CARE
COLLEGE OF ENGINEERING
(An Autonomous Institution)
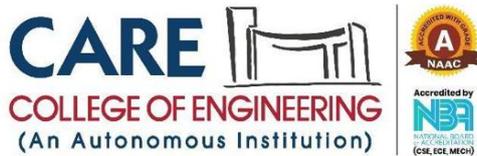
Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade

#27, Thayanur, Tiruchirappalli - 620009

Regulations 2024

Undergraduate Degree

B.E. / B. Tech./B.Des.

Full Time Programmes

Curriculum and Syllabus

CARE COLLEGE OF ENGINEERING:: TIRUCHIRAPPALLI 620 009
(AN AUTONOMOUS INSTITUTION)
REGULATION 2024
CURRICULUM AND SYLLABUS FOR FIRST
CHOICE BASED CREDIT SYSTEM

B.E. MECHANICAL ENGINEERING

SEMESTER I

S. No	Course Code	Course Title	Category	Periods per week			No of Contact Periods	Credits
				L	T	P		
THEORY COURSES								
1	U24MA111	Matrices and Calculus	BSC	3	1	0	4	4
2	U24GE111	Problem solving using Python	ESC	3	0	0	3	3
3	U24HS111	Heritage of Tamils	HSMC	1	0	0	1	1
THEORY CUM PRACTICAL COURSES								
4	U24HS123	Communicative English for Engineers	HSMC	3	0	2	5	4
5	U24PH113	Engineering Physics	BSC	3	0	2	5	4
6	U24CY113	Engineering Chemistry	BSC	3	0	2	5	4
PRACTICAL COURSES								
7	U24GE122	Problem solving using Python Laboratory	ESC	0	0	4	4	2
			TOTAL	**16**	**1**	**10**	**27**	**22**

SEMESTER II

S. No	Course Code	Course Title	Category	Periods per week			No of Contact Periods	Credits
				L	T	P		
THEORY COURSES								
1	U24MA211	Statistics and Numerical Methods	BSC	3	1	0	4	4
2	U24PH211	Materials Science	BSC	3	0	0	3	3
3	U24EE211	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
4	U24CE211	Engineering Graphics	ESC	2	0	4	6	4
5	U24HS211	Tamils and Technology	HSMC	1	0	0	1	1
THEORY CUM PRACTICAL COURSES								
6	U24HS223	Technical English for Engineers	HSMC	2	0	2	4	3
PRACTICAL COURSES								
7	U24CE232	Engineering Practices for Civil and Mechanical Engineers	ESC	0	0	4	4	2
8	U24EE222	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
9	U24EM212	Professional Development	EEC	0	0	2	2	1
			TOTAL	**14**	**1**	**16**	**31**	**23**

Department of Mechanical Engineering

Regulation 2024 Third Semester Curriculum

Sl. No	Course Code	Course Name	Category	No. of periods/week			Total Periods	Credits
				L	T	P		
1	U24MA311	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2	U24ME311	Engineering Mechanics	ESC	3	0	0	3	3
3	U24ME321	Engineering Materials & Metallurgy	PCC	3	0	0	3	3
4	U24ME331	Engineering Thermodynamics	PCC	3	1	0	4	4
5	U24ME341	Manufacturing Technology I	PCC	3	0	0	3	3
6	U24ME352	Computer Aided Machine Drawing	ESC	0	0	4	4	2
7	U24ME362	Manufacturing Technology Laboratory	PCC	0	0	4	4	2
8	U24EM312	Design Thinking and Innovation	EEC	0	0	2	2	1
			Total	**15**	**2**	**10**	**27**	**22**

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Department of Mechanical Engineering

R2024 Fourth Semester Curriculum

S. No	Course Code	Course Title	Category	Periods per week			No of Contact Periods	Credits
				L	T	P		
1	U24ME411	Fluid Mechanics and Machinery	ESC	3	1	0	4	4
2	U24ME421	Theory of Machines	PCC	3	0	0	3	3
3	U24ME431	Thermal Engineering	PCC	3	0	0	3	3
4	U24ME441	Manufacturing Technology – II	PCC	3	0	0	3	3
5	U24EM411	Aptitude and Reasoning – I	EEC	1	0	0	1	1
6	U24ME453	Strength of Materials	PCC	3	0	2	5	4
7	U24ME463	CAD /CAM	PCC	3	0	2	5	4
8	U24ME472	Fluid Mechanics and Machinery Laboratory	ESC	0	0	2	2	1
9	U24ME482	Thermal Engineering Laboratory	PCC	0	0	4	4	2
10	U24EM422	Soft skill and Personality Development – I	EEC	0	0	2	2	1
		Total		**19**	**1**	**12**	**32**	**26**

	L	**T**	**P**	**C**
U24MA111　　　　**MATRICES AND CALCULUS**	**3**	**1**	**0**	**4**

Course Objectives:
- To develop the use of matrix algebra techniques those are needed to engineers for practical applications.
- To familiarize the students with differential calculus.
- To introduce the methods of solving linear and nonlinear ordinary differential equations.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.

UNIT I MATRICES　　　　　　　　　　　　　　　　　　　　　　　　　　　**9+3**
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNIT II DIFFERENTIAL CALCULUS　　　　　　　　　　　　　　　　　　　**9+3**
Functions of single variable – Limit of the function- Continuity and Differentiability - Mean value Theorems - Partial derivatives - Total derivative - Taylor series (in one and two variables) - Maxima and Minima (in one and two variables).

UNIT III ORDINARY DIFFERENTIAL EQUATION　　　　　　　　　　　　　　**9+3**
Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT IV INTEGRAL CALCULUS　　　　　　　　　　　　　　　　　　　　　**9+3**
Evaluation of definite and improper integrals - Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals.

UNIT V VECTOR CALCULUS　　　　　　　　　　　　　　　　　　　　　　　**9+3**
Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　TOTAL: 60 PERIODS

Text Books
1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 44th Edition, New Delhi, 2015.
2. Erwin Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016

Reference Books
1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
3. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Apply the matrix algebra methods for solving practical problems.	Applying
CO2	Apply differential calculus tools in solving various Engineering problems.	Applying
CO3	Apply various techniques in solving differential equations.	Applying
CO4	Apply double and triple integration techniques in solving areas and volumes.	Applying
CO5	Evaluate of line, surface and volume integrals using Gauss, Stokes and Green's Theorems.	Applying

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3						2	2		3		
CO2	3	3	3						2	2		3		
CO3	3	3	3						2	2		3		
CO4	3	3	3						2	2		3		
CO5	3	3	3						2	2		3		
Avg.	3	3	3						2	2		3		

U24GE111	**PROBLEM SOLVING USING PYTHON**	L	T	P	C
		3	0	0	3

Course Objectives:
- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING   9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS   9

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS   9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES   9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES   9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors

and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL: 45 PERIODS

Text Books
1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference Books
1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data'', Third Edition, MIT Press , 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Develop algorithmic solutions to simple computational problems.	Applying
CO2	Write simple python programs using the basic data types, expressions and Statements.	Applying
CO3	Write simple Python programs using conditionals and loops for solving problems and decompose a Python program into functions.	Applying
CO4	Represent compound data types using Python lists, tuples, dictionaries etc.	Applying
CO5	Read and write data from/to files in Python programs.	Applying

CO-PO/PSO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	2	1			2	3	3	2			
CO2	2	2	1	2	1			2	3	3	2			
CO3	2	2	1	2	1			2	3	3	2			
CO4	2	2	1	3	1			2	3	3	2			
CO5	2	2	1	3	1			2	3	3	2			
Avg.	**2**	**2**	**1**	**2**	**1**			**2**	**3**	**3**	**2**			

	L	**T**	**P**	**C**
U24HS111 தமிழர் மரபு / HERITAGE OF TAMILS	**1**	**0**	**0**	**1**

Course Objectives:
- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thinai in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

UNIT I LANGUAGE AND LITERATURE   **3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature

Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE   3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS   3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS   3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE   3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

Text Books
1. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M. Valarmathi) (Published by: International Institute of Tamil Studies).
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K. Pillay) (Published by: The Author).
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Describe the various types of Tamil Literature.	Understanding
CO2	Discuss about Tamil Arts and Sculpture.	Understanding
CO3	Explain the Tamil Folks and Martial Arts.	Understanding
CO4	Summarize the Thinai Concepts of Tamil.	Understanding
CO5	Review the contribution of Tamil Culture to Indian Culture and National Movements.	Understanding
CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2		2	2	3				
CO2						2		2	2	3				
CO3						2		2	2	3				
CO4						2		2	2	3				
CO5						2		2	2	3				
Avg.						**2**		**2**	**2**	**3**				

		L	**T**	**P**	**C**
U24HS123	**COMMUNICATIVE ENGLISH FOR ENGINEERS**	**3**	**0**	**2**	**4**

Course Objectives:
To improve the communicative competence of learners
- To learn to use basic grammatical structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in both informal and professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION   1
What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION   8
Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh / Yes or No / and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION   9
Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing; Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT   9
Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS   9
Reading – Newspaper articles; Journal reports –and Non-Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non-verbal (chart, graph etc., to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION   9
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative), Dialogue-writing. Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.
                                                          TOTAL: 45 PERIODS

Sl. No.	Practical – List of experiments:
1	Listening comprehension
2	Telephone conversation & Introductions (listening & speaking)
3	Mock Interviews
4	Narrating personal experiences
5	Short Oral Presentations
6	Advertising a product

7	Situational conversation – 3 in a team
8	Creating educational videos
9	Group discussion
10	ICT based presentations

TOTAL: 30 PERIODS

Text Books
1. Communication Book, Portfolio Penguin, 2018. Authored by Mikael Krogerus, Roman Tschäppeler. ISBN-13: 978-0241982280.
2. Communicative English for Engineers and Professionals, Pearson Education India, 2010. Authored by Bhatnagar Nitin, ISBN: 9788131732045, 8131732045
3. English for Science & Technology, Cambridge University Press, 2021. Authored by Dr.Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference Books
1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. English For Technical Communication (With CD) By Aysha Viswamohan, McGraw Hill Education, ISBN: 0070264244, 2008.
3. How to win at Interviews & Group Discussions, Abhishek Publications, 2014. Authored by D.S. Cheema, ISBN: 9788182475175, 8182475171.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Explain different points of view during discussions.	Applying
CO2	Prepare for formal ICT based presentations and video creation.	Applying
CO3	Construct English sentences in both formal and informal contexts.	Applying
CO4	Interpret technical texts, audio materials and visual representation.	Understanding
CO5	Write letters, definitions, descriptions, narrations and essays on various topics.	Applying

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								1	2	3		3		
Avg.								**1**	**2**	**3**		**3**		

U24PH113	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Course Objectives:
- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves, optics and its applications.
- To introduce the basics knowledge of lasers and fibre optics.
- Equipping the students to successfully understand the importance of quantum mechanics.
- To make the students understand the basics of crystal structure and its importance in studying materials properties.

UNIT I MECHANICS   **9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM
Rotation of rigid bodies: Rotational kinematics – Theorems of M .I –moment of inertia of continuous bodies – torque – rotational dynamics of rigid bodies — gyroscope - torsional pendulum – double pendulum

UNIT II ELECTROMAGNETIC WAVES AND OPTICS 9

Maxwell's equations - wave equation; Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - Producing electromagnetic waves - Cell-phone reception.
Reflection and refraction of light waves - interference –Michelson interferometer –Theory of air wedge and experiment.

UNIT III LASERS AND FIBRE OPTICS 9

Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.
Fiber optics: Principle, Numerical aperture and acceptance angle –types of optical fibers (material, refractive index, mode)- fibre optic communication- losses associated with optical fibers- fibre optic sensors: pressure and displacement- medical endoscope.

UNIT IV QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization – particle in a infinite potential well: 1D- particle in a infinite potential well:2D and 3D Boxes (Qualitative).

UNIT V CRYSTAL PHYSICS 9

Crystal structures: Crystal structures: BCC, FCC and HCP – crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burgers vector and elastic strain energy- Slip systems, plastic deformation of materials and Miller indices –distance between successive planes – crystalline and non-crystalline material.

TOTAL: 45 PERIODS

Sl. No.	Practical – List of experiments (Any Seven experiments)
1	Determination of rigidity modulus – Torsion pendulum
2	Determination of Young's modulus by non-uniform bending method
3	Determination of wavelength using Laser.
4	Determination of Numerical aperture and acceptance angle in an optical fiber.
5	Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6	Determination of thickness of a thin wire – Air wedge method
7	Determination of band gap of a semiconductor
8	Determination of Young's modulus by uniform bending method.
9	Compact disc- Determination of width of the groove using laser.
10	Simple harmonic oscillations of cantilever.
11	Spectrometer - Determination of wavelength of Mercury Spectrum using diffraction grating.
12	Michelson's interferometer -Determine the wave length of monochromatic light.
13	Melde's Experiment - Determine the Frequency of a tuning fork.

TOTAL: 30 PERIODS

Text Books

1. D. Kleppner and R. Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M. Purcell and D.J. Morin, Electricity and Magnetism, Cambridge Univ. Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

Reference Books

1. Gaur R K and Gupta S L, "Engineering Physics", Dhanpat Rai Publications, 2018.
2. Charles Kittel, "Introduction to Solid State Physics", Wiley India Pvt. Ltd, 7th ed., 2017.
3. D. K. Mynbaev and Lowell L. Scheiner, Fiber Optic Communication Technology, 2011,1st Edition, Pearson, USA.

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Apply the principles of mechanics to solve problems.	Applying
CO2	Apply the knowledge of the Maxwell's equations for electromagnetic waves and optics.	Applying
CO3	Apply the knowledge on the concepts of laser and their applications in fiber optics.	Applying
CO4	Apply quantum mechanical principles towards the formation of energy bands.	Applying
CO5	Describe the basics of crystals, their structures and defects.	Understanding

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		2			1	2	2		3		
CO2	3	3	2		2			1	2	2		3		
CO3	3	3	2		2			1	2	2		3		
CO4	3	3	2		2			1	2	2		3		
CO5	3	3	2		2			1	2	2		3		
Avg.	3	3	2		2			1	2	2		3		

U24CY113	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	2	4

Course Objectives:
- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT 9
Water: Sources and impurities, Water quality parameters - color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic.
Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water-Reverse Osmosis.
Boiler troubles - Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming.
Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

UNIT II NANOCHEMISTRY 9
Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic);
Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications of nanomaterials** in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES 9
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.
Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Nano**

Composites: Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION   9
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method.

UNIT V ENERGY SOURCES AND STORAGE DEVICES   9
Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of Silicon (si) Solar cell, Wind energy, Geo thermal energy.
Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion battery; Electric vehicles - working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell; Super capacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

Sl. No.	Practical – List of experiments
1	Determination of types and amount of alkalinity in a water sample. - Split the first experiment into two.
2	Determination of total, temporary & permanent hardness of water by EDTA method.
3	Determination of DO content of water sample by Winkler's method.
4	Determination of chloride content of water sample by Argentometric method.
5	Determination of strength of given hydrochloric acid using pH meter.
6.	Determination of strength of acids in a mixture of acids using conductivity meter.
7.	Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
8.	Conductometric titration of strong acid vs strong base.
9.	Estimation of iron content of the given solution using potentiometer.
10.	Estimation of sodium /potassium present in water using a flame photometer.

TOTAL: 30 PERIODS

Text Books:
1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.

Reference Books:
1. Mary Francisca. L.J, Engineering Chemistry-I, 1, 2004.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Describe the water treatment processes and calculate the quality parameters of different types in Water Samples and Apply the appropriate method to find the PH, conductance and potential values of various solutions	Understanding
CO2	Apply the concepts of nano science in Engineering Applications.	Applying
CO3	Apply the knowledge of phase rule and composites for material selection requirements	Applying
CO4	Identify the types of fuels and calculate the calorific value, explosive range for engineering processes.	Understanding
CO5	Apply suitable energy resources for Engineering sectors.	Applying

CO-PO/PSO Mapping

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

U24GE122	PROBLEM SOLVING USING PYTHON LABORATORY	L T P C
		0 0 4 2

Course Objectives:
- To learn about Variables, Operators available and how to write loops and decision statements in Python.
- To learn and Implement programs using non recursive and recursive functions.
- To Learn and execute a program using different Data Types - String, List, advance List, Dictionary, Tuple, Sets, Python Modules and packages.
- To learn how to read and write files in Python and also learn to use exception handling in Python applications for error handling.
- To build a mini project using fundamental programming constructs like variables, conditional logic, looping, and function and other required modules.

Sl. No.	Practical – List of experiments
1	Environment Setup and execute Basic Exercise to learn about Variables, Operators available in python.
2	Execute programs using Python Control Flow -Python Loops and Control Statements
3	Implement programs using String and array in python.
4	Write functions and pass arguments [Non-Recursive, Recursive] in Python
5	Execute program to learn different Data Types in python- String, List, advance List, Dictionary, Tuple, Sets
6	Learn and execute programs using Python Modules and packages.
7	Execute program using Python Directory and Files Management.
8	Implement program to learn about python exception handling
9	Mini project [Group project- demo and presentation]

TOTAL: 60 PERIODS

Text Books
1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference Books
1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data'', Third Edition, MIT Press , 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Understand and make use of Variables, Operators available and how to write loops and decision statements in Python.	Applying
CO2	Execute programs to implement non recursive and recursive functions in python.	Applying
CO3	Write Python Programs using core data structures like array, string, Lists, Set, Dictionaries and use Tuples.	Applying
CO4	Use and carry out examples to handle File Systems and exception handling in Python.	Applying
CO5	Deconstruct exemplary applications in Python.	Analysing

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1			2	1	2	2		2	2
CO2	2	2	1	2	1			2	1	2	2		2	2
CO3	2	2	1	2	1			2	1	2	2		2	2
CO4	2	2	1	3	1			2	1	2	2		2	2
CO5	2	2	1	3	1	1	1	2	1	3	2	1	2	2
Avg.	2	2	1	3	1	1	1	2	1	3	2	1	2	2

		L	**T**	**P**	**C**
U24MA211	**STATISTICS AND NUMERICAL METHODS**	**3**	**1**	**0**	**4**

Course Objectives:
- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and gives procedure for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9+3
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F-distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS 9+3
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3
Solution of algebraic and transcendental equations - - Fixed point iteration method - Newton Raphson method - Solution of linear system of equations - Gauss elimination method –Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3
Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS   9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

TOTAL: 60 PERIODS

Text Books
1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 44th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference Books
1. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
2. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition 2020.
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.

CO	Course Outcome Statement	Knowledge level
**Course Outcomes: At the end of the course, the students will be able to**
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.	Applying
CO2	Apply the basic concepts of classifications of design of experiments in the engineering field.	Applying
CO3	Determine the numerical solution of algebraic, transcendental and system of linear equations.	Applying
CO4	Apply appropriate numerical methods to solve the interpolation with equal and unequal intervals.	Applying
CO5	Determine the solution of ordinary differential equation of first order by Euler, Taylor and Runge-Kutta methods.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3						2	2		3		
CO2	3	3	3						2	2		3		
CO3	3	3	3						2	2		3		
CO4	3	3	3						2	2		3		
CO5	3	3	3						2	2		3		
Avg.	3	3	3						2	2		3		

		L	T	P	C
U24PH211	**MATERIALS SCIENCE**	3	0	0	3

Course Objectives:
- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications.
- To impart knowledge on the ventilation and air conditioning of buildings.
- To introduce the concepts of sound insulation and lighting designs.
- To introduce the properties and applications of semiconductor, magnetic materials.
- To give an introduction to the processing and applications of new engineering materials.

UNIT I THERMAL APPLICATIONS 9

Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-heat transfer through fenestrations, thermal insulation and its benefits- heat gain and heat loss

estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices-central heating.

UNIT II VENTILATION AND REFRIGERATION   9
Requirements, principles of natural ventilation- ventilation measurements, design for natural ventilation-Window type sand packaged air conditioners- chilled water plant- fan coil systems-water piping-cooling load-Air conditioning systems for different types of buildings-Protection against fire to be caused by AC. Systems.

UNIT III ACOUSTICS AND LIGHTING DESIGNS   9
Methods of sound absorptions – absorbing materials – noise and its measurements, sound insulation and its measurements, impact of noise in multistoried buildings. Visual field glare, colour daylight calculations – daylight design of windows, measurement of day – light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT IV SEMICONDUCTOR AND MAGNETIC PROPERTIES OF MATERIALS   9
Intrinsic Semiconductors – Energy band diagram – Direct and indirect band gap semiconductors –Intrinsic semiconductors – Extrinsic semiconductors –Variation of carrier concentration with temperature – Carrier transport in Semiconductor: drift and diffusion – Ohmic contacts.
Magnetic dipole moment –Magnetic permeability and susceptibility – Magnetic material classification: Diamagnetism – Paramagnetism – Ferromagnetism – Antiferromagnetism–Hard and soft magnetic materials

UNIT V NEW ENGINEERING MATERIALS   9
Composites – Definition and Classification – Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) – Metallic glasses – Shape memory alloys – Ceramics – Classification – Crystalline –Non-Crystalline – Bonded ceramics, Manufacturing methods – Slip casting - Isostatic pressing- Gas pressure bonding – Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics – High Aluminium ceramics.

TOTAL: 45 PERIODS

Text Books
1. Marko Pinteric, Building Physics, Springer 2017
2. William D Callister and David G. Rethwisch, "Material Science and Engineering: An Introduction", John Wiley, 10th Edition, 2018.
3. Stevens. W.R. "Building Physics: Lighting: Seeing in the Artificial Environment, Pergamon Press, 2013.

Reference Books
1. D.S. Mathur, Elements of Properties of Matter, S Chand & Company, 2010.
2. Hugo Hens, Building Physics: Heat, Air and Moisture, Wiley, 2017.
3. Hugo Hens, Applied Building Physics, Wiley,2016.
4. Raghavan.V, "Materials Science and Engineering", Prentice-Hall, 6th Edition, 2015.

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Apply the basics of heat transfer through different materials, thermal performance of building and various thermal applications.	Applying
CO2	Describe knowledge on the ventilation and air conditioning of buildings.	Understanding
CO3	Apply the concepts of sound insulation and lighting designs.	Applying
CO4	Describe concepts of semiconductors and magnetic properties of materials	Understanding
CO5	Describe basic knowledge about new engineering materials.	Understanding

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								1	2		2		
CO2	3								1	2		2		
CO3	3								1	2		2		
CO4	3								1	2		2		
CO5	3								1	2		2		
Avg.	3								1	2		2		

U24EE211   BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

To improve the communicative competence of learners

- To understand Basic DC & AC electrical circuits
- To impart knowledge in Basic Electrical wiring & Safety and Protection.
- To understand basic principles of Transformers and Rotating Machines.
- To educate on the fundamental concepts of analog devices & digital electronics.
- To introduce the Working principle of various measuring instruments.

UNIT I BASIC CONCEPTS OF DC ELECTRIC CIRCUITS: 9

Basic Terminology, Resistances in series and parallel; Capacitors & Inductors: energy stored. Ohm's Law and Kirchhoff's Laws-Problems; Analysis of DC electric circuits: Mesh current method - Node voltage methods- Numerical problems. Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, power, power factor. solutions of sinusoidally excited R-L-C circuits.

UNIT II ELECTRICAL WIRING: 9

Connectors and switches, systems of wiring, domestic wiring installation, sub circuits in domestic wiring, simple control circuit in domestic installation, industrial electrification. SAFETY and PROTECTION: Safety, electric shock, first aid for electric shock and other hazards, safety rules, use of multimeters, grounding, importance of grounding, equipment grounding for safety. Protection-need for earthing , fuses and circuit breakers. Energy Tariff calculation for domestic loads.

UNIT III ELECTRICAL DC & AC MACHINES: 9

Constructional features, working principle of DC motor and DC generator, Emf and Voltage equations. Three phase circuit and production of rotating magnetic field. Working principle of induction motor and torque-speed characteristics (concept only). Single-Phase Transformer: Brief idea on constructional parts, classifications, working principle. EMF equation.

UNIT IV ANALOG & DIGITAL ELECTRONICS   9

Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor, Thyristors- Types, I-V Characteristics and Applications. Review of number systems-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems).

UNIT V MEASUREMENTS & INSTRUMENTATION 9

Transducers; Definitions, Types of transducers and their applications for measurements-Classification of instruments-Types of indicating Instruments - Energy meter - multimeters – Oscilloscopes – three-phase power measurement, instrument transformers (CT and PT), DSO- Block diagram

TOTAL: 45 PERIODS

Text Books
1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2. Sedha R.S., "A text book book of Applied Electronics", S. Chand & Co., 2008

Reference Books
1. S.K. Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
2. Fundamentals of Electrical and Electronics Engineering, B. L. Theraja, S. Chand and Company. REPRINT 2013, ISBN 8121926602.
3. Del. Toro, "Principles of Electrical Engineering", Prentice Hall of India
4. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Demonstrate a comprehensive understanding of elementary concepts in DC & AC electrical circuits.	Applying
CO2	Explain the principles and practices of electrical wiring & concepts of safety and protection.	Understanding
CO3	Summarize a comprehensive observation of electrical rotating machines.	Understanding
CO4	Analyze the characteristics, basic concepts of analog & digital electronics.	Analysing
CO5	Classify operating principles of measuring Instruments.	Analysing

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1			1			1	3	2	1	
CO2	3	3	2	2			1			1	3	3	2	
CO3	3	3	3	3			1			1	3	3	3	
CO4	3	3	3	3			1			1	3	3	3	
CO5	3	3	3	2			1			1	3	3	3	
Avg.	3	3	3	2			1			1	3	3	3	

U24CE211	ENGINEERING GRAPHICS	L	T	P	C
		2	0	4	4

Course Objectives:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing projection of points, lines and plane surfaces.
- Drawing orthographic projection of solids and freehand sketches.
- Drawing projection of sectioned solids and development of surfaces.
- Drawing isometric and perspective projections of simple solids.

UNIT I PLANE CURVES 6+12

Basic Geometrical constructions, Curves used in engineering practices: Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid, Epicycloid and Hypocycloid - construction of involutes of square, circle and polygon - Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- Principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true

lengths and true inclinations by rotating line method. Projection of planes (square, circle and polygon) - Inclined to H.P & V.P

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING   6+12
Projection of simple solids like prisms, pyramids, cylinders, cones when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles -Representation of Three Dimensional objects - Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12
Sectioning of solids (Prisms, pyramids cylinders and cones) in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other - Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones.(Inclined to H.P or V.P)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS   6+12
Principles of isometric projection - isometric scale - isometric projections of simple solids Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple Solids-Prisms, pyramids and cylinders by visual ray method.
                                                TOTAL: (L=30; P=60) 90 PERIODS

Text Books
1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
3. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.

Reference Books
1. Basant Agarwal and Agarwal C.M.,"Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27thEdition, 2017.
3. Luzzader, Warren. J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Construct the conic curves, cycloids and involutes.	Applying
CO2	Solve problems involving projection of points, lines and plane surfaces	Applying
CO3	Construct projection of simple solids and Free hand sketches	Applying
CO4	Construct projection of simple sectioned solids and development of surfaces	Applying
CO5	Solve problems involving isometric and perspective projections of simple solids.	Applying

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2					2	2	3		2	2	2
CO2	3	2	2					2	2	3		2	2	2
CO3	3	2	2					2	2	3		2	2	2
CO4	3	2	2					2	2	3		2	2	2
CO5	3	2	2					2	2	3		2	2	2
Avg.	3	2	2					2	2	3		2	2	2

| **U24HS211** | தமிழரும் தொழில்நுட்பமும் / **TAMILS AND TECHNOLOGY** | **L** | **T** | **P** | **C** |
| | | **1** | **0** | **0** | **1** |

Course Objectives:
- To facilitate the student to understand weaving and technology of sangam age.
- To create an awareness on structural design of Tamils during sangam age.
- To help students to distinguish between all the levels of manufacturing technology in ancient period.
- To understand the ancient knowledge of agriculture and irrigation technology.
- To enable the students to understand the digitalization of Tamil Language.

UNIT I WEAVING AND CERAMIC TECHNOLOGY   **3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY   **3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY   **3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY   **3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING   **3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

Text Books
1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies).
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K. Pillay) (Published by: The Author).
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Review the Weaving and Ceramic Technology during Tamil Sangam Age.	Understanding
CO2	Describe the Construction Technology and various Architecture during Tamil Sangam Age.	Understanding
CO3	Discuss the Manufacturing Technology with Archaeological Evidences.	Understanding
CO4	Explain the Agriculture and Irrigation Technology during Tamil Sangam Age.	Understanding
CO5	Describe Tamil Software and Digitalization Tamil Literatures.	Understanding

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2			2		2	1	3				
CO2			2			2		2	1	3				
CO3			2			2		2	1	3				
CO4			2			2		2	1	3				
CO5			2			2		2	1	3				
Avg.			**2**			**2**		**2**	**1**	**3**				

U24HS223	TECHNICAL ENGLISH FOR ENGINEERS	L 2	T 0	P 2	C 3

Course Objectives:
- To engage learners in meaningful language activities to improve their LSRW skills.
- To enhance learners' awareness of general rules of writing for specific audiences.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I MAKING COMPARISONS   **6**
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases.

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING   **6**
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III PROBLEM SOLVING   **6**
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV REPORTING OF EVENTS AND RESEARCH   **6**
Reading –Newspaper articles; Writing – Proposal writing - Picture description - Accident Report, Survey Report. Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions.

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY   **6**
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

TOTAL: 30 PERIODS

Sl. No.	Practical – List of experiments
1	Role Play Exercises Based on Workplace Contexts
2	Understanding lexical items via movie clippings – Individual task
3	Discussing news stories
4	Dialogues (with cue cards)-Understanding common technology terms
5	Pronunciation, Intonation, Stress and Rhythm (Level 1)

6	Pronunciation, Intonation, Stress and Rhythm (Level 2)
7	Public Speech: Talking about self in a Professional Setting, Introduction of Speakers, Vote of thanks - 3 in a team
8	Writing a short article (Can be compiled as a magazine)
9	Verbal ability exercises for competitive examinations
10	Visume

TOTAL: 30 PERIODS

Text Books
1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021 Authored by Dr.Veena Selvam, Dr.Sujatha Priyadarshini, Dr.Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
3. Better English Pronunciation, (2005), J.D.O'Connor, Second Edition, ISBN-13:978-0521682589.

Reference Books
1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. A Modern Approach to Verbal & Non-Verbal Reasoning - Includes Latest Questions and their Solutions, Revised Edition, R.S. Aggarwal, January 2018.

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Articulate English with proper pronunciation, intonation, stress and rhythm.	Applying
CO2	Develop verbal ability skills for attending competitive examinations.	Applying
CO3	Employ speaking and writing skills in professional contexts.	Applying
CO4	Write effective resumes in the context of job search.	Applying
CO5	Interpret the denotative and connotative meanings of technical texts.	Understanding

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								1	2	3		3		
Avg.								**1**	**2**	**3**		**3**		

U24CE232	ENGINEERING PRACTICES FOR CIVIL AND MECHANICAL ENGINEERS	L	T	P	C
		0	0	4	2

Course Objectives:
- Use suitable tools for making carpentry components and pipe connections for plumbing works.
- Apply the welding techniques to join the structures.
- Performing the basic machining operations using Lathe and drilling machine.
- Apply sheet metal and foundry operations to make household products.
- Demonstrating assembly of a Fridge and household washing machine.

CIVIL ENGINEERING PRACTICES
Plumbing Works

Demonstrating basic plumbing operations
1. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in households.
2. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

Carpentry Works

Demonstrating basic carpentry operations
1. Making a T-Joint
2. Making wooden furniture using carpentry operations

MECHANICAL ENGINEERING PRACTICES
Welding

Demonstrating basic welding operations
1. Preparation of butt joint and lap joints by Shielded metal arc welding.
2. Studying on Gas welding practice

Basic Machining

1. Making (simple)Turning on mild steel rod using Lathe machine
2. Making (simple) Drilling on mild steel plate using drilling machine

Sheet metal Work

Demonstrating basic sheet metal operations
1. Model Making of a square Tray

Foundry Work

Demonstrating basic foundry operations.
1. Model Making of a computer Mouse

Assembly Work:

Demonstrating basic assembly operations
1. Study on Assembling a Fridge.
2. Study on Assembling a household washing machine

Course Outcomes: At the end of the course, the students will be able to		
CO	Course Outcome Statement	Knowledge level
CO1	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork.	Applying
CO2	Apply weld techniques to join structures using arc welding	Applying
CO3	Practice simple machining work	Applying
CO4	Apply sheet metal and foundry operations to make household products.	Applying
CO5	Demonstrate assembling of a Fridge and household washing machine	Applying

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2	2	2	2				3	3	2
CO2	3	3			2	2	2	2				3	3	2
CO3	3	3			2	2	2	2				3	3	2
CO4	3	3			2	2	2	2				3	3	2
CO5	3	3			2	2	2	2				3	3	2
Avg.	3	3			2	2	2	2				3	3	2

U24EE222	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives:

To improve the communicative competence of learners
- To provide hands-on experience in the operation and testing of basic electrical circuits and components.
- To familiarize students with laboratory equipment and techniques commonly used in electrical engineering
- To promote teamwork, communication, and problem-solving abilities through collaborative laboratory activities and projects.

Sl. No.   Practical – List of experiments:
1   To identify and understand the use of different electronic and electrical instruments.
2   Load test on separately excited DC generator
3   Load test on DC shunt motor.
4   Load test on Single phase Transformer
5   Load test on Induction motor
6   Verification of Circuit Laws
7   Three-phase Power measurement with two wattmeter methods.
8   Study of half wave and Full-wave (Bridge) rectifiers with and without capacitor filter circuit.
9   Realization of basic logic gates: Truth table verification of OR, AND, NOT, NOT and NAND logic gates
10   Study of CRO and measurement of AC signals
11   Characteristics of LVDT

TOTAL: 60 PERIODS

Text Books
1.   "Basic Electrical and Electronics Engineering Laboratory Manual"Author: S. K. Bhattacharya, Debabrata Chattopadhyay Publisher: Prentice Hall India Learning Private Limited Sedha R.S., "A text book book of Applied Electronics", S. Chand & Co., 2008.

Reference Books
1.   "Introduction to Electrical Engineering Laboratory Experiments"Author: Anthony J. Hayter, David T. Hayt Publisher: Wiley.
2.   "Electrical Engineering Laboratory Experiments" Author: Allen M. Agarwal, Dr. S. T. Kamala, Dr. S. Jayalakshmi Publisher: New Age International Del. Toro, "Principles of Electrical Engineering", Prentice Hall of India.
3.   "Fundamentals of Electric Circuits Laboratory Manual" Author: Charles K. Alexander, Matthew N. O. Sadiku Publisher: McGraw-Hill Education.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Identify and use common electrical components.	Understanding
CO2	Analyze the basic characteristics of transformers and electrical machines.	Applying
CO3	Demonstrate a thorough understanding of basic electrical principles, including Ohm's Law, Kirchhoff's laws	Analysing
CO4	Distinguish of using laboratory equipment such as oscilloscopes, multimeters, LVDT	Analysing
CO5	Practice teamwork and communication skills through collaborative laboratory exercises	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3					2		2		1
CO2	3	2	3	3	3					2		2		1
CO3	3	2	3	3	3					2		2		1
CO4	3	2	3	3	3					2		2		1
CO5	3	2	3	3	3					2		2		1
Avg.	**3**	**2**	**3**	**3**	**3**					**2**		**2**		**1**

U24EM212	PROFESSIONAL DEVELOPMENT	L	T	P	C
		0	0	2	1

Course Objectives:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations

Sl. No	List of exercises
1	**MS WORD: (10 Periods)** Create and format a document Working with tables Working with Bullets and Lists Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools Creating and Using document templates Inserting equations, symbols and special characters Working with Table of contents and References, citations Insert and review comments Create bookmarks, hyperlinks, endnotes footnote Viewing document in different modes Working with document protection and security Inspect document for accessibility
2	**MS EXCEL: 10 Periods** Create worksheets, insert and format data Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae Create and Work with different types of charts Use pivot tables to summarize and analyse data Perform data analysis using own formulae and functions Combine data from multiple worksheets using own formulae and built-in functions to generate results Export data and sheets to other file formats Working with macros Protecting data and Securing the workbook
3	**MS POWERPOINT: 10 Periods** Select slide templates, layout and themes Formatting slide content and using bullets and numbering

	Insert and format images, smart art, tables, charts
	Using Slide master, notes and handout master
	Working with animation and transitions
	Organize and Group slides
	Import or create and use media objects: audio, video, animation
	Perform slideshow recording and Record narration and create presentable videos
	Total: 30 Hours

Course Outcomes: At the end of the course, the students will be able		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Create quality documents, by structuring and organizing content for their day to day technical and academic requirements using MS Word	Applying
CO2	Perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding using MS Excel	Applying
CO3	Create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects using MS Power Point	Applying
CO4	Prepare an effective report using MS word and MS Excell on any subject content	Applying
CO5	Present the report using MS Power Point	Applying

CO-PO/PSO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	2		2		
CO2									2	2		2		
CO3									2	2		2		
CO4									2	2		2		
CO5									2	2		2		
Avg.									**2**	**2**		**2**		

B.E. Mechanical Engineering
R2024 Third Semester Syllabus

U24MA311	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

(Common to B.E. Civil Engineering)

Course Objectives:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNITI PARTIAL DIFFERENTIAL EQUATIONS   **9+3**
Formation of partial differential equations–Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types-Lagrange's linear equation-Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNITII FOURIER SERIES   **9+3**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

UNITIIIAPPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   **9+3**
Classification of PDE – Method of separation of variables - Fourier series solutions of one-dimensional wave equation–One dimensional equation of heat conduction –Steady state solution of two-dimensional equation of heat conduction (Cartesian coordinates only).

UNITIV FOURIER TRANSFORMS   **9+3**
Statement of Fourier integral theorem–Fourier transform pair–Fourier sine and cosine transforms–Properties–Transforms of simple functions–Convolution theorem–Parseval's identity.

UNITV Z-TRANSFORMS AND DIFFERENCE EQUATIONS   **9+3**
Z-transforms - Elementary properties – Convergence of Z-transforms – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

TOTAL: 60 PERIODS

Text Books
1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2019.

2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2022.
3. Veerarajan .T " Transforms and Partial Differential Equation" 3rd Edition McGraw Hill Education
4. Mercy Merlin . R "Transforms and Partial Differential Equation" Charulatha Publication Private limited

Reference Books

1. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics",10thEdition, Laxmi Publications Pvt. Ltd, 2021.
3. James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge level
CO1	Apply the concept of partial differential equation to solve the problems.	Applying
CO2	Determine the Fourier coefficients in the Fourier series expansion of the specified function of various complex problems in engineering.	Applying
CO3	Apply the Fourier series techniques in solving one and two dimensional heat flow problems.	Applying
CO4	Solve the problems in Fourier Transforms.	Applying
CO5	Solve partial differential equations using Z transform techniques.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3					2	2		3
CO2	3	3	3					2	2		3
CO3	3	3	3					2	2		3
CO4	3	3	3					2	2		3
CO5	3	3	3					2	2		3
Avg.	3	3	3					2	2		3

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME311	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

Course Objective:
- To learn the use of scalar and vector analytical techniques for analyzing forces in statically determinate structures
- To introduce the equilibrium of rigid bodies, vector methods and free body diagram
- To study and understand the distributed forces, surface, loading on beam and intensity.
- To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To develop basic dynamics concepts – force, momentum, work and energy.

UNIT I: STATICS OF PARTICLES 9

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II: EQUILIBRIUM OF RIGID BODIES 9

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III: DISTRIBUTED FORCES 9

Centroids of lines and areas – symmetrical and unsymmetrical shapes. Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Moments of Inertia of Areas and Mass - Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates.

UNIT IV FRICTION 9

The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Friction in screw threads, Ladder friction.

UNIT V DYNAMICS OF PARTICLES 9

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.

TOTAL: 45 PERIODS

Text Books

1 P .Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.
2 Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2019

Reference Books

1 Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage Learning, 2008
2 Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 15th edition, Prentice Hall, 2021
3 Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4 Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 9th edition, Wiley student edition, 2020.
5 Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2017

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Determine the force and moment scalar and vector methods of static bodies	Applying
CO2	Construct the free body diagram and analyses the rigid body in	Applying
CO3	Evaluate the properties of surfaces and solids	Applying
CO4	Determine the friction and the effects by the laws of friction	Applying
CO5	Calculate dynamic forces exerted in rigid body	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2		2			2	2		2	2	2
CO2	3	2	2		2			2	2		2	2	2
CO3	3	2	2		2			2	2		2	2	2
CO4	3	2	2		2			2	2		2	2	2
CO5	3	2	2		2			2	2		2	2	2
Avg.	3	2	2		2			2	2		2	2	2

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME321   ENGINEERING MATERIALS AND METALLURGY   L T P C
                                                        3 0 0 3

Course Objective:
- Understand the concept of constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
- Understand the various heat treatment processes and its microstructure formation.
- Understand the different types of ferrous and non-ferrous alloys and their uses in engineering field.
- Understand the different polymer, ceramics and composites and their uses in engineering field.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS   9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast-Iron microstructure, properties and application.

UNIT II HEAT TREATMENT   9

Definition – Full annealing, stress relief, recrystallisation and spheroidising –normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – continuous cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability, Jominy end quench test -case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementary ideas on sintering

UNIT III FERROUS AND NON-FERROUS METALS   9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, Ni, V,Ti& W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys – shape memory alloys- Properties and Applications - overview of materials standards

UNIT IV NON-METALLIC MATERIALS   9

Polymers – types of polymers, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PAI, PPO, PPS, PEEK, PTFE, Thermoset polymers – Urea and Phenol formaldehydes –Nylon, Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON – intermetallics- Metal Matrix Composites (MMCs) and Ceramic Matrix Composites (CMCs) - applications of MMCs and CMCs - Nano composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS   9

Mechanisms of plastic deformation, slip and twinning – Types of fracture – fracture mechanics- Griffith's theory- Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test lzod and charpy, fatigue and creep failure mechanisms.

TOTAL 45 PERIODS

Text Books

1 Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th Edition, 2018.

2 Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, 2nd edition Reprint 2019.

Reference Books

1 A. Alavudeen, N. Venkateshwaran, and J. T.Winowlin Jappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.

2 Sydney H. Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 2nd Edition, 2017

3 Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd. 6th edition, 2019.

4 Amandeep Singh Wadhwa, and Harvinder Singh Dhaliwal, A Textbook of Engineering Material and Metallurgy, University Sciences Press, 2008.

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Construct phase diagrams of different Alloys and explain the formation microstructure.	Applying
CO2	Explain the various heat treatment process involved in stress relieving of engineering materials	Understanding
CO3	Elaborate the properties and applications of ferrous and non-ferrous alloys.	Understanding
CO4	Explain the properties and applications of different types of polymers, Ceramics and Composites.	Understanding
CO5	Identify the type of failure mechanism of materials under different loads and explain different testing methods of materials	Understanding

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2					2	2		2	2	2
CO2	3							2	2		2	2	2
CO3	3							2	2		2	2	2
CO4	3							2	2		2	2	2
CO5	3							2	2		2	2	2
Avg.	3	2	2					2	2		2	2	2

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME331	**ENGINEERING THERMODYNAMICS**	L 3	T 1	P 0	C 4

Course Objective:
- Understand the basics and application of zeroth and first law of thermodynamics.
- Understand the second law of thermodynamics in analysing the performance of thermal devices.
- Understand availability and applications of second law of thermodynamics
- Understand the properties of steam and processes.
- Understand thermodynamic cycles and its performance

UNIT I: BASICS, ZEROTH AND FIRST LAW   12
Definition – macroscopic and microscopic view points – Thermodynamic systems, Properties and processes Thermodynamic Equilibrium – Displacement work – P-V diagram. Thermal equilibrium – Zeroth law – Concept of temperature and Temperature Scales. First law – application to closed and open systems – steady and unsteady flow processes.

UNIT II: SECOND LAW AND ENTROPY   12
Heat Engine – Refrigerator – Heat pump. Statements of second law and their equivalence & corollaries. Carnot cycle – Reversed Carnot cycle – Performance – Clausius inequality. Concept of entropy – T-s diagram – Tds Equations – Entropy changes for a pure substance. Ideal gases undergoing different processes – principle of increase in entropy. Applications of II Law.

UNIT III: AVAILABILITY AND GASEOUS MIXTURES   12
High and low-grade energy. Availability and Irreversibility for open and closed system processes – Gibbs and Helmholtz function, Gouy-Stodola theorem, I and II law Efficiency.
Properties of gaseous mixtures – Daltons law of partial pressure, Amagat's law of partial volume, gas constant, specific heats, specific heat, internal energy, enthalpy and entropy of gaseous mixtures

UNIT IV: PROPERTIES OF PURE SUBSTANCES AND RANKINE CYCLE   12
Steam – formation and its thermodynamic properties – p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart. Basic Rankine Cycle, modified, reheat and regenerative cycles.

UNIT V: THERMODYNAMIC CYCLES   12
Air Standard Cycles – Otto cycle, Diesel cycle, Dual cycle, Brayton cycle – modified, reheat and regenerative cycles – Cycle Analysis, Performance and Comparison.

TOTAL: 60 PERIODS

Text Books
1. P.K. Nag, "Engineering Thermodynamics", 6th Edition, Tata McGraw Hill (2017), New Delhi.
2. Y. Cengel, and M. Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill, 9th Edition, 2019.

Reference Books
1. R.K. Rajput, Engineering Thermodynamics, Laxmi Publications, New Delhi, 4th Edition 2016
2. C.P. Arora, Thermodynamics, McGraw Hill Edition, New Delhi. 2017
3. Robert Balmer, Thermodynamics Theory and applications, Jaico Publishing House, 1999

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply the first law of thermodynamics for simple open and closed systems	Applying
CO2	Apply the second law of thermodynamics to engineering devices and entropy calculation	Applying
CO3	Calculate the availability and irreversibility for open and closed system processes and properties of gaseous mixture	Applying
CO4	Apply properties of steam to Rankine cycle	Applying
CO5	Determine performance parameter of thermodynamic cycles	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2					2	2		2	2	2
CO2	3	2	2					2	2		2	2	2
CO3	3	2	2					2	2		2	2	2
CO4	3	2	2		2			2	2		2	2	2
CO5	3	2	2					2	2		2	2	2
Avg.	**3**	**2**	**2**		**2**			**2**	**2**		**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME341	MANUFACTURING TECHNOLOGY I	L	T	P	C
		3	0	0	3

Course Objective:
- To illustrate the working principles of various metal casting processes.
- To identify a suitable welding process for an application
- To analyse the working principles of bulk deformation of metals.
- To learn the working principles of the sheet metal forming process.
- To study and practice the working principles of plastics molding and powder metallurgy.

UNIT I: METAL CASTING PROCESSES (9)

Types of casting processes and applications; Sand Casting, Sand Mold, Type of patterns; Pattern Materials: Pattern allowances – Molding sand Properties and testing— types and applications – Molding machines types and applications – Design of gating system and riser;

Melting furnaces Cupola and Blast; Principles of special casting processes: Shell, investment – Ceramic mould - Pressure die casting; gravity die casting – centrifugal casting – Defects in Sand casting process and remedies.

UNIT II: METAL JOINING PROCESSES (9)

Joining Processes - Classification; Fusion Welding Processes: Gas Welding: oxy fuel welding, types of flames. Arc Welding: GMAW, GTAW, SMAW, plasma arc welding, submerged arc welding; Filler and Flux materials - Electrodes, Coating, and specifications; Resistance Welding, Laser beam Welding, Thermit Welding, and Electroslag Welding.

Solid State Welding Processes: Friction, Friction stir welding, Ultrasonic welding, explosive welding, diffusion welding. Welding defects, causes and remedies; Brazing and Soldering; Adhesive joining

UNIT III: BULK DEFORMATION PROCESSES (9)

Hot working and cold working of metals; Forging processes: Open, impression and closed die forging – cold forging- Characteristics of the processes – Typical forging operations; Rolling of metals – Types of Rolling mills – Flat strip rolling – shape rolling operations – Defects in rolled parts; Principle of rod and wire drawing – Tube drawing; Principles of Extrusion – Types – Hot and Cold extrusion. Introduction to shaping operations; Defects in metal working and their causes.

UNIT IV: SHEET METAL PROCESSES (9)

Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – Special forming processes - Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming – Incremental forming.

UNIT V: MANUFACTURE OF PLASTIC COMPONENTS & POWDER METALLURGY (9) Plastics - Moulding of thermoplastics & Thermosetting polymers; Shaping process for plastics; Extrusion, injection Moulding (Plunger and screw machines), Blow Moulding, Rotational Moulding, Compression Moulding – Transfer Moulding; Calendaring; and thermoforming.

Powder metallurgy: Production of metal powders; Stages in powder metallurgy: compaction and sintering of metals and ceramics; Cold and hot isostatic Pressing; Powder injection molding, Powder rolling, extrusion and forging, liquid phase sintering; Powder Metallurgy defects and their remedies.

TOTAL: 45 PERIODS

Text Books

1. Serope Kalpakjian; Steven R. Schmid, Manufacturing Engineering and Technology, 6th Edition, Prentice Hall, ISBN-10 0 13 – 608168-1, 2020
2. Mikell P. Groover; Fundamentals of Modern Manufacturing Materials, Processes, and Systems, 5th Edition; John Wiley & Sons, Incorporated, 2021
3. Hajra Choudhry, Elements of Workshop Technology, Vol – I Media Promoters & Publishers, 2008.

Reference Books

1. Khanna, O.P., and Lal, M., A Text Book of Production Technology, Vol I, Dhanpat Rai & Sons, 2010.
2. P.N. Rao, Manufacturing Technology Foundry, Forming and Welding, 2nd Edition, McGraw Hill, 2013,
3. Angelo P.C. Ravisankar B. Subramanian R, Powder Metallurgy: Science, Technology and applications PHI Learning Pvt. Ltd, 2022
4. Anish Upadhyaya, Gopal Shankar Upadhyaya, Powder Metallurgy: Science, Technology, and Materials, CRC Press 2018

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Illustrate the working principles of various metal casting processes.	Understanding
CO2	Explain the working principles of various metal joining processes	Understanding
CO3	Explain the working principles of various for bulk deformation of metals.	Understanding
CO4	Discuss the working principles of the sheet metal forming process.	Understanding
CO5	Discuss the processes to manufacture plastics for various applications and produce an object using powder metallurgy.	Understanding

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3				2			2	2		2	2	2
CO2	3				2			2	2		2	2	2
CO3	3				2			2	2		2	2	2
CO4	3				2			2	2		2	2	2
CO5	3				2			2	2		2	2	2
Avg.	3				2			2	2		2	2	2

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME352	COMPUTER AIDED MACHINE DRAWING	L 0	T 0	P 4	C 2

Course Objective:
1. To acquaint the skills and practical experience in handling 2D drafting and3D modelling software systems, standard drawing practices using fits and tolerances.
2. To prepare assembly drawings both manually and using standard CAD packages.
3. To Preparing standard drawing layout for modeled parts, assemblies with BoM.

PART I: DRAWING STANDARDS & FITS AND TOLERANCES (12)

Code of practice for Engineering Drawing, BIS specifications–Welding symbols, riveted joints, keys, fasteners– Reference to handbook for the selection of standard components like bolts, nuts, screws, keys etc.-Limits, Fits–Tolerancing of individual dimensions IS919-Specification of Fits – Preparation of production drawing sand reading of part and assembly drawings, basic principles of Geometric Dimensioning & Tolerancing.

PART II: 2D Drafting   (48)

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.
1. Bearings– Bush Bearing,
2. Valves – Safety and Non-return Valves.
3. Couplings– Flange, Oldham's, Muff, Gear couplings.
4. Joints– Universal, Knuckle, Gib & Cotter, Strap, Sleeve & Cotter joints.
5. Engine parts – Piston, Connecting Rod, Crosshead (vertical and horizontal), Stuffing box, multi- plate clutch.
6. Machine Components–Screw Jack, Machine Vice, Lathe Tail Stock, Lathe Chuck, Plummer Block, Vane and Gear pumps.

TOTAL PERIODS: 60

Total: 20% of classes for theory classes and 80%of classes for practice.
Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D CAD software.

Text Books

1   Gopalakrishna K.R,"Machine Drawing", 23rd Edition, Subhas Stores Books Corner, Bangalore, 2017.
2   N. D. Bhattand V.M. Panchal, "Machine Drawing", 51st Edition, Charator Publishers, 2022.

Reference Books

1   K. L Narayana, P. Kannaiah, K. Venkata Reddy, Machine Drawing , 15 Edition , New Age International Publication, New Delhi, India 2012.

2   Goutam Pohit and Goutam Ghosh, "Machine Drawing with AutoCAD", 1st Edition, Pearson Education, New Delhi, India 2004.

3   Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, New Delhi, India 2004.

4   N. Siddeshwar, P. Kanniah, V.V.S. Sastri," Machine Drawing", published by Tata McGraw Hill, New Delhi, India 2017 edition.

5   S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007.

Course Outcomes:

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply the knowledge on standards in drawing practices to prepare the engineering drawing.	Applying
CO2	Apply the principles behind dimensions and tolerances in an engineering drawing.	Applying
CO3	Explain the commands in CAD for 2D and 3D drafting.	Applying
CO4	Prepare the 2D orthographic views of standard machine components both manually and CAD packages.	Applying
CO5	Prepare the 3D geometric and assembly models of standard machine components using the CAD packages.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	3	-	2	2	2	-	2	2	2
CO2	3	2	2	-	3	-	2	2	2	-	2	2	2
CO3	3	2	2	-	3	-	2	2	2	-	2	2	2
CO4	3	2	2	-	3	-	2	2	2	-	2	2	2
CO5	3	2	2	-	3	-	2	2	2	-	2	2	2
Avg.	3	2	2	-	3	-	2	2	2	-	2	2	2

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low).

U24ME362   MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	4	2

Course Objective:
- To familiarize students with various turning operations such as taper turning, eccentric turning, knurling, external and internal thread cutting, and grooving using a lathe machine.
- To develop skills in force measurement by using a lathe tool dynamometer to analyze cutting forces and optimize machining parameters for improved efficiency.
- To provide hands-on experience in shaping, planning, and turret/capstan lathe operations for producing precise square and hexagonal profiles on circular components.
- To impart knowledge on gear manufacturing techniques, including spur gear cutting using a milling machine and gear generation using a hobbing machine.
- To enhance competency in grinding and finishing processes, such as cylindrical and surface grinding, to achieve high accuracy and superior surface quality in machined components.

Sl No	List of Experiments
1	Preparing green sand moulds with cast patterns.
2	Fabricating simple structural shapes using an arc welding machine.
3	Manufacturing of simple sheet metal components using shearing and bending operations.
4	Taper Turning with compound rest swiveling method using a lathe machine.
5	Eccentric turning on circular parts using the lathe machine.

6   Knurling, external and internal thread cutting on circular parts using a lathe machine.

7   Measurement of cutting forces using a lathe tool dynamometer.

8   Knurling, Grooving, Drilling using Capstan and turret Lathe.

9   Shaping square and hexagonal heads on circular parts using a shaper machine.

10   Creating square heads using a Planer machine.

11   Spur gear cutting in a milling machine.

12   Generating gears using gear hobbing machines.

13   Drilling and reaming using a vertical drilling machine.

14   Grinding components using a cylindrical grinding machine.

15   Plain surface grinding of components using a surface grinding machine.

Total Periods: 60

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply casting, welding, and metal forming techniques to fabricate basic mechanical components.	Analyzing
CO2	Perform turning operations such as taper turning, eccentric turning, knurling, and thread cutting on a lathe, and evaluate cutting forces using a lathe tool dynamometer.	Analyzing
CO3	Operate shaping, planning, and turret/capstan lathes to produce precise square and hexagonal profiles.	Analyzing
CO4	Demonstrate gear manufacturing techniques, including spur gear cutting and gear hobbing.	Analyzing
CO5	Execute grinding, drilling, and finishing operations to achieve required dimensional accuracy and surface quality.	Analyzing

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			3		2	2	2		2	2	2
CO2	3	2			3		2	2	2		2	2	2
CO3	3	2			3		2	2	2		2	2	2
CO4	3	2			3		2	2	2		2	2	2
CO5	3	2			3		2	2	2		2	2	2
Avg.	3	2			3		2	2	2		2	2	2

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EM312	DESIGN THINKING AND INNOVATION	L	T	P	C
	(Common to B.E. Civil, CSE and Mechanical and B./Tech. AIDS in Third Semester and B.E. ECE in Fifth Semester)	0	0	2	1

Course Objective:
- Empathizing with users to uncover their real problems and desires.
- Promoting out-of-the-box thinking to develop unique and effective solutions.
- Using prototyping, testing, and refining ideas to ensure the best outcome.
- Testing assumptions early to prevent costly mistakes and enhance decision-making.
- Creating innovative products, services, or processes that improve market competitiveness.

Sl No	List of Exercises	No of periods
1	Design Thinking – models – Why design thinking? Case Studies. Innovation – 7Cs of Innovation. Identify a case study.	4
2	Empathize – tools - customer Journey map – case studies – Empathize the identified case study	4
3	Analyze – tools, multi-whys, case study, conflict of interest. Analyze the identified case study	4
4	Ideate and solve – brainstorming – TRIZ method, trial and error method – Solve the identified case study	4
5	Prototype/process and test – tools and methods – create a prototype for the identified case study	4
6	Iterate to improve the prototype/process – revisit the methods to improve the prototype.	8
7	Submit the report and final prototype/process of the case study.	2
	Total Periods	**30**

Text Books
1. Pavan Soni, Design your thinking, Penguin Random House India Pvt, Ltd., India, 2022
2. Don Norman, The Desing of everyday things, Basic Books, New York, 2013

Reference Books

1. B.K. Chakravarthy, Janaki Krishnamoorthi, Innovation by Design Lessons from Post Box Design & Development, Springer, New Delhi 2013

2. Balaramadurai, Karmic Design Thinking, 2020
3. Design by Innovation NPTEL Course B.K. Chakravarthy IIT Bombay
   https:/ /npt el.ac.in/ courses/107 101086

4. Design Thinking and Innovation NPTEL Cours Ravi Poovaiah, IIT Bombay
   https:/ /onlinecourses.swa yam2.ac.in/ aic23_g e17/preview

5. Design Thinking A Premier NPTEL Course, Prof. Ashwin Mahalingam, Prof. Bala Ramadurai, IIT Madras https:/ /onlinecourses.npt el.a c.in/ noc22 _mg32/ preview

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply the tools to empathize the identified case study	Applying
CO2	Analyze the data and information to conceptualize the solution for the case study	Analyzing
CO3	Ideate and solve the case study using appropriate tools	Applying
CO4	Create a prototype/process of the case study	Creating
CO5	Iterate to improvise the prototype/process of the case study	Analyzing

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2			2	2	2	2	2	2	2	2	
CO2	2	2			2	2	2	2	2	2	2	2	
CO3	2	2			2	2	2	2	2	2	2	2	
CO4	2	2			2	2	2	2	2	2	2		3
CO5	2	2			2	2	2	2	2	2	2		3
Average	2	2			2	2	2	2	2	2	2	2	3

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

B.E. Mechanical Engineering

Fourth Semester Syllabus

U24ME411	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	1	0	4

Course Objective:

- To introduce the students about properties of the fluids, behavior of fluids under static conditions.
- To impart basic knowledge of the dynamics of fluids and boundary layer concept
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends.
- To exposure to the significance of boundary layer theory and its thicknesses.
- To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, pumps.

Detailed Syllabus

Unit Title and detailed syllabus
UNIT I   FLUID PROPERTIES AND FLOW CHARACTERISTICS   10+3
Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold's transportation theorem - Continuity equation, energy equation and momentum equation - Applications.
UNIT II   FLOW THROUGH PIPES AND BOUNDARY LAYER   9+3
Reynold's Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.
UNIT III   DIMENSIONAL ANALYSIS AND MODEL STUDIES   8+3
Fundamental dimensions - Dimensional homogeneity - Rayleigh's method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.
UNIT IV   HYDRAULIC TURBINES   9+3
Impact of jets - Velocity triangles - Theory of rotodynamic machines - Classification of turbines - Working principles - Pelton wheel - Modern Francis turbine - Kaplan turbine - Work done - Efficiencies - Draft tube - Specific speed - Performance curves for turbines - Governing of turbines.
UNIT V   PUMPS   9+3
Classification of Pumps – NPSH/Cavitations – Pump Impellers and Its Applications – Pump Static Head and Frictional Head – Lubrication (Oil/ Grease Pumps) – Affinity Law – Power Calculations – Pumps Operated in Parallel and Series – Advanced in Mechanical Sealing System –various Flow Control Systems - Selection of Pumps – MOC Of Pumps – Energy Conservation in Pumps.
Total Periods: 60

Text Books

1	Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014. 12th Edition 2024
2	Kumar K. L., Engineering Fluid Mechanics, S Chand & Co Ltd, 2016.

Reference Books

1	Cengel Y A and Cimbala J M, Fluid Mechanics, McGraw Hill Education Pvt. Ltd., Fourth Edition, 2017.
2	Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co., 9th Edition 2017.
3	Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
4	S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., Third Edition, 2017.
5	Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2011.

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Solve the problems on fluids under kinematics and dynamics by conservation laws	Applying
CO2	Determine losses in pipelines for both laminar and turbulent conditions. Also, describe the concept of boundary layer and its thickness	Applying
CO3	Apply the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies	Applying
CO4	Describe the working principles of various turbines and design the various types of turbines.	Analyzing
CO5	Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps	Analyzing

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3						2	2		2	2	3
CO2	3	3			2			2	2		2	2	3
CO3	3	3						2	2		2	2	3
CO4	3	3	2	2	2			2	2		2	2	3
CO5	3	3	2	2	2			2	2		2	2	3
Avg.	3	3	2	2	2			2	2		2	2	3

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME421	THEORY OF MACHINES	L	T	P	C
		3	0	0	3

Course Objective:
- Apply foundational knowledge to analyze simple mechanisms, perform kinematic analysis of basic linkages, and design cam systems.
- Calculate speed ratios for different gear train types and apply toothed gearing concepts to solve mechanical system problems
- Apply friction principles to analyze motion transmission in machine components and solve related engineering problems.
- Understand the concepts of Free body diagram and Principle of superposition, perform dynamic analysis on simple machine elements
- Perform balancing of rotating and reciprocating masses in mechanical systems. Calculate natural frequencies in torsional systems, determine governor effort and power,

Detailed Syllabus

Unit Title and detailed syllabus
Unit I Kinematics of Machines   **9**
Mechanisms – Terminology and definitions – kinematic inversions of four bar and slider crank chain – Basics of kinematic analysis in simple mechanisms – Velocity and Acceleration of Links using relative velocity method (Slider crank and Four bar mechanism) – Cams – Terminologies & Classification – Derivatives of follower motion – Cam profiles – Knife edge, Roller & Flat face followers (Inline and offset followers)- Circular Arc and Tangent Cam (Basic Concepts only)
Unit II Gears and Gear Trains   **9**
Spur gear – Terminology - Law of toothed gearing – Involute and Interchangeable gears – Gear tooth action – Length of path of contact, Length of arc of contact, contact ratio – interference and undercutting – Non standard teeth – Gear trains -Basics of Gear trains – Calculation of Speed ratio of Simple, Compound and Epicyclic gear trains using tabular method.
Unit III Friction in Machine Elements   **9**
Surface contacts – Sliding and Rolling friction – Friction drives – Bearings and lubrication – Friction clutches (Single plate and Multi Plate clutch only) – Belt and rope drives – Friction aspects in brakes– Friction in vehicle propulsion and braking (Basic Concepts only).
Unit IV Force Analysis and Balancing of masses   **9**
Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members - Dynamic Force Analysis – Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing of machines.
Unit V Free and Forced Vibration   **9**
- Free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation (Basic Concepts only) – Gyroscopic Principles (Basic Concepts only)

Text Books

1	R.S. Khurmi&J.K. Gupta., "Theory of Machines", S. Chand & Company Pvt. Ltd., Eurasia publishing housPvt. Ltd., 2013
2	Shigley J. E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press, 2003
3	Ambekar A.G., "Mechanism and Machine Theory" Prentice Hall of India, New Delhi, 2007

Reference Books

1	Rao.J.S. and Dukkipatti'R.V. "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi, 1992.
2	V. Ramamurthi, "Mechanisms of Machines" Viva Low Prices Student Edition, 1999.
3	Robert L. Norton, Design of Machinery, McGraw-Hill, 2004

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Solve problems in simple mechanisms and draw the cam profiles.	Applying
CO2	Determine kinematic parameters of spur gears and calculate the speed ratios for different types of gear trains.	Applying
CO3	Compute the power transmission in various friction drives.	Applying
CO4	Draw free body diagrams and determine torque, Calculate the engine forces, balancing mass for rotating and reciprocating parts.	Analysing
CO5	Determine the natural frequency of free and forced vibrations, apply the concepts of Gyroscopic couple.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2					2	2		2	3	2
CO2	3	2	2					2	2		2	3	2
CO3	3	2	2					2	2		2	3	2
CO4	3	2	2					2	2		2	3	2
CO5	3	2	2					2	2		2	3	2
Avg.	**3**	**2**	**2**					**2**	**2**		**2**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME431	THERMAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:
- Understand the working of IC engines and its auxiliary systems
- Understand and evaluate performance parameter of IC engine
- Understand theory and design of steam nozzle
- Understand theory and design of steam turbine
- Understand refrigeration and psychrometrics and its applications

Detailed Syllabus

Unit Title and detailed syllabus
UNIT I INTERNAL COMBUSTION ENGINES – FEATURES AND COMBUSTION   9 IC engine – Classification, working, components and their functions. Ideal and actual: Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control
UNIT II INTERNAL COMBUSTION ENGINE PERFORMANCE AND AUXILIARY SYSTEMS   9 Performance and Emission Testing, Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common rail direct injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms
UNIT III STEAM NOZZLES   9 Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.
UNIT IV STEAM AND GAS TURBINES   9 Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.
UNIT V REFRIGERATION AND AIR – CONDITIONING   9 Refrigeration, ton of refrigeration-Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, and vapour absorption system. Psychrometrics, properties and processes. Psychrometric chart. Air conditioning systems, types, concept of RSHF, GSHF and ESHF, Cooling load calculations.
Total Periods: 45

Text Books

1	C.P. Kothandaraman, S. Domkundwar and A.V. Domkundwar, "A course in Thermal Engineering", Dhanpat Rai & Sons, New Delph 2016.
2	Mahesh. M. Rathore, "Thermal Engineering", Tata Mc Graw Hill Publications, New Delhi 2010.

Reference Books

1	R.K. Rajput, "Thermal Engineering", Laxmi Publications, New Delhi 2010
2	V. Ganesan, "Internal Combustion Engines", Tata Mcgraw-Hill, New Delhi 2020

| 3 | J.B. Heywood, "Fundamentals of IC engines", Mc Graw Hill Publications, New Delhi 2017 |
| 4 | C.P. Arora, "Refrigeration and Air Conditioning", Tata Mc Graw Hill, New Delhi 2008 |

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Explain the functioning and features of IC engine and combustion phenomenon	Understanding
CO2	Discuss auxiliary systems and calculate the various performance parameters of IC engines	Applying
CO3	Determine velocity and area at various sections of nozzle	Applying
CO4	Compare steam turbines and determine various efficiencies	Applying
CO5	Explain refrigeration and air-conditioning system and solve problems	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2					2	2		2	2	2
CO2	3	2	2					2	2		2	2	2
CO3	3	2	2		2			2	2		2	2	2
CO4	3	2	2					2	2		2	2	2
CO5	3	2	2		2			2	2		2	2	2
Avg.	3	2	2		2			2	2		2	2	2

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U25ME441	MANUFACTURING TECHNOLOGY – II	L	T	P	C
		3	0	0	3

Course Objective:
- To study the concepts and basic mechanics of metal cutting and the factors affecting machinability
- To learn the workings of basic and advanced turning machines.
- To teach the basics of machine tools with reciprocating and rotating motions and abrasive finishing processes.
- To classify non-traditional machining processes and describe various machining processes.
- To understand the fundamentals of additive manufacturing, its principles, various processes.

Detailed Syllabus

UNIT I: MECHANICS OF METAL CUTTING   9
Mechanics of chip formation, forces in machining, types of chips, cutting tools—single-point cutting tool nomenclature. Orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish and cutting fluids.

UNIT II: TURNING MACHINES   9
Centre lathe, constructional features, specifications, operations—taper turning methods, Work holding devices. Special lathes—capstan and turret lathes- tool layout, automatic lathe, Swiss type lathe.

UNIT III: RECIPROCATING MACHINES   9
Reciprocating machine tools: shaper, planer: Types and operations; Hole making: Drilling, reaming, boring, tapping, Milling - types, operations, attachments and types of milling cutters; Gear hobbing and gear shaping – gear finishing methods; Abrasive processes: grinding wheel—specifications and selection, types of grinding process—cylindrical grinding, surface grinding, centerless grinding, internal grinding.

UNIT IV: NON-TRADITIONAL MACHINING PROCESSES   9
Classification of non-traditional machining processes, basic principles, process variables, applications, and limitations of Mechanical Energy-Based Processes: Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Ultrasonic Machining (USM).
 Thermo-Electric Energy-Based Processes: Electrical Discharge Machining (EDM), Wire Electrical Discharge Machining (Wire EDM), Laser Beam Machining (LBM). Chemical Energy-Based Processes: Chemical Machining (CHM), Electrochemical Energy-Based Processes: Electrochemical Machining (ECM).

UNIT V: ADDITIVE MANUFACTURING	9
Introduction to Additive Manufacturing (AM)—principles and key features— comparison with traditional manufacturing processes— advantages, limitations, and challenges; Liquid-based systems—Stereolithography (SLA) top-down and bottom-up approach—Advantages—Limitations—Applications. Powder-based systems: Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP); Molten material systems—Fused-Deposition Modelling (FDM), Solid sheet-based systems—Laminated-Object Manufacturing (LOM)	
	TOTAL: 45

Textbooks

1	Serope Kalpakjian; Steven R.Schmid (2023), Manufacturing Engineering and Technology, 8th
2	Mikell P. Groover; Fundamentals of Modern Manufacturing Materials, Processes, and Systems, 5th Edition; John Wiley & Sons, Incorporated, 2019
3	Hajra Choudhry, Elements of Workshop Technology, Vol. II Media Promoters & Publishers,
4	Adithan, M., "Unconventional Machining Processes," Atlantic, New Delhi, India, 2018. ISBN-13 : 978-8126910458

Reference Books

1	Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani "Additive manufacturing technologies.". 3rd edition Springer Cham, Switzerland. (2021). ISBN: 978-3-030-56126-0
2	Carl Sommer, "Non-Traditional Machining Handbook," Advance Publishing., United States, 2000, ISBN-13: 978-1575373256.

Course Outcomes

	At the end of the course, the students will be able to	
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the mechanics of metal cutting to evaluate cutting forces, tool life, and surface finish using appropriate cutting tool materials and machining conditions.	Applying
CO2	Illustrate the construction and operation of centre lathes, capstan, turret, and automatic lathes to select suitable machines for turning operations	Understanding
CO3	Explain the working of reciprocating and rotating machine tools and abrasive machining processes.	Understanding
CO4	Apply the principles of non-traditional machining processes to select suitable methods for given engineering applications.	Applying
CO5	Explain the principles, processes, advantages, limitations of various additive manufacturing technologies.	Understanding

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2		2			2	2		2	2	2
CO2	2				2			2	2		2	2	2
CO3	2				2			2	2		2	2	2
CO4	2	2	2					2	2		2	2	2
CO5	2							2	2		2	2	2
Avg.	2.2	2	2		2			2	2		2	2	2

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EM411	APTITUDE AND REASONING – I	L	T	P	C
		1	0	0	1

Course Objective:
- Enhance analytical and logical reasoning skills to solve problems efficiently.
- Strengthen understanding of basic arithmetic, algebra, geometry, and data interpretation.
- Train students to approach problems systematically and apply suitable techniques.
- Foster quick thinking and reduce error rates through practice and time-bound exercises.

Syllabus

Topic titles	No of periods
Quantitative aptitude • Numbers: Number series, arithmetic progression, geometric progression • HCF and LCM: Highest common factor – split method, division method, Least Common Multiples – prime factor method, division method. • Simplification – BODMAS rule • Average and Percentage • Simple and Compound Interest • Profit, loss and discounts • Ratio and proportion: Ratio – compound ratio, inverse ratio. Proportion – direct proportion, inverse proportion • Mixture and alligation: Mixture, alligation, mean concentration • Problems based on ages • Partnerships: Simple partnership, compound partnership	20
Reasoning: • Number series and letter series • Odd one out • Coding and decoding • Missing characters/numbers and analogies • Blood relations problems • Direction sense tests • Sequencing and ranking test	10

References

1	R.V. Praveen, "Quantitative Aptitude and Reasoning", 3rd Edition , Eastern Economy Edition, PHI Learning, New Delhi, 2016
2	Dr. R.S. Aggarwal, " Quantitative Aptitude", S Chand Publishing, New Delhi 2017
3	Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand Publishing, New Delhi 2017
4	https://www.indiabix.com/
5	https://www.geeksforgeeks.org/
6	https://faceprep.in/
7	https://prepinsta.com/
8	https://www.javatpoint.com/

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Solve quantitative aptitude problems involving arithmetic, algebra, percentages, ratios, etc., using logical approaches.	Applying
CO2	Analyze problems and apply reasoning strategies such as deduction, inference, and pattern recognition.	Analysing
CO3	Solve problems in simple and compound interest, profit, loss and discount	Applying
CO4	Solve problems based on ages and partnership	Applying
CO5	Demonstrate improved performance in time-bound aptitude tests through consistent practice.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								2	1		2		
CO2								2	1		2		
CO3								2	1		2		
CO4								2	1		2		
CO5								2	1		2		
Avg.								2	1		2		

For CO-PO/PSO Mapping:3 – Substantial (High), 2– Moderate (Medium), 1– Slight (Low)

U24ME453	STRENGTH OF MATERIALS	L	T	P	C
		3	0	2	4

Course Objective:

- Understand and apply the concepts of stress and strain in simple and compound bars.
- Understand and draw shear force and bending moment diagrams for various types of beams.
- Understand and apply fundamental torsion equations in the design of shafts and helical springs.
- Understand and determine the slope and deflection of beams.
- Understand and evaluate stresses in thin- and thick-walled cylinders and spherical shells.

Detailed Syllabus

Unit Title and detailed syllabus
UNIT I Stress, Strain and Deformation of Solids   **9**
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simple and compound bars – Thermal stresses – Elastic constants - Volumetric strains - Principal stresses and principal planes - Mohr's circle graphical method.
UNIT II Transverse Loading on Beams and Stresses in Beam   **9**
Beams – Types - Transverse loading on beams – Shear force and Bending moment in beams – Cantilever, simply supported and over hanging beams. Theory of simple bending – Bending stress distribution – Load carrying capacity - Proportioning of sections - Flitched beams.
UNIT III Torsion   **9**
Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.
UNIT IV Deflection of Beams   **9**
Deflection and slope of a Beam subjected to Uniform Bending Moment - Deflection of a simply supported Beam with a Central Point load, Eccentric Point load and Uniformly Distributed load by Double Integration method, Moment Area Method (Mohr's Theorems) and Macaulay's Method.
UNIT V Thin Cylinders, Spheres and Thick Cylinders   **9**
Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Thick cylinders - Lame's theory.
Total Periods: 45

Sl. No	List of Experiments
1	Tension test on mild steel rod.
2	Torsion test on mild steel rod.
3	Brinell Hardness hardness test on metals.
4	Rockwell hardness test on metals.
5	Compression test on open coil helical spring.
6	Tension test on closed coil helical spring.
7	Impact test on mild steel square rod.
	Total Periods: 30

Total Periods: 75

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply the concepts of stress and strain in simple and compound bars and understand principal stresses and principal planes	Applying
CO2	Analysis shear force, bending moment and stress distribution of various beam and draw SF & BM diagrams.	Analyzing
CO3	Apply basic equation of simple torsion in designing of shafts and helical spring.	Applying
CO4	Analysis slope and deflection in various beams by different methods.	Analyzing
CO5	Apply the concepts of stresses on thin, thick cylinder and spherical shells.	Applying

Text Books

1	Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 7th edition, 2018.
2	Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt.Ltd., New Delhi, 2017.

Reference Books

1	Singh. D.K., "Strength of Materials", Ane Books Pvt Ltd., New Delhi, 2021.
2	Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi,2015.
3	Beer. F.P. & Johnston. E.R. "Mechanics of Materials", Tata McGraw Hill, 8th Edition, New Delhi 2019.
4	Vazirani. V.N, Ratwani. M.M, Duggal. S.K "Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1", Khanna Publishers, New Delhi 2014.

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3			2		2	2	2		2	2	2
CO2	3	3	3					2	2		2	2	2
CO3	3	3			2		2	2	2		2	2	2
CO4	3	3	3					2	2		2	2	2
CO5	3	3						2	2		2	2	2
Avg.	3	3	3		2		2	2	2		2	2	2

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME463	CAD/CAM	L	T	P	C
		3	0	2	4

Course Objective:
* To provide an introduction to the fundamentals of design and to understand the basics of 2D and 3D works.
* To understand the principles of two-dimensional (2D) drafting and the creation of a bill of materials (BOM).
* To provide exposure to three-dimensional (3D) modeling techniques and their advantages in engineering design.
* To undertake the study of basic assembly modeling concepts and understand their purpose in 2D and 3D works.
* To provide exposure to the basics of computer-aided machining and part programming for manufacturing applications.

Detailed Syllabus

UNITI: BASICS OF DESIGN   **9**

Understanding of Projections, Scales, units, GD & T; its 14 symbols, Special characteristics; Title Block readings. Revision / ECN status of drawings – Customer Specific requirements – Drawing Grid reading. 2D & 3D transformations: Reflection, Translation and Rotation.

UNIT II: 2D DRAFTING   **9**

Projection views – Orthographic view, Auxiliary view, Full & Half Section views, Broken Section view, Offset Section view – Title Block creation – BOM Creation – Notes creation – Ballooning of 2D drawing and its features for Inspection reporting.

UNIT III: 3D MODELING   **9**

Conversion of Views – 2D to 3D & 3D to 2D – Parametric and Non-Parametric Modeling – Tree features of 3D Modeling and its advantages – Surface Modeling – BIW (Body in White) – Solid Modeling, Boolean operations like Unites, Subtraction and Intersect.

UNIT IV: ASSEMBLY MODELING   **9**

Basics of Assembly modeling, Purpose of Assembly modeling and its advantages – Top to Down & Bottom-Up modeling approaches – Analysis of Clearances – Undercuts – Interferences – Stack up analysis –Cumulative effect of Tolerances in after assembly conditions- Motion analysis.

UNIT V: CAM   **9**

Basics of CNC Machining – 3, 4, 5 Axis machines - CNC and Part Programming, CAM programming 2D & 3D. Elements of CAM Orientation, Boundary Creation, Cutter Path Selection, Cutter Compensation –Machining Stocks, Roughing, Re-roughing, Semi Finishing, Finishing - Tool Path Generation, and Milling Programming. Machining program simulation, integration of program with machine; Estimation of CNC Cycle time. – Post Process NC Code conversion and Setup Sheet Preparation. Work holding methods in turning and machining centres, coolant systems and safety features.

Total Periods: 45

PRACTICAL-LIST OF EXPERIMENT

S.No	ASSEMBLY MODELLING USING ANY 3D MODELLING SOFTWARE'S (CREO, NXCAD AND SOLID WORKS ETC.,)
1	Study of Sketch, Part Modeling & Solid modeling: Extrude Revolve, Sweep, Variational sweep and Loft. Surface modeling: Extrude, Sweep, Trim, Mesh of curves and Free form. Feature manipulation: Copy, Edit, Pattern, Suppress, History operations.
2	a. Study of Assembly Modeling: Constraints, Exploded Views, Interference check b. Study of Drafting: Layouts, Standard & Sectional Views, Detailing & Plotting
3	Creation of 3D assembly model Flange Coupling using 3D Modelling software
4	Creation of 3D assembly model Plummer Block using 3D Modelling software
5	Creation of 3D assembly model Screw Jack using 3D Modelling software
6	Creation of 3D assembly model Universal Joint using 3D Modelling software
7	Creation of 3D assembly model Piston using 3D Modelling software
	MANUAL PART PROGRAMMING
8	CNC Machining Centre a. Write a CNC Part Program to the Linear Cutting using standard G and M codes. Also check the tool path simulation using appropriate CAM software. b. Write a CNC Part Program to the Circular cutting using standard G and M codes. Also check the tool path simulation using appropriate CAM software
9	CNC Turning Centre a. Write a CNC Part Program to the Straight, Taper and Radial Turning using standard G and M codes. Also check the tool path simulation using appropriate CAM software. b. Write a CNC Part Program to the Drilling Cycle using standard G and M codes. Also check the tool path simulation using appropriate CAM software.
10	COMPUTER AIDED PART PROGRAMMING Generate CL Data and Post process data using CAM packages for Machining and Turning Centre
	Total Periods: 30
	Total Periods: 75

Textbooks

1	Ibrahim Zeid ,"Mastering CAD CAM" ,Tata McGraw-Hill Publishing Co.2007
2	Jacob Moses, Ruchi Agarwal "Computer Aided Design; Manufacturing ,Technical Publications" 2020 Edition
3	J. Srinivas, CAD / CAM Principles & Application -Oxford HED, 2016 Edition

Reference Books

1	Ibrahim Zaid, R. Sivasubramanian "CAD / CAM Theory and Practice", Mc Graw Hills (Publisher), Second Edition
2	Chandandeep Grewal & Kuldeep Sareen, CAD / CAM Theory and Concepts, S CHAND Publishing, 2007
4	Anup Goel, A. Jacob Moses & Renjin J. Bright, Computer Aided Design & Manufacturing, Technical Publications,2021 Edition
5	PN Rao, CAD / CAM: Principles and Applications, McGraw Hill Education, Edition 2017

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Understanding the basics of design concepts to solve engineering problems using industry-relevant 2D and 3D practices.	Understanding
CO2	Understanding two-dimensional (2D) drafting techniques and generate projection views as per industrial standards.	Understanding
CO3	Apply three-dimensional (3D) modeling techniques, including parametric and non-parametric modeling, for industry-oriented product development.	Applying
CO4	Apply assembly modeling principles using top-down and bottom-up approaches for industrial design and manufacturing applications and undertaking project work to enhance modeling skills.	Applying
CO5	Analyze the computer-aided machining techniques for given components and develop industrial part programming for CNC manufacturing.	Analysing

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2				2		2	2	2		2	3	3
CO2	2				2		2	2	2		2	3	3
CO3	3	2			2		2	2	2		2	3	3
CO4	3	2			2		2	2	2		2	3	3
CO5	3	2	2		2		2	2	2		2	3	3
Avg.	2.6	2	2		2		2	2	2		2	3	3

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME472	FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:
- Understand and compute material properties: Hardness, Tensile Strength, Young's Modulus, and Toughness.
- Understand and estimate spring deflection under different loads.
- Understand and determine the coefficient of discharge for flow devices and evaluate metacentric height.
- Understand and analyze pump performance characteristics and interpret curves.
- Understand and evaluate hydraulic turbine performance and analyze curves.

List of Experiments

Sl. No	List of Experiments
1	Calculation of the rate of flow using Rota meter
2	Determination of the Coefficient of discharge of given Orifice meter.
3	Determination of coefficient of discharge of a venturimeter.
4	Determination of friction factor for flow through pipes.
5	Determination of metacentric height.
6	Characteristics of centrifugal pumps.
7	Characteristics of reciprocating pump.
8	Characteristics of Pelton wheel turbine.
9	Characteristics curves of Francis turbine.
10	Characteristic curves of Kaplan turbine.
	Total Periods: 60

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Determine the rate of flow and discharge coefficients using flow measuring devices such as rotameter, orifice meter, and venturi meter.	Applying
CO2	Evaluate friction losses and determine the friction factor for flow through pipes under different flow conditions.	Applying
CO3	Apply the concept of buoyancy and determine the metacentric height to study the stability of floating bodies.	Applying
CO4	Analyze the performance characteristics of pumps, including centrifugal and reciprocating types, through experimental testing.	Analyzing
CO5	Examine the performance and characteristic curves of hydraulic turbines such as Pelton wheel, Francis, and Kaplan turbines under various operating conditions.	Analyzing

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3			2		2	2	2		2	2	3
CO2	3	3			2		2	2	2		2	2	3
CO3	3	3			2		2	2	2		2	2	3
CO4	3	3	2		2		2	2	2		2	2	3
CO5	3	3	2		2		2	2	2		2	2	3
Avg.	3	3	2		2		2	2	2		2	2	3

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24ME482	THERMAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:
- To analyze the valve and port timing diagram and performance characteristics of IC engines
- To examine the Performance & retardation characteristics of 4 stroke Engine
- To investigate the Performance & retardation characteristics of 2 stroke Engine
- To analyze the Performance characteristics of Air compressor.
- To determine COP of Refrigeration system.

List of Experiments

Sl No	List of Experiments
1	Valve Timing and Port Timing diagrams.
2	Performance Test on four – stroke Diesel Engine.
3	Heat Balance Test on 4 – stroke Diesel Engine.
4	Retardation Test on a Diesel Engine.
5	Determination of Flash Point and Fire Point of various fuels / lubricants
6	Performance test on a two stage Reciprocating Air compressor
7	Determination of two stroke petrol engine performance using Electrical bulb loading.
8	Determination of four stroke Diesel engine performance using Hydraulic Dynamometer.
9	Study of Steam Generators and Turbines.
10	Actual p-v diagrams of IC engines.
11	Determination of COP of a Refrigeration system
12	Determination of p-θ diagram and heat release characteristics of an IC engine.
	Total Periods: 60

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Draw the valve and port timing diagram of IC engines.	Applying
CO2	Analyze the performance and retardation characteristics of a four-stroke engine.	Analyzing
CO3	Evaluate the performance and retardation characteristics of a two-stroke engine.	Analyzing
CO4	Analyze the performance characteristics and efficiency of an air compressor.	Analyzing
CO5	Analyze performance tests and energy balance analysis on a steam generator.	Analyzing

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			2		2	2	2		2	3	2
CO2	3	2	2		2		2	2	2		2	3	2
CO3	3	2	2		2		2	2	2		2	3	2
CO4	3	2	2		2		2	2	2		2	3	2
CO5	3	2	2		2		2	2	2		2	3	2
Avg.	**3**	**2**	**2**		**2**		**2**	**2**	**2**		**2**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EM422	SOFT SKILLS AND PERSONALITY DEVELOPMENT – I	L	T	P	C
		0	0	2	1

Course Objective:

- To understand and interpret human perception and behavior, enhancing interpersonal awareness.
- To enhance self-management, including habit formation, stress regulation, and personal productivity
- Develop conflict-resolution skills, aiming for win-win outcomes through structured strategies.
- Strengthen communication abilities—active listening, telephone etiquette, and overcoming listening barriers.

List of Exercises

Sl. No.	List of Exercises
1	Introduction: A New Approach to Learning, Planning and Goal-Setting
2	Human Perceptions: Understanding People
3	Aiming for Excellence: Developing Potential and Self-Actualisation
4	Self-Management Skills- Time management & Self-motivation
5	Self-Management Skills- Stress management & Adaptability
6	Conflict Resolution Skills
7	Using The Zeigarnik Effect for Productivity and Personal Growth, Forming Habits of Success
8	Communication: Significance of Listening, Active Listening, Barriers to Active Listening
9	Telephone Communication: Basic Telephone Skills, Advanced Telephone Skills , Essential Telephone Skills
10	Profile Building
	Total Periods: 30

Text Books

1	Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2	Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.

Reference Books

1	Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
2	Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.

Course Outcomes

	At the end of the course, the students will be able to	
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Develop an actionable growth plan aligning self-development with objectives.	Applying
CO2	Analyze the habit loop; design personal interventions to break bad habits.	Analysing
CO3	Analyze examples of interpersonal conflict, propose dual solutions using conflict-model frameworks.	Analysing
CO4	Apply stress-management strategies: reframing, planning, relaxation exercises.	Applying
CO5	Apply techniques to rectify the barriers in active listening	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1							2	2	2		2		
CO2							2	2	2		2		
CO3							2	2	2		2		
CO4							2	2	2		2		
CO5							2	2	2		2		
Avg.							**2**	**2**	**2**		**2**		

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)