GITHUB and student should Create his/ her own simple repositories.

Task 3: Students should take simple experiments /presentations and upload them in their GITHUB Account.

Task 4: Students should understand how GITHUB Enterprise Cloud is used and also explore the GIT and GIT HUB resources. **COs-CO3**

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition

3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
6. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCOPress, Pearson Education, 3rd edition
7. "Microsoft Word 2021: A Beginner's Guide"by Steve Lambert.
8. "Excel 2021: A Comprehensive Guide"by Chris Benham.
9. "Microsoft PowerPoint 2021: A Beginner's Guide" by Steve Lambert
10. GITHUB Quick Start Tutorials

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Main_Page
2. https://edu.gcfglobal.org/en/office2007
3. https://www.w3schools.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)
L1	30
L2	20
L3	30
L4	20
Total (%)	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Identify Peripherals of a computer
2. Draw a Block Diagram of the CPU and explain the components along with the functions.
3. Explain the various steps in assembling and dissembling of the CPU.
4. Write the basic utilities used while creating a PowerPoint presentation.

L2: Understand

1. How to install windows operating system.
2. What are search engines and brief the advantages of search engines.
3. Explain the process of creating a project abstract.
4. Explain how to explore GITHUB resources

L3: Apply

1. Explain the process orientation and connectivity boot camp
2. Write the different formulae used while calculating GPA
3. Explain the insertion of various templates while creating power point presentations.
4. Discuss the format for customization your browser for effective searching and online etiquette

L4: Analysing

1. Analyze a structured approach to experiment with prompts.

2. Explore different repositories available in GITHUB.
3. "Imagine a world where every person is born with a unique, magical ability that reflects their deepest desire or fear. Describe a day in the life of a character who discovers that their ability is far more powerful and dangerous than they ever imagined. How does this revelation affect their relationships, their view of themselves, and their place in society?"

Chairperson
Board of Studies (CSE)

R24MEPC02 ENGINEERING MECHANICS LAB 0 0 3 1.5

Course Objectives:

- Verify the Law of Parallelogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyze the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel, Screw jack

Course Code	Course Outcomes	Mapping with POs and PSOs							
		PO1	PO2	PO3	PO4	PO6	PO7	PO12	PSO1
R24MEPC02.1	Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller and study the mechanical characterization.	3	3	2	2	2	1	1	2
R24MEPC02.2	Verify Law of Polygon of forces and Law of Moment using force polygon and bell crank	3	3	3	2	1	2	1	2
R24MEPC02.3	Determine the Centre of gravity and Moment of Inertia of different configurations.	3	3	3	2	1	2	1	2

List of Experiments

1. Verification of Law of Parallelogram of Forces. **COs: CO2**
2. Verification of Law of Triangle of Forces. **COs: CO2**
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table. **COs: CO2**
4. Determination of coefficient of Static and Rolling Frictions **COs: CO1**
5. Determination of Centre of Gravity of different shaped Plane Lamina. **COs: CO3**
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam **COs: CO2**
7. Study of the systems of pulleys and draw the free body diagram of the system. **COs: CO2**
8. Determine the acceleration due to gravity using a compound pendulum **COs: CO3**
9. Determine the Moment of Inertia of a Flywheel. **COs: CO3**
10. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever. **COs: CO2, CO3**
11. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency. **COs: CO1**
12. Develop a mini project on above experimental knowledge. **COs: CO1-CO3**

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

Board of Studies: Mechanical Engineering
Approved in BOS No: 01, 31st July, 2024
Approved in ACM No: 01

Sample Experiments

1. What is parallelogram law of forces?
2. Explain triangle law of forces?
3. What is the condition for equilibrium of a body under various concurrent and non-concurrent forces?
4. What do you mean by concurrent forces?
5. What are the reasons for the deviation in theoretical value and experimental value?
6. Why in general beam is supported by one hinge and one roller supports?
7. Define various types of supports and which type of support is used in this experiment?
8. Sketch various types of beams sections
9. What is limiting friction?
10. Define angle of repose, angle of friction and laws of friction
11. Define cone of friction.
12. Differentiate between static and dynamic friction.
13. Explain the theory of dry friction.
14. Does force of friction depends on area of contact surfaces?
15. List the practical application of this experiment?
16. Define machine, mechanical advantage, velocity ratio and efficiency?
17. What is self locking and state its mathematical condition.
18. Where is the Flywheel most commonly used? And what are its primary uses?
19. What is moment of inertia?
20. What is the formula for moment of inertia for hollow circular lamina about its centroidal axis?
21. Discuss moment of force?
22. Discuss varignon’s theorem?
23. What do you mean by principle of moment?

24. Define Static and Dynamics
25. What is the value of the first moment of area of about Centroid axis
26. Define stress and strain.
27. What is Hooke's Law?
28. What are the different types of stress?
29. Explain the concept of modulus of elasticity.
30. What is a shear force and bending moment?
31. Describe the procedure for determining the centre of gravity of a plane figure.
32. Explain the experimental setup for verifying the principle of moments.
33. How do you measure the moment of inertia of a flywheel?
34. Describe the method to find the Young's modulus of a material.
35. What are the common sources of error in a mechanics lab experiment?
36. How would you resolve a force into its components?
37. Describe the steps to solve a static equilibrium problem.
38. How can you determine the resultant of multiple forces acting at a point?
39. Explain how to draw the free body diagram of a structure.
40. What is the procedure to analyze a truss for internal forces?
41. What is the difference between mass and weight?
42. Define force.
43. What is a vector? Give examples.
44. Define scalar quantity. Give examples.
45. What are the fundamental units in the SI system?
46. What is meant by the term 'moment of force'?
47. Explain the principle of transmissibility of forces.
48. Explain the concept of work-energy principle.
49. What is impulse? How is it related to momentum?
50. Define and explain the principle of conservation of momentum.

Chairperson
Board of Studies (ME)

Code: R24MC02 NSS /NCC/ SCOUTS & GUIDES / COMMUNITY SERVICE 0 0 1 0.5

(Common to All branches of Engineering)

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

SYLLABUS

UNIT I: Orientation

General Orientation on NSS/NCC/ Scouts & Guides/ Community Service activities, career guidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II: Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.

UNIT III: Community Service

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

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Board of Studies : BS&H (Mathematics)
Approved in BoS No : 01, August, 2024
Approved in ACM No: 01

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., ―Introduction to Environmental Engineering‖, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R ―Introduction to Environmental Engineering and Science‖, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

Chairperson
Board of Studies (Mathematics)

R24BS10 NUMERICAL METHODS AND TRANSFORM TECHNIQUES 3 0 0 3
(Common to MECH and EEE)

Course Objectives:

1. To elucidate the different numerical methods to solve nonlinear algebraic equations.
2. To disseminate the use of different numerical techniques for carrying out numerical integration.
3. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs			Dok
		PO1	PO2	PO12	
R24BS10.1	Evaluate the approximate roots of polynomials and transcendental equations by different algorithms. Apply Newton's forward and backward interpolation and Lagrange's formulae for equal and unequal intervals.	2	2	1	L1,L2,L3
R24BS10.2	Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations.	2	2	1	L1,L2,L3
R24BS10.3	Apply the knowledge of Laplace transforms to solve differential equations.	2	2	1	L1,L2,L3
R24BS10.4	Compute the Fourier series of periodic signals.	2	2	1	L3,L4
R24BS10.5	Know and be able to apply integral expressions for the forward and inverse Fourier transforms to a range of non-periodic wave forms.	2	2	1	L4,L5

SYLLABUS

UNIT- I: Iterative Methods **10 hours**

Introduction- Solution of algebraic and transcendental equations: Bisection method-Secant method-Method of false position-Iteration method –Newton-Raphson method.

Interpolation: Newton's forward and backward formulae for interpolation-interpolation with unequal intervals-Lagrange's interpolation formula. **Cos-CO1**

Self-Learning Topic: Gauss's forward and backward interpolation formula

UNIT- II: Numerical Integration, Solution of ordinary differential equation with initial conditions: **10 hours**

Trapezoidal rule-Simson's $1/3^{rd}$ and $3/8^{th}$ rule-Solution of initial value problems by Taylor's series-

Picard's method of successive approximations-Euler's method – Runge-Kutta method (second and fourth order). **Cos-CO2**

Self-Learning Topic: Milne's Predictor and Corrector Method

UNIT- III: Laplace Transforms: 10 hours

Definition of Laplace transform-Laplace transform of standard functions- Properties of Laplace Transforms-Shifting theorems-Transforms of derivatives and integrals-Unit step function-Dirac's delta function-Inverse Laplace transforms-Convolution theorem (without proof)

Applications: Solving ordinary differential equations (initial value problems) and integral differential equation using Laplace transforms. **COs-CO3**

Self-Learning Topic: Solution of simultaneous differential equations by Laplace transforms.

UNIT- IV: Fourier series 10 hours

Introduction- Periodic functions- Fourier series of periodic functions-Dirchlet's conditions –Even and odd functions- Change of intervals-Half-range sine and cosine series. **COs-CO4**

Self-Learning Topic: Applications of Fourier series

UNIT- V: Fourier Transforms: 10 hours

Fourier integrals theorems (without proof)-Fourier sine and cosine integrals-Infinite Fourier transforms-Sine and cosine transforms-Properties-Inverse transforms-Convolution theorem (without proof)-Finite Fourier transforms- Parseval's identity for Fourier transforms(without proof). **COs-CO5**

Self-Learning Topic: Solve Partial differential equation by Fourier transform.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition
2. B.V.Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018, 10th Edition.
2. M.K.Jain,S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Compuation, New Age International Publication.

Board of Studies : Basic Science and Humanities (Mathematics)
Approved in BOS No: 01, 2nd August, 2024
Approved in ACM No: 01

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	10
L2	30	10
L3	40	30
L4	-	25

L5	-	25
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

UNIT 1

1. Find a real root of $xe^x = 3$ using Regula –Falsi method. (L1)
2. Using Newton Raphson method finds a real root of $\cos x = xe^x$ and correct to four decimal places. (L2)
3. Find a real root of the equation $x\log_{10} x = 1.2$ by Regula-Falsi method correct to four decimal Places (L2)
4. If $y(1) = -3, y(3) = 9, y(4) = 30, y(6) = 132$ find the $y(x)$ (L3)

UNIT 2

1. State Simson's 1/3 rule
2. Find $y(0.1)$ and$d$ $y(0.2)$ using Picard's method given that $\frac{dy}{dx} = x + y$ given that $y = 1$ when $x = 0$ (L 2)

3.

4. By RK method of second order find $y(0.1)$ and $y(0.2)$ given that $\frac{dy}{dx} = 1 - 2xy^2$, $y(0) = 1$. (L 2)
5. By Taylor's series method find $y(0.2)$ given that $\frac{dy}{dx} = 3x + y^2$, $y(0) = 1$. (L 2)
6. Find $y(0.1)$ given that $\frac{dy}{dx} = x^2 - y^2$, $y(0) = 1$. (L 3)

UNIT 3

1. Define Laplace transform (L1)
2. Find the Laplace transform of $f(t) = \begin{cases} t^2, 0 \le t < 2 \\ t-1, 2 \le t < 3 \\ 7, t \ge 3 \end{cases}$ L2
3. Solve the differential equation $(D^2 + 9)y = \sin t, y(0)1, y'(0) = 0$ L3

UNIT 4

1. Find the Half range cosine series of $f(x) = \begin{cases} 1 & 0 < x < 1 \\ -1 & 1 < x < 2 \end{cases}$ in $[0,2]$ L3
2. Find the Fourier series of $f(x) = \frac{1}{4}(\pi - x)^2$, $0 < x < 2\pi$

   Hence deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} \ldots = \frac{\pi^2}{6}$

(L4)

UNIT 5

1. State Parseval's identity L1

2. .Find the Fourier transform of $f(x)$ defined by $f(x)=\begin{cases} x & \text{if } 0<x<1 \\ 1-x & \text{if } 1<x<2 \\ 0 & \text{if } x<2 \end{cases}$

   (L2)

3. Find the Fourier cosine transform of $\frac{1}{1+x^2}$ (L3)

4. If the Fourier sine transform of $f(x)=\frac{1-\cos n\pi}{n^2\pi^2}(0\le x\le \pi)$, find $f(x)$

   (L4)

5. Find the Fourier transform of $f(x)=\begin{cases} 1-x^2, |x|\le 1 \\ 0, \quad |x|>1 \end{cases}$ L4

6. hence evaluate $\int_0^\infty \frac{x\cos x-\sin x}{x^3}\cos\frac{x}{2}dx$ L5

Chairperson
Board of Studies (Mathematics)

R24MEPC03 **Thermodynamics** **3 0 0 3**

(Mechanical Engineering)

Course Objectives:

1. Understand basic thermodynamic terms, types of systems, and how temperature is measured using the Zeroth Law.
2. Learn how energy is conserved and converted in engines, refrigerators, and other systems using the First and Second Laws.
3. Study different gas processes and understand how energy loss (entropy) affects system efficiency.
4. Learn how steam behaves during phase changes and compare engine cycles like Otto and Diesel.
5. Understand how refrigeration systems work, their components, and the role of refrigerants.

Course Code	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO11	PSO1	PSO2	PSO3	DOK
R24MEPC03.1	Understand and explain the basic concepts and laws of thermodynamics including systems, processes, and equilibrium.	3	2			2	1	1	1			L1
R24MEPC03.2	Apply the first and second laws of thermodynamics to various systems and understand limitations and efficiencies.	3	3			2		1	2		1	L2
R24MEPC03.3	Analyze different thermodynamic processes and compute work done; understand the concept of entropy and energy availability.	3	3		2	2		2	3	2	2	L3
R24MEPC04.4	Interpret steam tables and Mollier charts; evaluate the performance of air standard cycles like Otto, Diesel, and Dual.	3	2	2		2		2	3	2	3	L4
R24MEPC05.5	Describe the working of refrigeration and air conditioning systems and evaluate their performance using psychrometric principles.	2	2			3	2	2	3	2	2	L2

SYLLABUS

UNIT-I **12 Hours**

Fundamentals And Laws of Thermodynamics: Basic Concepts: System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility

Zeroth Law of Thermodynamics: Introduction, Zeroth law of thermodynamics, Reversible and

Irreversible Processes.

Applications: Thermometers, IC Engines, Thermo flask, Pis1ton Cylinder arrangement without valves. **CO's:CO1**

Self-Learning Topics: Non-Equilibrium Thermodynamics, Thermoeconomics & Sustainability, Thermodynamics of Modern Energy Systems

UNIT-II **14 Hours**

First Law of Thermodynamics: PMM-I, Joule's Experiment and applications. Limitations of the First Law–Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.

Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality

Applications: Nozzles, Diffusers, Turbines, Compressors, Refrigerators, Heat Pump and Heat Engines **CO's:CO2**

Self-Learning Topics: Statistical Thermodynamics, Thermodynamics of Real Substances, Thermodynamic Modeling and Simulation

UNIT-III **14 Hours**

Thermodynamic Processes on Gases: Types of thermodynamic processes Isochoric, Isobaric, Isothermal, Hyperbolic, Isentropic, Polytrophic and Throttling processes. Represent the processes on Pressure-Volume diagrams. Derive an expression for work done in isothermal process, polytropic process and isentropic process.

Entropy: Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

Applications: Refrigerators, gas turbines, air conditioning and cooling system **CO's:CO3**

Self-Learning Topics: Jet Engines & Gas Turbines, Chemical Thermodynamics, Thermodynamic Potential Applications

UNIT-IV **14 Hours**

Properties of Steam: Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations– Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables.

Air Standard Cycles: Otto, Diesel, Dual Combustion cycles- Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Applications: Steam Power Plants, Steam Engines, IC Engines. **CO's:CO4**

Self-Learning Topics: Energy Analysis and Energy Efficiency, Nano thermodynamics, Molecular

Thermodynamics, Non-Conventional Power Cycles

UNIT-V **12 Hours**

Introduction of Refrigeration: working of Air, Vapour compression, VCR system Components, COP Refrigerants.

Introduction of Air Conditioning: Psychrometric properties & processes–characterization of sensible and latent heat loads – load concepts of SHF

Applications: Refrigerators and Air Conditioners. **CO's:CO5**

Self-Learning Topics: Multi-Stage Vapour Compression Systems, Sub cooling and Superheating in VCR Systems, Advanced Psychrometric Chart Analysis, Smart HVAC Control and Automation

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Text Books:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009.

Reference Books:

1. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, 1995.
2. Y.A.Cengel & M.A.Boles ,Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.
3. P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.
4. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_ch01/preview
2. https://onlinecourses.nptel.ac.in/noc19_me56/preview
3. https://onlinecourses.swayam2.ac.in/nou23_me01/preview
4. https://www.classcentral.com/course/youtube-applied-thermodynamics-for-engineers-47448

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	--
L2	40	20
L3	30	40
L4	--	40
Total (%)	**100**	**100**

Sample Questions of Various Cognitive Levels

L1: Remember

1. Define a thermodynamic system and give two examples.
2. State the Zeroth Law of Thermodynamics. Why is it important?

3. Explain the classification of thermodynamic systems with suitable diagrams and examples
4. Differentiate between macroscopic and microscopic viewpoints in thermodynamics. Give suitable examples.
5. What is meant by a quasi-static process? How is it different from an irreversible process?

L2: Understand

1. What is PMM-I and why is it considered impossible?
2. State the limitations of the First Law of Thermodynamics.
3. Prove that Kelvin-Planck and Clausius statements are equivalent
4. What are the main components of a Vapour Compression Refrigeration (VCR) system?
5. Explain any two air conditioning processes using the psychrometric chart.

L3: Apply

1. What is the significance of the area under the curve in a P-V diagram for different processes, and how does it help in comparing work done?
2. Explain the limitations of using P-V diagrams alone to analyze complex thermodynamic processes. How can T-s diagrams complement this analysis?
3. Define availability and show how it can be used to quantify the loss due to irreversibility in a real process.
4. Write down all four Maxwell relations. Explain the physical significance of one of them in terms of measurable thermodynamic properties.
5. Discuss the role of Gibbs and Helmholtz functions in predicting equilibrium and spontaneity of processes, particularly in chemical and phase transformations.

L4: Analyze

1. Explain the significance of the Mollier diagram (h-s diagram) in steam turbine performance analysis. How is it used to estimate work output?
2. What is the dryness fraction of steam and how does it affect the performance of steam engines and turbines?
3. A pure substance undergoes phase transformation. With reference to the P-V and T-S diagrams, explain how properties like specific volume and entropy change from subcooled liquid to superheated vapor.
4. Derive the expression for thermal efficiency of an Otto cycle in terms of compression ratio. Then analyze how efficiency changes with increasing compression ratio.
5. Define mean effective pressure (MEP) and explain how it is used to compare performance between Otto, Diesel, and Dual cycles.

Chairperson
Board of Studies (ME)

R24MEPC04 **Mechanics of Solids** **3 0 0 3**

(Mechanical Engineering)

Course Objectives:

1. To find the stresses & deformations of a member due to axial loading under uniform and non-uniform conditions.
2. To interpret the variation of SF&BM indeterminate beam.
3. To analyze the structural members subjected to bending stress and shear loads.
4. To identify the slope and deflection for different support arrangements by different methods and shear stresses induced in circular shafts.
5. To analyze the stresses induced in thin and thick cylinders subjected to internal and external pressures and analyze the columns in stability point of view with different end conditions.

Course Code	Course Outcomes	Mapping with POs and PSOs						DoK
		PO1	PO2	PO3	PO4	PO5	PO11	
R24MEPC04.1	Find the stresses & deformations of a member due to axial loading under uniform and non- uniform conditions.	3	3	3	2	3	2	L1
R24MEPC04.2	Interpret the variation of SF&BM indeterminate beams	3	3	3	3	3	2	L2, L3
R24MEPC04.3	Analyze the structural members subjected to bending stress and shear loads.	3	3	3	3	3	2	L4, L5
R24MEPC04.4	Identify the slope and deflection for different support arrangements by different methods and shear stresses induced in circular shafts	3	3	3	3	3	2	L4, L6
R24MEPC04.5	Analyze the stresses induced in thin and thick cylinders subjected to internal and external pressures.	3	3	3	3	3	2	L3, L4

SYLLABUS

UNIT –I **16 Hours**

Simple Stresses & Strains : Elasticity and plasticity– Types of stresses &strains–Hooke's law – stress– strain diagram for mild steel –Working stress – Factor of safety– Lateral strain, Poisson's ratio and volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uni axial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic

constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings. **CO's: CO1**

Self Learning Topics*:* Advanced visualization of Mohr's circle using simulation tools Applications of strain energy in failure prediction

UNIT –II **16 Hours**

Shear Force And Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam. **CO's: CO2**

Self Learning Topics: Use of software like AutoCAD or SolidWorks for beam modeling, Interactive tools for understanding load distribution

UNIT –III **16 Hours**

Flexural Stresses : Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections. **CO's: CO3**

Self Learning Topics: Bending in composite and laminated beams,Concept of lateral-torsional buckling in beams

UNIT –IV **16 Hours**

Deflection of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, Statically indeterminate Beams and solution methods.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel. **CO's: CO4**

Self Learning Topics: Shaft design in electric vehicles or turbines, Material selection for shafts under torsion

UNIT –V **16 Hours**

Thin and Thick Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia and volume of thin cylinders – Riveted boiler shells – Thin spherical shells. Wire wound thin

cylinders. Lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

Columns: Buckling and Stability, Columns with Pinnedends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula **CO's: CO5**

Self Learning Topics: Burst testing of pressure vessels, Modern design standards for pressure vessels

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Text Books:

1. Strength of materials/GHRyder/McMillan publishers India Ltd
2. Mechanics of materials by Gere & Timeshenko

Reference Books:

1. Strength of Materials –By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani- Khanna Publishers
3. MechanicsofStructuresVol-III,byS.B.Junnarkar-CharotarPublishingHouse
4. Strength of Materials by S.Timshenko-D. VANNOSTRAND Company-PHI Publishers
5. Strength of Materials by Andrew Pytel and Ferdinond L.Singer Longman- Harpercollins College Division
6. Solid Mechanics, by Popov.
7. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

Web References:

1. http://nptel.ac.in/courses/112107147/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-001-mechanics-materials-i-fall-2006/
3. http://freevideolectures.com/Course/92/Mechanics-of-Solids
4. http://www.indiabix.com/mechanical-engineering/strength-of-materials/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	--
L2	30	10
L3	20	30
L4	10	30
L5	--	20

L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

Remember

1. Defineandexplainthefollowingterms:Shearforce,bendingmoment,shearforcediagramand bending moment diagram
2. Define the following terms: slope and deflection
3. Definetheterms:Elasticity,elasticlimit,Young'smodulusandmodulusofrigidity
4. Define the terms: Longitudinal strain, Lateral strain and poisons ratio
5. What do you understand by neutral axis, section modulus and moment of resistance?
6. What is Torsion? What are the assumptions made in the derivation of shear stress produced in a circular shaft subjected to torsion?
7. Definethincylinders.Namethestressessetupinathincylindersubjectedtointernalfluidpressure
8. Findanexpressionforthechangeinvolumeofathincylindricalshellsubjectedtointernalfluid

Understand

1. Deriveanexpressionbetweenmodulusofelasticityandmodulusofrigidity
2. Drawtheshearforceandbendingmomentdiagramforacantileveroflength'L'carryingapoint load 'W' at the free end
3. Explain clearly the different types of stresses and strains
4. Explain the different types of equilibrium equations
5. Show that for a rectangular section of the maximum shear tressis1.5timestheaveragestress
6. Explain Macaulay's method
7. Explain thin and thick cylinders

Apply

1. A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter 4 cm. the composite bar is then subjected to an axial pull of 45000 N. if the length of eachbarisequalto15cm,determine:i)the stresses in the rod and tube ii)load carried by each bar. Take E for steel is 2.1 x 10^5N /$mm^2$and for copper is 1.1 x 10^5N/mm^2
2. A rod 200cm long and of diameter 3.0cm is subjected to an axial pull of 30 kN. If the Young's modulus of the material of the rod is 2×104 N/mm^2, determine: (i)stress. (ii) Strain and (iii) the elongation of the rod.
3. Asimplysupportedbeamof10m longcarriesauniformlydistributedload2kN/m over entire

length and point loads 1kN and 2kN at distances 2m and 5m from the left support. Draw the sheer force and bending moment diagrams

4. A cast Iron beam has an I- section with top flange 80mm×40mm, web120mm×20mm and bottom flange 160mm×40mm.Iftensile stress is not to exceed 30 N/mm^2andcompressive stress90N/mm^2,what is the maximum uniformly distributed load the beam can carry over a simply supported span of 6m if the larger flange is in tension
5. Develop an expression for the slope and deflection of a beam subjected to uniform Bending moment
6. A thick cylinder of external and internal diameters of 300mm and 180mm is subjected to an internal pressure of 42 $N/mm^2$and external pressure 6 N/mm^2. Determine the stresses in the material. If the external pressure is doubled, what internal pressure can be maintained without exceeding the previously determined maximum stress?

Analyze

1. Two shafts of the same material and of same lengths are subjected to the same torque, if the first shaft is of a solid circular section and the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shafts
2. A timber beam of rectangular section is to support a load of 20kN uniformly distributed over a span of 3.6m when beam is simply supported. If the depth of the section is to be twice the breadth, and the stress in the timber is not to exceed 7 N/mm^2, find the dimension of the cross section
3. Distinguish between the following, giving due explanation (i) Stress and strain (ii) Force and stress and (iii) Tensile stress and compressive stress
4. Compare the weights of the two shafts if the maximum shear stress developed in the two shafts is equal. A solid circular shaft and a hollow circular shaft whose inside diameter is ¾ of the outside diameter, are of the same material, of equal lengths and are required to transmit a given torque.
5. Compareslopeanddeflectionofasimplysupportedbeamandcantileverbeam.
6. Compare circumferential and longitudinal strains

Chairperson
Board of Studies (ME)

R24MEPC05 Engineering Materials & Manufacturing Processes 3 0 0 3

(Mechanical Engineering)

Course Outcomes

1. Understand the Classification and Properties of Materials**.**
2. Understand and Apply Heat Treatment and Powder Metallurgy**.**
3. Analyze and Apply Casting Processes**.**
4. Understand and Evaluate Welding and Joining Processes**.**
5. Demonstrate Bulk Forming Techniques**.**

Course Code	Course Outcomes	PO1	PO8	PO9	PO10	PO11	PSO2	DOK
R24MEPC05.1	Classify and describe the microstructure and applications of steels, cast irons, copper, aluminum, and composites.	3	3	3	3	3	2	L1, L2
R24MEPC05.2	Explain and apply heat treatment and powder metallurgy processes.	3	3	3	3	3	2	L2, L3
R24MEPC05.3	Analyze the various casting methods and casting defect mechanisms.	3	3	3	3	3	2	L2, L3
R24MEPC05.4	Compare and evaluate different welding and joining techniques and their metallurgical effects.	3	3	3	3	3	2	L1,L2, L3
R24MEPC05.5	Demonstrate bulk forming techniques such as forging, rolling, extrusion, and drawing.	3	3	3	3	3	2	L2, L4

SYLLABUS

UNIT I: 16 Hours

Introduction to Engineering Materials: Classification of steels, along with the structure and characteristics of plain carbon steels and low alloy steels. Introduction to stainless steels, including their structure and properties.

Classification and properties of cast irons: white cast iron, malleable cast iron, grey cast iron-focusing on their structures and properties. Study of the structure, properties and applications of copper and its alloys, as well as aluminium and its alloys. Introduction to composite materials.

Self-Learning Topics: Classification of Steels, Copper & Alloys and Composites. **CO's: CO1**

UNIT II: 16 Hours

Heat treatment of Steels: Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, age hardening treatment, Cryogenic treatment.

Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization-Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering- Methods of manufacturing sintered parts. **CO's: CO2**

Self-Learning Topics: Heat Treatment Processes, Powder Metallurgy

UNIT III: **16 Hours**

Casting: Overview of the casting process, Steps involved in making a casting, Advantages and applications of casting.

Patterns and Pattern Making: Types of patterns – Materials used for patterns – Pattern allowances and their construction.

Molding and Cores: Molding processes – Different types of cores.

Gating and Risering: Principles of gating – Functions and design of risers – Casting design considerations.

Melting Methods and Furnaces: Various methods of melting – Types of furnaces.

Solidification and Defects: Solidification of castings – casting defects, their causes and remedies.

Special Casting Processes: Basic principles and industrial applications of special casting methods – Centrifugal casting, Die casting, Investment casting, and Shell molding. **CO's: CO3**

Self-Learning Topics: Casting Fundamentals, Patterns, Solidification & Defects and Special Casting.

UNIT – IV **16 Hours**

Welding: Classification of welding processes – Types of welded joints and their characteristics.

Gas Welding: Principles of gas welding – Types of flames and their applications – Oxy- cetylene gas cutting.

Arc Welding: Basic principles – characteristics – Submerged arc welding – TIG and MIG welding.

Solid-State and Advanced Welding Techniques: Resistance welding – Friction welding – Friction stir welding – Forge welding – Explosive welding – Thermit welding.

Joining Processes: Soldering and brazing.

Welding Metallurgy: Heat-affected zones – Pre-heating and post-heating techniques – Welding defects: causes and remedies. **CO's: CO4**

Self-Learning Topics: Welding Classification, Soldering & Brazing and Welding Metallurgy.

UNIT – V **16 Hours**

Bulk Forming: Plastic deformation in metals and alloys – Recovery, recrystallization, and grain growth.

Working Processes: Hot working and cold working – Strain hardening – Annealing. Bulk Forming Techniques:

- **Forging:** Types of forging – Common forging defects and their remedies.
- **Rolling:** Fundamentals of rolling – Types of rolling mills and rolled products – Rolling forces and power requirements.
- **Extrusion:** Characteristics of extrusion – Types of extrusion processes, including impact and hydrostatic extrusion.
- **Drawing Processes:** Wire drawing and tube drawing. **CO's: CO5**

Self-Learning Topics: Hot vs Cold Working, Forging, Rolling, Extrusion and Drawing.

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Text Books:

1. V. Raghavan, Elements of Materials Science, PHI Learning, 6th Edition, 2021
2. S.Kalpakjian, S R. Schmid, Manufacturing - Engineering and Technology, Pearson publications, 4th Edition, 2019
3. P.N.Rao, Manufacturing Technology –Foundry, Forming and Welding, McGrawHill Companies, Volume 1, 3rd Edition, 2021

Reference Books:

1. R.K. Rajput, Engineering Materials & Metallurgy", S. Chand Publications, 2nd Edition, 2020
2. O.P. Khanna, Welding Technology, Dhanpat Rai Publications, 22nd Edition, 2022
3. Amitabha Ghosh, and Ashok Kumar Mallik, Manufacturing Science, East West Press Private Ltd., 2nd Edition, 2020
4. H S Bava, Manufacturing Processes – II, Tata McGraw-Hill Publishing Company Limited, First Reprint, 2021

Web References:

1. https://nptel.ac.in/courses/112/
2. https://ocw.mit.edu/courses/materials-science-and-engineering/
3. https://www.asminternational.org/
4. https://www.twi-global.com/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	25	15
L2	40	35

L3	35	35
L4	-	15
Total (%)	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the main types of stainless steels?
2. Define annealing in heat treatment.
3. List the basic steps in the casting process.
4. What is MIG welding?
5. Name any two bulk forming processes.

L2: Understand

1. Differentiate between low alloy steel and plain carbon steel.
2. Explain the purpose of a riser in casting.
3. Describe the working principle of oxy-acetylene gas welding.
4. What is strain hardening, and when does it occur?
5. Discuss the structure and properties of Aluminium alloys.

L3: Apply

1. Select a suitable heat treatment for hardening cutting tools and justify your choice.
2. Choose the best casting process for manufacturing a hollow cylindrical pipe and explain.
3. Suggest a welding process suitable for joining thin aluminium sheets.
4. Identify a forging defect and suggest a practical method to avoid it.
5. Apply your knowledge to classify a given steel sample based on its carbon content.

L4: Analyze

1. Compare hot working and cold working processes based on grain structure and mechanical properties.
2. Analyze the effect of tempering on the hardness and toughness of steel.
3. Distinguish between TIG and MIG welding in terms of heat source and shielding.
4. Break down the causes of porosity in castings and how to prevent it.
5. Analyze the role of composite materials in reducing vehicle weight.

L5: Evaluate

1. Evaluate the suitability of powder metallurgy for producing aerospace components.
2. Assess the benefits and drawbacks of using grey cast iron in engine blocks.
3. Justify the use of cryogenic treatment in industrial applications.

4. Critically examine the importance of pre-heating in welding high carbon steels.
5. Recommend the most appropriate forming process for making a complex aluminum part, with reasons.

Chairperson
Board of Studies (ME)

R24MEPC06 **CAD/CAM** **3 0 0 3**

(Mechanical Engineering)

Course Objectives:

1. To understand the role of computers in industrial manufacturing and the basics of computer hardware, input/output devices, and computer graphics used in design documentation.
2. To learn the fundamentals of geometric modeling and gain hands-on knowledge of drafting and modeling systems for 2D and 3D design.
3. To understand the structure and working of CNC machine tools and develop skills in manual and computer-aided part programming.
4. To explore the concept of Group Technology, part classification, and computer-aided process planning for improving manufacturing productivity.
5. To study the components, layouts, and applications of Flexible Manufacturing Systems (FMS) and understand their role in modern automated production.

Course Code	Course Outcomes	PO1	PO3	PO5	PO11	PSO1	PSO2	DOK
R24MEPC06.1	To understand the role of computers in manufacturing and hardware components.	3	-	2	1	1	3	L1.L2
R24MEPC06.2	To apply computer graphics and geometric modeling in design and drafting.	-	3	3	1	-	3	L2,L3
R24MEPC06.3	To develop NC/CNC part programs using manual and computer-aided methods.	2	3	3	1	-	2	L3, L4
R24MEPC06.4	To analyze group technology, process planning.	-	2	2	2	3	-	L5
R24MEPC06.5	To learn how flexible manufacturing systems work**.**	1	3	3	2	2	2	L4,L5

SYLLABUS

UNIT – I **16 Hours**

Computers in industrial manufacturing, product cycle, design documentation, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal. **CO's: CO1**

Self-Learning Topics: Evolution of computers in industry, overview of the product life cycle in manufacturing, architecture and functions of CPU, RAM, ROM, 3D transformations

UNIT -II **14 Hours**

Geometric Modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

Drafting and Modeling Systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling. **CO's: CO2**

Self-Learning Topics: Fundamentals of geometric modeling, types of geometric models - wireframe, surface, solid

UNIT –III **14 Hours**

Part Programming for NC Machines: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, Numerical control codes, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Automatic tool changers, Adaptive Control. **CO's: CO3**

Self-Learning Topics: Introduction to NC and CNC machines, comparison between traditional and CNC machines

UNIT –IV **14 Hours**

Group Technology: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types. Machine cell design, Advantages of GT **CO's: CO4**

Self-Learning Topics: Concept of group technology (GT) in manufacturing, various part classification and coding systems

UNIT –V **14 Hours**

Flexible Manufacturing Systems: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, Advantages and applications. **CO's: CO5**

Self-Learning Topics: Overview of flexible manufacturing systems, components of an FMS – workstations

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Text Books:

1. Mikell P-Grover, Emory W. Zimmers, Jr., CAD/CAM –5th Edition 2008.
2. Ibrahim Zeid - CAD/CAM Theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2nd Edition, 1992.

3. Michael E. Mortenson, Geometric modeling, Industrial Press, 3rd Edition, 2006. 4. Koren, Computer Control of Manufacturing Systems, Tata McGraw-Hill Education, 2nd Edition, 2005.

References:

1. P.N Rao, CAD/CAM Principles & Applications, TMH, 2nd Edition, 2008.
2. Chennakesava R. Alavala, CAD/CAM: Concepts and Applications, PHI Learning Pvt. Ltd., 2nd Printing, 2008.
3. David F. Rogers, Mathematical Elements for Computer Graphics, McGraw-Hill, 2nd Edition, 1990.
4. Tien-Chien Chang, Richard A. Wysk, Hsu-Pin Wang, Computer-Aided Manufacturing, Pearson Prentice Hall, 3rd Edition, 2006.

Web References:

1. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
2. https://www.coursera.org/lecture/computer-aided-design/cad-overview-VaEjQ
3. https://www.tutorialspoint.com/numerical_control/index.htm
4. https://www.engineersgarage.com/flexible-manufacturing-systems/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	10	-
L2	30	20
L3	30	30
L4	20	30
L5	10	20
Total (%)	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define the term "Product Cycle" in manufacturing.
2. List any four types of input devices used in CAD/CAM systems.
3. What are the different types of memory used in computer systems?
4. Define Raster Scan in computer graphics.
5. List the basic geometric commands used in CAD systems.
6. What is CNC and DNC?
7. Mention the function of a Machining Center.

8. Name four components of Flexible Manufacturing Systems (FMS)

L2: Understand

1. Explain the role of input and output devices in industrial manufacturing.
2. Describe the coordinate system used in raster graphics.
3. Explain with a neat sketch the Product Cycle in Industrial Manufacturing.
4. Explain the need for geometric modeling in CAD.
5. Discuss the importance of coding and classification in Group Technology.
6. Describe the advantages of using FMS in production.
7. Describe how curve representation is used in geometric modeling.
8. Explain Production Flow Analysis with an example.
9. Discuss planning for FMS.

L3: Apply

1. Use geometric construction methods to model a simple mechanical part.
2. Apply transformation techniques to rotate a 3D object in CAD software.
3. Write a basic manual part program for drilling operation on a CNC machine.
4. Use display control commands to modify views in a CAD system.
5. Apply production flow analysis to identify part families.
6. Apply GT principles to design a machine cell.
7. Apply layout planning strategies for an FMS with 4 machines.

L4: Analyze

1. Analyze the structure of CNC machine tools and explain how each part contributes to machining.
2. Break down the process of part classification in Group Technology.
3. Examine different types of FMS layouts and their suitability for various manufacturing needs.
4. Compare wireframe and solid modeling techniques.
5. Differentiate between manual and computer-aided programming.
6. Analyze the impact of part classification in Group Technology
7. Differenciate curve and surface modeling in CAD.
8. Analyze how Computer Aided Process Planning (CAPP) improves process efficiency.

L5: Evaluate

1. Evaluate the effectiveness of computer-aided part programming over manual programming.
2. Judge the advantages and disadvantages of using automatic tool changers.
3. Assess the impact of adaptive control on CNC machining accuracy.
4. Justify the selection of a specific FMS layout for a job-shop environment.

5. Evaluate the pros and cons of Direct Numerical Control (DNC).
6. Justify the use of GT in a batch production environment

Chairperson
Board of Studies (ME)

R24MEPC07 **Mechanics of Solids and Material Science Lab** **0 0 3 1.5**
(Mechanical Engineering)

Course Objectives:

1. To familiarize the students on conducting various destructive tests for determining the strength of various materials under externally applied loads from the theoretical knowledge gained from Mechanics of Solids.
2. To familiarize the students on Material properties and their structures.

Course Code	Course Outcomes	Mapping with POs and PSOs							DoK
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	
R24MEPC07.1	Perform standard mechanical tests such as impact, hardness, deflection, and torsion tests	3	2	3	3	1	3	3	L1
R24MEPC07.2	Analyze and interpret data obtained from mechanical tests to determine material properties such as strength, ductility, toughness	3	2	3	3	1	3	3	L1 L2
R24MEPC07.3	Identify and evaluate the microstructures of ferrous and non-ferrous materials, including heat-treated steels, using metallographic techniques to understand structure-property relationships.	3	2	3	3	1	3	3	L1 L2

Cycle I: List of Experiments: Mechanics of Solids Lab

1. Tension test and Compression test on Springs **CO's: CO1**
2. Rockwell & Brinell hardness test of materials. **CO's: CO1**
3. Izod & Charpy impact tests. **CO's: CO1**
4. Deflection test on Cantilever and Simply Supported beams. **CO's: CO1**
5. Torsion test on Mild Steel bar. **CO's: CO1**
6. Tensile test on Mild steel rod. **CO's: CO2**
7. Compression test on Wooden cube. **CO's: CO2**

Cycle II: List of Experiments: Materials Science Lab

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al. **CO's: CO3**
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high– Carbon steels. **CO's: CO3**
3. Study of the Micro Structures of Cast Irons. **CO's: CO3**
4. Study of the Micro Structures of Non-Ferrous alloys. **CO's: CO3**
5. Study of the Micro structures of Heat-treated steels. **CO's: CO3**

6. Hardenability of steels by Jominy End Quench Test. **CO's: CO3**
7. To find out the hardness of various treated and untreated steels **CO's: CO3**

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

References/Manuals:

1. Text Book: Solid Mechanics by Kazimi.S.M.A, second revised Edition, Tata McGraw Hill Publishing Company Limited.
2. Laboratory Manual

Web References:

1. http://www.aboutcivil.org/strength-of-materials.html
2. http://www.learnerstv.com/Free-engineering-Video-lectures-ltv047-Page1.htm
3. https://www.esm.psu.edu/online
4. http://www.mathalino.com/reviewer/mechanics-and-strength-of-materials/mechanics-and-strength-of-materials

Sample Experiments

1. Explain the difference between tensile and compression tests.
2. Describe how the Rockwell and Brinell hardness tests differ in principle.
3. Summarize the importance of impact tests in material selection.
4. Explain how load and elongation data are used to draw a stress-strain curve.
5. Discuss why different materials show different impact energy values.
6. Interpret the result of a compression test on a wooden cube.
7. Describe the microstructure of annealed low-carbon steel.
8. Explain how heat treatment affects the grain structure of steel.
9. Compare the microstructure of cast iron with that of mild steel.
10. Conduct a tensile test on a mild steel rod and determine the yield strength.
11. Perform a torsion test on a mild steel bar and calculate the modulus of rigidity.
12. Measure the deflection of a simply supported beam using standard formulas.
13. Plot and analyze the stress-strain curve from a tensile test.
14. Determine the Brinell hardness number from given test data.
15. Use beam theory to calculate deflection and compare with observed values.
16. Prepare and observe the microstructure of a copper sample under a microscope.
17. Identify phases in a heat-treated steel sample using a metallurgical microscope.
18. Conduct the Jominy End Quench test and interpret the hardness variation along the length.

Chairperson
Board of Studies (ME)

R24MESC01 **Computer Aided Modelling Lab** **0 0 3 1.5**

(Mechanical Engineering)

Course Objectives:

1. To develop skills in 2D drafting
2. To gain proficiency in surface modeling techniques
3. To create and visualize mechanical assemblies

Course Code	Course Outcomes	Mapping with POs and PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
R24MESC01.1	Develop and interpret 2D orthographic and isometric drawings with appropriate dimensioning and tolerance standards.	3	2	2	1	3	2	3
R24MESC01.2	Create and manipulate 3D part models and complex surfaces using features such as pad, revolve, sweep, shell, Boolean operations, and surface modelling techniques.	3	2	2	2	3	2	3
R24MESC01.3	Perform assembly modelling of mechanical components and demonstrate proficiency in CAD data exchange formats like DXF and IGES.	3	2	3	2	3	3	3

Part- A:

The following contents to be done by any 3D software package:

1. **Part Modelling**: Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.
2. **Assembly drawings:** Any Seven of the following using solid model software
3. **Surface Modelling:** Generation of various Surfaces using surface modelling.

Part- B:

The following are to be done by any 2D software package:

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.

List of Experiments:

Part- A:

Solid Modelling:

Generate any four of the following components using any solid modelling software.

i. Generation of various Parts/assemblies of Oldham's coupling.
ii. Generation of various Parts/assemblies of Plummer Block.
iii. Generation of various Parts/assemblies of Helical Gear and Pinion.
iv. Generation of various Parts/assemblies of Lathe Tool Post.
v. Generation of various Parts/assemblies of Universal Coupling
vi. Generation of various Parts/assemblies of Quick Return Mechanism (eg. with worth)
vii. Generation of various Parts/assemblies of Knuckle joint.
viii. Generation of various Parts/assemblies of Lead Screw with Nut.
ix. Generation of various Parts/assemblies of Bushed Pin Type Flexible Coupling.
x. Generation of various Parts/assemblies of Screw Jack.
xi. Generation of various Parts/assemblies of Helical Suspension Spring with Guide Rod.

Surface Modelling:

Generate any four of the following components using any Surface Modelling software.

i. Generation of Aircraft Wing Surface by using surface modelling.
ii. Generation of Smartphone Back Cover by using surface modelling.
iii. Generation of Water bottle by using surface modelling.
iv. Generation of Chair by using surface modelling.
v. Generation of Jet Engine Inlet by using surface modelling.

Part- B:

Drafting:

Generate drafting of any four components of the above.

Text Books:

1. "CAD/CAM: Computer Aided Design and Manufacturing" by Mikel P. Groover and Emory W.Zimmers.

Reference Books:

1. "CATIA V5 Workbook" by Richard Cozzens

Board of Studies: Mechanical Engineering

Approved in BOS No: 02,13th May, 2025

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Sample Experiments:

1. Create orthographic projections **(**front, top, and side views) of a machine component such as a Oldham's coupling using any 2D CAD software**.**
2. Create a surface model of an aircraft wing and extract its 2D views.
3. Create a 3D model of a Knuckle joint using features like pad, revolve, and sweep.

4. Design a Universal Coupling using Boolean operations. Save and export the model using standard translators such as STEP or IGES.
5. Generate a chair using shell and sweep commands. Provide section views of your final model.
6. Assemble the parts of a Helical Gear and Pinion in 3D space and simulate the movement.
7. Create an exploded view of a Lathe Tool Post and annotate all parts.

Chairperson
Board of Studies (ME)

R24MEPC04 **Manufacturing Processes Lab** **0 0 3 1.5**

(Mechanical Engineering)

Course Objective:

1. Develop Proficiency in Pattern Making and Molding Processes
2. Gain Expertise in Welding and Joining Techniques
3. Understand and Apply Sheet Metal and Advanced Manufacturing Techniques

Course Code	Course Outcomes	Mapping with POs and PSOs					
		PO1	PO8	PO9	PO10	PO11	PSO2
R24MEPC04.1	Develop proficiency in pattern making and molding processes.	3	3	3	3	3	2
R24MEPC04.2	Gain expertise in welding and joining techniques.	3	3	3	3	3	2
R24MEPC04.3	Understand and apply sheet metal and advanced manufacturing techniques.	3	3	3	3	3	2

List of Experiments:

1. Design and making of pattern **CO's: CO1**
   a. Single piece pattern
   b. Split pattern
2. Mould preparation **CO's: CO1**
   a. Straight pipe
   b. Dumble
3. Gas cutting and welding **CO's: CO2**
4. Manual metal arc welding **CO's: CO2**
   a. Lap joint
   b. Butt joint
5. Injection Molding **CO's: CO2**
6. Blow Molding **CO's: CO2**
7. Simple models using sheet metal operations **CO's: CO3**
8. To weld using Spot welding machine **CO's: CO2**
9. To join using Brazing and Soldering **CO's: CO2**
10. Bending and other operations **CO's: CO3**
11. Deep drawing and extrusion operations. **CO's: CO3**
12. To make simple parts on a 3D printing machine **CO's: CO3**

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

References/Manuals:

1. Manufacturing Technology -Vol I- P.N. Rao- TMH
2. Laboratory Manual

Web References:

1. https://nptel.ac.in/courses/112/
2. https://www.asminternational.org/
3. https://www.twi-global.com/

Sample Experiments:

1. What are the key differences between a single-piece pattern and a split pattern?
2. How does the choice of pattern type affect the casting process?
3. Demonstrate how to design a split pattern for a cylindrical casting.
4. What materials are commonly used for preparing a straight pipe mould?
5. Explain the importance of venting in mould preparation.
6. Prepare a mould for casting a straight pipe using appropriate materials and techniques.
7. What is the principle behind gas cutting?
8. How does the heat generated in welding affect the material properties of the workpiece?
9. Perform a gas cutting operation on a mild steel plate.
10. What are the components of a lap joint in welding?
11. Describe the steps involved in preparing a butt joint for welding.
12. Weld a lap joint using manual metal arc welding on a mild steel plate.
13. What is the function of the injection unit in an injection molding machine?
14. How does the cooling rate affect the quality of the molded part?
15. Set up an injection molding machine to produce a simple plastic component.
16. What are the types of blow molding processes?
17. Explain the role of air pressure in the blow molding process.
18. Operate a blow molding machine to produce a hollow plastic bottle.
19. What are the basic sheet metal operations?
20. How does the thickness of the sheet metal influence the choice of operation?
21. Create a simple box model using cutting and bending operations on sheet metal.
22. What is the principle of spot welding?
23. How does the electrode pressure affect the weld quality in spot welding?
24. Perform a spot-welding operation to join two mild steel sheets.
25. What are the differences between brazing and soldering?

26. Explain the significance of flux in the brazing process.
27. Join two metal parts using the brazing technique
28. What are the types of bending operations?
29. How does the radius of the bend affect the material during bending?
30. Perform a U-bend operation on a mild steel strip using a bending machine.
31. What is the difference between deep drawing and extrusion?
32. Describe the factors that influence the success of a deep drawing operation.
33. Demonstrate a simple deep drawing process to form a cup shape from a metal sheet.
34. What are the common materials used in 3D printing?
35. How does layer height affect the resolution of a 3D printed object?
36. Create a simple 3D model using CAD software

Chairperson
Board of Studies (ME)

R24HS04 **Logical Reasoning and Corporate Skills** **0 0 2 1**
(Common to all UG programmes)

Course Objectives:

1. **Develop Logical thinking skills:** Students will be able to analyze information, identify patterns, and make informed decisions.
2. **Enhance analytical skills:** Students will be able to break down complex information into its component parts, analyze each part, and draw conclusions.
3. **Understand corporate culture and etiquette:** Students will be able to understand and demonstrate corporate culture and etiquette, including professional behaviour and networking.
4. **Develop effective communication skills:** Students will be able to communicate effectively in a corporate setting, including verbal and written communication.
5. **Develop negotiation and conflict resolution skills:** Students will be able to negotiate effectively and resolve conflicts in a corporate setting.
6. **Improve teamwork and collaboration skills:** Students will be able to work effectively in teams, build strong relationships, and manage conflicts.

At the end of the course, students will be able to:

Course Code	Course Outcome	PO1	PO7	PO9	P011	Dok
R24HS04.1	Use their logical thinking and analytical abilities to solve reasoning questions from number analogy and series and letter and coding and decoding based aptitude questions company specific and other competitive tests.	2	---	---	---	L4,L5
R24HS04.2	Solve questions related to Blood Relations clock and calendar, etc. From company specific and other competitive tests.	1	---	---	---	L4,L5
R24HS04.3	Enforce corporate etiquette, and precise usage of English grammar to enhance their professional communication.	---	2	3	1	L1,L3
R24HS04.4	Master negotiation skills and telephone etiquette with emotional intelligence for corporate interactions.	---	2	3	1	L3
R24HS04.5	Enhance email writing skills by incorporating vocabulary acquired from storytelling, situational dialogues and reading activities by using various digital tools.	2	---	3	1	L2,L3

SYLLABUS

UNIT I **15 Hours**

Number Series, Letter Series, Number analogy, letter analogy, word analogy. Coding Decoding-Letter to letter, letter to digit, letter to number and symbol, Word to word coding, odd man out. Directions-Finding distance, Direction and Shadow based problem, Blood Relations-Mixed Blood Relations, Puzzle-Based Blood Relation, Single-Person Blood Relation, Symbol based Blood Relations.

Self Learning Topic: Number Puzzles

UNIT II **15 Hours**

Clocks–finding Angle, Time, Mirror image, Faulty clock, Calendars – Finding day of the week, Number of odd days, Repetition of same calendar, Seating Arrangement-Circular arrangement, linear arrangement, Order Sequence and Ranking

Self Learning Topic: Arrangement puzzles

UNIT III **10 Hours**

Corporate Etiquette – Work Place Etiquette and Conflict Resolution – Grammar Revision, Leadership and Management skills. Verbal Ability: Prepositions, Articles, tenses and conjunction

Self Learning Topic: Successful Team Leadership

UNIT IV **10 Hours**

EQ – Negotiation Skills – Telephone Etiquette – MNCs Paper Model Introduction, Situational Dialogue Practice – Team Activities Related to Spoken
English Verbal Ability: Fill in the blanks (Based on the given appropriate words)

Self Learning Topic: Group Discussion Skills

UNIT V **10 Hours**

E Mail Writing–Vocabulary, Story Telling Activity, Functional English–IELTS Vocabulary News Paper Reading.
Verbal Ability: Sentence arrangements

Self Learning Topic: Sentence Construction

Board of Studies: MBA
Approved in BOS No: 02, 13th, April, 2025
Approved in ACM No: 02

Text Books:

1. A Modern Approach to Logical Reasoning R.S Aggarwal – S.chand publications.
2. Personality Development and Soft Skills by Barun K.mitra

Reference Books:

1. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical & Critical) for Competitive Exams Disha's publications
2. Communication by C.S.G Krishnamacharyulu & Lalitha Ramakrishnan–Himalaya publishing house

Web References:

1. https://faceprep.in/ logical reasoning
2. www.sawaal.com
3. http://nptel.ac.in/courses
4. www.prepinsta.com

Model Questions of Logical Reasoning & Corporate Skills

L1: Remember

1. What is the proper way to greet a client or colleague in a professional setting?
2. The book is _____ the table.
3. I'm going _____ the store to buy some milk.
4. If I _____ (know) the answer, I would tell you.
5. By next year, I _____ (study) English for five years.
6. If it _____ (rain), we would have stayed home.
7. I _____ (finish) my homework before I went to bed.

L2: Understand

1. What is your favorite childhood story? Why do you enjoy it?
2. Tell a story about a memorable experience from your life.
3. If you could tell a story to inspire others, what would it be about?
4. Rearrange the following sentences to form a coherent paragraph:
   A. The sun was setting over the ocean.
   B. The sound of the waves was soothing.
   C. We walked along the beach, enjoying the peaceful atmosphere.
   D. The smell of saltwater filled the air.
5. Put the following sentences in the correct order to tell a story:
   A. She packed her bags and said goodbye to her family.
   B. After a few months, she returned home with new experiences and stories.
   C. Emily had always wanted to travel abroad.
   D. She boarded a plane and took off for a new adventure.
6. Rearrange the following sentences to form a logical argument:
   A. Therefore, we should prioritize renewable energy sources.
   B. Fossil fuels are a finite resource and contribute to climate change.
   C. In conclusion, our reliance on fossil fuels is unsustainable.
   D. Renewable energy sources, on the other hand, are sustainable and environmentally friendly.

L3: Apply

1. What qualities do you think are essential for a good leader?
2. How would you motivate a team member who is struggling with their work?
3. Describe a time when you had to make a difficult decision as a leader.
4. The new policy aims to _____ the gap between the rich and the poor.
5. The company's _____ in the market has increased significantly over the past year.
6. The teacher asked the students to _____ their essays before submitting them.
7. The _____ of the new smart phone is its advanced camera system.
8. The company will _____ a new product line next quarter.

9. By the time I arrived, they _____ (eat) dinner.

L4: Analyzing

1. Complete the series: 2, 4, 8, and 16?
2. Find the next number: 1, 2, 4, 7, 11,?
3. Identify the pattern: 3, 6, 9, 12, ?
4. Complete the sequence: 5, 10, 15, 20, ?
5. Determine the next number: 2, 6, 12, 20, ?
6. Identify the pattern: B, D, F, H, ?
7. Complete the sequence: M, O, Q, S, ?
8. Determine the next letter: T, S, R, Q, ?
9. Complete the series: Monday, Tuesday, Wednesday, ?
10. Find the next word: January, February, March, ?
11. Determine the next word: Book, Magazine, Newspaper, ?
12. Find the odd one out: Apple, Banana, Carrot, Mango
13. Identify the odd one out: Football, Basketball, Tennis, Piano
14. Determine the odd one out: Car, Bus, Train, Book
15. Find the odd one out: Red, Blue, Green, Chair
16. Identify the odd one out: Dog, Cat, Elephant, House
17. What is the angle between the hour and minute hands of a clock at 3:15?
18. 1. What is the mirror image of the time 3:45?
19. 2. A person sees their mirror image and notices that their watch shows 9:30. What is the actual time?

L5: Evaluating

1. Five friends - A, B, C, D, and E - are sitting in a row. If A is at one end, B is next to A, and C is in the middle, who is sitting at the other end?
2. Seven people - A, B, C, D, E, F, and G - are sitting in a circle. If A is between B and C, and D is opposite A, who is sitting next to D?
3. If today is Monday, what day of the week will it be 30 days from now?
4. A meeting is scheduled for the 15th of March, which falls on a Wednesday. What day of the week will the 22nd of March be?
5. If you are facing north and turn 90 degrees to your right, which direction are you facing?
6. A person walks 5 km east and then 3 km west. How far is he from his starting point?
7. If you are facing south and walk 2 km, then turn left and walk 1 km, which direction are you facing?
8. A is the brother of B. C is the sister of A. How is B related to C?
9. A woman introduces a man as the son of her brother's father. How is the man related to the woman?
10. A man points to a woman and says, "She is the daughter of my mother's only child." How is the woman related to the man?

R24 MC03 **Environmental Science** **2 0 0 0**

(Common to all branches)

Course Objectives:

1. To make the students to get awareness on environment.
2. To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
3. To save earth from the inventions by the engineers.

SYLLABUS

UNIT I **6 Hours**

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems , Energy resources:

Self-Learning Topics: Food resources, World Food Problems.

UNIT II **7 Hours**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem. b. Aquatic ecosystem

Biodiversity and its Conservation : Introduction ,Definition, Values of biodiversity– India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity, Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Self-Learning Topics: Desert Ecosystem, Bio-Geographical Classification of India.

UNIT III **6 Hours**

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Self-Learning Topics : Cause, effects and control measures of :Marine Pollution,Thermal Pollution.

UNIT IV **6 Hours**

Social Issues and the Environment: From Unsustainable to Sustainable development Water conservation, rain water harvesting, – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate Changes: global warming, acid rain, ozone layer depletion. Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Wildlife Protection Act – Forest Conservation Act .

Self-Learning Topics: Water Shed Management, Water (Prevention and control of Pollution) Act

UNIT V **7 Hours**

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information

Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Board of Studies : Basic Science and Humanities Chemistry
Approved in BOS No: 05th, August, 2024
Approved in ACM No: 01

Text Books:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice Hall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

Sample Questions

Unit –I

1. Environmental Science is Multidisciplinary in nature .Justify?
2. Explain the difference between renewable and non-renewable resources.
3. Why forests are considered a critical natural resource?
4. Discuss the positive & negative impacts of Big Dams.
5. Explain the Scope and importance of Environmental Science.
6. Apply the idea of conservation to suggest ways a community can reduce its reliance on fossil fuels.

Unit-II

1. Explain how energy flows through an ecosystem.
2. Describe the role of producers, consumers, and decomposers in an ecosystem
3. Apply the concept of ecological succession to explain how a forest might develop after a wildfire.
4. Explain the Values of Bio-Diversity
5. Evaluate the effectiveness of protected areas in conserving biodiversity.

Unit-III

1. Explain how air pollution can impact human health.
2. Examine how deforestation contributes to both air and water pollution.
3. Explain how agricultural runoff contributes to water pollution.
4. Compare the effects of chemical pollutants versus biological pollutants on freshwater

ecosystems.

5. How can a municipality implement a successful recycling program to reduce the amount of waste sent to landfills?
6. What steps should a local government take to enhance resilience against floods in an urban area?

Unit-IV

1. Describe how sustainable development aims to balance economic growth, environmental protection, and social equity.
2. Explain how a rainwater harvesting system works from collection to storage.
3. How can a government design a resettlement program that minimizes disruption to affected communities?
4. What steps can individuals take to lower their personal contribution to global warming?
5. Discuss (i) Air (Prevention and Control of Pollution) Act (ii) Wildlife Protection Act

Unit-V

1. Explain how rapid population growth can impact natural resources.
2. Examine how population growth trends influence energy consumption and
3. Discuss possible solutions for sustainable energy use.
4. Evaluate the effectiveness of population control measures in addressing environmental issues in a specific country or region.
5. How can healthcare providers ensure that people at high risk for HIV are tested and receive appropriate prevention and care services?
6. Explain the concept of gender equality and its importance in women and child welfare.

7 Discuss the Role of information Technology in Environment and human health

Chairperson
Board of Studies (Chemistry)

R24BS09 COMPLEX VARIABLES AND STATISTICAL METHODS 3 0 0 3

(Common to MECH and EEE)

Course Objectives:

1. To familiarize the complex variables.
2. To familiarize the students with the foundations of probability and statistical methods.
3. To equip the students to solve application problems in their disciplines.

At the end of the course student will be able to:

Course Code	Course Outcomes	Mapping with POs			Dok
		PO1	PO2	PO12	
R24BS09.1	To obtain an analytic function for a given harmonic function using C-R equations.	2	2	1	L1, L2
R24BS09.2	Make use of the Cauchy residue theorem to evaluate certain integrals.	2	2	1	L1,L2
R24BS09.3	Apply the theoretical probability distributions like Binomial, Poisson, and normal in the relevant application areas.	2	2	1	L1,L2,L3
R24BS09.4	Analyze to test various hypotheses included in theory and types of errors for large samples.	2	2	1	L4
R24BS09.5	Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real-life problems.	2	2	1	L4,L5

SYLLABUS

UNIT- I: Functions of a complex variable and Complex integration: 10 hours

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates –Harmonic and conjugate harmonic functions – Milne –Thompson method. Complex integration: Line integral– Cauchy's integral theorem–Cauchy's integral formula. **COs-CO1**

Self- learning Topics: Evaluating contour integrals, Integration along a smooth path

UNIT- II: Series expansions and Residue Theorem: 10 hours

Radius of convergence –Expansion in Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated –Essential – Pole of order m –Residues–Residue theorem (without proof) and evaluation of real integrals of the form $\int_{-\infty}^{\infty} f(x)\,dx$, **COs-CO2**

Self- learning Topics: Approximating a function or data using a series of function is a fundamental tool for data analysis.

UNIT- III: Probability and Distributions: 10 hours

Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability Density function and Cumulative distribution functions – Mathematical Expectation and Variance –Binomial, Poisson,

Uniform and Normal distributions. **COs-CO3**

Self -learning Topics: To understand risk and return on investment.

UNIT-IV: **Sampling Theory:** **10 hours**

Introduction –Population and Samples–Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions– Introduction to t, χ^2 and F-distributions–Point and Interval estimations –Maximum error of estimate. **COs-CO4**

Self- learning Topics: Estimate health outcomes, behaviors and attitudes within a population.

UNIT- V: Tests of Hypothesis: **10 hours**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors –Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples)–Tests on proportions. **COs-CO5**

Self- learning Topics: Hypothesis Testing is employed to ensure product quality and process efficiency.

Textbooks:

1. **B.S.Grewal,** Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2017.
2. **Miller and Freund's,** Probability and Statistics for Engineers, Pearson, 7thedition, 2008.

Approved in BOS No: 01, 02 August, 2024 Mathematics

Approved in ACM No: 01

Internal Assessment Pattern

Cognitive Level	InternalAssessment#1(%)	InternalAssessment#2(%)
L1	30	10
L2	30	10
L3	40	30
L4	-	25
L5	-	25
Total(%)	**100**	**100**

Sample Questions based on cognitive levels

Unit 1

1) Show that $u(x,y)$ is harmonic in some domain and find a harmonic conjugate $v(x,y)$ When $u(x,y)=2x-x^3+3xy^2$. (L1)

2) Show that the function $f(z)=\sqrt{|xy|}$ is not analytic at the origin even though CR equations are satisfied. (L 1, L2)

3) 3) Find the analytic function $f(z)=u+iv$ if $u+v=\dfrac{2\sin 2x}{e^{2y}-e^{-2y}-2\cos 2x}$ (L 1)

4) If $f(z)=\begin{cases}\dfrac{x^3y(y-ix)}{x^6+y^2}, & z\neq 0\\ 0, & z=0\end{cases}$ prove that $\dfrac{f(z)-f(0)}{z}\to 0$ as $z\to 0$ along any radius vector but not as $z\to 0$ along the curve $y=ax^3$. (L1, L2)

Unit 2

Cauchy Integral formula

1) Use Cauchy's integral formula to calculate $\int_C \dfrac{\sin\pi z+\cos\pi z}{(z-1)(z-2)}dz$ where C is $|z|=4$. (L 3)

2) Evaluate $\int_C \dfrac{\sin^2 z}{\left(z-\frac{\pi}{6}\right)^3}dz$ where C is the circle $|z|=1$. (L 5)

3) Use Cauchy Integral formula to evaluate

4) $\int_C \dfrac{\cos\pi z^2}{(z-1)(z-2)}dz$ Where C is the curve $|z|=3$. (L 3)

Laurent series expansion

1) 1)Expand $f(z)=\dfrac{1}{[(z-1)(z-2)]}$ in the region:

(i) $|z|<1$ (ii) $1<|z|<2$ (iii) $|z|>2$ (L2)

2) Evaluate $\int_C \dfrac{z-3}{z^2+2z+5}dz$ where C is the circle

(i) $|z|=1$ (ii) $|z+1-i|=2$ (iii) $|z+1+i|=2$ (L2)

Unit 3

1) Define: (i) Binomial (ii) Poisson (iii) Uniform and (iv) Normal distributions. (L1)
2) State and prove Chebyshevs Inequality. (L3)
3) Fit the Poisson distribution for the following data (L3)

X	0	1	2	3	4	5
Y	147	147	74	25	6	1

Unit 4

1) Explain point and interval estimations. (L2)

2) Explain the types of errors in sampling. (L2)
3) A random sample of 125 teachers in a large metropolitan area revealed a mean weekly salary of Rs. 527 with a standard deviation Rs. 45. With what degree of confidence can we assert that the average weekly salary of all teachers in the metropolitan area is between 495 to 532? (L3)

Unit 5

1) Define: t, F and chai square test. (L1)

2) Write the test statistic for (L3)
   (i) The test of significance for single mean for the test of significance for single proportion and difference of means
3) Find the maximum difference that we can expect with probability 0.95 between the means of sample sizes 10 and 12 from normal population if their standard deviations are found to be 2 and 3 respectively. (L5)

Chairperson
Board of Studies (Mathematics)
Chairperson

R24MEPC09 **Fluid Mechanics & Hydraulic Machines** **3 0 0 3**

(Mechanical Engineering)

Course Objectives:

1. **Understand** the properties of fluids and principles of fluid statics and kinematics
2. **Apply** Bernoulli's and momentum equations to analyze practical fluid flow situations.
3. **Analyze** flow through pipes and evaluate jet impact on vanes in fluid machinery.
4. **Evaluate** performance parameters of hydraulic turbines and their components.
5. **Assess** and compare the performance of centrifugal and reciprocating pumps.

Course Code	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO9	PO10	PO11	PSO1	PSO2	DOK
R24MEPC09.1	Understand the fundamental properties of fluids and apply fluid statics principles to pressure measurement devices.	3	3	2	2	2	-	1	2	2	2	L1, L2
R24MEPC09.2	Analyze different fluid flow types using kinematic and dynamic equations including continuity, Bernoulli's and momentum equations.	3	3	3	2	3	-	1	2	3	3	L2, L3
R24MEPC09.3	Evaluate energy losses in pipe systems and the impact of fluid jets on different vane geometries.	3	3	3	2	3	-	-	2	3	3	L3
R24MEPC09.4	Illustrate the working principles and performance characteristics of impulse and reaction turbines along with their governing systems.	3	2	3	2	3	1	1	3	3	3	L3, L4
R24MEPC09.5	Compare the construction, operation, and performance of centrifugal and reciprocating pumps in various engineering applications.	3	2	3	2	3	1	1	3	3	3	L3, L4

SYLLABUS

UNIT-I **15 Hours**

Fluid statics: Physical properties of fluids: Specific mass, Specific weight, Specific Volume – Specific gravity, Viscosity, Surface tension & Capillarity, Vapour pressure and Compressibility – Pressure: Pascal's law, Hydrostatic law, Atmospheric Gauge and Vacuum pressure –Measurement of pressure, Pressure gauges – Manometers: Simple & Differential manometers.

Fluid Kinematics: Description of fluid flow: Path line, Streamline, Streak line, Stream tube, Velocity & Acceleration – Classification of fluid flows: Steady & Unsteady, Uniform & Non-

uniform, Rotational & Irrotational flows – Reynolds Experiment: Laminar & Turbulent flows - Continuity equation for 1D, 2D and 3D flows– Stream function, Velocity potential function and Flow net analysis.

Applications: Marine Ship Design, Pressure Measurement in Industrial Devices **CO's: CO1**

Self-Learning Topic: Fluid Statics Applications in Weather Forecasting and Oceanography.

UNIT-II **15 Hours**

Fluid dynamics: Surface and Body forces – Euler's and Bernoulli's equations for flow along a stream line for 3D flow – Momentum equation and its applications: Force on pipe bend– Flow between parallel plates, Flow through long tubes, Flow through inclined tubes.

Measurement of flow: Pitot tube, Venturi meter and Orifice meter, Flow nozzle and Turbine flow meter. **CO's: CO2**

Self-Learning Topic: Design and Optimization of Flow Measuring Devices in Aerospace and Automotive Applications.

UNIT-III **15 Hours**

Closed Conduit Flow: Darcy Weisbach equation – Minor losses in pipes: Pipes in series and pipes in parallel – Total energy line and Hydraulic gradient line

Basics of turbo machinery: Impact of jet on vanes: Impact of jet on Flat, Inclined & Curved vanes (Stationary & Movable), Impact of jet on series of curved vanes. **CO's: CO3**

Self-Learning Topic: Computational Fluid Dynamics (CFD) in Pipe Flow and Jet Systems

UNIT-IV **20 Hours**

Hydraulic Turbines: Classification of turbines: Impulse and Reaction turbines – Pelton Wheel, Franci's turbine and Kaplan turbine – working proportions, work done, efficiencies, hydraulic design – Draft tube: Theory, functions and efficiency

Performance of hydraulic turbines: Geometric similarity – Unit and Specific quantities – Characteristic curves – Governing of turbines – Selection of type of turbine – Cavitation –Surge tanks – Water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications. **CO's: CO4**

Self-Learning Topic: Modern Trends in Hydro Power and Smart Fluidic Control Systems

UNIT-V **10 Hours**

Centrifugal pumps: Classification, working, and work done – Manometric head– Losses and efficiencies – Specific speed – Pumps in series and parallel – Performance curves – NPSH.

Reciprocating pumps: Working, Discharge, Slip and indicator diagrams

Applications: Municipal Water Supply and Treatment Systems, Hydropower Plant Operations and Management, Industrial Fluid Handling Systems **CO's: CO5**

Self-Learning Topic: Pump Selection and Troubleshooting in Real-World Industrial Systems

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Text Books:

1. Hydraulics, Fluid Mechanics and Hydraulic Machinery, P.N.Modi, S.M.Seth, Standard Book House Publications.
2. Fluid Mechanics and Hydraulic Machines, R.K.Rajput, S.Chand Publications.

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering, D.S.Kumar, S.K.Kotaria& Sons Publications.
2. Fluid Mechanics and Machinery, D.Rama Durgaiah, NewAge Publications.
3. Hydraulic Machines,T.R.Banga, S.C.Sharma, Khanna Publications.
4. Instrumentation for Engineering Measurements, James W.Dally, WilliamE.Riley, John Wiley and Sons Publications.

Online Learning Resources:

- https://archive.nptel.ac.in/courses/112/105/112105206/
- https://archive.nptel.ac.in/courses/112/104/112104118/
- https://www.edx.org/learn/fluid-mechanics
- https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in
- www.coursera.org/learn/fluid-powerera

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	--
L2	40	30
L3	30	40
L4	--	30
Total (%)	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Convert a pressure of 2 bar into kPa and mm of Hg.
2. A fluid has a specific gravity of 0.85. Find its density and specific weight.
3. A manometer shows a height difference of 30 cm of mercury. What is the pressure in kPa?
4. Identify the type of turbine best suited for a head of 500 m.

5. A liquid has a viscosity of 0.01 Pa.s and flows at 25°C. Name the liquid.

L2: Understand

1. Explain with a diagram the variation of pressure in a fluid at rest.
2. Compare the velocity profiles of laminar and turbulent flows in pipes.
3. Draw and interpret the characteristic curves of centrifugal pumps.
4. Describe how a Venturimeter works and how flow rate is derived.
5. Explain the phenomenon of capillarity and how it affects pressure readings.

L3: Apply

1. A pipe of 200 mm diameter carries water at a velocity of 3 m/s. Calculate the discharge.
2. A Venturimeter is installed in a horizontal pipe carrying water. The inlet diameter is 100 mm, throat diameter is 50 mm, and pressure difference is 5 kPa. Find the discharge.
3. Calculate the pressure drop in a pipe 50 m long, 150 mm in diameter, with a flow velocity of 2 m/s. Take Darcy friction factor as 0.02.
4. Water flows over a flat plate 2 m long with a thickness of 0.1 mm. Compute shear stress assuming dynamic viscosity of 1×10^{-3} Pa.s.
5. Find the force exerted by a jet of water (diameter = 0.05 m, velocity = 20 m/s) on a stationary flat vertical plate.

L4: Analyze

1. A hydraulic system lifts a load of 500 kg using a piston of 100 mm diameter. Find the pressure required.
2. Analyze the energy loss due to sudden contraction in a pipeline. Given diameters and flow velocities.
3. A Pelton wheel receives water from a height of 250 m. Analyze the power developed if the flow rate is 2 m^3/s and efficiency is 85%.
4. Determine whether the flow in a pipe of 25 mm diameter and velocity 0.3 m/s is laminar or turbulent. Take $\nu = 1 \times 10^{-6}$ m^2/s.
5. A water hammer effect occurs in a 200 m pipeline. Analyze pressure rise if the valve is closed suddenly.

Chairperson
Board of Studies (ME)

R24MEPC10 **Theory of Machines** **3 0 0 3**

(Mechanical Engineering)

Course Objectives:

1. To introduce the fundamental concepts of mechanisms and machines, including types of kinematic pairs, constrained motion, and inversions, to build a strong foundation for analyzing motion systems.
2. To examine various lower pair mechanisms such as pantographs, straight-line motion mechanisms, steering systems, and Hooke's joints, and understand their kinematic behavior and practical relevance.
3. To develop the ability to perform velocity and acceleration analysis of planar mechanisms using graphical methods such as the relative velocity method and the instantaneous center method.
4. To impart knowledge on gyroscopic effects and turning moment diagrams, enabling analysis of dynamic behavior in rotating and reciprocating systems like vehicles and engines.
5. To explore the design principles and functional characteristics of higher pair mechanisms, including cams and governors, with a focus on motion programming and control.

Course Code	Course Outcome (CO)	PO1	PO2	PO3	PO4	DoK
R24MEPC10.1	Explain the basic types of mechanisms and their motion characteristics.	3	2	-	-	L1
R24MEPC10.2	Analyze and synthesize lower pair mechanisms (pantographs, straight-line, steering, Hooke's joint) for practical engineering applications.	3	3	2	1	L2, L3
R24MEPC10.3	Analyze cam profiles for various follower motions.	3	3	-	2	L3
R24MEPC10.4	Evaluate gyroscopic effects and interpret turning moment diagrams for various engines and vehicles.	3	2	-	2	L4
R24MEPC10.5	Design cam profiles for specified follower motions and compare governor types based on sensitivity and performance.	3	2	3	2	L5

SYLLABUS

UNIT-I **14 Hours**

Introduction of Mechanisms and Machines:

Mechanisms: Elements or Links, Classification, Rigid Link, flexible and fluid link, Types of kinematic pairs, sliding, turning, rolling, screw and spherical pairs lower and higher pairs, closed

and open pairs, constrained motion, completely, partially or successfully constrained and incompletely Constrained.

Machines: Mechanism and machines, classification of machines, kinematic chain inversion of mechanism, inversions of quadric cycle, chain, single and double slider crank chains.

Applications: Robotics (manipulator arm design), Automotive transmissions, Packaging machinery linkages **CO's: CO1**

Self-Learning Topics: History and evolution of mechanical linkages, Simulation tools for mechanism analysis (e.g., Working Model, ADAMS), Role of kinematic pairs in robotics

UNIT-II **14 Hours**

Lower Pairs: Pantograph – straight line motion mechanisms –Peaucellier mechanism (Exact St. Line) -Watt mechanism (Approximate St. Line). Steering Gear mechanisms -Condition for correct steering-Working principle of Davis & Ackerman's steering gear mechanisms**.** Hooke's joint: Ratio of shaft velocities – maximum and minimum speed of driven shaft – condition for equal speeds – Angular acceleration of driven shaft – Double Hooke's joint.

Applications: Mechanical linkages in drawing machines and plotters (Pantograph), Steering mechanisms in automobiles (Davis & Ackerman), universal joints in drive systems (e.g., in CV joints) **CO's: CO2**

Self-Learning Topics: Study of 3D kinematics and the application of lower pairs in robotics, Virtual simulation of Pantograph and Watt mechanisms

UNIT–III **12 Hours**

Velocity & Acceleration Analysis by Relative Velocity Method: Velocity and acceleration analysis of simple planar mechanisms, Angular velocity and angular acceleration of links, velocity of rubbing, Coriolis component of acceleration.

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's theorem, Determination of linear and angular velocity using instantaneous center method.

Applications: Automotive suspension design (velocity analysis of suspension systems), Robotics (velocity and acceleration analysis of robotic arms), Mechanical system optimization in manufacturing (e.g., conveyor systems) **CO's: CO3**

Self-Learning Topics: Study of advanced concepts in velocity and acceleration analysis, Real-world case studies: Analysis of machinery using relative velocity

UNIT–IV **12 Hours**

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as, aero planes and motor car.

Turning moment Diagrams: Single cylinder double acting steam engine, Four Stroke Cycle

Internal Combustion Engine, Multi-cylinder Engine, and Flywheel.

Applications: Gyroscopic stability in ships, aircraft, and satellites, Internal combustion engine design, Vibration analysis in machinery **CO's: CO4**

Self-Learning Topics: Detailed study of gyroscopic effects on aircraft stability using simulations, Exploration of turning moment diagrams and their relation to engine efficiency, Precession in space exploration and satellites

UNIT–V **10 Hours**

Cams: Types of cams, Types of followers, Follower displacement programming, Derivatives of follower Motion, Layout of cam profiles-knife edge and roller follower.

Governors: introduction, Watt Governor, Porter Governor**,** Proell Governor- Problematic

Applications: Engine valve timing systems, Automatic control systems, Manufacturing processes **CO's: CO5**

Self-Learning Topics: Exploring the design of cams and followers in cam profiles software, Study of governor systems in modern engine management systems, Simulation of cam mechanisms in automotive and industrial applications.

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Text Books:

1. Rattan S.S, "Theory of Machines" Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edition -2005.
2. Sadhu Singh, "Theory of Machines," Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2ND Edi. 2006.
3. Jagadish Lal, 'Theory of Machine', Dhanpat Rai Publications, New Delhi..

Reference Books:

1. Shigley. J. V. and Uickers, J.J., "Theory of Machines & Mechanisms" OXFORD University press.2004
2. "Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004

Web References:

1. http://archive.nptel.ac.in/courses/112/106/112106270/
2. http://www.youtube.com/watch?v=JQ5Elv36el4
3. http://onlinecourses.nptel.ac.in/noc24_me44/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1 (Remembering)	30	-
L2 (Understanding)	40	-
L3 (Applying)	30	30
L4 (Analyzing)	-	50
L5 (Evaluating)	-	20
Total	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

Short Answer Questions

Level-1: Remembering

1. Define a kinematic link and list its types.
2. What is a mechanism? How is it different from a machine?

Level-2: Understanding

1. Explain the difference between rigid, flexible, and fluid links.
2. Classify kinematic pairs with suitable examples.
3. What are the different types of constrained motion? Explain with examples.
4. Explain gyroscopic couple with an example.
5. Describe the effect of gyroscopic forces on an airplane.

Level-3: Applying

1. Construct the Peaucellier mechanism and describe its function.
2. Apply the condition for correct steering to Davis steering mechanism.
3. Show how Hooke's joint transmits motion between two shafts.
4. Calculate the angular velocity of a link in a given four-bar mechanism.
5. Determine the velocity of a slider in a slider-crank mechanism using the relative velocity method.
6. Apply Kennedy's theorem to locate the instantaneous centers of a planar mechanism.
7. Analyze the Coriolis component of acceleration in a reciprocating engine mechanism.
8. Examine the rubbing velocity between two turning links and its impact on mechanism performance.
9. Apply the concept of turning moment diagram to a single cylinder engine.
10. Determine the energy fluctuation in a flywheel using turning moment data.
11. Draw the cam profile for a knife-edge follower with uniform velocity motion.
12. Show the displacement diagram for a roller follower.

Level-4: Analyzing

1. Analyze the angular acceleration of the driven shaft in a Hooke's joint.
2. Compare Davis and Ackermann steering mechanisms in terms of geometry.
3. Show how Hooke's joint transmits motion between two shafts.
4. Analyze the gyroscopic effect on a vehicle negotiating a curve.
5. Analyze the motion of the follower for a tangent cam.
6. Compare the performance of Porter and Proell governors.

Level-5: Evaluating

1. Evaluate the effect of friction on the sensitivity of a governor.

Long Answer Questions

Level-1: Remembering

1. Describe various types of kinematic links and kinematic pairs with sketches.
2. Define mechanism and machine. Explain with examples how they are classified.

Level-2: Understanding

1. Explain different types of constrained motion with neat diagrams.
2. Discuss the inversions of four-bar chain and slider crank chain mechanisms.
3. Illustrate and explain different types of kinematic chains with real-world examples.
4. Explain the principle of precession and its application in mechanical systems.

Level-3: Applying

1. Design and explain a pantograph mechanism and its practical applications.
2. Apply the velocity ratio expression for a Hooke's joint with given data.
3. Perform a complete velocity and acceleration analysis for a given four-bar mechanism.
4. Use the instantaneous center method to determine the linear velocity of all points in a slider-crank mechanism
5. Construct a turning moment diagram for a four-stroke engine and analyze its features.
6. Apply the concept of flywheel design in regulating speed fluctuations.
7. Design a cam profile for a radial cam with specified follower motion.
8. Apply follower displacement equations to develop a cam layout.

Level-4: Analyzing

1. Analyze the working and condition for equal speed in a double Hooke's joint.
2. Differentiate and evaluate the practical performance of Peaucellier vs Watt mechanisms.
3. Investigate how improper geometry affects the steering in a Davis system.
4. Analyze a complex mechanism using the relative velocity and acceleration method,

identifying all acceleration components.

5. Evaluate the motion and forces acting on a slider in a high-speed crank-slider mechanism.
6. Investigate the effect of Coriolis acceleration in mechanisms involving reciprocating parts.
7. Analyze the stability of a motor car taking a turn considering gyroscopic forces.
8. Investigate the effect of varying torque in a multi-cylinder engine using turning moment diagrams
9. Analyze the motion and equilibrium of a Proell governor under dynamic conditions.
10. Investigate the influence of mass and geometry in the operation of a Porter governor.

Level-5: Evaluating

1. Evaluate different types of governors based on their sensitivity and stability under varying load conditions.

Chairperson
Board of Studies (ME)

R24MEPC11 **Machine Tools & Metrology (Mechanical Engineering)** **3 0 0 3**

Course Objectives:

1. To gain fundamental knowledge of machining processes.
2. To understand the principles of lathe, shaping, slotting and planning machines.
3. To demonstrate the principles of drilling, milling and boring processes.
4. To understand the concepts of finishing processes and the system of limits and fits.
5. To gain knowledge about the concepts of surface roughness and optical measuring instruments.

Course Code	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	DoK
R24MEPC11.1	Understand the fundamental machining and apply Principles and operation of lathe, drilling and Boring Machines	2	2	2	-	-	2	-	L2
R24MEPC11.2	Apply the principles of shaping, slotting planning, and milling machines.	-	-	-	3	-	2	-	L2
R24MEPC11.3	Analyze the concepts of finishing processes	3	-	3	3	-	-	3	L3, L4
R24MEPC11.4	Analyze the concepts of the system of limits and fits	-	3	-	-	3	-	3	L3, L4
R24MEPC11.5	Learn the concepts of surface roughness and optical measuring instruments	1	2	3	-	3	2	-	L5

UNIT-I

Rotary Machines **16 Hours**

Elementary treatment of metal cutting theory – element of cutting process – Types of cutting tool, Geometry of Single point cutting tools. Chip formation and types of chips.

Lathe: Introduction- types of lathe - Engine lathe – principle of working - construction - specification of lathe - work holders and tool holders – accessories and attachments – lathe operations – taper turning methods and thread cutting – drilling on lathes – cutting speed and feed-depth of cut.

Drilling and Boring Machines: Introduction – construction of drilling machines – types of drilling machines - principles of working – specifications- types of drills – geometry of twist drill - operations performed –cutting speed and feed – machining time calculations - Boring Machines –

fine Boring Machines – jig boring machines - deep hole Drilling Machines **CO's: CO1**

Self Learning Topics: Cutting speed, feed and depth of cut- rotary machines

UNIT-II **16 Hours**

Reciprocating Machines Shaping, Slotting and Planning Machines: Introduction - principle of working – principle parts – specifications - operations performed - slider crank mechanism - machining time calculations.

Milling Machines:

Introduction - principle of working – specifications – milling methods - classification of Milling Machines –types of cutters - geometry of milling cutters – methods of indexing, accessories to milling machines - cutting speed and feed – machining time calculations **CO's: CO2**

Self Learning Topics: Cutting speed, feed and depth of cut- reciprocating machines

UNIT–III

Finishing Processes: **16 Hours**

Introduction, Construction and working, Classification- cylindrical and surface grinders, tool and cutter grinders, Abrasives, Bonds and bonding processes, Specification and selection of a grinding wheel, Honing, Lapping, Broaching & Polishing, Buffing, Super finishing and burnishing operations- comparison to grinding. **CO's: CO3**

Self Learning Topic: Comparing of Finishing Processes

UNIT–IV

Limits, Fits and Tolerances: **16 Hours**

Introduction, nominal size, tolerance, limits, deviations, different types of fits -Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, deterministic & statistical tolerances, selective assembly- International standard system of tolerances, selection of limits and tolerances for correct functioning, simple problems related to limits and fits, Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges – inspection of gauges. Measurement of angles using Bevel protractor and Sine bar. Measurement of flatness using straight edges, surface plates. **CO's: CO4**

Self Learning Topics: Performance on linear measurements using Vernier Calliper and angular measurement of given specimen by using Vernier bevel protractor and sine bar

UNIT–V **16 Hours**

Surface Roughness Measurement: Differences between surface roughness and surface waviness – Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, simple problems - method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish. Machine Tool Alignment Tests on lathe, milling and drilling machines. Coordinate

Measuring Machines: Types and Applications of CMM.

Optical Measuring Instruments: Tools maker's microscope, Autocollimators, Optical projector, Optical flats-working principle, construction, merits, demerits and their uses. Optical comparators.

CO's: CO5

Self Learning Topics: Measurement of thread parameters using Optical Projector, Surface roughness using Talysurf and Alignment test on lathe.

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Text Books:

1. Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition, 2013
2. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill, 2019
3. Engineering Metrology – R.K. Jain/Khanna Publishers, 2022
4. B. S Raghuwanshi, Workshop Technology Vol-II, Dhanpatrai & Co., 11th Edition, 2013

References:

1. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A. Knight / Taylor & Francis
2. Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).
3. Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers
4. Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/ TMH
5. Manufacturing Processes for Engineering Materials-Kalpak Jian S & Steven R Schmid /Pearson Publications 5th Edition

Web References:

1. https://nptel.ac.in/courses/112106179
2. https://onlinecourses.nptel.ac.in/noc24_me99/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L2 (Understanding)	50	-
L3 (Applying)	30	20
L4 (Analyzing)	20	40
L5 (Evaluating)	-	40

Total	**100**	**100**

Sample Questions of Various Cognitive Levels

Understanding (L2)

1. Describe the mechanism of metal cutting
2. Differentiate between orthogonal and oblique cutting
3. Discuss various operations performed on lathe machine
4. Explain working of shaper, slotter and planer
5. Explain the quick return mechanism used in shaper, slotter and planer
6. Describe the various drilling and boring machines
7. Explain working of various milling machines
8. Describe the working of various grinding machines
9. Explain working and applications of lapping and honing process
10. Explain fits & tolerances and employ plug and ring gauges for dimensional inspections
11. Discuss the use of slip gauges, dial test indicator, and angle gauges
12. Describe Auto collimator, Tool maker's microscope and N.P.L. Flatness interferometer
13. Explain numerical assessment of surface finish for different surface texture using Talysurf surface meter
14. Explain measurement of effective diameter, angle of thread and thread pitch
15. Describe measurement of gear elements and generate gear tooth profile

Applying (L3)

1. Determine the cutting speed and machining time per cut when the work having 40 mm diameter is
2. Rotated at 300 rpm. The feed given is 0.1mm/rev and length of cut is 65mm
3. A C.I. plate measuring 300mm×100mm×40mm is to be rough shaped along its wider face. Calculate the machining time take approach = 25mm; over travel = 25mm; cutting speed = 12m/min; return speed = 20m/min; allowance on either side of the plate width = 5mm and feed per cycle = 1 mm.
4. Determine limit dimensions for a clearance fit between mating parts of diameter 40 mm, providing a minimum clearance of 0.10 mm with a tolerance on the hole equal to 0.025mm and on shaft 0.05mm using both systems.
5. Design the general type GO gauges and NOGO gauges for components having 20H7/f8 fit. Given Gauge tolerance =work tolerance =10% of work tolerance. Assume the data following: Upper deviation of shaft 'f' is -5.5D0.41 , The standard tolerance unit i=0.45 D1/3+0.001D , where D is the geometric mean of the lower and upper limits of diameter

step in which the diameter consideration lies. D is in mm. 20mm falls in diameter steps of 18-30mm. The standard tolerance for IT7=16i and IT8=25i

6. In the measurement of surface roughness, heights of 20 successive peaks and troughs were measured from a datum and were 35, 25, 40, 22, 35, 18, 42, 25, 35, 22, 36, 18, 42, 22, 32, 21, 37, 18, 35 and 20 microns. If these measurements were obtained over a length of 20 mm. determine the CLA and RMS value of the rough surface.

Analyzing (L4)

1. Distinguish between various taper turning methods and evaluate which method is most suitable for long tapers
2. Compare the effectiveness of various thread cutting methods on a lathe in terms of accuracy and efficiency
3. Analyze the relationship between cutting speed, feed, and depth of cut, and how they influence surface finish and tool life
4. Break down the construction of a typical engine lathe and explain the function of each major part
5. Analyze the impact of twist drill geometry (point angle, helix angle, lip relief angle) on drilling performance and accuracy
6. Classify the various types of drilling machines based on their construction and application scope
7. Analyze the advantages and limitations of jig boring machines compared to conventional boring machines
8. Compare the constructional features and applications of fine boring machines and deep hole drilling machines.
9. Compare the working principles and applications of shaping, slotting, and planning machines.
10. Differentiate between horizontal and vertical slotting machines based on their construction and use-cases
11. Break down the various components of a shaping machine and explain the function of each part.
12. Classify the operations performed on shaping machines based on the direction and nature of cutting
13. Analyze the factors affecting machining time calculation in slotting and shaping machines.
14. Compare the up milling and down milling methods in terms of chip formation, surface finish, and tool life.

15. Analyze how the geometry of milling cutters (rake angle, clearance angle, helix angle) influences cutting efficiency.
16. Distinguish between various milling machines (horizontal, vertical, universal, CNC) based on their construction and capabilities.
17. Compare the functionality and application of different types of milling cutters (e.g., slab, face, side-and-face, form).
18. Evaluate the steps required to calculate machining time for a given milling operation and the variables that influence it.
19. Compare and contrast the construction and working principles of cylindrical grinders and surface grinders.
20. Analyze the differences in tool design and application between a tool and cutter grinder and a universal cylindrical grinder.
21. Distinguish between various abrasive materials (e.g., aluminum oxide, silicon carbide, CBN, diamond) based on their properties and applications.
22. Break down the components of a grinding wheel and explain how each part (abrasive, bond, grade, structure) affects performance
23. Analyze the factors that go into the selection of a grinding wheel for a specific material and operation.
24. Compare honing and lapping processes in terms of accuracy, surface finish, and typical applications
25. Distinguish between polishing, buffing, and burnishing with respect to their tools, abrasives, and resulting surface finishes.
26. Analyze why superfinishing operations are sometimes preferred over grinding for certain high-precision applications, despite slower material removal rates.
27. Compare and contrast the hole basis system and shaft basis system in terms of manufacturing ease and part interchangeability.
28. Analyze how the unilateral and bilateral tolerance systems affect the manufacturing process and inspection strategy.
29. Break down the different types of fits (clearance, interference, and transition) and explain how each affects assembly and function
30. Analyze how Taylor's Principle governs the design of Go and No-Go gauges and improves quality control.
31. Classify the various types of gauges (plug, ring, snap, taper, profile, position, gap), and explain their specific applications
32. Compare the Bevel Protractor and the Sine Bar in terms of precision and typical angle

measurement scenarios

33. Differentiate between surface roughness and surface waviness with respect to their causes, measurement, and implications in functional performance.
34. Compare the measurement techniques of Profilograph and Talysurf, highlighting their construction, working principles, and limitations.
35. Break down a typical surface finish profile and explain how numerical values (e.g., Ra vs Rz) provide insight into process control.
36. Examine the procedures involved in performing a machine tool alignment test, and identify the instruments typically used.
37. Distinguish between the different types of CMMs (manual, DCC, portable, bridge type) in terms of design, applications, and accuracy.
38. Compare the working principles, accuracy, and applications of a toolmaker's microscope and an autocollimator
39. Evaluate the effectiveness of optical comparators in comparison to electronic and mechanical comparators.

Creating (L6)

1. Design a Go and No-Go gauge for a shaft with given tolerance values using Taylor's principle.
2. Create a comparison chart of different surface roughness parameters (Ra, Rz, RMS, Rt) including definitions, formulas, and application scenarios.

Chairperson
Board of Studies (ME)

R24HS03 Universal Human Values-Understanding Harmony & Human Ethical Conduct

(Common to CSE, CSE (DS), CSE (AI&ML), ECE, EEE, ME) **2 0 0 2**

Course Objectives:

The main objectives of the course are to:

- To enable students to recognize the vital connection between **values and skills**, emphasizing how their integration leads to lasting happiness and prosperity core aspirations shared by all human beings.
- To guide students in developing a **holistic outlook on life and profession** grounded in a deep understanding of human nature and existence. This perspective supports the cultivation of **Universal Human Values** and encourages a natural transition toward **value-based living**.
- To illustrate the practical outcomes of a holistic understanding, particularly in fostering **ethical behavior**, **trust-based and fulfilling relationships**, and **harmonious interaction with nature**.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs & PSOs											DoK
		PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	
R24HS03.1	Develop an understanding of human values.	2	2	-	-	2	3	3	2	2	-	3	L1, L2
R24HS03.2	Achieve harmony within self and body.	2	-	-	-	-	3	3	2	-	-	3	L2, L3
R24HS03.3	Build trustful and respectful relationships.	2	-	-	2	3	2	3	3	3	-	3	L3, L4
R24HS03.4	Understand harmony in nature.	2	2	-	-	-	3	3	2	2	-	3	L4, L5
R24HS03.5	Practice ethical and value-based living.	2	2	-	-	2	2	3	2	2	-	3	L5, L6

SYLLABUS

Unit I: Introduction to Value Education (6 lectures and three tutorials for practice session)

Lecture 1: Introduction to Human Development – Physical, Emotional, and Intellectual Dimensions

Lecture 2: Core Concepts of Value Education in Contemporary Society

Tutorial 1: Practice Session PS1 – Reflective Sharing on Life Values and Personal Experiences

Lecture 3: Self-awareness and Self-exploration: Tools for Inner Clarity

Lecture 4: Aspirations of the Human Being – Joy, Fulfillment, and Meaning

Tutorial 2: Practice Session PS2 – Exploring Self-awareness and Emotional Intelligence

Lecture 5: Challenges to Human Fulfillment in Modern Life

Lecture 6: Mindfulness and Ethical Decision-Making as a Path to Human Aspiration Fulfillment

Tutorial 3: Practice Session PS3 – Identifying Personal Ethical Dilemmas and Responses **CO's CO1**

Self-Learning Concepts: Explore how education influences the development of core human values, the significance of emotional intelligence in personal growth, the role of mindfulness in enhancing self-awareness, the impact of consumerism and modern lifestyle on ethical choices, and reflect on one's own aspirations and value system – all of which build a foundation for inner development.

Unit II: Harmony in the Human Being (6 lectures and three tutorials for practice session)

Lecture 7: Human Being: Alignment of Thoughts, Emotions, and Actions

Lecture 8: Needs and Desires: Distinguishing Between Essentials and Superfluous

Tutorial 4: Practice Session PS4 – Mind Mapping Personal Needs and Desires

Lecture 9: The Role of Body, Mind, and Consciousness in Well-being

Lecture 10: Cultivating Harmony within the Self – Practices and Techniques

Tutorial 5: Practice Session PS5 – Journaling: Tracking Inner Conflicts and Clarity

Lecture 11: Body Awareness and Physical Well-being Practices (Yoga/Meditation)

Lecture 12: Sustainable Self-Regulation and Lifestyle Choices for Health

Tutorial 6: Practice Session PS6 – Wellness and Lifestyle Assessment Activity **CO's-CO2**

Self-Learning Concepts: Understand the benefits of journaling for emotional and mental clarity, examine the relationship between diet, exercise, and mental well-being, explore how to identify and manage sources of stress, study the scientific basis of meditation and mindfulness, and create a personalized routine for achieving physical and emotional balance – fostering harmony within the self.

Unit III: Harmony in the Family and Society (6 lectures and three tutorials for practice session)

Lecture 13: Foundations of Healthy Relationships – Emotional and Ethical Dimensions

Lecture 14: Cultivating Trust and Empathy in Family and Social Contexts

Tutorial 7: Practice Session PS7 – Role-play on Building Trust in Relationships

Lecture 15: Respect and Empathy – Cornerstones of Human Interaction

Tutorial 8: Practice Session PS8 – Group Activity: Expressing Respect in Conversations

Lecture 16: Conflict Resolution and Emotional Safety in Social Interaction

Lecture 17: Principles of Ethical Leadership and Community Engagement

Lecture 18: Global Citizenship and Social Justice in the Modern World

Tutorial 9: Practice Session PS9 – Simulation: Creating a Model Ethical Society **CO's-CO3**

Self-Learning Concepts: Learn how to practice active listening and empathy, recognize and overcome personal biases in relationships, analyze inspiring examples of ethical leadership and community service, understand the concept of emotional safety in interpersonal dynamics, and explore the role of volunteerism in building a responsible and connected society – enhancing harmony in relationships and the social fabric.

Unit IV: Harmony in the Nature/Existence (4 lectures and two tutorials for practice session)

Lecture 19: Ecological Intelligence and Human-Nature Relationship

Lecture 20: Sustainability and Resource Responsibility – A Human Imperative

Tutorial 10: Practice Session PS10 – Case Study: Local Environmental Issue & Action Plan

Lecture 21: Systems Thinking – Viewing Nature as an Interconnected Whole

Lecture 22: Eco-Spirituality and the Harmony of Existence

Tutorial 11: Practice Session PS11 – Nature Walk + Reflection on Human-Nature Coexistence

CO's-CO4

Self-Learning Concepts: Study the principles of minimalism as a lifestyle for environmental consciousness, calculate and reduce your carbon footprint, compare environmental issues in urban and rural areas, explore sustainable agriculture and local food movements, and research the involvement of youth in global climate action – deepening your understanding of harmony with nature.

Unit V: Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and tutorials for practice session)

Lecture 23: Personal Integrity and Professional Ethics – Building the Link

Lecture 24: Ethics in the Digital Age – Responsibility and Cyber Citizenship

Tutorial 12: Practice Session PS12 – Case Analysis: Ethical Dilemma in Technology Use

Lecture 25: Humanistic Leadership and Social Entrepreneurship

Lecture 26: Corporate Social Responsibility and Sustainable Business Models

Tutorial 13: Practice Session PS13 – Designing a Value-based Startup Idea

Lecture 27: Innovation with Purpose: Case Studies in Ethical Innovation

Lecture 28: Life Planning and Career Pathways Anchored in Values

Tutorial 14: Practice Session PS14 – Action Plan: Aligning Career with Core Human Values

CO's-CO5

Self-Learning Concepts: Explore ethical concerns in the digital age such as data privacy and responsible AI use, understand the concept of human-centered design in business, study successful examples of green and socially responsible enterprises, formulate your own personal code of ethics, and analyze real-life ethical dilemmas encountered in the workplace – promoting value-based professionalism and ethical living.

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference between the Needs of the self and body

PS5 Exploring Sources of Imagination in the Self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to Fulfill Human Goals

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Board of Studies: Master of Business Administration
Approved in BoS No: 02, 13th May, 2025
Approved in ACM No: 02

Text Book and Teachers Manual

1. **R R Gaur, R Asthana, G P Bagaria**, A Foundation Course in Human Values and Professional
2. Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 **R R Gaur, R Asthana, G P Bagaria**, Teachers' Manual for A Foundation Course in Human
3. Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. **JeevanVidya: EkParichaya**, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. **Human Values, A.N. Tripathi**, New Age Intl. Publishers, New Delhi, 2004.
3. **The Story of Stuff** (Book).
4. **The Story of My Experiments with Truth** - by Mohandas Karamchand Gandhi
5. **Small is Beautiful** - E. F Schumacher.
6. **Slow is Beautiful** - Cecile Andrews
7. **Economy of Permanence** - J C Kumarappa
8. **Bharat Mein Angreji Raj** – PanditSunderlal
9. **Rediscovering India** - by Dharampal
10. **Hind Swaraj or Indian Home Rule** - by Mohandas K. Gandhi
11. **India Wins Freedom** - Maulana Abdul Kalam Azad
12. **Vivekananda** - Romain Rolland (English)
13. **Gandhi** - Romain Rolland (English)

Web References:

1. **https://www.uhv.org.in/uhve**

2. https://fdp-si.aicte-india.org/UHVII.php
3. https://www.aicte-india.org/sites/default/files/Model_Curriculum/Minor%20Degree%20in%20UHV.pdf

Mode of Conduct:

1. Lecture hours are to be used for interactive discussion, where proposals about the topics are to be made and students are to be motivated to reflect, explore, and verify them.
2. Tutorial hours are to be used for practice sessions.
3. While analyzing and discussing the topic, the faculty mentor's role is to point to essential elements to help sort them out from the surface elements. In other words, it allows the students to explore the critical components.
4. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with oneself and do self-observation, self-reflection, and self-exploration.
5. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" rather than" extraordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentors in a group setting.
6. Tutorials (experiments or practical) are essential for the course. The difference is that the laboratory is part of everyday life; it is helpful in how you behave and work in real life. Worksheets, home assignments, and/or activities are included depending on the nature of the topics.
7. The practice sessions (tutorials) would also support student in performing actions commensurate to their beliefs. It is intended that this would lead to the development of commitment, namely behaving and working based on fundamental human values.
8. It is recommended that this content be placed before the student as it is, in the form of an introductory foundation course, without including anything else or excluding any part of this content. Additional content maybe offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Internal Assessment Pattern

Cognitive Level	Internal Assessment # 1 (%)	Internal Assessment # 2 (%)
L1	15	-
L2	34	-
L3	34	15
L4	17	34
L5	-	34
L6	-	17
Total (%)	**100**	**100**

Sample Short and Long Answers to Questions of Various Cognitive Levels

L1: Remember

1. What is meant by Natural Acceptance?
2. Define Right Understanding.
3. List the four orders of nature.
4. What are the basic human aspirations?
5. State the meaning of Sanyam (self-regulation).
6. What is meant by prosperity?
7. Name the two parts of a human being.
8. What is the role of the body according to Value Education?
9. List the feelings essential in human-to-human relationships.
10. What is meant by co-existence?

L2: Understand

1. Explain the relationship between Right Understanding and Relationship.
2. Describe the harmony between the self and the body.
3. Interpret the concept of continuous happiness and prosperity.
4. Discuss the difference between the needs of the self and the body.
5. Explain the meaning of justice in relationships.
6. Describe the importance of self-exploration.
7. Clarify the concept of mutual fulfillment in nature.
8. Discuss how education helps in holistic development.
9. Explain the vision of a universal human order.
10. Describe what is meant by 'respect' as the right evaluation.

L3: Apply

1. Apply the concept of Natural Acceptance in making ethical decisions.
2. Illustrate harmony in the family with an example from your own life.
3. Demonstrate how you can practice self-regulation in your daily routine.
4. Use the idea of mutual fulfillment in a plan for an eco-friendly campus.
5. Apply the idea of Right Understanding to resolve a conflict.
6. Show how holistic development can be integrated into your lifestyle.
7. Implement practices that promote harmony in your social group.
8. Use the concept of the body as an instrument to improve physical health.
9. Plan a group activity that promotes trust and respect.
10. Apply the principles of co-existence in managing natural resources.

L4: Analysing

1. Differentiate between happiness and prosperity with examples.
2. Analyze the role of the self and body in human behavior.
3. Compare trust and respect in family relationships.
4. Examine how lack of Right Understanding leads to disharmony.
5. Distinguish between self-regulation and external regulation.
6. Investigate the root causes of conflict in society.
7. Analyze the systems in nature that demonstrate harmony.
8. Examine how justice arises from mutual fulfillment.

9. Break down the structure of a universal human order.
10. Explore the interconnection between individual values and societal peace.

L5: Evaluating

1. Evaluate the relevance of Value Education in modern society.
2. Assess the impact of materialism on human happiness.
3. Judge the effectiveness of education in achieving holistic development.
4. Critique current societal systems in light of natural co-existence.
5. Appraise the role of mutual trust in building strong relationships.
6. Defend the need for harmony at all levels of human existence.
7. Evaluate the importance of distinguishing between self and body.
8. Justify the inclusion of Value Education in professional courses.
9. Compare the traditional vs. modern views on personal success.
10. Argue whether self-exploration is sufficient for understanding human values.

L6: Create and Develop

1. Design a value-based weekly routine for students.
2. Construct a model society based on mutual trust and justice.
3. Formulate strategies to integrate value education into school curricula.
4. Develop a plan for promoting harmony in a multicultural community.
5. Compose an essay on the role of harmony in personal and professional life.
6. Create a campaign to raise awareness on sustainable coexistence with nature.
7. Design a self-assessment tool for personal value alignment.
8. Develop a short workshop on self-exploration for college students.
9. Write a story that illustrates the principles of Right Understanding.
10. Create a visual mind map connecting harmony at the individual, family, and societal levels.

Chairperson
Board of Studies (MBA)

R24MEPC12 **Fluid Mechanics & Hydraulic Machinery Lab** **0 0 3 1.5**

(Mechanical Engineering)

Course Objectives:

- To give the practical exposure about fundamentals of fluid mechanics and hydraulics.
- To provide practical knowledge about the turbo-machinery
- To provide practical knowledge about the centrifugal pump and reciprocating pump.

Course Code	Course Outcomes	Mapping with POs and PSOs							
		PO1	PO2	PO3	PO4	PO5	PO8	PSO1	PSO2
R24MEPC12.1	Conduct experiments to evaluate the impact of jets and performance of impulse turbines (e.g., Pelton wheel).	3	2	1	3	2	1	1	2
R24MEPC12.2	Analyze and interpret the performance characteristics of reaction turbines such as Francis and Kaplan turbines.	3	2	1	3	2	2	1	2
R24MEPC12.3	Evaluate the efficiency and operational behavior of various pumps and flow meters used in fluid systems.	3	2	1	3	2	2	1	2

List of Experiments

1. Impact of jets on Vanes. C**O's: CO1**
2. Performance Test on Pelton Wheel. **CO's: CO1**
3. Performance Test on Francis Turbine. **CO's: CO2**
4. Performance Test on Kaplan Turbine. **CO's: CO2**
5. Performance Test on Single Stage Centrifugal Pump. **CO's: CO3**
6. Performance Test on Multi Stage Centrifugal Pump. **CO's: CO3**
7. Performance Test on Reciprocating Pump. **CO's: CO3**
8. Calibration of Venturi meter. **CO's: CO3**
9. Calibration of Orifice meter. **CO's: CO3**
10. Determination of friction factor for a given pipeline. **CO's: CO3**
11. Determination of loss of head due to sudden contraction in a pipeline. **CO's: CO3**
12. Turbine flow meter. **CO's: CO3**

Virtual Lab:

1. To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html)

2. To calculate Total Energy at different points of venture meter. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html).
3. To calculate the flow (or point) velocity at center of the given tube using different flow rates. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html)
4. To determine the hydrostatic force on a plane surface under partial submerge and full submerge condition. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html).
5. To determine the discharge coefficient of a triangular notch. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html)
6. To determine the coefficient of impact of jet on vanes. (https://fm-nitk.vlabs.ac.in/exp/impact-of-jet).
7. To determine friction in pipes. (https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html).

Board of Studies: Mechanical Engineering

Approved in BOS No: 02, 13th May, 2025

Approved in ACM No: 02

Sample Experiments

1. What is the function of a Pelton wheel?
2. Define manometric efficiency of a pump.
3. What is the formula for discharge through a Venturimeter?
4. What is the difference between a turbine and a pump?
5. Name the types of losses that occur in pipelines.
6. Explain the working principle of a Kaplan turbine.
7. How does a centrifugal pump convert mechanical energy into pressure energy?
8. Describe the significance of impact of jet experiment.
9. Why is the Francis turbine classified as a reaction turbine?
10. What happens when sudden contraction occurs in a pipe?
11. How do you calculate the efficiency of a Pelton wheel from experimental data?
12. Apply Bernoulli's theorem to explain how a Venturimeter works.
13. How would you determine the discharge in a turbine flowmeter?
14. How is the friction factor calculated using the Darcy-Weisbach equation?
15. How can the slip of a reciprocating pump be calculated?
16. Compare the working principles of Pelton and Francis turbines.
17. How do performance curves differ between single-stage and multi-stage centrifugal pumps?
18. Why does cavitation occur in pumps and how can it be identified experimentally?
19. What differences would you expect in head loss due to sudden contraction vs friction loss?

20. Analyze the effect of vane angle on force exerted by a jet.
21. Justify the use of a Kaplan turbine in low head applications.
22. Interpret the pump performance curves and suggest reasons for efficiency drop.
23. Assess why turbine flowmeters are preferred in specific applications.
24. Evaluate the suitability of reciprocating pumps for high-pressure applications.
25. Why should orifice meters not be used for highly viscous fluids?

Chairperson

Board of Studies (ME)

R24MEPC13 **Theory of Mechanics Lab** **0 0 3 1.5**

(Mechanical Engineering)

Course Objectives:

- Determine natural and forced vibration frequencies and Analyze whirling of shafts and gyroscopic motion.
- Perform static and dynamic balancing and Study and interpret motion in governors, cams, and slider-crank/four-bar mechanisms
- Experiment with belts, pulleys, and gears to understand friction and gear characteristics and demonstrate teamwork and manage projects effectively.

Course Code	Course Outcomes	Mapping with POs and PSOs										
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
R24MEPC13.1	Apply fundamental principles of vibrations, gyroscopic effects, and mechanical balancing to analyze the performance of machine elements.	3	3		2	3	2			2	3	
R24MEPC13.2	Analyze the working and motion characteristics of mechanical systems such as governors, cams, linkages, and power transmission elements.	3		3	2	2		2			3	2
R24MEPC13.3	Demonstrate effective teamwork, communication, and problem-solving skills through project-based learning.	3	2		3	2			2	2	3	2

List of Experiments:

1. To determine whirling speed of shaft theoretically and experimentally. **CO's: CO1**
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation. **CO's: CO1**
3. To analyze the motion of a motorized gyroscope when the couple is applied along its spin axis **CO's: CO1**
4. To determine the frequency of undamped free vibration of an equivalent spring mass system. **CO's: CO1**
5. To determine the frequency of damped force vibration of a spring mass system

CO's: CO1

6. To study the static and dynamic balancing using rigid blocks. **CO's: CO1**
7. To plot follower displacement vs cam rotation for various Cam Follower systems.

CO's: CO2

8. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism **CO's: CO3**
9. To find coefficient of friction between belt and pulley. **CO's: CO3**
10. To study various types of gears- Spur, Helical, Worm and Bevel Gears **CO's: CO2**
11. Study of friction clutches and brakes. **CO's: CO2**
12. To determine the position of sleeve against controlling force and speed of a Proell governor and to plot the characteristic curve of radius of rotation. **CO's: CO2**
13. To verify the Dunkerley's Rule **CO's: CO3**
14. To experimentally determine the mechanical advantage (MA) of a compound pulley system and compare it with the theoretical value. **CO's: CO3**

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Text Books:

1. "Theory of Machines" by S.S. Rattan
2. "Theory of Machines and Mechanisms" by Joseph E. Shigley and John U. Ood
3. "Applied Mechanism and Machine Theory" by C.M. Gupta and P.K. Khurmi

Reference Books:

1. "Theory of Machines and Mechanisms" by Jagdish Lal
2. "Theory of Machines" by R.S. Khurmi and J.K. Gupta
3. "Machine Design: An Integrated Approach" by Robert L. Norton

Virtual Lab:

1. **Mechanical Engineering Labs**: https://www.vlab.co.in/broad-area-mechanical-engineering vlab.co.in+2vlab.co.in+2Wikipedia+2
2. **Dynamics of Machines Lab**: https://dom-nitk.vlabs.ac.in/iitb.vlabs.co.in+4dom-nitk.vlabs.ac.in+4mm-nitk.vlabs.ac.in+4
3. **Mechanics of Machines I Lab**: https://mm-nitk.vlabs.ac.in/mm-nitk.vlabs.ac.in

Sample Questions:

1. What is whirling speed?
2. What is the function of a Hartnell governor?
3. What is gyroscopic precession?
4. What is natural frequency?
5. What is damping?
6. What is the difference between static and dynamic balancing?
7. What is a cam follower system?
8. What is a slider-crank mechanism?
9. What is the coefficient of friction?
10. Name different types of gears.
11. What are friction clutches and brakes?
12. Explain why a shaft vibrates at its whirling speed.
13. Explain the relationship between sleeve position, controlling force, and speed in a Hartnell governor.
14. Explain how a motorized gyroscope reacts to an applied couple.
15. Explain the concept of undamped free vibration.
16. Explain the concept of damped forced vibration.
17. Explain the importance of balancing rotating masses.
18. Explain the relationship between cam profile and follower motion.
19. Explain the relationship between crank rotation and slider displacement.
20. Explain how friction affects power transmission in a belt drive.
21. Explain the working principle of different gear types.
22. Explain the working principles of friction clutches and brakes.
23. How would you calculate the whirling speed of a shaft in a specific industrial application?
24. How would you adjust a Hartnell governor to maintain a desired engine speed?
25. How would you apply the principles of gyroscopic motion in the design of a navigation system?
26. How would you determine the natural frequency of a spring-mass system?
27. How would you determine the frequency of damped forced vibration in a system?
28. How would you balance a rotating component using rigid blocks?
29. How would you plot a follower displacement diagram for a given cam profile?
30. How would you plot the displacement, velocity, and acceleration curves for a slider?
31. How would you determine the coefficient of friction between a belt and pulley?

32. How would you calculate the gear ratio for a gear train?
33. How would you calculate the torque capacity of a friction clutch?
34. Analyze the factors that affect the whirling speed of a shaft.
35. Analyze the characteristic curve of a Hartnell governor.
36. Analyze the effects of varying the applied couple on the motion of a gyroscope.
37. Analyze the factors that affect the natural frequency of a vibration system.
38. Analyze the effects of damping on the vibration response of a system.
39. Analyze the effects of unbalance on the vibration of a rotating machine.
40. Analyze the effects of different cam profiles on follower motion.
41. Analyze the motion characteristics of a slider-crank or four-bar mechanism.
42. Analyze the factors that affect the coefficient of friction in a belt drive.
43. Analyze the advantages and disadvantages of different gear types.
44. Analyze the factors that affect the performance of friction clutches and brakes.
45. Evaluate the importance of considering whirling speed in the design of high-speed rotating machinery.
46. Evaluate the advantages and disadvantages of using a Hartnell governor compared to other types.
47. Evaluate the impact of gyroscopic effects on the stability of rotating machinery.
48. Evaluate the importance of knowing the natural frequency of a machine component.
49. Evaluate the effectiveness of different damping methods in reducing vibrations.
50. Evaluate the effectiveness of different balancing methods.
51. Evaluate the suitability of different cam follower systems for specific applications.
52. Evaluate the advantages and disadvantages of using these mechanisms in different applications.
53. Evaluate the efficiency of different belt drive systems.
54. Evaluate the suitability of different gear types for specific applications.
55. Evaluate the suitability of different friction clutches and brakes for specific applications.
56. Design a system to prevent or mitigate the effects of whirling in a long shaft.
57. Design a modified Hartnell governor for a specific industrial application with unique speed control requirements.
58. Design a gyroscopic stabilizer for a ship or aircraft.
59. Design a system to minimize undamped free vibrations in a given situation.
60. Design a damping system for a machine to reduce vibrations caused by external forces.
61. Design a balancing procedure for a complex rotating assembly.

62. Design a cam profile to achieve a specific follower motion.
63. Design a slider-crank or four-bar mechanism for a specific application.
64. Design a belt drive system for a specific power transmission requirement.
65. Design a gear train for a specific speed reduction or torque multiplication.
66. Design a friction clutch or brake system for a specific application.

Chairperson
Board of Studies (ME)

R24MESC02 **Drones & Digital Fabrication Lab** **0 0 3 1.5**

(Mechanical Engineering)

Course Objectives:

- To provide hands-on experience with 3D modeling and FDM-based 3D printing technologies.
- To introduce basic drone hardware, safety protocols, and flight operations.
- To build familiarity with design-to-manufacturing workflows using additive manufacturing.

Course Code	Course Outcomes	Mapping with POs and PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
R24MESC02.1	Create simple 3D models and print them using FDM printers.	3	2	3	2	3	2	1
R24MESC02.2	Understand and operate FDM 3D printers and engraving machines.	3	2	2	2	3	2	2
R24MESC02.3	Assemble and operate basic drones for manual control and testing.	2	2	3	3	2	1	2

List of Experiments

3D Modeling & Printing (Any 7):

1. Introduction to CAD software and modeling a keychain. **CO's: CO1**
2. Designing and printing a gear mechanism. **CO's: CO1**
3. Modeling and printing a mobile stand. **CO's: CO2**
4. Creating and printing a threaded fastener (bolt and nut). **CO's; CO2**
5. Designing a box with a snap-fit lid and printing. **CO's: CO1**
6. Printing a small mechanical linkage (e.g., four-bar mechanism). **CO's: CO2**
7. Engraving a nameplate or logo using the engraving machine. **CO's: CO2**

Drone-Based Experiments (Any 4–6):

1. Study of drone components and assembling a basic quadcopter. **CO's: CO3**
2. Safety precautions and pre-flight checklist demonstration. **CO's: CO3**
3. Manual flying of a drone in a confined indoor space. **CO's: CO3**
4. Measuring hover stability and battery performance. **CO's: CO3**

Virtual Lab:

1. Virtual 3D Printing Simulation lab using Vlabs. https://3dp-dei.vlabs.ac.in/List%20of%20experiments.html
2. Simulation of drone flight path using DroneSim Pro or similar tools – https://www.dronesimpro.com

3. Virtual slicing and G-code simulation using Cura – https://ultimaker.com/software/ultimaker-cura
4. Simulation of drone flight path using open-source software

Board of Studies: Mechanical Engineering

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Sample Experiments

1. Define FDM in 3D printing.
2. Name basic components of a quadcopter.
3. What is STL file format?
4. What is the use of slicing software?
5. Explain the working of an FDM printer.
6. Describe the role of propellers in drone stability.
7. Why is support structure used in 3D printing?
8. How does a drone maintain hover?
9. Design a simple 3D printable tool holder.
10. Calibrate the bed level on an Ender 3 printer.
11. Manually control a drone to navigate a basic path.
12. Compare PLA and ABS materials in 3D printing.
13. Analyze slicing settings affecting print quality.
14. Compare indoor and outdoor flight behaviors of a drone.
15. Evaluate the performance of a drone in hovering test.
16. Suggest design modifications for improving 3D print accuracy.
17. Assess the feasibility of using a drone for simple delivery tasks.
18. Design and print a custom-fit part to improve drone balance.
19. Develop a 3D printed prototype of a wearable/mechanical tool.

Chairperson
Board of Studies (ME)

R24HS05 Numerical Ability & Professional Communication skills 0 0 2 1
(Common to all UG Programmes)

Course Objectives:

1. **Develop problem-solving skills**: Students will be able to apply numerical concepts and techniques to solve problems in various contexts.
2. **Enhance data analysis skills**: Students will be able to collect, analyze, and interpret numerical data to inform decision-making.
3. **Develop effective communication skills**: Students will be able to communicate effectively in various professional settings, including verbal and non-verbal communication.
4. **Improve presentation skills**: Students will be able to deliver clear, concise, and engaging presentations to different audiences.
5. **Enhance writing skills**: Students will be able to write clear, concise, and well-structured professional documents, such as reports, emails, and memos.
6. **Develop interpersonal skills**: Students will be able to build and maintain effective relationships with colleagues, clients, and stakeholders.

At the end of the course, students will be able to:

Course Code	Course Outcomes	PO1	PO7	PO9	P011	Dok
R24HS05.1	Use their logical thinking and analytical abilities to solve Quantitative aptitude questions from company specific and other competitive tests..	2	---	---	---	L4
R24HS05.2	Solve questions related to time and distance and time and work etc. from company specific and other competitive tests.	1	---	---	---	L5
R24HS05.3	Comprehend the essentiality of LSRW skills in paper presentations, seminars, workshops, conferences etc. with teams and to solve different types of questions based on vocabulary, structure, grammar and verbal reasoning.	2	2	3	1	L1, L2
R24HS05.4	Attain the knowledge of soft skills in various conditions, Solve questions based on sentence completion and fill in the blanks	---	1	3	---	L2, L3
R24HS05.5	Explore diverse fields through English , To solve different types of questions based on vocabulary, structure, grammar and verbal reasoning	---	---	3	---	L4

SYLLABUS

UNIT-I: Numerical computation **15 Hours**

Application based on Numbers –Classification of Number System, Prime and Composite, Even and Odd Numbers, Divisibility Rule, BODMAS Rule, Unit digit, fractions, LCM &HCF**.** Percentages and its Applications, Profit Loss and Discount, Simple interest and Compound interest. Averages, Ratio Proportion, Application of Ratios**,** Partnerships, Shares and dividends.

Self Learning Topic: Problems on Ages

UNIT-II: Numerical Estimation **15 Hours**

Time and work, Application of Time-work (pipes and cisterns) , Time and Distance, circular Tracking, concept of Boats & steams. Mixtures and allegations, application of percentage and Ratios and Averages in Mixtures

Self Learning Topic: Problems on Trains

UNIT-III **5 Hours**

Abstract Preparation – Noticing Key Words –Literature Survey – Using Academic Verbs Verbal Ability: Sentence correction, Resume Writing and Cover letter

Self Learning Topic: Project Report

UNIT-IV **5 Hours**

Organizational Skills – Time Management – IELTS Test Papers Exercises Verbal Ability: sentence completion

Self Learning Topic: Jumbled Sentences

UNIT-V **5 Hours**

Analogy, origin of Words, Idioms and phrases, MNC's question papers Verbal Ability: Error Identification

Self Learning Topic: Speaking and writing diction (Choice of Words)

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Text Books:

1. Quantitative Aptitude for competitive examinations by R.S.Agrawal - S.Chand publications.
2. Business Communication by C.S.G Krishnamacharyulu & Lalitha Ramakrishna – Himalaya publishing house

Reference Books:

1. Numerical Aptitude and Reasoning Ability tests in Competitive exams by Prof.A.Balasubramanian.
2. Numerical Ability and Mathematical Aptitude by Dr.A.B.Rao
3. Communication skills and soft skills by E.Suresh Kumar , p.sreehari & j.savithri

Web References:

1. https://faceprep.in/ logical reasoning

2. www.sawaal.com
3. http://nptel.ac.in/courses
4. www.prepinsta.com

Model Questions from Numerical Ability

1. What is the unit digit of 2^10?
2. Find the unit digit of 17^5.
3. What is the unit digit of 3 × 7 × 9 × 11?
4. Determine the unit digit of 123^4.
5. Find the unit digit of 2^20 + 3^15.
6. Is 432 divisible by 3?
7. Check if 756 is divisible by 9.
8. Determine if 1240 is divisible by 8.
9. Is 531 divisible by 11?
10. Check if 2700 is divisible by 15.
11. Simplify: 2 × 3 + 12 ÷ 4 - 5
12. Evaluate: 18 - 3 × 2 + 12 ÷ 4
13. Simplify: 9 + 8 ÷ 2 × 3 - 1
14. Evaluate: 15 - 2 × 3 + 8 ÷ 2
15. Simplify: 24 ÷ 4 × 2 + 10 – 3
16. Find the HCF of 12 and 18.
17. Determine the HCF of 24 and 30.
18. The HCF of two numbers is 6 and their LCM is 72. What are the two numbers?
19. The LCM of two numbers is 120 and their HCF is 10. If one of the numbers is 24, what is the other number?
20. A shirt is marked at $80 and sold at a 20% discount. What is the selling price?
21. A student scored 75% marks in an exam. If the total marks were 200, how many marks did the student score?
22. A number is increased by 25% and then decreased by 10%. What is the net percentage change?
23. A book is bought for $50 and sold for $60. What is the profit percentage?
24. A shopkeeper sells an item at a 15% loss. If the cost price is $100, what is the selling price?
25. A person buys a product for $80 and sells it for $100. What is the profit percentage?
26. Find the simple interest on $1000 at 5% per annum for 2 years.
27. A sum of money amounts to $1200 in 3 years at 8% per annum simple interest. What is the principal amount?
28. What is the rate of interest if a sum of $500 amounts to $600 in 4 years at simple interest?

Model Questions from professional communication skills

1. You're working with a team member who has a different work style. How would you adapt your communication approach?
2. A client is unhappy with the project's progress. How would you handle the situation?
3. You're part of a team, and there's a conflict between two members. How would you facilitate a resolution?
4. How would you use body language to convey confidence during a presentation?
5. You're in a virtual meeting, and your internet connection is unstable. How would you

handle the situation?

6. You're meeting a client for the first time. What nonverbal cues would you use to build rapport?
7. You're presenting a project update to a client. How would you structure your presentation to ensure effective communication?
8. A colleague is not meeting their deadlines, affecting the team's project timeline. How would you approach the conversation?
9. You're in a meeting, and a team member is dominating the discussion. How would you politely intervene?
10. You're tasked with writing a report on a project's progress. How would you structure the report?

Chairperson
Board of Studies (MBA)

R24ES13 **Design Thinking & Innovation** **0 1 2 2**

(Common to All Branches)

Course Objectives:

1. The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation.
2. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Code	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO9	PO10	PO11	PSO1	PSO2	DOK
R24ES13.1	Define the concepts related to design thinking. Explain the fundamentals of Design Thinking and innovation	3	3	2	2	2	-	1	2	2	2	L1, L2
R24ES13.2	Apply the design thinking techniques for solving problems in various sectors.	3	3	3	2	3	-	1	2	3	3	L3
R24ES13.3	Analyse to work in a multidisciplinary environment	3	3	3	2	3	-	-	2	3	3	L4
R24ES13.4	Evaluate the value of creativity	3	2	3	2	3	1	1	3	3	3	L5
R24ES13.5	Formulate specific problem statements of real time issues	3	2	3	2	3	1	1	3	3	3	L3, L6

SYLLABUS

UNIT-I **10 Hours**

Introduction to Design Thinking: Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry. **CO's: CO1**

UNIT-II **10 Hours**

Design Thinking Process: Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development. **CO's: CO2**

UNIT-III **10 Hours**

Innovation: Art of innovation, Difference between innovation and creativity, role of creativity and

innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation. **CO's: CO3**

UNIT IV **10 Hours**

Product Design: Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

CO's: CO4

UNIT V **10 Hours**

Design Thinking in Business Processes: Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

CO's: CO5

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Text Books:

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons..

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)

L1	10	--
L2	30	--
L3	30	20
L4	30	30
L5	--	30
L6	--	20
Total (%)	**100**	**100**

Chairperson
Board of Studies (ME)