Loyola-ICAM

College of Engineering and Technology (LICET)

(Autonomous)

Loyola Campus, Nungambakkam, Chennai – 600 034

Curriculum and Syllabi (R-2024)

B.E. MECHANICAL ENGINEERING

Loyola-ICAM
College of Engineering and Technology (LICET)
(Autonomous)

CURRICULUM AND SYLLABI (R-2024)

CHOICE BASED CREDIT SYSTEM (CBCS)

B.E. MECHANICAL ENGINEERING

Vision of the Institution:

- To form responsible engineers, who would engineer a just society.

Mission of the Institution:

- To provide technical education in a Christian atmosphere to deserving students who are economically poor and socially marginalized
- To train young men and women of quality to be leaders in all walks of life and serve their fellow men with justice, truth and love
- To implement teaching learning processes that ensure guidance and mentoring for students throughout their period of study
- To provide higher education through academic collaboration and pursue research in the international perspective of Engineering.

Vision of the Department:

To develop competent and socially responsible mechanical engineers by providing quality education and research facilities.

Mission of the Department:

M1: To collaborate with world class technical institutions both national, international and R&D organizations to impart practical training, teaching, research and entrepreneurship in order to prepare globally competitive mechanical engineers.

M2: To provide state of the art infrastructure and research facilities and adopting modern teaching methodologies and training to achieve academic excellence.

M3: To form socially responsible mechanical engineers by inculcating ethics through value based education.

Programme Educational Objectives:

PEO1: Have a successful career in Mechanical Engineering and allied Industries.

PEO2: Have expertise in the areas of Design, Thermal, Materials and Manufacturing

PEO3: Practice their position with good communication skills, leadership, ethics and social responsibility.

Programme Outcomes:

PO 1 – Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

PO 2 – Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences**.**

PO 3 – Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations

PO 4 – Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5 – Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6 – The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7 – Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

PO 8 – Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO 9 – Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 – Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 – Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12 – Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1: The graduates will be able to combine their theory, hands-on and software knowledge in the field of mechanical engineering to design and develop components and provide solutions to practical problems.

PSO2: The graduates will be able to apply their knowledge in the field of thermal and fluid sciences to simulate and develop solutions for real-time applications

PSO3: The graduates will be able to apply knowledge and skills in various aspects of manufacturing technology and automation to enhance productivity and cater to current industrial needs.

PSO4: The graduates will be able to engage professionally in industries or as entrepreneurs by applying modern management practices.

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CURRICULUM AND SYLLABI (R-2024)
CHOICE BASED CREDIT SYSTEM (CBCS)
B.E. MECHANICAL ENGINEERING

SEMESTER – I

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	MA24101	Calculus for Engineers	BSC	3	1	0	4	4
2	BE24101	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
3	HS24101	English for Professional Communication	HSMC	3	0	0	3	3
4	PH24102	Engineering Physics	BSC	3	0	0	3	3
5	GE24101	Heritage of Tamils/ **தமிழர் மரபு**	HSMC	1	0	0	1	1
LABORATORY INTEGRATED THEORY COURSES								
6	GE24111	Engineering Graphics	ESC	2	0	4	6	4
LABORATORY COURSES								
7	GE24122	Engineering Practices Laboratory – Electrical and Electronics	ESC	0	0	2	2	1
8	PH24121	Physics Laboratory	BSC	0	0	2	2	1
FORMATION COURSES								
9	GE24123	Design Thinking$	HSMC	0	0	2	2	1
10	FC24102	Cultural Identities and Globalization	HSMC	2	0	0	2	0
			TOTAL	17	1	10	28	21

$ - Skill based course

SEMESTER - II

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	MA24203	Applied Mathematics and Statistics	BSC	3	1	0	4	4
2	ME24201	Engineering Mechanics	ESC	3	1	0	4	4
3	CY24202	Engineering Chemistry	BSC	3	0	0	3	3
4	GE24201	Tamils and Technology / **தமிழரும் தொழில்நுட்பமும்**	HSMC	1	0	0	1	1
LABORATORY INTEGRATED THEORY COURSES								
5	GE24112	Problem Solving using Python	ESC	2	0	4	6	4
LABORATORY COURSES								
6	BE24221	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	3	3	1.5
7	CY24121	Engineering Chemistry Laboratory	BSC	0	0	2	2	1
7	GE24121	Engineering Practices Laboratory – Civil and Mechanical	ESC	0	0	2	2	1
FORMATION COURSES								
8	FC24101	Life Skills$	HSMC	2	0	0	2	1
			TOTAL	15	1	9	27	20.5

$ - Skill based course

SEMESTER - III

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	MA24304	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2	ME24301	Fluid Mechanics and Machinery	ESC	3	1	0	4	4
3	ME24302	Engineering Thermodynamics	PCC	3	0	0	3	3
4	ME24303	Manufacturing Technology-I	PCC	3	0	0	3	3
5	ME24304	Engineering Materials and Metallurgy	PCC	3	0	0	3	3
LABORATORY COURSES								
6	ME24321	Manufacturing Technology Laboratory	PCC	0	0	3	3	1.5
7	ME24322	Fluid Mechanics and Machinery Laboratory	ESC	0	0	3	3	1.5
8	ME24323	Computer Aided Machine Drawing Laboratory	ESC	0	0	3	3	1.5
FORMATION COURSES								
9	HS24321	Communication Skills Building Laboratory$	HSMC	0	0	2	2	1
10	BS24321	System Discovery and Analysis	BSC	0	0	2	2	0
			TOTAL	15	2	13	30	22.5

$ - Skill based course

SEMESTER – IV

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	MA24402	Numerical Methods	BSC	3	1	0	4	4
2	ME24401	Strength of Materials	PCC	3	0	0	3	3
3	ME24402	Kinematics of Machinery	PCC	3	0	0	3	3
4	ME24404	Thermal Engineering	PCC	3	0	0	3	3
5	BS24301	Environmental Science and Sustainability	BSC	3	0	0	3	3
LABORATORY INTEGRATED THEORY COURSES								
6	ME24403	Manufacturing Technology-II	PCC	2	0	2	4	3
LABORATORY COURSES								
7	ME24421	Strength of Materials Laboratory	PCC	0	0	3	3	1.5
8	ME24422	Thermal Engineering Laboratory	PCC	0	0	3	3	1.5
FORMATION COURSES								
9	ME24423	Project Driven Learning$	EEC	0	0	2	2	1
10	FC24301	Soft Skills$	HSMC	2	0	0	2	1
TOTAL				19	0	10	30	24

$ - Skill based course

Foreign Language Course to be completed by the end of IV semester.

SEMESTER – V

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	ME24501	Design of Machine Elements	PCC	3	1	0	4	4
2		Professional Elective - 1	PEC				3	3
3		Professional Elective - 2	PEC				3	3
4		Professional Elective - 3	PEC				3	3
5	GE24502	Entrepreneurship and International Business Market	HSMC	2	0	0	2	2
LABORATORY INTEGRATED THEORY COURSES								
6	ME24511	Dynamics of Machinery	PCC	2	0	2	4	3
7	ME24512	Metrology and Measurements	PCC	2	0	2	4	3
LABORATORY COURSES								
8	ME24521	CAD/CAM Laboratory	PCC	0	0	3	3	1.5
FORMATION COURSES								
9	FC24501	Universal Human Values and Service Learning$	HSMC	1	0	1*	1	1
10	BS24502	Logical Reasoning and Aptitude Training	BSC	2	0	0	2	1#
			TOTAL				29	23.5

$ Skill based course

* Activities on non- working days / hours

\# Not included for GPA calculation

SEMESTER – VI

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	ME24601	Finite Element Analysis & Surrogate Modelling	PCC	3	1	0	4	4
2	ME24602	Heat and Mass Transfer	PCC	3	1	0	4	4
3		Professional Elective - 4	PEC				3	3
4		Professional Elective - 5	PEC				3	3
5		Professional Elective - 6	PEC				3	3
6	GE24501	Project Management and Operations Management	HSMC	2	0	0	2	2
LABORATORY COURSES								
7	ME24621	Finite Element Analysis & Surrogate Modelling Laboratory	PCC	0	0	4	3	2
8	ME24622	Heat and Mass Transfer Laboratory	PCC	0	0	3	3	1.5
FORMATION COURSES								
9	GE24621	Interdisciplinary Project$	EEC	0	0	2	2	1
10	GE24622	Problem Solving Techniques	EEC	0	0	2	2	1#
11	GE24503	Financial Literacy	HSMC	2	0	0	2	0
			TOTAL				31	23.5

$ Skill based course

Not included for GPA calculation

SEMESTER – VII

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	ME24701	Mechatronics and IoT	PCC	3	0	0	3	3
2		Professional Elective - 7	PEC				3	3
3		Open Elective - I	OEC				3	3
4		Open Elective - II	OEC				3	3
5		Open Elective - III	OEC				3	3
6	GE24701	Working to Engineer a Better World	HSMC	2	0	0	2	2
7		Audit course	HSMC	0	0	0	2	0
LABORATORY COURSES								
8	ME24721	Mechatronics & IoT Laboratory	PCC	0	0	4	4	2
9	ME24722	Professional Project - I	EEC	1	0	2	3	2
FORMATION COURSES								
10	ME24723	Internship$	EEC	-	-	-	-	2
			TOTAL				26	23

$ Skill based course

SEMESTER – VIII

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
LABORATORY COURSES								
1	ME24821	Professional Project - II	EEC	0	0	20	20	10
			TOTAL				20	10

MA24101	Calculus for Engineers	BSC	L	T	P	C
			3	1	0	4

Course Objectives:

- To develop the usage of matrix algebra techniques and its applications, which are essential for engineers.
- To provide the students with the rules of differentiation.
- To impart the students with the concepts of functions of several variables.
- To make the students understand various techniques of integration.
- To acquaint the students with mathematical knowledge in evaluating multiple integrals and their applications.

UNIT I TRANSFORMATIONS 12

Stretching of an elastic membrane - eigenvalues and eigenvectors of a real matrix – properties – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms - Cayley Hamilton Theorem

UNIT II DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Parametric differentiation- Maxima and Minima of functions of single variable

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Total derivative – Partial differentiation of implicit functions – Jacobians – Taylor's series – Maxima and Minima of a function of two variables - Method of Lagrangian Multipliers - Evaluating extremum of single and two variable functions.

UNIT IV INTEGRAL CALCULUS 12

Techniques of Integration: Substitution rule, Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Moments and centre of mass.

UNIT V MULTIPLE INTEGRALS 12

Double integrals in Cartesian and Polar coordinates – Area enclosed by plane curves - Change of order of integration – Change of variables in double integrals - Triple integrals in Cartesian coordinates – Volume of solids - Change of variables from Cartesian to Spherical polar coordinates and Cylindrical polar coordinates.

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

- To identify the eigenvalues and eigenvectors of a matrix and to execute diagonalization.
- Identify the limit of functions and apply the rules of differentiation to differentiate functions.

- Apply differentiation to functions of several variables
- Evaluate extreme values of functions
- Evaluate integrals using various techniques of integration
- Evaluate multiple integrals in various coordinate systems and applications of multiple integrals

Suggested Activities:

1. Evaluation of eigenvalues and eigenvectors using scientific tool
2. Plotting and visualizing curves, and extreme values using a scientific tool
3. Plotting and visualizing surfaces, and extreme values using a scientific tool
4. Evaluation of line integrals using scientific tool
5. Evaluation of multiple integrals using a scientific tool
6. Visualizing 2D and 3D functions using GeoGebra and Desmos

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, " Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015.

References:

1. Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016.
2. Bali.N., Goyal.M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain.R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
5. Kuldeep Singh, “Engineering Mathematics Through Applications”, 2nd Edition, Bloomsbury Academic.
6. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.
7. Amos Gilat, “MATLAB: An Introduction with Applications”, 4th Edition, John Wiley.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	2	-	-	-	-	-	2	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	2	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	2	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	2	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	2	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	2	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**

BE24101	Basic Electrical and Electronics Engineering	ESC	L	T	P	C
			3	0	0	3

Course Objectives:

- To introduce the basics of Electric Circuits and analysis.
- To impart knowledge in the basics of working principles and application of Electrical Machines.
- To introduce analog devices and their characteristics.
- To educate on the fundamental concepts of digital electronics.
- To interpret the fundamentals of Sensors.

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Basic circuit components - Ohm's Law - Kirchhoff's Laws – Nodal Analysis, Mesh analysis - Simple problems with Independent Sources – Introduction to AC Circuits - Purely resistive, Inductive & Capacitive excited by AC Source (Qualitative Treatment Only).

UNIT II ELECTRICAL MACHINES 9

Construction, Working principle, Types and Applications: DC Motor – DC Generator - Single phase Transformers - Stepper Motor - Servo Motor (Qualitative Treatment Only).

UNIT III ANALOG ELECTRONICS 9

Construction, Operation, Characteristics and Application of PN Junction diode – Zener diode – Bipolar Junction Transistor (Common Emitter Characteristics only) – Half wave and full wave Rectifiers.

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, Binary codes, Hamming and Parity code, Combinational logic - representation of logic functions - SOP and POS forms, K-Map representations- minimization using K maps (Simple Problems with 3 variables only).

UNIT V SENSORS 9

Introduction to Sensors - Photovoltaic - LDR - Piezo electric - RTD - Principle and application of IR sensor - Ultrasonic sensor.

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

- Understand the fundamental components of DC circuits.
- Compute the electric circuit parameters for simple problems.
- Explain the working principle and applications of electrical machines.
- Describe the characteristics of analog electronic devices.
- Explicate the basic concepts of digital electronics.
- Explain the principles and applications of sensors.

Text Books:

1. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
2. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

References:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	-	-	-	1	-	-	-	2	-	-	-	-
CO2	2	2	1	-	-	-	1	-	-	-	2	-	-	-	-
CO3	2	1	1	-	-	-	1	-	-	-	2	-	-	-	-
CO4	2	2	1	-	-	-	1	-	-	-	2	-	-	-	-
CO5	2	2	1	-	-	-	1	-	-	-	2	-	-	-	-
CO6	2	2	1	-	-	-	1	-	-	-	2	-	-	-	-
Avg.	2	1.8	1	-	-	-	1	-	-	-	2	-	-	-	-

HS24101	English for Professional Communication	Category	L	T	P	C
		HSMC	3	0	0	3

Course Objectives:

- To develop effective listening, speaking, reading, and writing skills for professional contexts.
- To cultivate formal correspondence skills for workplace communication.
- To analyze and apply rhetorical techniques in writing and speaking.
- To encourage self-expression through storytelling and reflective writing.
- To strengthen grammar and vocabulary for improved language proficiency.

UNIT I Communication basics 9

Listening - Link verbal and nonverbal cues and listen to podcasts and news stories.
Reading - Read brochures and running headlines. Social media messages and electronic correspondence relevant to professional advancement
Writing - Formal letters
Speaking - Self-introduction - Dialogues and role plays, discussing news stories, asking doubts (clarification, direction, inquiring details…)
Grammar - Noun, Pronoun, Articles
Vocabulary - one-word substitution, phrasal verbs

UNIT II Professional Correspondence 9

Listening - Listen to voicemails, presentations, and panel discussions
Reading - MoM - minutes of the meeting, memos, business and economic articles
Writing - Respond to Business Emails
Speaking - Inaugural speech, Vote of thanks, and mini-presentation
Grammar - Verb, concord, wh questions, and Yes/no, question tag
Vocabulary - Word forms (Prefix & suffix)

UNIT III Rhetoric Communication 9

Listening - Monologue from plays and movies, and sale pitches (marketing and promotions)
Reading - Looking for ambiguity - Ethos, pathos, and logos (poem or play)
Writing - Essays - problem solution, cause and effect essay
Speaking - Deliver a monologue - situational scenarios
Grammar - Conjunctions, prepositions, interjections
Vocabulary - Discourse markers for contextual essays, idioms, and phrases

UNIT IV Extended narration 9

Listening - Listen to documentaries, debates, discussions, and Toastmasters speech
Reading - Read professional resumes, LinkedIn profiles, newsletter
Writing - Blog writing, writing reviews
Speaking - Debate, group discussion
Grammar - Mixed tenses, Adverb
Vocabulary - Compound words, Collocation

UNIT V Language and self 9

Listening - Listen to tone, mood, and attitude. Find meanings based on the context, and listen to different accents.
Reading - An excerpt from an autobiography
Writing - Reflective journal and diary entries
Speaking - Narrate stories from personal experience
Grammar - Adjective, direct, and indirect speech
Vocabulary - Contextual meaning of words, Abbreviations, and acronyms

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

- Demonstrate enhanced listening, speaking, reading, and writing skills tailored for professional environments.
- Compose clear formal emails and letters for workplace communication.
- Analyze and use rhetorical techniques to engage and persuade audiences.
- Develop storytelling and reflective writing skills to share personal experiences.
- Improve grammar and vocabulary for effective communication.
- Foster teamwork and discussion abilities through debates and group presentations.

Suggested Activities:

1. Take a set of 15 messages and classify them into spam, alerts, scams, discount texts, news, cautionary, personnel, and informative.
2. Reflective journal - write your own personal and learning experience so far at LICET. Page limit: 3 pages.
3. Rhetoric Writing - Find a product or create a product and employ ethos, pathos, and logos to persuade the customers to buy your product. Write in 250 words.
4. Creative writing - Create your account on Blogger and write reviews, articles, and stories.

Text Books:

1. English for Engineers and Technologists. Volume I by Orient Blackswan, 2022
2. English for Science & Technology - I by Cambridge University Press, 2023

References:

1. Interchange. Cambridge University Press. USA, 2022.
2. Embark. Cambridge University Press. USA, 2016.
3. A course in Technical English. Cambridge University Press. USA, 2023.
4. High School English Grammar & Composition. Wren & Martin's Regular & Multicolour Edition. S.Chand Publishing, 2016.
5. Interchange by Jack C. Richards, Fifth Edition, Cambridge University Press, 2017.
6. English for Academic Correspondence and Socializing. Adrian Wallwork, Springer, 2011.
7. The Study Skills Handbook. Stella Cortrell, Red Globe Press, 2019
8. www.uefap.com

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	1	1	3	-	2	3	-	3	-	-	-	-
CO2	-	-	-	1	1	3	-	2	3	-	3	-	-	-	-
CO3	-	-	-	1	1	3	-	3	3	1	3	-	-	-	-
CO4	-	-	-	1	1	3	1	1	1	2	3	-	-	-	-
CO5	-	-	-	1	1	3	-	2	3	-	3	-	-	-	-
CO6	-	-	-	1	1	3	-	3	3	1	3	-	-	-	-
Avg.	**-**	**-**	**-**	**1**	**1**	**3**	**1**	**2.1**	**2.6**	**1.3**	**3**	**-**	**-**	**-**	**-**

PH24102	Engineering Physics	Category	L	T	P	C
		BSC	3	0	0	3

Course Objectives:

- To make the students understand the basics of crystallography and its importance in studying materials properties.
- To instill knowledge of oscillations and waves and make them able to apply this knowledge in engineering situations.
- To establish a sound grasp of foundational principles of quantum mechanics and enable them to perform basic quantum mechanical calculations.
- To introduce the basics principles of photonics and fibre optic communication to students
- To make students understand the applications of quantum mechanics in solid state physics to decipher the electrical properties of materials.

UNIT I CRYSTAL PHYSICS 9

Crystal structures: Crystal lattice – basis - unit cell and lattice parameters – crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic & HCP systems– crystal planes, directions and Miller indices – distance between successive planes - imperfections in crystals-classification of defects.

UNIT II OSCILLATIONS AND WAVES 9

Simple harmonic motion - Torsional pendulum – Damped oscillations –Shock Absorber -Forced oscillations and Resonance (qualitative)–Applications of resonance - Electrical analogy of mechanical oscillators - waves on a string - progressive waves - stationary waves- Energy transfer of a wave.

UNIT III QUANTUM MECHANICS 9

Black body radiation – Planck's hypothesis and black body radiation formula (qualitative)- Wave particle duality–de Broglie hypothesis– Uncertainty Principle – The Schrodinger Wave equation (time-dependent and time-independent) – Physical interpretation of wave function - Normalization - Particle in an infinite potential well - Energy values and wavefunctions-Quantum mechanical tunneling. Scanning tunneling microscope.

UNIT IV PHOTONICS AND FIBRE OPTICS 9

Laser – characteristics – Spontaneous and Stimulated emission-Einstein's coefficients - population inversion - Metastable states - Basic components of a laser system - CO2 laser, Semiconductor laser - Industrial and medical applications - Optical Fibres – Total internal reflection – Numerical aperture and acceptance angle – Fibres optic communication system.

UNIT V QUANTUM THEORY OF SOLIDS 9

Particle in a three-dimensional box - Degenerate energy states. Electrons in metals -Classical free electron theory- quantum free electron theory Fermi- Dirac statistics – Density of energy states. Fermi energy and free electron density. Drawbacks of quantum free electron theory- Electrons in a periodic potential- Kronig-Penney Model (qualitative) -Band theory. Classification of solids based on energy band structure.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

- Describe the structural properties of semiconducting materials possessing cubic structure.
- Estimate the vibrational stability of an engineering system which employs periodic motion.
- Calculate basic measurable quantities of simple quantum mechanical models.
- Apply the characteristics of lasers for material processing and in the medical field.
- Outline the operational principle of fiber optic communication systems.
- Apply quantum mechanical principles towards the formation of energy bands.

Text Books:

1. Avadhanulu M N, Kshirsagar P G, “A Textbook of Engineering Physics”, S Chand & Co Ltd, Ninth Revised Edition, 2012.
2. Hitendra K Malik, A K Singh " Engineering Physics McGraw Hill Education; Second edition, 2017.
3. Gaur R K, Gupta S L, “Engineering Physics”, Dhanpat Rai Publishers, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	-	-	-	-	-	-	1	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	1	-	-	-	-
CO3	2	1	1	1	-	-	-	-	-	-	1	-	-	-	-
CO4	2	1	1	1	-	-	-	-	-	-	1	-	-	-	-
CO5	2	2	1	1	-	-	-	-	-	-	1	-	-	-	-
CO6	2	2	1	1	-	-	-	-	-	-	1	-	-	-	-
Avg.	**2**	**1.66**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**

GE24101	Heritage of Tamils	Category	L	T	P	C
		HSMC	1	0	0	1

Objectives:

This course enables the students to

- provide an insight to the students into the rich culture and heritage of the state
- provide the students with detailed information on the engineering techniques to construct architectural marvels practiced in Tamil Nadu
- make the students connect with their roots, appreciate, and preserve it.

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, Leather puppetry, 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 Periods:15

Course Outcomes:

On completion of the course, the students will be able to

- Understand the human values and rights in Tamil literature
- Learn the art and culture being practiced by the people of Tamil Nadu
- Understand various games and dance practices by the people of Tamil Nadu
- Understand the Tamil Culture and Customs through Folklore
- Learn the concepts of Sangam Literature and the bravery of Kings
- Learn the life history of freedom fighters Vedic herbs and developments in lifestyle

TEXT-CUM-REFERENCE BOOKS:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. 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)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

GE24101	தமிழர் மரபு	Category	L	T	P	C
		HSMC	1	0	0	1

அலகு I மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தொல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குக் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Total Periods:15

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. 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)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

GE24111	Engineering Graphics	Category	L	T	P	C
		ESC	2	0	4	4

Course Objectives:

- To draw engineering curves and freehand sketches of simple objects.
- To draw orthographic projections of solids and sections of solids.
- To draw development of solids
- To draw isometric and perspective projections of simple solids.

CONVENTIONS AND GEOMETRIC CONSTRUCTION (Not for examinations) 1

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 6+11

Basic curves used in engineering practices: Construction of conic sections by eccentricity method - Construction of cycloidal curves - Construction of involutes of square and circle - Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles - Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+11

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 and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 6+11

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV SECTION AND DEVELOPMENT OF SOLIDS 6+12

Sectioning of simple solids like prisms, pyramids, cylinders, and cone in a 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.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection - isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only, Not for Exam) 3

The Concepts of Computer Aided Drafting for Engineering drawing, Computer graphics & Geometrical modelling (2D Orthographic Views) and 3D drafting (Isometric Views) using design software.

Total Periods: 90

Course Outcomes:

On completion of the course, the students will be able to

- Construct the conic curves, involutes and cycloids.
- Visualize and construct multiple views of solid.
- Solve practical problems involving projection of lines and planes.
- Draw the projection of simple solids.
- Draw the sectional views of simple solids, obtain true shape and develop sectioned solids.
- Draw the isometric and perspective projections of simple solids.

Text Books:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Jayapoovan T, "Engineering Graphics using AUTOCAD", Vikas Publishing ,7 th Edition.
3. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.

References:

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, 27th Edition, 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. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS10711 — 2001: Technical products Documentation — Size and layout of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation —Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
4. 5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to Semester End Examinations on Engineering Graphics:

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2		2				2		2	2			
CO2	3	1	2		2				2		2	2			
CO3	3	1	2		2				2		2	2			
CO4	3	1	2		2				2		2	2			
CO5	3	1	2		2				2		2	2			
CO6	3	1	2		2				2		2	2			
Avg.	3	1	2		2				2		2	2			

GE24122	Engineering Practices Laboratory– Electrical and Electronics	Category	L	T	P	C
		ESC	0	0	2	1

Course Objectives:

- To learn the basics of electronic components.
- To understand the internal structure and working of the measuring instruments.
- To construct a prototype circuit on a breadboard and verify.
- To understand the process behind the PCB fabrication.
- To introduce the functionality of various electrical components namely switches, fuse, and meters to perform wiring various electrical joints in common household electrical wire work.
- To introduce the methods for measuring electrical quantities.

LIST OF EXPERIMENTS:

Electrical

1. Introduction to Electrical Components switches, fuses, indicators, and lamps
2. Basic switchboard wiring with lamp, fan, three-pin socket, and energy meter
3. Staircase wiring
4. Fluorescent Lamp wiring with introduction to CFL and LED types
5. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit

Electronics

1. Study of electronic components resistor, capacitor, inductor, transistor and diode.
2. Introduction to CRO, DSO, MSO, FG and their working principles.
3. Circuit prototyping and verification.
4. Build a printed circuit board and verify the desired output.

Total Periods:30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Identify and describe the function of various electronic components, leading to successful application in circuit design.
CO2: Accurately interpret and apply measurement data in practical scenarios.
CO3: Build a prototype of a circuit and validate its output.
CO4: Gain knowledge of PCB fabrication processes, including design, etching, and assembly.
CO5: Understand the working of electrical switches, measuring instruments, and wiring layouts used in domestic applications and carry out basic electrical wiring work.
CO6: Comprehend the concepts of current, voltage, power, and power factor using various measuring instruments

Laboratory Requirements:

S.No.	Description of equipment	Required numbers (for a batch of 30 students)
1.	Resistors, Capacitors, Inductors – sufficient quantities. Bread Boards	15 nos.
2.	CRO, MSO, DSO, FG, Power Supply	5 Nos.
3.	PCB etching kit (Ferric Chloride, Drilling machine, Layout design)	15 kits
4.	Soldering iron, paste, lead, desoldering pump	15 nos. each
5.	Single way switch, Two way switch, fuses, indicators, 230 V -60W incandescent lamp	5 nos. each
6.	Basic switchboard wiring kit and ,Energy meter	5 nos. each
7.	Staircase wiring kit	5 nos. each
8.	Fluorescent Lamp wiring kit, CFL and LED lamps	5 nos. each
9	1φ Auto Transformer, Voltmeter, Ammeter, Rheostat, Capacitor, Choke	5 nos. each
10.	Multimeters	6 nos.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	1	2	1	2	1						
CO2	2	1	1	2	1			2	1						
CO3	2	1	1	1	1			2	1						
CO4	2	1	1	1	1			2	1						
CO5	2	1	1	1	1		1	2	1						
CO6	2	1	1	2	1	2	-	2	1						
Avg.	2	1	1	1	1	1	1	2	1						

PH24121	Physics Laboratory	Category	L	T	P	C
		BSC	0	0	2	1

Course Objectives:

- To learn the measurements of various elastic moduli of materials
- To learn determination of thermal properties of materials.
- To study different optical phenomena involving ordinary light.
- To measure the characteristic properties of lasers.
- To understand the characteristics of oscillatory motion.
- To learn measurement of rigid body moment of inertia.

LIST OF EXPERIMENTS (any six experiments):

1	Non-uniform bending - Determination of Young's modulus
2	Uniform bending – Determination of Young's modulus
3	Lee's Disc Experiment - Determination of thermal conductivity of bad conductors.
4	Torsional pendulum - Determination moment of inertia of regular and irregular objects.
5	Simple harmonic oscillations of cantilever
6	Ultrasonic interferometer – determination of sound velocity and liquids compressibility
7	Viscosity of Liquids
8	Air wedge - Determination of thickness of a thin sheet/wire
9	Optical fibre -Determination of Numerical Aperture and acceptance angle
10	Spectrometer-Determination of the wavelength of light using grating
11	a. Laser- Determination of the wavelength of the laser using grating a. Compact disc- Determination of width of the groove using laser.

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

- Determine various moduli of elasticity of materials
- Determine thermal properties of solids
- Analyze various optical phenomena involving ordinary light.
- Determine the characteristic properties of lasers.
- Measure characteristic properties of systems executing oscillatory motion.
- Determine the moment of inertia of rigid bodies

Text Books:

1. Engineering Physics Practicals by Dr. P. Mani, Dhanam Publications, 2023
2. Practical Physics by Gordon L Squires, Cambridge University Press; 4th edition, 2001

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	3				2			1				
CO2	2	2	1	3				2			1				
CO3	2	2	1	3				2			1				
CO4	2	2	1	3				2			1				
CO5	2	2	1	3				2			1				
CO6	2	2	1	3				2			1				
Avg.	2	2	1	3				2			1				

GE24123	Design Thinking	Category	L	T	P	C
		HSMC	0	0	2	1

Course Objectives:

- Students will understand the different learning methodologies
- Students will learn the art of observation and visualization
- Students will understand the need for empathy in problem-solving
- Students will learn how to work in a team
- Students will learn to use different design thinking tools to solve problems

Module 1	An Insight to Learning: Understanding the Learning Process and Kolb's Learning Styles	2
Module 2	Journey of my life: Visualization and Wheel of Life. *Introduction to project*	4
Module 3	Observation: Listening vs hearing, Beyond observations and Mind maps	2
Module 4	Teamwork: Divergent thinking and Brainstorming	2
Module 5	Customer Journey: Journey mapping	2
Module 6	Conflict management: Balancing priorities, Reacting and Responding, Constraints to opportunities	2
Module 7	Empathy: Persona and Empathy map	2
Module 8	Design Thinking Model: 5-step process: Empathize, define, ideate, prototype, and scale	2
Module 9	Appreciation: The wonder of recognition, Articulation and Influence	2
Module 10	Project presentation	10

Total Periods:30

Course Outcomes:

On completion of the course, the students will be able to

1. To understand various learning processes and stages
2. To observe and visualize different scenarios
3. To empathize with a customer
4. To develop a journey map based on experiences
5. To understand the art of conflict management
6. To use design thinking as a tool to solve problems

Suggested Activities:

- Solve real-life problems using Design Thinking

Text Books:

1. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Pavan Soni, Penguin Random House India, Pvt. Ltd. 2020
2. Developing Thinking Skills (The Way to Success), E. Balagurusamy, 2024, Khanna Publishing House
3. The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods, Michael Lewrick, Patrick Link, Larry Leifer, Wiley, March 2020

References:

1. Internet Reference: https://www.interaction-design.org/
2. Internet Reference: https://online.hbs.edu/
3. Internet Reference: https://dschool.stanford.edu/

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1						2	1	1			3				
CO2						2					3				
CO3						2	2	2	2		3				
CO4						2					3				
CO5						2	2	2	2		3				
CO6						3	2	3	2	2	3				
Avg.						2.1	1.7	2	2	2	3				

FC24102	Cultural Identities and Globalisation	Category	L	T	P	C
		HSMC	2	0	0	0

Course Objectives:

- To enable students to reflect on their own cultural identity in relation to their socialisation.
- To encourage cultural diversity that underpins the formation of identity and social behaviours.
- To give exposure to the varied cultural influences on the parent culture.
- To prepare to address the challenges and tensions in the globalised society.

UNIT I Exploring Social and Cultural Identity 5

Identity formation & environmental interaction

- Race/ethnicity
- Gender
- Language
- Religion
- Socialisation (contact with different cultures)

UNIT II Regional and Cultural Influence on Social Behaviour and Identity 6

- Assimilation, Amalgamation and Hybridisation
- Cultural Behaviour - dialect, traditions, social behaviour (customs), etiquette (work culture), habits, cuisine and regional variation

UNIT III Dissemination of Mass Culture Practices 6

- Cultural Imperialism
- Colonisation and Globalization - Cultural turn
- Manufacturing pop culture - Language, food, movies, music, fashion, cosmetics.

UNIT IV Socio-Cultural Changes via Globalisation 6

- Indian globalisation through trade liberalisation
- Increased migration flow with economic opportunities
- Cultural exchange, global networks
- Urbanisation - impact on family ideology and social structure

UNIT V Embracing Global Identities 7

- Challenges and tension
- Adaptable to changing society - etiquettes (in cross-cultural workspace) and social behaviours
- Building understanding and tolerance

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

- Engage in conversations with themselves in relation to their local culture and society.
- Realise the nuances of identity formation through various means of socialisation.

- Critically assess the countless social and cultural behaviours that influence their identity and behaviour.
- Examine the role of globalisation and liberalisation in urbanisation and cultural imperialism.
- Adapt to the cross-cultural changes and engage in global networking.
- Respond appropriately in a multicultural space by building tolerance and understanding.

Suggested Activities:

- Exercise on identity formation - creation of mind maps / storyboards
- A mini presentation on "Identifying one's own culture amidst the influence of the diverse cultural environment" - expressing only one cultural aspect (language, attire, habits, food, …)
- Opinion piece speech - Deliver a short speech expressing personal opinions
- Survey report - Comparison chart (5 exchanges) by engaging conversations with a elderly stranger or grandparents
- Produce a 30-second reel showcasing their understanding of the social etiquette of a specific country.

References:

1. Brooks, Ann. Popular Culture: Global Intercultural Perspectives. United Kingdom, Bloomsbury Publishing, 2014.
2. Verkuyten, Maykel. Identity and Cultural Diversity: What Social Psychology Can Teach Us. United Kingdom, Taylor & Francis, 2013, pp. 1-27.
3. Savage, Michael, et al. Globalization and Belonging. United Kingdom, SAGE Publications, 2004, pp. 29-77.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1						2		2	1		2				
CO2						2			1						
CO3						2			1		2				
CO4						2		2	1		2				
CO5											-				
CO6						2		2	1		2				
Avg.						**2**		**2**	**1**		**2**				

MA24203	Applied Mathematics and Statistics	Category	L	T	P	C
		BSC	3	1	0	4

Course Objectives:

The objective of this course is to enable the student to

- To introduce vector differential operator and evaluation of line, surface and volume integrals
- To introduce the basic understanding and application of the concepts of divergence and curl
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations
- To provide the required skill to apply statistical tools in engineering problems
- To acquaint the knowledge of testing of hypothesis for small and large samples
- To introduce the basic ANOVA techniques

UNIT I VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green‘s theorem, Gauss divergence and Stoke‘s theorems

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 12

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 first order differential equations with constant coefficients

UNIT III INTRODUCTION TO STATISTICS 12

Descriptive statistics - Measures of central tendency- Measures of variability (Problems on Range, standard deviation, variance, quartiles, skewness, kurtosis)

UNIT IV TESTING OF HYPOTHESIS 12

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 V ANOVA TECHNIQUES 12

One-way and Two-way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

- Compute vector differential quantities and vector integrals
- Solve higher-order linear differential equations with constant coefficients
- Solve higher-order linear equations with variable coefficients
- Implement statistical tools to analyze and interpret data
- To apply the concept of testing of hypothesis for large samples and small samples in real-life problems

- To apply the basic ANOVA techniques

Suggested Activities:

- Visualizing curl and divergence using GeoGebra
- Evaluation of higher order ODE using scientific tool
- Finding and visualizing mean, standard deviation and variance using scientific tool
- Performing Z-test using scientific tool
- Performing analysis of variance using scientific tool

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

References:

1. Jain R.K. and Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 5th Edition, 2016.
2. Narayanan, S. and Manicavachagom Pillai, T. K., Calculus Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
3. Srimantha Pal and Bhunia, S.C, Engineering Mathematics, Oxford University Press, 2015.
4. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
5. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
6. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
7. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	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				
CO6	3	2	2	2	2						2				
Avg.	**3**	**2**	**2**	**2**	**2**						**2**				

ME24201	Engineering Mechanics	Category	L	T	P	C
		ESC	3	1	0	4

Course Objectives:

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of moment, couple, and support reactions.
- To understand the concept of centroid and moment of inertia.
- To understand the concept of various types of friction
- To understand the principle of motion, work /energy, impulse-momentum and impact of elastic bodies

UNIT I STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics - Principle of transmissibility - Parallelogram and triangular Law of forces - Vectorial representation of forces - Vector operations of forces - additions, subtraction, dot product, cross product - Coplanar Forces - rectangular components - Equilibrium of a particle - Lami's theorem - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces. Demonstration using MATLAB / PYTHON for the computation of resultant force

UNIT II STATICS OF RIGID BODIES 12

Moment of a force about a Point, - varignon's theorem, Moment of a Force about an Axis, Couple - moment of a couple - resolution of a given force into a force – couple system - reduction of a system of forces - reactions at supports and connections - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in and three dimensions. Demonstration using MATLAB / PYTHON for the computation of moment of a force

UNIT III CENTROID AND MOMENT OF INERTIA 12

Centroid and Centre of Gravity - Determination of centroids of rectangular, circular and triangular areas by integration - Centroids of simple and composite areas, Centroid of a Volume, Composite Bodies - Theorems of Pappus and Guldinus- Area Moment of Inertia - Determination of the Moment of Inertia of Rectangular, circular, triangular areas by Integration - Parallel axis theorem and perpendicular axis theorem - determination of moment of inertia of composite plane figures, polar moment of inertia-radius of gyration - mass moment of inertia of simple solids. Demonstration using MATLAB / PYTHON for the computation of centroid / moment of inertia

UNIT IV FRICTION AND KINEMATICS OF PARTICLES 12

Role of frictional force – Types of friction – Limiting friction - Laws of Dry Friction, Coefficients of static and kinetic friction, Angle of Friction, Angle of repose, Wedge friction, surface contact friction - Ladder friction, belt friction, screw friction, Wheel Friction, Rolling Resistance. Kinematics of Particles - Displacements, Velocity, acceleration, and their relationship - Rectilinear Motion, Uniform and variable acceleration – Motion of particle under gravity - Curvilinear Motion of Particles, Projectiles. Demonstration using MATLAB / PYTHON for the computation of coefficient of friction.

UNIT V DYNAMICS OF PARTICLES AND KINEMATICS OF RIGID BODIES 12

Kinetics of Particles - Newton's Second Law of Motion - D'Alembert's principle - Equations of Motions, Dynamic Equilibrium - Energy - potential energy - kinetic energy - conservation of energy - work done by a force - work energy method- Principle of Impulse and Momentum - Impact of elastic bodies. Kinematics of rigid bodies -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere. Demonstration using MATLAB / PYTHON for

the computation of displacement / velocity / acceleration.

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

- Resolve the forces distributed in the static structural members and to determine the resultant force.
- Determine the moment produced by various force systems and the reactions at supports and connections.
- Determine the centroid and moment of inertia of the given geometry
- Analyze the impact of friction on torque at the contact surfaces of various engineering systems.
- Apply different principles to study the motion of bodies and to determine its displacement, velocity and acceleration.
- Apply the principles of dynamic equilibrium, work – energy and impulse – momentum in resolving the forces acting on the system

Text Books:

1. 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. Bhavikatti S S, Engineering Mechanics, New Age International Publishers, 2016

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	2		1				2	3		1	3
CO2	3	2	2	1	2		1				2	3		1	3
CO3	3	2	2	1	2		1				2	3		1	3
CO4	3	2	2	1	2		1				2	3		1	3
CO5	3	2	2	1	2		1				2	3		1	3
CO6	3	2	2	1	2		1				2	3		1	3
Avg.	3	2	2	1	2		1				2	3		1	3

CY24202	Engineering Chemistry	Category	L	T	P	C
		BSC	3	0	0	3

Course Objectives:

- To familiarize the water quality criteria and interpret its applications in water purification.
- To identify various boiler troubles and its treatment techniques.
- To assimilate the preparation, properties and applications of nanomaterials in various fields.
- To acquire knowledge on the fundamental principle of energy storage devices and corrosion Science.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To identify the different types of polymers and explore their applications in Engineering and Technology.

UNIT I	WATER TECHNOLOGY	9

Water – Sources and Impurities, Water Quality Parameters: Definition and Significance of Colour, Odour, Turbidity, pH, Hardness, Alkalinity, TDS, COD and BOD, Fluoride and Arsenic.
Municipal water treatment: Screening, Sedimentation, Coagulation, Sand filtration and Disinfection (Ozonation, UV treatment, Chlorination), Desalination of Brackish water: Reverse Osmosis. Boiler Troubles (Scale & Sludge, Caustic Embrittlement, Boiler Corrosion, Priming & Foaming). Internal Conditioning (Colloidal, Sodium Aluminate, Phosphate and Calgon Conditioning) and External Conditioning (Zeolite and Ion - Exchange Demineralization).

UNIT II	NANO CHEMISTRY	9

Basics: Distinction Between Molecules, Nanomaterials and Bulk materials; Size- Dependent Properties (Optical, Electrical, Mechanical, Magnetic and Catalytic). 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	BATTERIES AND CORROSION	9

Batteries - Introduction- Types of Batteries – Primary Battery (Dry Cell), Secondary Battery (Lead Acid, Lithium-Ion-Battery)-Fuel Cells: H2-O2 Fuel Cell and Microbial Fuel Cell.
Corrosion - Causes - Factors - Types - Chemical and Electrochemical Corrosion (Galvanic, Differential Aeration Theory), Corrosion Control - Material Selection and Design Aspects, Electrochemical Protection - Sacrificial Anode Method and Impressed Current Cathodic Method, Paints: Constituents and Functions. Electroplating of Copper and Electroless Plating of Nickel.

UNIT IV	FUELS AND COMBUSTION	9

Fuels: Introduction: Classification of Fuels; Solid Fuels: Analysis of Coal (Proximate Analysis only), Carbonization, Manufacture of Metallurgical Coke (Otto Hoffmann Method). Liquid Fuels: Manufacture

of Synthetic Petrol (Bergius process), Knocking - Octane number, Cetane number, Anti Knocking Agents - Gasoline Additives, Gaseous Fuels: Composition and Uses of Compressed Natural Gas (CNG) and Liquified Petroleum Gas (LPG) - Liquid Hydrogen Fuel.
Combustion of Fuels: Introduction: Calorific Value - Higher and Lower Calorific Values, Theoretical Calculation of Calorific Value; Flue Gas Analysis (ORSAT Method).

UNIT V	**POLYMER TECHNOLOGY**	**9**

Introduction: Terminologies-Thermoplastics and Thermosetting Plastics-Types and Mechanism of Polymerisation: Addition (Free Radical) - Condensation and Copolymerisation- Properties and Applications of Polymers: Some Commercial Thermosetting Resin - Phenol Formaldehyde resin, Amino resins, Silicone Resins - Some Thermoplastics - Polyethylene, Polyvinyl Chloride, Polyvinyl Acetate – Polymer based bio sensors – Types and applications.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

- Analyze the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- Explain the various boiler problems and water treatment techniques.
- Apply basic concepts of nanochemistry in designing the synthesis of nanomaterials for engineering applications.
- Interpret the principles of storage devices and corrosion control.
- Analyze various fuels, their manufacture and calorific values in order to recommend suitable fuels for engineering processes.
- Analyze different types of polymeric materials, their preparation methods and applications to futuristic material fabrication needs.

Suggested Activities:

- Quiz
- Mind Mapping on Types of Nanomaterials
- Seminar
- Animated videos on Reverse Osmosis, Knocking
- Demonstration of water parameter analysis
- Electroplating process by group of students

Text Books:

1. Jain P. C. & Monica Jain., “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi,2012.
3. Dara S.S., “A Textbook of Engineering Chemistry”, Chand Publications, 2004.

References:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text Book of Nanoscience and Nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.

4. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.
6. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, “Polymer Science”, New AGE International Publishers, 2009.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1		2	1				2				
CO2	3	2	2	1		2	1				2				
CO3	2	1	-	1		-	2				-				
CO4	3	1	2	1		2	2				2				
CO5	3	1	2	-		1	2				1				
CO6	3	1	2	-		2	2				1				
Avg.	2.8	1.3	2	1		1.8	1.7				1.6				

GE24201	Tamils and Technology	Category	L	T	P	C
		HSMC	1	0	0	1

Objectives:

This course enables the students to

- Understand the art of making things and developments in the lifestyle of people
- Understand the various methods of constructing buildings
- Understand the techniques being used in Architecture by Tamils
- Understand and apply the concepts of Tamils with modern technology

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 gold- Coins 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 Periods:15

Course Outcomes:

On completion of the course, the students will be able to

- Know the gradual improvement in the life history of Tamils
- Construct buildings with the impact of the past with the present
- Learn to manufacture remarkable things with the help of technology
- Apply new Concepts in agriculture to the upliftment of the future society
- Apply the ancient skills to find out the measurements of oceans
- Apply the concepts of Tamil with modern technology

TEXT-CUM-REFERENCE BOOKS:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. 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)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

GE24201	தமிழரும் தொழில்நுட்பமும்	Category	L	T	P	C
		HSMC	1	0	0	1

அலகு I	**நெசவு மற்றும் பானைத் தொழில்நுட்பம்:**	3

சங்க காலத்தில் நெசவு தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:**	3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் –நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தொ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III	**உற்பத்தித் தொழில் நுட்பம்:**	3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:**	3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V	**அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:**	3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

Total Periods:15

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. 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)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

GE24112	Problem Solving using Python	Category	L	T	P	C
		ESC	2	0	4	4

Course Objectives:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To define Python functions and use function calls to solve problems.
- Learn to manage file operations, handle exceptions, and apply object-oriented programming principles in Python
- To familiarize with Python's module system, packages, and essential scientific libraries

UNIT I	PROBLEM SOLVING AND INTRODUCTION TO PYTHON PROGRAMMING	7

Fundamentals of computational thinking, algorithmic problem solving and logical thinking, problem solving and decomposition, notations (pseudo code, flowchart) - Introduction to Python – Literals – Variables and Identifiers -Comments- Reserved words – Data Types - Operators and Expressions - Input and Output: Working with user input, displaying output, and formatting - Conditional if - alternative if - chained conditional - Iteration: state, while, for, break, continue, pass

UNIT II	DATA STRUCTURES AND MANIPULATION	5

Lists: List operations - List slices - List methods - List loop - Mutability - Aliasing - Cloning lists - List parameters - Lists as arrays-Advanced list processing-List Comprehension- Tuples: Tuple assignment - Tuple as return value. Dictionaries: Operations and Methods- Sets: Creating Sets – Operations and methods – Set comprehension

UNIT III	STRINGS AND FUNCTIONS	6

Functions - definition and use - Flow of execution - Parameters and arguments - Fruitful functions: Return values - Parameters - Local and global scope -Function composition - Recursion - Strings: string slices, immutability, string functions and methods, string module

UNIT IV	FILES, EXCEPTIONS, CLASSES AND OBJECTS	6

Files and exception: Text files - Reading and writing files - Command line arguments-Errors and exceptions - Handling exceptions - Classes and Objects: Defining classes - Creating Objects Data abstraction – Class variables and Object variables – Working with objects and Methods

UNIT V	MODULES AND PACKAGES	6

Introduction to Modules and Packages- Basics of NumPy - N-dimensional Array in NumPy - Methods and Properties - Basics of SciPy - Broadcasting in NumPy Array Operations - Array Indexing in NumPy, Pandas - Introduction - Series - Data Frame - Matplotlib - Basics - Figures and Axes - Method subplot - Axis container

Periods: 30

LIST OF EXPERIMENTS:

1. Identification and solving of simple real life or technical problems related to applications to specific discipline and developing algorithms/flowcharts.
2. Python programming using simple statements and expressions.
3. Solving problems using conditional statements.
4. Solving problems using iterative loops (Palindrome, Factorial, Prime Numbers).
5. Implementing real-time/technical applications using List.
6. Implementing real-time/technical applications using Tuples.
7. Implementing real-time/technical applications using Dictionaries.
8. Implementing real-time/technical applications using sets.
9. Implementing programs using functions.
10. Implementing programs using strings.
11. Implementing programs using modules.
12. Implementing programs using command line arguments
13. Implementing real-time/technical applications using file handling (Word count- longest word - Copy file).
14. Implementing real-time/technical applications using exception handling.
15. Creating and Instantiating classes (Creating student class and object, Voter's age validation, Marks range validation (0-100)).
16. Implement programs using standard libraries (Pandas, Numpy, Scipy).
17. Generating basic plots using Matplotlib.
18. Developing a game activity using Pygame

Periods: **60**

Total Periods: 90

Course Outcomes:

On completion of the course, the students will be able to

- Develop algorithmic solutions to simple computational problems.
- Develop solutions to problems using control structures.
- Process compound data using Python data structures.
- Structuring python program into functions and to implement String handling functions
- Read and write data from/to files in Python programs and handle exceptions
- Understand object-oriented programming concepts through classes and objects.
- Utilize Python modules and packages for performing data analysis.

Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Assign a project to create a small application that uses various Python data structures (lists, tuples, dictionaries, and sets) to manage and process a dataset (e.g., a contact list or inventory system).
- Data Analysis and Visualization using NumPy, Pandas, and Matplotlib - Provide a dataset (e.g., weather data, sales records) and ask students to perform data analysis using NumPy and Pandas, followed by visualizing the results using Matplotlib.
- External Learning - Recursion vs. Iteration.
- Flipped Learning - tkinter package

- Mini-project

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.

References:

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.

Laboratory Requirements:

S.No	Description of Equipment	Required numbers (for batch of 30 students)
1	Stand alone desktops (Windows/Linux) with Python 3 interpreter	30

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2			2					1	1				
CO2	2	2	1		2					1	1				
CO3	2	2			2					1	1				
CO4	2	2	2	2	2					1	1				
CO5	2	2			2					1	1				
CO6	2	2	2	2	2			1		1	1				
CO7	2	2	2	2	2			1		1	1				
Avg	2	2	2	2	2			1		1	1				

BE24221	Basic Electrical and Electronics Engineering Laboratory	Category	L	T	P	C
		ESC	0	0	3	1.5

Course Objectives:

- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS:

1. Verification of ohms and Kirchhoff's Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self-excited DC Generator
4. Load test on Single Phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half-wave and Full-wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Use experimental methods to verify the Ohm's and Kirchhoff's Laws.
CO2: Analyze experimentally the load characteristics of electrical machines
CO3: Analyze the characteristics of basic electronic devices
CO4: Use DSO to measure the various parameters

References:

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
3. James A. Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
4. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

Laboratory Requirements:

S.No.	Description of Equipment	Required numbers (for batch of 30 students)
1	DC Shunt Motor with Loading Arrangement	2
2	Single Phase Transformer	2
3	DC Shunt Motor Coupled With DC Shunt Generator	2
4	Tachometer -Digital/Analog	10
5	Single Phase Auto Transformer	2
6	Single Phase Resistive Loading Bank	2
7	Rheostats	As per the requirement for the machines
8	Regulated Power Supply (0-30V)	15 Nos
9	AC/DC – Voltmeters of required rating	10
10	AC/DC – Ammeters of required rating	10
11	Multimeters	10
12	Circuit Connection Boards	10 Nos
13	Necessary Quantities of Resistors	As required
14	Semiconductor devices like Diode, Zener Diode	2
15	Logic Gates IC's - 7408,7486,7404,7432	Each 2
16	IC Trainer Kit	2
17	Regulated Power supply +12/-12V,5V	2
18	Cathode Ray Oscilloscope (CRO) 50 Mhz	3
19	SCR, MOSFET Characateristics	2
20	Step-down Transformer 230V/12-0-12V	4
21	Patch Cords	As required

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1		1	1								
CO2	3	3	3	2	1		1	1								
CO3	3	3	3	2	1		1	1								
CO4	3	3	3	2	1		1	1								
CO5	3	3	3	2	1		1	1								
CO6	3	3	3	2	1		1	1								
Avg	3	3	3	2	1		1	1								

CY24121	Engineering Chemistry Laboratory	Category	L	T	P	C
		BSC	0	0	2	1

Course Objectives:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity, hardness, DO, TDS, and Chloride.
- To demonstrate the synthesis of nanoparticles.
- To familiarize the students with the determination of the molecular weight of a polymer by a viscometer.
- To familiarize the students with electroanalytical techniques such as pH metry, Potentiometry, and Conductometry to determine impurities in aqueous solutions.
- To understand the factors influencing corrosion.

LIST OF EXPERIMENTS:(Minimum of 7 experiments to be conducted)

1. Estimation of HCl using Na2CO3 as primary standard
2. Determination of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Determination of strength of given hydrochloric acid using pH meter.
8. Conductometric titration of strong acid vs strong base.
9. Estimation of iron content of the given solution using potentiometer.
10. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
11. Estimation of sodium and potassium present in water using a flame photometer.
12. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
13. Determination of Glass transition temperature of a polymer.
14. Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol-Gel method.
15. Corrosion experiment-weight loss method.
16. Conductometric titration of barium chloride Vs Sodium Sulphate - Precipitation method.

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

- Analyze the quality of water samples with respect to their acidity, alkalinity.
- Determine the hardness and chloride content of the water sample.
- Demonstrate precipitation method for synthesis of nanoparticles.
- Determine the molecular weight of the polymer.
- Estimate the amount of analyte by conductometry.
- Quantitatively analyze the impurities in solution by electroanalytical techniques.

References:

1. Engineering Chemistry Laboratory Manual – Department of SH-CHEMISTRY, LICET,2024.
2. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

Laboratory Requirements:

1.Conductivity meter – 15 Nos.
2. pH meter - 15 Nos.
3. Potentiometer - 15 Nos.
4.Viscometer - 35 Nos.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	2	2	-	-	-	2	-	-	-	-
CO2	3	2	1	-	-	2	2	-	-	-	2	-	-	-	-
CO3	2	1	2	-	-	2	2	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	1	1	-	-	-	1	-	-	-	-
CO5	3	1	2	-	1	2	2	-	-	-	2	-	-	-	-
CO6	3	1	2	-	1	2	2	-	-	-	2	-	-	-	-
Avg	**2.7**	**1.3**	**1.7**	**-**	**1**	**1.8**	**1.8**	**-**	**-**	**-**	**1.8**	**-**	**-**	**-**	**-**

GE24121	Engineering Practices Laboratory - Civil and Mechanical	Category	L	T	P	C
		ESC	0	0	2	1

Course Objectives:

- Familiarize students with basic tools and equipment used in engineering.
- Develop practical skills in Mechanical, Civil and 3D Printing practices.
- Encourage teamwork and collaboration in a lab environment.
- Foster an understanding of safety protocols and procedures.

INTRODUCTION AND SAFETY PRACTICES

Overview of lab rules, expectations, and safety protocols**,** Personal Protective Equipment (PPE), handling tools and equipment safely, emergency procedures.

MECHANICAL PRACTICES

Workshop Tools: Identification and usage of basic mechanical tools (hammers, wrenches, screwdrivers, etc.).
Basic Machining: Introduction to lathe and drilling machines. Practicing Facing, Turning, and Drilling.
Sheet Metal Works: Making a dustpan and funnel.

CIVIL PRACTICES

Plumbing: Exposure to different plumbing components. Exposure to plumbing repair methods and troubleshooting of existing connections. Practicing pipe connection to the wash basin from the water tank. **Carpentry:** A study on carpentry procedure. Making joints like the Tee joint and the Dovetail joint. Exposure and usage of power tools.

ADDITIVE MANUFACTURING PRACTICES

Welding: Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding, CO2, gas, and MIG welding techniques. **Foundry:** Introduction to the foundry process and tools. Mold preparation for solid and split patterns. **3D Printing:** Basics of 3D printing and simple projects.

ASSEMBLING AND FITTING

Introduction to Systems - Dismantling and Assembling of Mixer/IC Engines/Refrigerator and Air Conditioner

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able

- To perform basic machining operations
- To perform operations on the given sheet metal
- To understand the concepts of additive manufacturing methods like Welding, Moulding and 3D Printing
- To understand the rudimentary concepts of refrigeration and air conditioning systems
- To do basic household works like Plumbing, Carpentry Joints

- To identify the components of Mixer/IC Engines/Refrigerator/AC.

Text Books:
1.Workshop Technology by W.A.J. Chapman
2.Electrical Engineering Fundamentals by Vincent Del Toro
3.Basic Civil Engineering by M.S. Palanichamy

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2							2				2		2	
CO2	2							2				2		2	
CO3	2				2			2				2	2	2	
CO4	2				1			2				2	2		
CO5	1							2				2			
CO6	1							2				2			
Avg	1.6				1.5			2				2	2	2	

FC24101	Life Skills	Category	L	T	P	C
		HSMC	2	0	0	1

Course Objectives:

- To enhance self-awareness and understanding of personal strengths, weaknesses, and potential.
- To develop mechanisms to navigate through emotions and stress.
- To build effective interpersonal skills and maintain healthy social relationships.
- To foster and develop strategies for holistic well-being.
- To reflect on personal growth.

UNIT I	Knowing Thyself	6

- Knowing Thyself
  - Strengths, Limitations, Characteristics, Habits and Experiences
- Sense of SELF
  - Self Awareness, Self Image, Self-esteem, Self Love, Self Respect
- Three Dimensions of SELF
  - 1) Ideal Self, 2) Social Self, and 3) Real Self
- Personality Types
  - 1) Introvert, 2) Extrovert, and 3) Ambivert

UNIT II	Emotional Competence	6

- Understanding emotions
- Understanding the patterns of thoughts, feelings, and behaviors (Cognitive Behavior Theory)
- Handling stress, anxiety, and fear (flight mode) / anger (fright mode)
- Happy chemicals (4 chemicals - Dopamine, Oxytocin, etc)
- Positive Thinking

UNIT III	Interpersonal Skills	6

- Interpersonal relationships
- Communicating Positive Expressions
  (Empathy, Trust, Forgiveness, Gratitude, Compassion)
- Personal and Social Associations - Family systems, Relationship management
- Building personal, social, and digital intelligence
- Sense of OTHERS
- Gender Equity

UNIT IV	Dimensions of Well-being	6

- Intellectual Well-being
- Emotional Well-being
- Spiritual Well-being
- Physical Well-being
- Social Well-being

UNIT V	Life to the fullest	6

- Happiness v/s Having fun
- Self-Retrospection and Positive Transformation
- Synthesis, Personal Reflection, and Way Forward

Total Periods: 30

Course Outcomes:
On completion of the course, the students will be able to

1. Identify their strengths and weaknesses and demonstrate self-awareness through reflective practices.
2. Demonstrate the ability to recognize emotions and handle stress.
3. Enhance interpersonal skills to build strong and positive relationships.
4. Adapt to a comprehensive understanding of well-being, and be able to implement strategies for maintaining mental health.
5. Develop a deeper understanding of personal and social relationships, and identify areas for growth.
6. Synthesize learning into a cohesive life plan for future growth.

Suggested Activities:

- Cognitive behavior therapy
- PLOT
- SLOT
- SWOT
- Johari Window

References:

1. Bradberry, Travis, and Jean Greaves. Emotional Intelligence 2.0. TalentSmart,2009.
2. Republic of Philippines, Department of Education. K to 12 Senior High School Core Curriculum. - Personal Development, May 2016.
3. US Department of Education, Career Guidance and Counselling Programs. Rich South High School Horizon Program: (Rich Town Park Illinois: Rich South High School, 1998)

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1							3								
CO2						2	3								
CO3						3	3	3	3						
CO4						3	3		3		3				
CO5						3	3				3				
CO6							3								
Avg						**2.8**	**3**	**3**	**3**		**3**				

MA24304	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	Category	L	T	P	C
		BSC	3	1	0	4

Course Objectives:

- To introduce the formation and solving techniques of partial differential equations
- To familiarise the representation of periodic functions as an infinite series
- To apply PDE techniques in modelling and solving physical systems
- To acquaint the student with Fourier transform techniques
- To introduce Z transform and difference equations and to equip with techniques for solving discrete time systems

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	9+3

Introduction to PDEs - Formation of PDEs by elimination of arbitrary constants/functions-solution: First order PDEs-Linear and quasi-linear equations - Higher order PDEs by separation of variables

UNIT II	FOURIER SERIES	9+3

Periodic Functions-Dirichlet's conditions, Euler's formulae - Full range Fourier Series - half-range series - convergence - Parseval's Identity - Harmonic analysis

UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9+3

Classification of second order PDEs - Applications of PDEs-Vibrations of strings-1D heat conduction-steady state heat transfer in plates

UNIT IV	FOURIER TRANSFORMS	9+3

Fourier Integral Theorem (statement only) - Fourier transform pair - Properties of Fourier Transforms - transforms of simple functions - Convolution theorem (application only) - Parseval's identity

UNIT V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	9+3

Z- transforms - Elementary properties (without proof) – Inverse Z - transform (using partial fraction, and residue technique) – Convolution theorem (application only) - Formation of Difference equations – Solution of difference equations using Z - transform

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Formulate partial differential equations
CO2: Solve standard partial differential equations
CO3: Represent periodic functions as an infinite series using Fourier series
CO4: Identify solutions for solving one dimensional wave, one and two dimensional heat flow problems
CO5: To solve problems of engineering using Fourier transform
CO6: To apply Z-transforms to solve linear difference equations arising in discrete time systems

Text Books:

1. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3. Boyce, W. E., DiPrima, R. C., and Meade, D.B., “Elementary Differential Equations and Boundary Value Problems,” Wiley Publishers, 12th Edition, 2021.

References:

1. B.V Ramana.., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
3. G. James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. L.C Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
5. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
6. R.C. Wylie, and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

MAPPING OF COs WITH POs AND PSOs

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

ME24301	FLUID MECHANICS AND MACHINERY	Category	L	T	P	C
		ESC	3	1	0	4

Course Objectives:

- To understand the properties of fluid and flow characteristics under static and dynamic conditions.
- To understand the concepts of boundary layer and energy losses in flow through pipes
- To understand the concepts of dimensional analysis and model studies.
- To understand the concepts and working principle of various types of turbines
- To understand the concepts and working principle of centrifugal pump
- To understand the concepts and working principle of reciprocating pump

UNIT I	FLUID PROPERTIES AND FLOW CHARACTERISTICS	12

Units and dimensions- Types of fluids - Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Concept of gauge pressure and absolute pressure – Pascal's law - Pressure measurement by U-tube manometers. Flow characteristics – Types of flow – Steady, uniform, laminar, turbulent, compressible, and rotational flow – Flow visualization – Stream, streak, and path lines - Continuity equation - Equations of motion – Eulers equation along a stream line – Bernoulli's equation - Applications – Venturimeter, Orifice meter, pitot tube – MATLAB / Python programming to determine the coefficient of discharge

UNIT II	BOUNDARY LAYER CONCEPTS AND FLOW THROUGH PIPES	12

Boundary layer theory - boundary layer separation – types of boundary layer – boundary layer thickness – Displacement thickness, momentum thickness and energy thickness - Laminar flow through circular pipes – Hagen Poiseuille equation - Major losses - Darcy Weisbach equation – friction factor and coefficient of friction - Moody diagram - commercial pipes- minor losses – types of minor losses - Flow through pipes in series and parallel - Hydraulic and energy gradient lines - MATLAB / Python programming to determine the head loss due to friction.

UNIT III	DIMENSIONAL ANALYSIS AND MODEL STUDIES	12

Units and dimensions - Need for dimensional analysis – methods of dimensional analysis - Dimensional homogeneity - Rayleigh's method and Buckingham Pi theorem - Similitude – types of similitude – Different types of fluid forces - Dimensionless parameters – types and applications of dimensionless parameters - Model analysis - Reynold's model law – Froude's model law – Mach model law - Distorted and undistorted models

UNIT IV	TURBINES	12

Introduction to Impact of jets - Theory of roto-dynamic machines - Classification of turbines – Impulse and reaction turbines - heads and efficiencies – velocity triangles - Tangential flow, radial flow, mixed flow and axial flow turbines - Pelton wheel, Modern Francis turbine and Kaplan turbine - working principles - work done by water on the runner – draft tube - Specific speed - unit quantities – performance curves for turbines – governing of turbines - MATLAB / Python programming to determine the specific speed of turbine.

UNIT V	PUMPS	12

Classification of pumps – Rotodynamic pump and positive displacement pump - Centrifugal pump - working principle - velocity triangles – work done by the impeller - efficiencies and characteristic curves. Minimum starting speed – specific speed of pumps – priming - cavitation in pumps - NPSH (net positive suction head). Reciprocating pump: working principle - indicator diagram - slip - work saved by fitting air vessel – Rotary pumps – classification - MATLAB / Python programming to determine the efficiency of centrifugal pump.

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

- Students will have the basic knowledge of properties and characteristics of fluids.
- Students can determine the boundary layer thickness and estimate the energy losses in laminar and turbulent conditions
- Students can perform dimensional analysis and can conduct model testing.
- Students can evaluate the performance of impulse and reaction turbines
- Students can evaluate the performance of centrifugal pump and plot characteristic curves.
- Students can evaluate the performance of reciprocating pump

Text Books:

1. P.J. Pritchard, A.T. McDonald and R.W. Fox, “Introduction to Fluid Mechanics,” Wiley India, 2019.
2. Victor L. Streeter, Wylie E. Benjamin and Bedford W. Keith W, “Fluid Mechanics”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 9th Edition, 2016.
3. Yunus Cengel and John Cimbala, Fluid Mechanics Fundamentals and Application, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi 2019
4. S. K. Som, G. Biswas and S. Chakraborty, “Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2017.

References:

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, Laxmi publications (P) Ltd, New Delhi, 11th Edition, 2020.
2. P.N. Modi, S.M. Seth, “Hydraulics and fluid mechanics including hydraulic machines”, Standard book house 22nd edition, 2019.
3. White, F.M., “Fluid Mechanics”, Tata McGraw-Hill, New Delhi, 7th Edition, 2013.
4. Kumar, K. L., “Engineering Fluid Mechanics”, S Chand, Eurasia Publishing House (P) Ltd, New Delhi, 7th Edition, 2020.
5. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing, 2021.
6. Ramamirtham, S., "Fluid Mechanics, Hydraulics and Fluid Machines", DhanpatRai and Sons, New Delhi, 9th edition, 2014.
7. Subramanya K, "Fluid Mechanics and Hydraulic Machines", 2nd Edition, McGraw Hill Education, India, 2018.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2								2	2	3		1
CO2	3	2	2								2	2	3		1
CO3	3	2	2								2	2	3		1
CO4	3	2	2								2	2	3		1
CO5	3	2	2								2	2	3		1
CO6	3	2	2								2	2	3		1
Avg.	3	2	2								2	2	3		1

ME24302	ENGINEERING THERMODYNAMICS	Category	L	T	P	C
		PCC	3	0	0	3

Course Objectives:

- To acquire knowledge on the basics of thermodynamics and thermodynamic processes.
- To impart knowledge on the second law of thermodynamics and entropy.
- To learn the properties of steam and the use of steam tables and Mollier chart.
- To analyse the working principles of various steam cycles.
- To acquire knowledge of gas mixtures and various thermodynamic relations.
- To acquire knowledge on the basics of psychrometry and psychrometric processes.

UNIT I	BASIC CONCEPTS, ZEROTH AND FIRST LAW	9

Thermodynamic systems, Properties and processes, Thermodynamic equilibrium, Displacement work, p-v diagram, Thermal equilibrium, Zeroth law, Temperature scales, First law of thermodynamics- Application to closed and open systems, Steady and unsteady flow processes.

UNIT II	SECOND LAW, ENTROPY AND AVAILABILITY	9

Heat Engine, Refrigerator and Heat pump, Statements of second law, Carnot cycle and reversed Carnot cycle, Concept of entropy, T-s diagram, High and low grade energy, Availability and irreversibility for open and closed system processes.

UNIT III	PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLES	9

Formation of steam and it's thermodynamic processes, p-v, T-s and h-s diagrams, Dryness fraction, Use of Steam tables and Mollier chart, Rankine cycle, Modified Rankine cycle, Reheat cycle, regenerative cycle and Binary cycle.

UNIT IV	GAS MIXTURES AND THERMODYNAMIC RELATIONS	9

Properties of ideal and real gases, Equations of state for ideal and real gases, Avogadro's law, Vander Waal's equation of state, Compressibility factor, Compressibility chart, Dalton's law of partial pressure, Maxwell relations, Tds equations, Difference and ratio of heat capacities, Joule- Thomson coefficient, Clausius-Clapeyron equation.

UNIT V	PSYCHROMETRY	9

Psychrometric properties, Psychrometric charts, Property calculations of air- vapour mixtures using charts and expressions, Psychrometric processes- Sensible heating and cooling, Humidification and dehumidification, Adiabatic saturation, Evaporative cooling and Adiabatic mixing, Developing computer programs to determine psychrometric properties.

Total Periods: 45

On completion of the course, the students will be able to

1. Explain the basic concepts of thermodynamics.
2. Describe the concepts of entropy and availability.
3. Determine the properties of steam using steam tables and Mollier chart.
4. Analyse the working of various steam power cycles.
5. Apply various thermodynamic relations to solve complex problems.
6. Determine the properties of air using psychrometric charts and expressions.

Text Books:

1. Nag P. K, "Engineering Thermodynamics", McGraw Hill (India), 6th Edition, 2017.
2. Natarajan E, "Engineering Thermodynamics", Anuragam Publications 2nd Edition, 2014.
3."Fundamentals of Classical Thermodynamics" by Gordon J. Van Wylen and Richard E. Sonntag, published by Wiley

References:

1. Yunus A. Cengel, Michael A. Boles and Mehmet Kanoglu, "Thermodynamics - An Engineering Approach", McGraw Hill (India), 9th Edition, 2019.
2. Chattopadhyay P, "Engineering Thermodynamics", Oxford Higher Education, 2nd Edition, 2016.
3. Rathakrishnan E, "Fundamentals of Engineering Thermodynamics", Prentice Hall of India Pvt. Ltd, 2nd Edition, 2006.
4. Claus Borgnakke and Richard E. Sonntag, "Fundamentals of Thermodynamics", Wiley Eastern, 10th Edition, 2019.
5. Venkatesh A, "Basic Engineering Thermodynamics", Universities Press (India), 2007

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	1							2		3		
CO2	3	3	2	1							2		3		
CO3	3	3	2	1							2		3		
CO4	3	3	2	1		1		2		1	2		3		2
CO5	3	3	2	1							2		3		
CO6	3	3	2	1	3	1	1	2	1	1	2	1	3		2
Avg.	3	3	2	1	3	1	1	2	1	1	2	1	3		2

ME24303	MANUFACTURING TECHNOLOGY I	Category	L	T	P	C
		PCC	3	0	0	3

Course Objectives:

- To illustrate the working principles of various metal casting processes.
- To learn and apply the working principles of various metal joining processes.
- To analyse the working principles of bulk deformation of metals.
- To learn the working principles of sheet metal forming process.
- To study and practice the working principles of plastics molding.
- To apply to enable precise control, real-time monitoring, and data-driven decision-making.

UNIT I	METAL CASTING PROCESSES	9

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Molding sand Properties and testing – Cores –Types and applications – Molding machines – Types and applications–Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – low pressure, gravity- Tilt pouring, high pressure die casting- Centrifugal Casting – CO2 casting –-Defects in Sand casting process-remedies.

UNIT II	METAL JOINING PROCESSES	9

Fusion welding processes – Oxy fuel welding – Filler and Flux materials-–Arc welding, Electrodes, Coating and specifications – Gas Tungsten arc welding –Gas metal arc welding - Submerged arc welding – Electro slag welding– Plasma arc welding — Resistance welding Processes -Electron beam welding – Laser beam Welding Friction welding – Friction stir welding – Diffusion welding – Thermit Welding, Weld defects –inspection & remedies – Brazing - soldering – Adhesive bonding.

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 – 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.

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	9

Types and characteristics of plastics – Molding of thermoplastics & Thermosetting polymers– working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – Introduction to blow molding – Automation, Artificial intelligence (AI), the Internet of Things (IoT), and Additive manufacturing (3D printing) and its application.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

- Explain the principle of different metal casting processes.
- Describe the various metal joining processes.
- Illustrate the different bulk deformation processes.
- Apply the various sheet metal forming process.
- Apply suitable molding technique for manufacturing of plastics components.
- Fabricate the product using 3D printing and laser machining process.

Text Books:

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,4th Edition, 2013
2. P.N.Rao Manufacturing Technology Volume 1 Mc Grawhill Education 5th edition,2018.

References:

1. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2. S. Gowri P. Hariharan, A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.
3. Paul Degarma E, Black J.T and Ronald A. Kosher, Eligth Edition, Materials and Processes, in Manufacturing, Eight Edition, Prentice – Hall of India, 1997.
4. Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II,
Media promoters and Publishers Private Limited, Mumbai, 1997
5. Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2							2	1			1	0	2	1
CO2	2							2	1			1	0	2	1
CO3	2							2	1			1	0	2	1
CO4	2							2	1			1	0	2	1
CO5	2							2	1			1	0	2	1
CO6	2							2	1			1	0	2	1
Avg.	2							2	1			1	0	2	1

ME24304	ENGINEERING MATERIALS AND METALLURGY	Category	L	T	P	C
		PCC	3	0	0	3

Course Objectives:

- To acquire knowledge about phase-diagrams, salient features of iron-carbon system and heat treatment process.
- To apply the mechanism of plastic deformation, principle of strengthening methods.
- To utilize the mechanical behavior of materials and learn about failure analysis.
- To identify structure, properties and applications of metals and non-metals.
- To acquire knowledge about properties and applications of advanced engineering materials.
- To integrate knowledge of material structures, properties, processing methods, and performance to select suitable materials for engineering applications.

UNIT I	PHASE DIAGRAM AND HEAT TREATMENT	9

Crystal structure, Imperfection in solids, Solid solutions – Types, factors governing solubility rules. Phase diagram – cooling curve, phase rule, types and interpretation. Iron-carbide ($Fe-Fe_3C$) phase diagram, Microstructural aspects and invariant reactions in $Fe-Fe_3C$ diagram. Effect of alloying elements on $Fe-Fe_3C$ diagram. TTT and CCT diagrams. Various heat treatment and surface hardening processes.

UNIT II	ELASTIC AND PLASTIC BEHAVIOR OF MATERIALS	9

Stress Strain relation in elastic and plastic region, Mechanism of plastic deformation– slip and twinning, Slip systems, critically resolved shear stress, Shear strength of perfect and real crystals. Dislocation–climb, interaction, multiplication and pileups. Strengthening mechanisms– Solid solution, Grain boundary, Dispersion, Precipitation, Fiber, Martensite strengthening, Strain aging and Strain hardening.

UNIT III	CHARACTERIZATION OF MATERIALS	9

Types of fracture in metals, Griffith's theory of brittle fracture, Stress intensity factor, Fracture toughness, Theory of Ductile to brittle transition. Creep – Creep curve, mechanism of creep deformation. Fatigue-S-N Curve, low and high cycle fatigue, stages of fatigue. Sources of failure, Procedure of failure analysis. Hardness: Rockwell, Brinell, Vickers hardness, Nano-Indentation Technique. Introduction to characterization of materials - XRD, SEM and TEM.

UNIT IV	PROPERTIES OF ADVANCED MATERIALS	9

Properties of plain carbon steel, Tool steel, Stainless steel, Cast iron. Need of micro alloying, HSLA steel - Dual phase steel, TRIP steel. Aluminium alloys - classifications, properties, applications, Titanium alloys. Polymers–Types, Properties and applications of PE, PP, PVC. Ceramics Types, Properties and applications of Al_2O_3, ZrO_2, SiC. Composites - classification, Reinforcement and matrix material, Rule of Mixture. Properties and applications of MMC, CMC and PMC. Functionally graded materials.

UNIT V	FUTURISTIC MATERIALS AND COMPUTATIONAL MATERIALS DESIGN	9

Smart materials – Types, Shape memory alloys. Nanomaterials: Carbon nanotubes, Graphene - properties and applications. Metallic foams, Metallic glasses, Super alloys, High entropy alloys, biomaterials, Multi-scale materials modeling. Integrated Computational Materials Engineering with application to the future of Metallurgy in Industry 4.0 powered by smart manufacturing, poised to transform industries, innovate materials, and contribute to a more sustainable and efficient future. Materials Informatics, Machine learning for design of materials, Property Optimization.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

- Interpret binary phase diagram, describe the micro-constituents in iron-carbon system, Effect of heat treatment and surface hardening on the properties of materials.
- Explain different strengthening mechanisms, concepts related to plastic deformation.
- Discuss the failure of engineering materials, material testing and characterization techniques.
- Classify metals and non-metals for various engineering applications.
- Apply advanced materials for specific applications based on their properties and describe computational methods related to materials.
- Demonstrate a comprehensive understanding of material behavior, selection, processing, and performance by integrating phase diagrams, strengthening mechanisms, failure analysis, material characterization, and the application of advanced materials aligning to latest demands of the engineering applications

Text Books:

1. Williams D Callister, “Material Science and Engineering”, Wiley India Pvt Ltd, 2nd edition, Reprint 2019.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Pvt Ltd, 9th edition, 2018.
3. G.S. Upadhyay and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt. Ltd, New Delhi, 2020.
4. Raghavan V, “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd., 6th edition, 2019.
5. A. Alavudeen, N. Venkateshwaran, and J. T. Winowlin Jappes, “A Textbook of Engineering Materials and Metallurgy”, Laxmi Publications, 2006.
6. Amandeep Singh Wadhwa and Harvinder Singh Dhaliwal, “A Textbook of Engineering Material and Metallurgy”, University Sciences Press, 2008.

References:

1. Budinski K.G, Budinski M.K, “Engineering Materials: Properties and Selection”, Edition 9, Pearson Publication, 2010.
2. Dieter G.E, “Mechanical Metallurgy”, McGraw Hill, Singapore, 2017.

3. Sydney H. Avner, “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994.
4. Chaudhery Mustansar Hussain, “Smart Materials and New Technologies”, Springer, 2022.
5. James F. Shackelford et al., “CRC Materials Science and Engineering Handbook”, Taylor & Francis, 2015.
6. Flake C. Campbell, “Elements of Metallurgy and Engineering Alloys”, ASM International, 2008.
7. ASM Handbook, “Failure Analysis and Prevention”, Vol:11, 2021.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	1	2								1	1	1	2	
CO2	2	1	2								1	1		2	
CO3	2	1	2		2						1		1	1	
CO4	2	1	2								1			1	
CO5	2	1	2		2	1					1			2	1
CO6	2	1	2		3						1			2	1
Avg.	2	1	2		2						1	1	1	2	1

ME24321	MANUFACTURING TECHNOLOGY LABORATORY	Category	L	T	P	C
		PCC	0	0	3	1.5

Course Objectives:

- Understand the principles and procedures for performing various welding operations using Arc and Gas Metal Arc Welding (GMAW) machines.
- Develop the skills to fabricate single ‘V’ and ‘U’ butt joints using GMAW and perform overhead and vertical welds using Arc welding.
- Gain hands-on experience in green sand moulding using different types of patterns like solid, split, and loose piece patterns.
- Understand the working of sheet metal bending equipment and practice sheet metal fabrication techniques.
- Learn the process of injection molding and its application in fabricating plastic components.
- Promote safety practices, precision, and quality in various fabrication processes across different materials and machines.

LIST OF EXPERIMENTS

1. Fabrication of single 'V’ butt joints using Gas Metal Arc Welding machine.
2. Practice the overhead weld joints using Arc Welding machine.
3. Practice the vertical weld joints using Arc Welding machine.
4. Fabrication of single 'U’ butt joints using Gas Metal Arc Welding machine.
5. Preparing green sand moulds with solid patterns.
6. Preparing green sand moulds with split patterns.
7. Preparing green sand moulds with loose piece patterns.
8. Fabrication of sheet metal components using sheet metal bending machine.
9. Fabrication of sheet metal components using sheet metal bending machine.
10. Fabrication of plastic components using injunction molding machine.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

1. Fabricate single ‘V’ and single ‘U’ butt joints using Gas Metal Arc Welding (GMAW) machine following standard procedure and safety protocols.
2. Perform overhead and vertical welding operations using Arc Welding machines with appropriate electrode selection and welding parameters.
3. Prepare green sand moulds using solid, split, and loose piece patterns, demonstrating understanding of moulding principles.

4. Fabricate sheet metal components using a sheet metal bending machine with proper measurement and quality control.
5. Fabricate plastic components using an injection molding machine while understanding machine setup and molding cycle.
6. Demonstrate professional safety practices, equipment handling skills, and quality assurance in various fabrication processes.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2							2	1			1		2	1
CO2	2							2	1			1		2	1
CO3	2							2	1			1		2	1
CO4	2							2	1			1		2	1
CO5	2							2	1			1		2	1
CO6	2							2	1			1		2	1
Avg.	2							2	1			1		2	1

ME24322	FLUID MECHANICS AND MACHINERY LABORATORY	Category	L	T	P	C
		ESC	0	0	3	1.5

Course Objectives:

- To understand the working principle of the U-tube manometer.
- To apply Bernoulli's equation for flow measurement like Orifice/ Venturi meter.
- To measure friction factor in pipes and compare with Moody diagram.
- To determine Metacentric height.
- To determine the performance characteristics of turbines.
- To determine the performance characteristics of pumps.

EXPERIMENTS

Fluid Mechanics:

1. Study on various U-tube manometers.
2. Calibration of Venturi meter / Orifice meter.
3. Calibration of Rotameter.
4. Determination of friction factor for flow through pipes.
5. Determine Metacentric height.

Fluid Machinery:

6. Performance characteristics of centrifugal pumps.
7. Performance characteristics of reciprocating pump / Submersible pump.
8. Performance characteristics of gear pump.
9. Performance characteristics of Pelton turbine.
10. Performance characteristics of Francis turbine / Kaplan turbine.

Total Periods: 45

Course Outcomes:

CO1 : To be able to understand the working principle of the U-tube manometer.

CO2 : To be able verify and apply Bernoulli's equation for flow measurement like Orifice/ Venturi meter.

CO3 : To be able to measure friction factor in pipes and compare with Moody diagram.

CO4 : To be able to determine Metacentric height.

CO5 : To be able to determine the performance characteristics of turbines.

CO6: To be able to determine the performance characteristics of pumps.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2								2	2	3		1
CO2	3	2	2								2	2	3		1
CO3	3	2	2								2	2	3		1
CO4	3	2	2								2	2	3		1
CO5	3	2	2								2	2	3		1
CO6	3	2	2								2	2	3		1
Avg.	3	2	2								2	2	3		1

ME24323	COMPUTER AIDED MACHINE DRAWING LABORATORY	Category	L	T	P	C
		ESC	0	0	3	1.5

Course Objectives:

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

UNIT I	DRAWING STANDARDS & FITS AND TOLERANCES	15

- **Code of Practice & BIS Specifications** – Adherence to engineering drawing standards as per BIS specifications.
- **Symbols & Standard Components** – Understanding welding symbols, riveted joints, keys, and fasteners. Reference to handbooks for selecting standard components like bolts, nuts, screws, and keys.
- **Limits, Fits & Tolerances** – Application of limits and fits, tolerancing of individual dimensions as per IS 919 specifications.
- **Production & Assembly Drawings** – Preparation and interpretation of part and assembly drawings, including production drawings.
- **Geometric Dimensioning & Tolerance (GD&T)** – Fundamentals of GD&T for precise and standardized engineering drawing

UNIT II	2D DRAFTING	30

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, Cross-head (vertical and horizontal), Stuffing box, multi-plate clutch.
6. Machine Components – Screw Jack, Machine Vice, LatheTail TailStock, Lathe Chuck, Plummer Block, Vane and Gear pumps.

Total: 20% of classes for theory classes and 80% of classes for practice

Note: 30% of assembly drawings must be done manually and remaining 70% 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.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1. Demonstrate the use of ISO/BIS standards in machine drawing.

CO2. Apply the concepts of conventional tolerancing and GD&T principles.

CO3. Develop professional drawing layouts for modeled assemblies, including Bills of Materials .

CO4. Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings

CO5. Model and present machine components using orthogonal projections.

CO6. Prepare detailed and standardized drawing layouts for individual modeled parts.

Text Books:

1. Gopalakrishna K.R., "Machine Drawing", 17th Edition, Subhas Stores Books Corner, Bangalore,2003.
2. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 51st Edition, Charator Publishers,2022.

References:

1. K. L Narayana, P.Kannaiah, K.Venkata Reddy, Machine Drawing , 15 Edition , New Age International Publication
2. Goutam Pohit and Goutam Ghosh, "Machine Drawing with AutoCAD", 1st Edition,Pearson Education, 2004
3. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
4. N. Siddeshwar, P. Kanniah, V.V.S. Sastri," Machine Drawing" , published by Tata McGrawHill,2006
5. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

Publication of Bureau of Indian Standards:

1. IS10711 — 2001: Technical products Documentation — Size and layout of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation —Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
4. 5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			2		2				2		2	2			
CO2			2		2				2		2	2			
CO3			2		2				2		2	2			
CO4			2		2				2		2	2			
CO5			2		2				2		2	2			
CO6			2		2				2		2	2			
Avg.			2		2				2		2	2			

HS24321	COMMUNICATION SKILLS BUILDING LABORATORY	Category	L	T	P	C
		HSMC	0	0	2	1

Course Objectives:

- Develop the ability to construct grammatically correct and contextually appropriate sentences
- Enhance critical thinking skills for analyzing and interpreting texts, media, and experiences
- Strengthen comprehension, summarization, and documentation skills for professional contexts
- Improve verbal and non-verbal communication for effective interaction in diverse professional settings
- Equip learners with teamwork, networking, and interview skills essential for career advancement
- Enable the creation of a professional digital identity through resumes, LinkedIn profiles, and self-presentation techniques

UNIT I	The Art of Discourse	6

Listening: Listen to stand-up comedy, political commentaries, and campaigns for appreciative listening.
Reading: Read and evaluate business and economic news articles; determine tone (neutral, positive, negative) and fact-check.
Writing: Craft commentary and opinion pieces to persuade or provoke discussion.
Speaking: Explain satire comic strips (e.g., Amul advertisements, political cartoons)

UNIT II	Professional Communication Essentials	6

Listening: Listen to voicemail, messages, and fill out forms.
Reading: Compare products & services; analyze advertisements.
Writing: Draft meeting agendas and minutes.
Speaking: Engage in open-field group discussions.

UNIT III	Documentation and Summation	6

Listening: Listen to documentaries, book summaries, and movie summaries for comprehensive understanding.

Reading: Read and analyze reports on significant events (e.g., environmental disasters, economic downturns).

Writing: Write survey reports and paraphrase key information.

Speaking: Report news, weather forecasts, and predictions.

UNIT IV	Refining Professional Competence	6

Listening: Translate informal language into formal business communication (Contextual translation)
Reading: Read and interpret technical texts and industry-specific jargon.

Writing: Write cover letters and statements of purpose. Speaking: Role-play professional etiquette in workplace scenarios (e.g., expressing empathy, kindness, courtesy).		
UNIT V	**Developing a Professional Profile**	6
Listening: Listen to podcasts, Josh Talks, and professional interviews. Reading: Analyze professional resumes and LinkedIn profiles. Writing: Set up a LinkedIn profile and write engaging posts. Speaking: Conduct mock interviews and deliver an effective elevator pitch.		
		Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

C01: Construct coherent and professional sentences tailored to various workplace scenarios

C02: Analyze and critically interpret professional texts and multimedia content

C03: Document, summarize, and report information effectively across multiple formats

C04: Communicate effectively in professional and social interactions

C05: Demonstrate teamwork, networking, and interview skills relevant to career development

C06: Curate a professional online presence through resume development - LinkedIn, Indeed, .

Text Books:

1. English for Engineers and Technologists. Volume I by Orient Blackswan, 2022
2. English for Science & Technology - I by Cambridge University Press, 2023

Suggested Activities:

Documentation and Summation
Assignment: Newsroom Simulation (20 Marks)
Students record a 2-minute news report on an environmental/economic issue.
Must include paraphrased content from real news reports (cite sources).
Submission: Video + written news script.

Group Discussion (30 Marks)
Refining Professional Competence
Assignment: Corporate Dilemma Roleplay (20 Marks)
Scenario-based role play on professional etiquette (handling client complaints, rejecting proposals kindly, etc.).
Each student submits a formal email responding to the scenario professionally.

Developing a Professional Profile
Assignment: LinkedIn Challenge (30 Marks)
Students create or optimize their LinkedIn profile and write a compelling post (e.g., career reflections, lessons from a recent project).
Submit a screenshot of updated profile + link to post.
Optional: Engage with at least three classmates' posts with meaningful comments.

References:

1. Seely, John. Oxford Guide to Effective Writing and Speaking: How to Communicate Clearly. Oxford University Press, 2013.
2. Cottrell, Stella. Critical Thinking Skills: Developing Effective Analysis and Argument. Bloomsbury Academic, 2017.
3. Bhatnagar, Nitin. Communicative English for Professional Courses. Pearson, 2010.
4. Guffey, Mary Ellen, and Dana Loewy. Essentials of Business Communication. Cengage Learning, 2021.
5. Collins, Patrick. Speak with Power and Confidence: Tested Ideas for Becoming a More Powerful Communicator. Prentice Hall, 2009.
6. Locker, Kitty O., and Stephen Kyo Kaczmarek. Business Communication: Building Critical Skills. McGraw-Hill, 2020.

MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						1		1	1	1	
CO2		1		1				1	1		1
CO3									1		1
CO4								1	1		
CO5								1	1		1
CO6											1

BS24321	SYSTEM DISCOVERY AND ANALYSIS	Category	L	T	P	C
		BSC	0	0	2	0

Course Objectives:

1.To impart hands-on experience in dismantling and assembling mechanical systems , enabling students to understand component functions, interrelationships, and mechanical fitment.
2.To develop practical skills in identifying standard mechanical elements, applying correct disassembly and assembly techniques, and adhering to safety norms and engineering standards.
3.To enhance analytical ability in inspecting mechanical components for wear and tolerance variations, interpreting engineering drawings, and assessing system performance using standard tools and practices.

Module I	SYSTEM DISCOVERY	12

Introduction to Mechanical Systems **2**

- Types and applications of mechanical systems with a focus on water dispenser & Air conditioner

Workshop Code of Practice & BIS Specifications **2**

- Safe handling of tools and components
- Compliance with standard practices during disassembly/assembly
- Introduction to workshop safety and BIS guidelines

Component Identification and Familiarization **2**

- Identification of key components of water dispenser & Air conditioner
- Understanding the function of each component within the system

Disassembly Procedure **2**

- Step-by-step guide for dismantling the water dispenser & Air conditioner
- Proper handling and orientation recording of each component
- Tool usage techniques and care

Fasteners, Keys, and Joints **2**

- Classification and selection of fasteners used in water dispenser & Air conditioner
- Use of circlips, keys, bolts, and nuts
- Discovering riveted and welded joints

System Assembly **2**

- Reassembling the water dispenser & Air conditioner using standard procedures
- Correct alignment, sequencing, and torquing
- Final inspection for fit and function

MODULE II	SYSTEM ANALYSIS	18

Introduction to Mechanical Systems **3**

- Types and applications of mechanical systems with a focus on petrol engine

Functional Analysis of Petrol Engine **3**
- Understanding the Construction and working principles of Petrol Engine.

Component Inspection and Condition Assessment **3**
- Visual and dimensional inspection of parts
- Identifying wear, deformation, and damage
- Use of micrometers, calipers, and feeler gauges

Disassembly Procedure **3**
- Step-by-step guide for dismantling Petrol Engine.
- Proper handling and orientation recording of each component
- Tool usage techniques and care

System Assembly **3**
- Reassembling petrol engine using standard procedures
- Correct alignment, sequencing, and torquing
- Final inspection for fit and function

Report Writing and Engineering Communication **3**
- Preparation of inspection reports
- Reflection on diagnostic outcomes and improvement recommendations

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Identify and describe the individual components of a mechanical system.

CO2: Demonstrate safe and systematic procedures for disassembling and assembling mechanical systems by adhering to engineering codes of practice and BIS standards.

CO3: Interpret and apply mechanical fastening methods, tolerances, and fits during system assembly to ensure accurate and reliable performance.

CO4: Inspect mechanical components for wear, misalignment, and dimensional variations using appropriate tools and measurement techniques.

CO5: Analyze mechanical systems for functional integrity using principles of geometric dimensioning, tolerance analysis, and failure mode identification.

CO6: Document the disassembly and assembly process, prepare inspection reports, and communicate technical findings effectively using standardized engineering terminology.

References:

1. **Richard R. Kibbe, John E. Neely, Roland O. Meyer, Warren T. White**, *Machine Tool Practices*, 10th Edition, Pearson Education.
2. **Robert C. Juvinall, Kurt M. Marshek**, *Machine Component Design*, 5th Edition, Wiley India.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	1						2	2	2	2	2		1	1
CO2	1	1						2	2	2	2	2		1	1
CO3	1	1						2	2	2	2	2		1	1
CO4	1	1						2	2	2	2	2		1	1
CO5	1	1						2	2	2	2	2		1	1
CO6	1	1						2	2	2	2	2		1	1
Avg.	1	1						2	2	2	2	2		1	1

MA24402	NUMERICAL METHODS	Category	L	T	P	C
		PCC	3	1	0	4

Course Objectives:

- To introduce the basic concepts of solving algebraic and transcendental equations, simultaneous equations and determine eigenvalues of a matrix using numerical techniques
- To introduce the numerical techniques of interpolation in various intervals in real-life situations
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines
- To acquaint the student with various techniques of solving initial value problems in ordinary differential equations
- To familiarise techniques to solve boundary value problems in partial differential and ordinary differential equations

UNIT I	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- Direct methods: Gauss elimination method — Gauss Jordan method — Iterative methods: Gauss Seidel - Gauss Jacobi — Eigenvalues of a matrix by Power method.

UNIT II	INTERPOLATION AND APPROXIMATION	9+3

Interpolation with equal intervals — Newton's forward and backward difference formulae–
Interpolation with unequal intervals — Lagrange's interpolation — Newton's divided difference interpolation.

UNIT III	NUMERICAL DIFFERENTIATION AND INTEGRATION	9+3

Approximation of derivatives using interpolation polynomials — Numerical integration using Trapezoidal, Simpson's 1/3 rule — Romberg's Method — Two point and three point Gaussian quadrature formulae — Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV	INITIAL VALUE PROBLEMS FOR 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.

UNIT V	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS	9+3

Finite difference methods for solving second order two — point linear boundary value problems — Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain — One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods — One dimensional wave equation by explicit method.

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Utilise numerical techniques in solving algebraic and transcendental equations, simultaneous equations and determine eigenvalues

CO2: Interpolate values for equal and unequal intervals of discrete data using numerical techniques

CO3: Approximate derivatives for equal and unequal intervals of discrete data using numerical techniques

CO4: Evaluate single and double integrals using numerical techniques

CO4: Compute solutions to initial value problems for ordinary differential equations

CO6: Approximate solutions to boundary value problems of ordinary and partial differential equations

Text Books:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

References:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

MAPPING OF COs WITH POs

	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2								
CO2	3	3	2								
CO3	3	3	2								
CO4	3	3	2								
CO5	3	3	2								
CO6	3	3	2								
Avg.	3	3	2								

ME24401	STRENGTH OF MATERIALS	Category	L	T	P	C
		PCC	3	0	0	3

Course Objectives:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.
- To study the concept of failure theories.

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 – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

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 – Shear stress distribution.

UNIT III	TORSION ON CIRCULAR SHAFTS AND SPRINGS	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

Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - Conjugate beam method for computation of slope and deflection of determinant beams.

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. Introduction to maximum principal stress theory, Maximum shearing stress theory, Strain energy theory, and maximum strain theory.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

1. Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
2. Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
3. Apply basic equation of torsion in designing of shafts and helical springs
4. Calculate slope and deflection in beams using different methods.
5. Analyze thin and thick shells for applied pressures.
6. Understand the concepts of failure theories.

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.

References:

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.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	1	1	1						1	3	1	2	
CO2	3	2	2	1	2						1	3		2	
CO3	3	2	3	1	2						1	3		3	
CO4	3	2	2	1	1						1	3		2	
CO5	3	2	2	1	1						1	3		2	
CO6	3	2	2	1	1						2	2	1	2	
Avg.	3	2	2	1	1						1	3		2	

ME24402	KINEMATICS OF MACHINERY	Category	L	T	P	C
		PCC	3	0	0	3

Course Objectives:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analysing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I	BASICS OF MECHANISMS	9

Classification of mechanisms– Basic kinematic concepts and definitions– Degree of freedom, Mobility– Kutzbach criterion, Gruebler's criterion - Grashof's Law - Kinematic inversions of four-bar chain and slider crank chains– Limit positions– Mechanical advantage - Transmission Angle - Description of some common mechanisms - Quick return mechanisms, Straight line generators.

UNIT II	KINEMATICS OF LINKAGE MECHANISMS	9

Displacement, velocity and acceleration analysis of simple mechanisms– Graphical method Velocity and acceleration polygons– Velocity analysis using instantaneous centres– kinematic analysis of simple mechanisms– Coincident points– Coriolis component of Acceleration.

UNIT III	KINEMATICS OF CAM MECHANISMS	9

Classification of cams and followers– Terminology and definitions– Displacement diagrams: Uniform velocity, Uniform acceleration and retardation, simple harmonic and cycloidal motions– Derivatives of follower motions– Layout of plate cam profiles– Specified contour cams– Circular arc and tangent cams. Pressure angle and undercutting– sizing of cams.

UNIT IV	GEARS AND GEAR TRAINS	9

Law of toothed gearing– Involutes and cycloidal tooth profiles– Spur Gear terminology and definitions–Gear tooth action–contact ratio–Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains–Speed ratio, train value–Parallel axis geartrains–Epicyclic Gear Trains.

UNIT V	FRICTION IN MACHINE ELEMENTS	9

Surface contacts - Sliding and Rolling friction - Friction drives - Friction in screw threads. Bearings and lubrication - Friction clutches - Belt and rope drives - Friction in brakes - Band and Block brakes.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1. Explain the principles of kinematic pairs of planar mechanisms.
CO2. Compute velocity and acceleration in planar mechanisms.
CO3. Apply various motion principles to draw cam profiles
CO4. Compute the gear terminology suitable for given application
CO5. Discuss the effect of various types of friction in power transmission
CO6. Apply the concepts of kinematics in predicting motion mechanism for given application

Text Books:

1. Rattan, S.S, "Theory of Machines",4th Edition, TataMcGraw-Hill,2014.
2. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, OxfordUniversityPress,2014.

References:

1. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall,1961
2. Cleghorn.W. L, "Mechanisms of Machines", Oxford University Press,2014
3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3rd Edition Affiliated East-West Pvt. Ltd., New Delhi,2006.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. ThomasBevan,"TheoryofMachines",3rd Edition, CBS Publishers and Distributors,2005.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	2									2			
CO2	2	2	2									2			
CO3	3	2	2									2			
CO4	2	2	2									2			
CO5	2	2	2									2			
CO6	3	2	2					2	2	2	3	2			
Avg.	2	2	2					1	1	1	1	2			

ME24404	THERMAL ENGINEERING	Category	L	T	P	C
		PCC	3	1	0	4

Course Objectives:

- To learn and analyze air standard thermodynamic cycles for evaluating engine and mean effective pressure.
- To evaluatE the performance of steam nozzle, calculate critical pressure ratio steam turbines through velocity triangles, understand the need for governing and compounding of turbines
- To evaluate the working and efficiency of reciprocating and rotary air compressors, including multistage compression.
- To analyzing the working and construction of IC engines and various auxiliary systems present in IC engines
- To evaluate the performance of refrigeration systems, including vapour compression, absorption, and thermoelectric systems.
- To integrate knowledge of thermal systems to assess and optimize the performance of cycles, compressors, turbines, IC engines, and refrigeration systems in real-world applications.

UNIT I	THERMODYNAMIC CYCLES	9

Air Standard Cycles – Otto, Diesel, Dual, and Brayton – Cycle Analysis, Performance and Comparison.

UNIT II	STEAM NOZZLES AND STEAM TURBINES	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. Types-Impulse and reaction Turbine -principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

UNIT III	AIR COMPRESSORS	9

Classification and comparison, working principle, work of compression – with and without clearance, volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.

UNIT IV	INTERNAL COMBUSTION ENGINES	9

IC engine – Classification, working, components and their functions. two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control. 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.

UNIT V	REFRIGERATION SYSTEMS	9

Terminology of Refrigeration- classifications, properties of Refrigerants, Vapour compression refrigeration cycle, Working of Domestic refrigerator .Effect of Superheat and Sub-cooling, Performance calculations, vapour absorption refrigeration system- water -ammonia, Li-Br -water system and thermoelectric refrigeration.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

1. Apply thermodynamic concepts to different air standard cycles and solve problems.
2. Solve problems in steam nozzle and calculate critical pressure ratio.
3. Analyse the flow in steam turbines, draw velocity diagrams, flow in Gas turbines and solve problems.
4. understand the functioning and features of IC engine, components and auxiliaries
5. understand the various performance parameters of IC engines
6. understand the modern performance enhancement methods in IC engines such as supercharging, turbocharging, and advanced fuel injection systems, and explain their role in improving efficiency and meeting emission norms.

Text Books:

1. Mahesh. M. Rathore, “Thermal Engineering”, 1st Edition, Tata McGraw Hill, 2010.
2. R.K .Rajput, “Thermal Engineering”, 8th Edition, Laxmi publications, 2019.

References:

1. Ballaney. P, “Thermal Engineering”, 25th Edition, Khanna Publishers, 2017.
2. Domkundwar & Kothandaraman, “A Course in Thermal Engineering”, 6th Edition, Dhanpat Rai& Sons, 2011.
3. Ganesan. V, "Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2012.
4. Gupta H.N, “Fundamentals of Internal Combustion Engines”, 2nd Edition Prentice Hall of India, 2013.
5. Mathur M.L and Mehta F.S., “Thermal Science and Engineering”, 3rd Edition, Jain Brothers Pvt. Ltd, 2017.
6. Soman. K, “Thermal Engineering”, 2nd Edition, Prentice Hall of India, 2011.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
Avg.	3.0	2.5	1.5	-	-	-	-	-	-	-	-	-	3.0	-	-

BS24301	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	Category	L	T	P	C
		BSC	3	0	0	3

Course Objectives:

- To introduce the basic concepts of environment, ecosystems.
- To emphasize on the biodiversity of India and its conservation.
- To familiarise with the causes and effects of different types of pollution in the environment.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability.
- To impart knowledge about waste management and their recovery methods.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles.

UNIT I	ENVIRONMENT AND BIODIVERSITY	9

Definition, scope and importance of environment – need for public awareness. Ecosystem and Energy flow – food chain, food web, ecological pyramids-ecological succession. Types of biodiversity: genetic, species and ecosystem diversity – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – endangered and endemic species of India, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, conservation of biodiversity: In-situ and ex-situ.

UNIT II	ENVIRONMENTAL POLLUTION	9

Causes, Effects and Preventive measures of Air, Water, Soil, Thermal and Noise Pollutions. Nuclear hazards and human health risks-case study. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection-Air act, Water act, Environmental protection act. Role of an individual in prevention of pollution.

UNIT III	SUSTAINABILITY AND MANAGEMENT	9

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals - intervention areas- Climate change-global warming, acid rain, Ozone layer depletion- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT IV	WASTE MANAGEMENT AND RESOURCE RECOVERY	9

Biodegradable, non-biodegradable wastes, Solid, Hazardous and E-Waste management.
Bio-medical waste management, Concept of waste to energy processes (WTE) - Combustion, Pyrolysis, Landfill gas (LFG) recovery. Recycling of spent batteries, end-of- life vehicle (ELV)

recycling-Waste engine oil recycling-Solvent recovery, Barriers for material recycling-social, legal and economic factors-Environment impact of waste recycling.		
UNIT V	**SUSTAINABILITY PRACTICES**	**9**
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources-Ocean energy sources, Geothermal energy, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.		
		Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

1. To understand the functions of the environment, ecosystems.
2. To analyse the threats of biodiversity and their conservation.
3. To explain the types of environmental pollution and environment protection acts.
4. To recognize the different goals of sustainable development and environmental standards.
5. To correlate the different types of waste management and possible resource recovery methods.
6. To explain the sustainability practices pertaining to sustainable energy, sustainable habitat and sustainable urbanization.

Suggested Activities

- Quiz
- Mind Mapping
- Group discussion
- Seminar
- Animated videos

Text Books:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998

References:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Text book of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MAPPING OF COs WITH POs AND PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1				3					2
CO2	2	1				3					2
CO3	3	2				3		1			2
CO4	3	2	1			2		1			2
CO5	3	2	1			2		-			2
CO6	3	2	1			2		1			2
Avg.	**2.7**	**1.6**	**1**			**2.5**		**1**			**2**

ME24403	MANUFACTURING TECHNOLOGY II		L	T	P	C
		PCC	2	0	2	3

Course Objectives:

- To study the concepts and basic mechanics of metal cutting and the factors affecting machinability
- 2. To learn working of basic and advanced turning machines.
- 3. To teach the basics of machine tools with reciprocating and rotating motions and abrasive finishing processes.
- 4. To study the basic concepts of CNC of machine tools and constructional features of CNC.
- 5. To learn the basics of CNC programming concepts to develop the part programme for Machine centre and turning centre.

UNIT I	MECHANICS OF METAL CUTTING	6

Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II	TURNING MACHINES	6

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

UNIT III	RECIPROCATING MACHINE TOOLS	6

Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods

UNIT IV	CNC MACHINES	6

Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features.

UNIT V	PROGRAMMING OF CNC MACHINE TOOLS	6

Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.

Total Periods: 30

LIST OF EXPERIMENTS

1. Taper Turning and Eccentric Turning on circular parts using lathe machine.
2. Knurling, external and internal thread cutting on circular parts using lathe machine.
3. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
4. Milling contours on plates using vertical milling machine.
5. Cutting spur and helical gear using milling machine.
6. Generating gears using gear hobbing machine.
7. Generating gears using gear shaping machine.
8. Grinding components using cylindrical and centerless grinding machine.
9. Grinding components using surface grinding machine.
10. Cutting force calculation using dynamometer in milling machine
11. Cutting force calculation using dynamometer in lathe machine
12. CNC Programming for Multi-operation Machining: Turning and Milling

TOTAL: 30 PERIODS

Course Outcomes:

On completion of the course, the students will be able to

1. Apply the principles of metal removal processes, identifying factors affecting machinability and improving performance in various machining operations.
2. Explain the construction and working of conventional and special purpose lathes as well as reciprocating machine tools, demonstrating their applications in manufacturing.
3. Understand the construction, features, and operation of CNC machine tools, applying this knowledge to advanced manufacturing processes.
4. Develop CNC programs, write G-code, and set up CNC machines to manufacture components as per given specifications.
5. Demonstrate hands-on skills in machining operations such as turning, shaping, drilling, milling, rolling, and drawing to produce components of required shape and size.
6. Apply workshop safety practices, perform metal joining using Gas Metal Arc Welding (GMAW), and fabricate gears while analyzing defects in cast and machined components.

Text Books:

1. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India,4th Edition, 2013

2. P.N.Rao Manufacturing Technology Volume 1 Mc Grawhill Education 5th edition,2018.

References:

1. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2. Geofrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 1984.

3. Ra o. P.N “Manufacturing Technology,” Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2009.
4. A. B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.
5. Peter Smid, CNC Programming Handbook, Industrial Press Inc.;Third edition, 2007.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2							2	1			1		2	1
CO2	2							2	1			1		2	1
CO3	2							2	1			1		2	1
CO4	2							2	1			1		2	1
CO5	2							2	1			1		2	1
CO6	2							2	1			1		2	1
Avg.	2							2	1			1		2	1

ME24421	STRENGTH OF MATERIALS LABORATORY	Category	L	T	P	C
		PCC	0	0	3	1.5

Course Objectives:

- To determine experimental data include universal testing machines and torsion equipment.
- To determine experimental data for spring testing machine, compression testing machine, impact tester, hardness tester.
- To determine stress analysis and design of beams subjected to bending and shearing loads using several methods.
- To study the mechanical properties of metals, wood and spring by testing in the laboratory.

LIST OF EXPERIMENTS **12**

1. Tension test of mild steel rod
2. Compressive test on brick
3. Deflection test on simply supported beam
4. Torsion test
5. Compressive test on springs
6. Tensile test on springs
7. Izod Impact test
8. Charpy impact test on metal specimen
9. Brinell hardness test
10. Rockwell hardness test

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

- Demonstrate the ability to conduct tensile and compressive tests on materials such as mild steel and bricks, and interpret the mechanical behavior under axial loading.
- Apply knowledge of mechanics to determine the deflection of beams under various loading conditions and validate theoretical results.
- Evaluate the torsional behavior of materials through torsion testing and derive the material's modulus of rigidity.
- Perform tensile and compressive tests on helical springs and analyze the spring constants and energy absorption characteristics.
- Conduct impact tests (Izod and Charpy) on metals and assess the toughness and fracture behavior under sudden loading.
- Determine the hardness of materials using Brinell and Rockwell hardness testing methods and compare different hardness scales.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	1	1							1	3	1	2	
CO2	3	2	2	1							1	3		2	
CO3	3	2	3	1							1	3		3	
CO4	3	2	2	1							1	3		2	
CO5	3	2	2	1							1	3		2	
CO6	3	2	2	1							2	2	1	2	
Avg.	3	2	2	1							1	3		2	

ME24422	THERMAL ENGINEERING LABORATORY	Category	L	T	P	C
		PCC	0	0	3	1.5

Course Objectives:

1. **To** Sketch the valve timing diagram and port timing diagram for single cylinder four stroke diesel engine and two stroke petrol engine.
2. To Measure the viscosity, flash and fire point of various fuel/lubricants
3. To Calculate the mechanical efficiency of four stroke SI engine by Morse test.
4. To Evaluate the performance of four stroke single cylinder CI engine & Predict actual diagram.
5. To Evaluate the performance of steam generator and steam turbines.

LIST OF EXPERIMENTS

1. Valve Timing and Port Timing diagrams.
2. Performance Test on 4 – stroke Diesel Engine.
3. Heat Balance Test on 4 – stroke Diesel Engine.
4. Morse Test on Multi-cylinder Petrol Engine.
5. Retardation Test on a Diesel Engine.
6. Determination of Flash Point and Fire Point of various fuels / lubricants.
7. Study on Steam Generators and Turbines.
8. Heat Balance Test on a Steam Generator.
9. Performance and Energy Balance Test on Steam Turbine.
10. Performance test in Refrigeration System
11. Performance test in a fluidized Bed Cooling Tower
12. Performance test on a reciprocating air compressor,
13. Performance test in air conditioning System

Total Periods: 45

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

NAME OF THE EQUIPMENT	
1. I.C Engine – 2 stroke and 4 stroke model	1 set
2. Apparatus for Flash and Fire Point	1 No.
3. 4-stroke Diesel Engine with mechanical loading.	1 No
4. 4-stroke Diesel Engine with hydraulic loading.	1 No.
5. 4-stroke Diesel Engine with electrical loading.	1 No.
6. Multi-cylinder Petrol Engine	1 No.
7. Single cylinder Petrol Engine	1 No.
8. Data Acquisition system with any one of the above engines	1 No.
9. Steam Boiler with turbine setup	1 No
10. Refrigeration Test rig	1 No
11. Fluidized Bed Cooling Tower	1 No
12. Air conditioning System	1 No
13. Reciprocating air compressor	1 No

Course Outcomes:

On completion of the course,

1. Students are able to draw and interpret valve timing and port timing diagrams for IC engines to understand their influence on engine performance.
2. Students are able to evaluate performance tests on IC engines, including heat balance, Morse test, and retardation test, to determine power output, losses, and efficiencies.
3. Students are able to Determine and analyze the flash and fire points of fuels and lubricants, and explain their relevance to engine safety and performance.
4. Students are able to understand the steam power systems by studying components like steam generators and turbines and conducting heat and energy balance tests.
5. Students are able to Evaluate the performance of refrigeration and air conditioning systems through experimental analysis of parameters like cooling effect, COP, and system behavior.
6. Students are able to Perform and assess the performance of thermal utility equipment such as fluidized bed cooling towers and reciprocating air compressors under varying operating conditions.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	2										2		
CO2	2	3	3										2		
CO3	2	2	2										3		
CO4	2	2	2										2		
CO5	2	2	2										2		
CO6	2	3	2										2		
Avg.	2	3	3										3		

ME24423 PROJECT DRIVEN LEARNING Category L T P C

EEC 0 0 2 1

Course Objectives:

- Apply Design Thinking & Problem-Solving Techniques
- Develop and Implement a Structured Project Plan
- Build Functional Prototypes & Minimum Viable Products (MVPs)
- Evaluate Performance & Optimize Solutions
- Present and Deploy Innovative Solutions

UNIT I Ideation & Problem Identification 6

- Icebreaker & Team Formation
  Tools: Miro, MURAL
- Brainstorming Sessions (Design Thinking, Mind Mapping)
  Tools: Miro, XMind, Lucidchart
- Understanding User Needs & Problem Validation
  Tools: Google Forms, Typeform
- Conducting Market Research & Competitor Analysis
  Tools: Google Trends, Statista, Crunchbase

UNIT II Solution Conceptualization & Planning 6

- Exploring Feasible Mechanical Solutions (Convergent Thinking)
  Tools: Mind Mapping Tools, Concept Screening Matrix, Morphological Charts
- Selecting Appropriate Tools & Platforms
  Examples: CAD (SolidWorks, CATIA), Simulation (ANSYS, MATLAB), Prototyping Tools
- Creating a Project Timeline (Gantt Charts, Stage-Gate Reviews)
  Tools: Microsoft Project, Excel Templates, Trello for task management
- Sketching Mechanical Layouts, Flow Diagrams, or System Models
  Tools: SolidWorks Drawings, Lucid chart, Simulink, Hand Sketching
- Risk Analysis & Contingency Planning
  Tools: FMEA (Failure Modes and Effects Analysis), Risk Assessment Matrix, Fishbone Diagram, SWOT Analysis

UNIT III Prototyping & Implementation 6

- Creating a Low-Fidelity Prototype (Sketches / CAD Models / Mock-ups)
  Tools: Hand Sketching, SolidWorks, Fusion 360, Cardboard Models, Foam Models
- Building a Minimum Viable Product (MVP)
  Using: 3D Printing (FDM/SLA), Laser Cutting, CNC Machining, Sheet Metal Fabrication
- Testing & Refining the Prototype Based on Functional and User Feedback
  Techniques: Fit & Tolerance Checks, Functional Testing, Design Validation
- Implementing Core Functionalities of the Mechanical System
  Focus: Mechanism Working, Load Testing, Motion & Thermal Performance
- Design Review, Analysis & Iteration
  Tools: CAE Tools (ANSYS, COMSOL), Peer Review Sessions, CAD Revision Control

UNIT IV Performance Metrics, Benchmarking & Optimization 6

- Defining Key Performance Metrics (KPIs) for Mechanical Projects
  Tools: Ansys, MATLAB, Strain Gauges, Data Acquisition Systems
- Setting Industry Benchmarks & Performance Goals
  (e.g., Stress limits, Thermal efficiency, Vibration thresholds)
- Conducting Functional & Experimental Testing of Mechanical Systems
  Tools: Universal Testing Machine (UTM), DAQ systems, Thermocouples
- Analyzing System Performance & Identifying Design Bottlenecks
- Using Optimization Techniques for Design Improvement
  Methods: Taguchi Methods, Design of Experiments (DOE), ML Models for Parameter Tuning.

UNIT V Presentation & Deployment 6

- Crafting a Compelling Engineering Pitch
  Focus: Design Rationale, Innovation, ROI, Sustainability, Industry Relevance
  Tools: Business Model Canvas, Engineering Pitch Deck Templates (Canva, Google Slides)
- Creating a Demo: Physical Prototype, Simulation Video, or Working Model
- Presenting to and Receiving Technical Feedback from Mentors/Peers/Industry Experts
- Documenting and Archiving the Project
  Tools: Engineering Reports, Bill of Materials (BOM), Test Reports, CAD Files
- Showcasing the Final Product with Performance Results & Reflections
  Optional: Present in Project Expo / Institutional Repository / Industry Portal

Periods: 30

Course Outcomes:
On completion of the course, the students will be able to

- Finalize a well-defined problem statement and identify key stakeholders
- Develop a structured project plan, defining goals, tech stack, and execution roadmap
- Build a functional prototype with key features working
- Establish clear performance benchmarks, conduct thorough testing, and optimize their project for efficiency, usability, and scalability.
- Successfully present and deploy their projects
- Demonstrate end-to-end project development skills**,** integrating problem-solving, technical implementation, optimization, and presentation to create impactful solutions

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	1						2	2	2	2	2		1	1
CO2	1	1						2	2	2	2	2		1	1
CO3	1	1						2	2	2	2	2		1	1
CO4	1	1						2	2	2	2	2		1	1
CO5	1	1						2	2	2	2	2		1	1
CO6	1	1						2	2	2	2	2		1	1
Avg.	1	1						2	2	2	2	2		1	1

			L	T	P	C
FC24301	**SOFT SKILLS**	**HSMC**	**0**	**0**	**2**	**1**

Course Objectives:

- Understand and apply proper etiquette in social, corporate, and online interactions
- Develop effective verbal and nonverbal communication skills, including body language and posture
- Enhance participation in group discussions and structured professional conversations
- Prepare for job interviews with appropriate etiquette, research, and response techniques
- Communicate professionally in written formats such as emails, inquiries, and job offer letters
- Deliver structured and engaging presentations using storytelling and persuasive techniques

UNIT I Etiquette **6**

Definition

- Social
- Corporate/Business - Meeting
- Telephone
- Netiquette

UNIT II Body Language and Nonverbal Communication 6

- Posture
- Personal grooming
- Facial expression/ gesture/eye contact

UNIT III Group Discussion 6

- Etiquette - Rules of conduct
- GD flow
- Pestel - Political, economic, social, tech, legal, environmental
- Handling unpredictable situation

UNIT IV Job Interview - Etiquette 6

- Pre-interview prep and research
- Responding to non technical questions (star model - situation/task/ action plan/ result)
- Speaking your resume
- Writing inquiries and responding to job offer letters

UNIT V Presentation skills 6

- Setting the tone/ storytelling
- JAM/ Turn your Court

Total Periods: 30

Course Outcomes:

1. Demonstrate professionalism in meetings, telephone calls, and digital communication
2. Use appropriate body language, facial expressions, and gestures to enhance communication
3. Participate effectively in group discussions, debates, and structured dialogues
4. Apply job interview strategies, including answering behavioral questions using the STAR model
5. Write clear and professional business correspondence, including inquiries and job offers
6. Present ideas confidently with a structured approach, engaging tone, and strong delivery

Suggested Activities

1. **Role-Playing Business Meetings** – Students are assigned different corporate roles (CEO, Manager, Employee) and have them conduct a mock meeting with proper etiquette.
2. Group Discussion
3. **PESTEL Case Study** – Students analyze a real-world company using PESTEL factors and present their findings.
4. **Resume Pitching** – Students present their resumes as a story, explaining their achievements in an engaging way.
5. **Turn the Court Debate Organizer** – Students list arguments for and against a topic to prepare for persuasive speaking.

Work Sheets:

1. Business Meeting Etiquette Checklist – A checklist where students identify correct/incorrect meeting behaviors.
2. PESTEL Case Study Template – A table where students analyze a company using Political, Economic, Social, Technological, Environmental, and Legal factors.
3. STAR Method Interview Worksheet – Students write answers to common behavioral questions using the situation, Task, Action, Result format.

References:

1. Pachter, Barbara. *The Essentials of Business Etiquette: How to Greet, Eat, and Tweet Your Way to Success.* McGraw-Hill, 2013.
2. Pease, Allan, and Barbara Pease. *The Definitive Book of Body Language.* Bantam, 2004.
3. Gage, Martha. *The Power of STAR Method: How to Succeed at Behavioral Job Interviews.* Independently published, 2019.

MAPPING OF COs WITH POs AND PSOs

	POs											PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1									1	1					
CO2										1					
CO3									1	1					
CO4										1					
CO5										1					
CO6									1	1					
Avg.									1	1					

		Category	L	T	P	C
ME24501	**DESIGN OF MACHINE ELEMENTS**	**PCC**	**3**	**1**	**0**	**4**

Course Objectives:

- To apply the concepts of stress in design of machine elements subjected to steady and variable loading
- To use design procedure to validate strength of shafts and couplings
- To demonstrate the design procedure for joints and suggest the suitable dimension for various mechanical applications
- To execute the design procedure for spring and connecting rod to validate the strength based upon the application and requirements
- To choose the appropriate bearings based on standard procedure for specific applications
- To integrate the design principles of various machine elements and develop an optimized system-level design that meets functional, safety, and performance requirements

UNIT I STEADY STRESSES AND VARIABLE STRESSES 9

Factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances, Factor of safety - principle stresses for various load combinations, curved beams - Crane hook – Crane sling, Theories of failure - Design for variable loading

UNIT II DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed - Keys, keyways and Splines - Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Welded joints, riveted joints for structures

UNIT IV ENERGY STORING ELEMENTS 9

Coil Springs: Tension Springs -Compression Springs - Optimization of helical springs - Leaf Springs – Design of Connecting Rods and crank shafts.

UNIT V DESIGN AND SELECTION OF BEARINGS 9

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfield Number, Raimondi and Boyd graphs - Selection of Rolling Contact bearings. Case Studies on Machine Elements using Software (Solidworks, CATIA, CREO, ANSYS, MATLAB – (Case Studies on Machine Elements using Software (Not for an Examination)

(*Usage of PSG Design Data Book is permitted in end semester examinations*)

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Explain the concepts of stress in design of machine elements subjected to steady and variable loading.

CO2: Use design procedure to validate strength of shafts and couplings.

CO3: Apply the design procedure for joints and suggest the suitable dimension for various mechanical applications.

CO4: Execute the design procedure for spring and connecting rod to validate the strength based upon the application and requirements.

CO5: Demonstrate the appropriate bearings based on standard procedure for specific applications.

CO6: Integrate the design concepts of various machine elements to develop an optimized and reliable mechanical system for real-world engineering applications.

Text Books:

1. Joseph Edward Shigley and Charles R. Misucke, "Mechanical Engineering Design", 10th Edition, Tata McGraw Hill, 2015.
2. Bhandari V, "Design of Machine Elements", 4 th Edition, Tata McGraw-Hill Book Co, 2016.
3. Sharma and Purohit, "Design of Machine Elements", 4 th Edition, PHI Learning, 2003.

References:

1. Jalaludeen S, "Machine Design, Vol -1", 4 th Edition, Reprint Anuradha Publications, 2021
2. M.F. Spott, "Design of Machine Elements", 8 th Edition, Pearson Education, 2019
3. R.B. Patel, "Design of Machine Elements",7th Edition, MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
4. PSG, "Design Data Book", Kalaikathir Achhangham Coimbatore, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2						1	2	2	1	1
CO2	3	3	3	2	2						1	3	2	1	1
CO3	3	2	3	2	2						1	3	2	2	1
CO4	3	2	3	1	1						1	3	1	2	1
CO5	2	2	3	1	3						1	2	3	2	1
CO6	2	3	3	2	3	1	1	1	2	2	3	3	3	3	1
Avg.	3	3	3	2	2	1	1	1	2	2	1	3	2	2	1

		Category	L	T	P	C
ME24511	**DYNAMICS OF MACHINERY**	**PCC**	**2**	**0**	**2**	**3**

Course Objectives:

- To understand the concept of static force analysis.
- To understand the concept of balancing of rotating and reciprocating masses.
- To understand the concept of free and forced vibration.
- To understand the concept of governors, its characteristics and speed control.
- To understand the concept of gyroscope and stability control.

UNIT I FORCE ANALYSIS 6

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 – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members

UNIT II BALANCING OF MASSES 6

Static and dynamic balancing – Balancing of rotating masses – Balancing of Reciprocating masses –Primary and secondary unbalanced forces – Partial Balancing of uncoupled two- & three-cylinder locomotives.

UNIT III VIBRATIONS 6

Basic concepts of simple harmonic motion - Types of vibration – Basic features of vibrating systems – Degrees of freedom – Free longitudinal vibrations – equations of motion – natural frequency - vibration damping – forced damped vibrations – whirling of shaft – free torsional vibrations (single rotor)- seismic effect vibration.

UNIT IV GOVERNORS 6

Governors – Types – Centrifugal governors – Characteristics - Watt governor – Porter governor – Proell governor – sensitiveness of governors – stability of governors – Effort and power of governors – controlling force diagrams.

UNIT V GYROSCOPES 6

Gyroscopic couple – precessional motion – Effect of the gyroscopic couple on an aeroplane – Effect of gyroscopic couple on a naval ship – stability of four-wheel drive in curvilinear motion – stability of a two-wheeler

Total Periods: 30

LIST OF EXPERIMENTS

2. Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
3. Undamped free vibration of Equivalent Spring mass system.
4. Torsional Vibration (Undamped) of single rotor shaft system.
5. Determination of critical speed of shaft.
6. Determination of mass moment of inertia of a body about its axis of symmetry.
7. Experiment on Watts Governor
8. Experiment on Porter Governor
9. Experiment on Proell Governor
10. Experiment on motorized gyroscope.
11. Dynamic analysis of cam mechanism
12. Balancing of rotating masses.
13. Balancing of reciprocating masses

LIST OF EQUIPMENTS FOR A BATCH OF 60 STUDENTS

- Models of various gears 1 No.
- Epicyclic gear setup 1 No.
- Differential Gear train setup 1 No.
- Compound Pendulum 1 No.
- Bifilar Suspension set up 1 No.
- Spring mass vibration system 1 No.
- Two rotor vibration setup 1 No.
- Torsional Vibration of single rotor system setup 1 No.
- Cam Analysis apparatus 1 No.
- Turn table apparatus 1 No.
- Motorized Universal Gyroscope 1 No.
- Static and Dynamic Balancing Apparatus 1 No.

- Universal Governor Setup 1 No.
- Whirling of Shaft apparatus 1 No.

Course Outcomes:
On completion of the course, the students will be able to

1. To evaluate the static force analysis of mechanisms.
2. To determine the unbalanced force in rotating and reciprocating masses.
3. To apply the fundamental concepts of vibrating system to predict the natural frequency.
4. To analyze the effects of vibration damping, free and forced vibrations.
5. To interpret the characteristics of governors in speed governing of automotives.
6. To determine the effect of gyroscopic couple in aeroplanes, ships and automotives.

Text Books:

- Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms”, V Edition, Oxford University Press, 2016.
- Rattan S S, "Theory of Machines", McGraw Hill Education, 5th edition, 2019
- Theory of Mechanisms and Machines by Amitabha Ghosh and A K Mallik, New Delhi Affiliated East-West Press 2022

References:

1. Grover. G.T., “Mechanical Vibrations”, Nem Chand and Bros., 2009.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 3rd Edition, 2005.
3. John Hannah and Stephens R.C., "Mechanics of Machines", Viva low–Priced Student Edition, 2006.
4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
5. Khurmi, R.S., “Theory of Machines”, S Chand Publications, 2005.
6. Sadhu Singh, “Theory of Machines: Kinematics and Dynamics”, Pearson Education, Third edition, 2011.
7. Rao J.S. and Dukkipati R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
8. Ghosh. A and Mallick, A.K., “Theory of Mechanisms and Machines", East-West Pvt. Ltd., New Delhi, 2008.
9. Rao,S.S, “Mechanical Vibrations,” Pearson Education, Fifth Edition, 2011.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2							2	2			
CO2	2	2	2	2							2	2			
CO3	2	2	2	2							2	2			
CO4	2	2	2	2							2	2			
CO5	2	2	2	2							2	2			
CO6	2	2	2	2							2	2			
Avg.	2	2	2	2							2	2			

		Category	L	T	P	C
ME24512	**METROLOGY AND MEASUREMENTS**	**PCC**	**2**	**0**	**2**	**3**

Course Objectives:

- To understand the fundamentals of metrology, measurement systems, errors, and uncertainty in engineering measurements.
- To impart knowledge on linear, angular, screw thread, and gear measurement techniques using conventional measuring instruments.
- To develop the ability to apply limits, fits, tolerances, and tolerance analysis in manufacturing and assembly processes.
- To introduce GD&T principles, surface metrology, optical measurement methods, and laser-based measurement systems for precision inspection.
- To familiarize students with advanced metrology tools such as Coordinate Measuring Machines (CMM), machine vision systems, and non-contact inspection techniques used in modern industries.

UNIT I BASICS AND INTRODUCTION TO LINEAR, ANGULAR MEASUREMENTS 6

Measurement – Need, Process, Role in quality control; Factors affecting measurement - SWIPE; Errors in Measurements – Types – Control – Measurement uncertainty – Types, Estimation. Introduction to linear and angular measurement– concept, significance, application in manufacturing and need in precision engineering.

UNIT II ASSEMBLY AND TRANSMISSION ELEMENTS 6

Measurement of Screw threads - Single element measurements – Pitch Diameter, Lead, Pitch. Measurement of Gears – purpose – Analytical measurement – Runout, Pitch variation, Tooth profile, Tooth thickness, Lead – Functional checking – Rolling gear test.

UNIT III TOLERANCE ANALYSIS 6

Tolerancing– Interchangeability, Selective assembly, Tolerance representation, Terminology, Limits and Fits, Problems (using tables IS919); Tolerance analysis in manufacturing, Process capability, tolerance stack up, tolerance charting.

UNIT IV GD & T AND LASER TECHNOLOGY 6

Fundamentals of GD & T- Conventional vs Geometric tolerance, Datums, Inspection of geometric deviations like straightness, flatness, roundness deviations; Simple problems- Optical Measurement techniques, Filters. Lasers in metrology - Advantages of lasers – Laser scan micro meters; Laser interferometers – Applications – Straightness, Alignment; Ball bar tests.

UNIT V ADVANCES IN METROLOGY 6

Computer Aided Metrology - Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Multi sensor CMMs. Machine Vision - Basic concepts of Machine Vision System – Elements – Applications - On-line and in process monitoring in production - Computed tomography – White light Scanners, Overview of re-engineering.

Total Periods: 30

LIST OF EXPERIMENTS

- Calibration and use of linear measuring instruments – Vernier caliper, micro meter, Vernier height gauge, depth micro meter, bore gauge, telescopic gauge, Comparators.
- Measurement of angles using bevel protractor, sine bar, autocollimator, precision level.
- Measurement of assembly and transmission elements - screw thread parameters – Screw thread Micro meters, three wire method, Toolmaker's microscope.
- Measurement of gear parameters – Micro meters, Vernier caliper, Gear tester.
- Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM), Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components.
- Non-contact (Optical) measurement using Measuring microscope / Profile projector and Video measurement system.
- Surface metrology - Measurement of form parameters – Straightness, Flatness, Roundness, Cylindricity, Perpendicularity, Runout, Concentricity – in the given component using Roundness tester.
- Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus-based instruments.

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

1. Explain the fundamentals of metrology, measurement systems, errors, and uncertainty analysis in precision engineering.
2. Measure linear, angular, screw thread, and gear parameters using conventional metrology instruments.
3. Apply limits, fits, tolerances, and tolerance analysis techniques in manufacturing and assembly applications.
4. Analyze geometric deviations using GD&T principles, surface metrology, and optical measurement methods.
5. Demonstrate the working and applications of laser-based metrology systems and Coordinate Measuring Machines (CMM).
6. Apply advanced metrology techniques such as machine vision, computed tomography, and non-contact inspection systems for industrial quality control.

Text Books:

- Dotson Connie, “Dimensional Metrology”, Cengage Learning, First edition, 2012.
- Mark Curtis, Francis T. Farago, “Handbook of Dimensional Measurement”, Industrial Press, Fifth edition, 2013.East-West Press 2022

References:

- AmmarGrous, J “Applied Metrology for Manufacturing Engineering”, Wiley-ISTE, 2011.
- Galyer, J.F.W. Charles Reginald Shotbolt, “Metrology for Engineers”, Cengage Learning EMEA; 5th revised edition, 1990.
- Raghavendra N.V. and Krishnamurthy. L., Engineering Metrology and Measurements, Oxford University Press, 2013.
- Venkateshan, S. P., “Mechanical Measurements”, Second edition, John Wiley &Sons, 2015.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2		1		1									1	
CO2	2		1		1									1	
CO3	2	2	1		1							2		1	
CO4	2	2	1		1							2		1	
CO5	2		1		1									1	
CO6	2		1		1									1	
Avg.	2	2	1		1							2		1	

		Category	L	T	P	C
ME24521	**CAD/CAM LABORATORY**	**PCC**	**0**	**0**	**3**	**1.5**

Course Objectives:

- To gain practical experience in handling 2D drafting and 3D modelling software systems

- Designing 3-Dimensional geometric model of parts, sub-assemblies, assemblies and exporting it to drawing
- Programming G & M Code programming and simulate the CNC program and Generating part programming data through CAM software

3D GEOMETRIC MODELLING **30**

3. **CAD Introduction**

Sketch: 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. Assembly: Constraints, Exploded Views, Interference check Drafting: Layouts, Standard & Sectional Views, Detailing & Plotting

4. **Creation of 3D assembly model of following machine elements using 3D Modelling software**

1. Flange Coupling
2. Plummer Block
3. Screw Jack
4. Lathe Tailstock
5. Universal Joint
6. Machine Vice
7. Stuffing box
8. Crosshead
9. Safety Valves
10. Non-return valves
11. Connecting rod
12. Piston
13. Crankshaft

** Students may also be trained in manual drawing of some of the above components (specify the number – progressive arrangement of 3D)*

MANUAL PART PROGRAMMING **30**

1. **CNC Machining Centre**
   i) Linear Cutting.
   ii) Circular cutting.
   iii) Cutter Radius Compensation.
   iv) Canned Cycle Operations.
2. **CNC Turning Centre**
   i) Straight, Taper and Radial Turning.
   ii) Thread Cutting.
   iii) Rough and Finish Turning Cycle.
   iv) Drilling and Tapping Cycle.
3. **Computer Aided Part Programming**

i) Generate CL Data and Post process data using CAM packages for Machining and Turning Centre.

ii) Application of CAPP in Machining and Turning

Course Outcomes:

On completion of the course, the students will be able to

1. Design experience in handling 2D drafting and 3D modelling software systems
2. Design 3 Dimensional geometric model of parts, sub-assemblies, assemblies and export it to drawing.
3. Demonstrate manual part programming and simulate the CNC program and Generate part programming using G and M code through CAM software.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2						2	2			
CO2	2	2	2	2	2						2	2			
CO3	2	2	2	2	2						2	2			
Avg.	2	2	2	2	2						2	2			

		Category	L	T	P	C
GE24502	**ENTREPRENEURSHIP AND INTERNATIONAL BUSINESS MARKET**	HSMC	2	0	0	2

Course Objectives:

- Introduce the fundamental concepts of entrepreneurship, entrepreneurial traits, creativity and innovation.
- Develop the ability to generate, evaluate and transform innovative ideas into feasible business plans.
- Explain the legal forms of business organization and the importance of intellectual property rights for entrepreneurs.
- Impart knowledge on the nature of international entrepreneurship and strategies for entering and operating in global markets.
- Explain the principles of international entrepreneurship and the dynamics of international trade and foreign exchange markets.

UNIT I Fundamentals of Entrepreneurship 6

Concept and importance of entrepreneurship - Characteristics and types of entrepreneurs - Entrepreneurship vs. Intrapreneurship - Creativity and Entrepreneurship - Innovation - Types of Innovation - Entrepreneurial innovation. Entrepreneurial ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors; Sources of finance – bootstrapping, venture capital, angel investors, government grants, crowdfunding; Stages of entrepreneurial process.

UNIT II Idea to Business Plan 6

Sources of new ideas - Techniques for generating ideas - Steps involved in assessing the business potential of an idea - Preparing a Business Plan - Pitching a Business Plan - Steps in Setting up a Small Business Enterprise.

UNIT III Legal Aspects of Business 6

Forms of Business Entity - Requirements for incorporation of a private or a public limited company - Introduction to Intellectual Property Rights: Patents, Trademarks, Copyright, Geographical Indication (GI), International Patents - IPRs and their importance - Importance of IP for start-ups. Patents - Types of Patents - Criteria for Patentability - Patent Process - Patent Infringement.

UNIT IV International Entrepreneurship 6

Nature of International Entrepreneurship - International Vs Domestic Entrepreneurship - Foreign Market Selection - Entrepreneurial Entry Strategies - Barriers to International Trade.

UNIT V International Trade and Foreign Exchange Markets 6

Interventionist and Free Trade Theories - Foreign Exchange - Aspects of Foreign Exchange Market - Major Foreign Exchange Markets - Foreign Exchange Trading Process.

Periods: 30 PERIODS

Course Outcomes:

On completion of the course, the students will be able to
CO1: Analyze entrepreneurial traits and apply creativity and innovation in entrepreneurial contexts.
CO2: Create viable business plans by generating, evaluating and developing entrepreneurial ideas.
CO3: Apply knowledge of business structures and protect innovations using intellectual property rights.
CO4: Analyze international business environments and formulate strategies for entering and sustaining in global markets.
CO5: Interpret trade theories, explain foreign exchange market operations and evaluate their impact on international business decisions.
CO6: Understand entrepreneurship concepts and apply them in domestic and international business contexts

Suggested Activities

14. Business Ideation using Design Thinking/ Brainstorming innovative product/service ideas using mind-mapping or SCAMPER technique.
15. Develop a mini business plan and pitch the plan/ Review and critique of a real-world business plan (available from start-up incubators).
16. Patent infringement case study/ Role-play on registering a company and selecting appropriate legal structure.
17. Study of an Indian company's international expansion/ Market research exercise: Identify potential foreign markets for a product/service.
18. Analysis of real-world trade agreements and their impact on a business (e.g., India–US trade relations)/ Study of a company affected by currency fluctuations in international operations.

Text Books:

- Arya Kumar (2012). *Entrepreneurship: Creating and leading an entrepreneurial organization*. Pearson Education, Inc.
- Khanka, S. S. (2026). *Entrepreneurial development*. S. Chand & Company Ltd.
- Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2020). Entrepreneurship. McGraw Hill Education.
- Daniels, J. D., Radebaugh, L. H., & Sullivan, D. P. (2021). International Business: Environments and Operations. Pearson Education.
- Kuratko, D. F. (2019). Entrepreneurship: Theory, Process and Practice. Cengage Learning.

References:

- Rajeev Roy, Entrepreneurship, 3rd Edition Oxford

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1		1	1				1		1	1	1			

CO2		1	1						1	2	1			
CO3		1				1	3		1		1			
CO4		1	1			1			1	2	1			
CO5		1				1			1	2	1			
CO6		1	1			1	1		1	2	1			
Avg.		1	1			1	1.67		1	1.8	1			

VERTICAL 2

		Category	L	T	P	C
MEP2410	**ADDITIVE MANUFACTURING**					

PEC 2 0 2 3

Course Objectives:

- To introduce the development of Additive Manufacturing (AM), various business opportunities and applications
- To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM.
- To be acquainted with vat polymerization and direct energy deposition processes
- To be familiar with powder bed fusion and material extrusion processes.
- To gain knowledge on applications of binder jetting, material jetting and sheet lamination processes

UNIT I INTRODUCTION 6

Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid PrototypingRapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain-ASTM/ISO 52900 Classification - Benefits. Applications: Building Printing - Bio Printing - Food PrintingElectronics Printing. Business Opportunities and Future Directions – Case studies: Automobile, Aerospace, Healthcare.

UNIT II DESIGN FOR ADDITIVE MANUFACTURING (DfAM) 6

Concepts and Objectives - AM Unique Capabilities - Part Consolidation – Topology Optimization Generative design - Lattice Structures - Multi-Material Parts and Graded Materials - Data Processing: CAD Model Preparation - AM File formats: STL-Problems with STL- AMF Design for Part Quality Improvement: Part Orientation - Support Structure - Slicing - Tool Path Generation – Design rules for Extrusion based AM.

UNIT III VAT POLYMERIZATION AND DIRECTED ENERGY DEPOSITION 6

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process – top down and bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications. Continuous Liquid Interface Production (CLIP)Technology. Directed Energy Deposition: Laser Engineered Net Shaping (LENS)- Process - Material Delivery - Materials -Benefits -Applications.

UNIT IV POWDER BED FUSION AND MATERIAL EXTRUSION 6

Powder Bed Fusion: Selective Laser Sintering (SLS): Process - Powder Fusion Mechanism - Materials and Application. Selective Laser Melting (SLM), Electron Beam Melting (EBM): Materials - Process - Advantages and Applications. Material Extrusion: Fused Deposition Modeling (FDM)-Process-Materials -Applications and Limitations.

UNIT V OTHER ADDITIVE MANUFACTURING PROCESSES 6

Binder Jetting: Three-Dimensional Printing - Materials - Process - Benefits- Limitations - Applications. Material Jetting: Multijet Modeling- Materials - Process - Benefits - Applications. Sheet Lamination: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding - Thermal Bonding- Materials-Application and Limitation.

Total Periods: 30

LIST OF EXPERIMENTS

- Modelling and converting CAD models into STL file.
- Manipulation and error fixing of STL file.
- Design and fabrication of parts by varying part orientation and support structures.
- Fabrication of parts with material extrusion AM process.
- Fabrication of parts with vat polymerization AM process.
- Design and fabrication of topology optimized parts.

Total Periods: 30

LIST OF EQUIPMENT REQUIRED

- Extrusion based AM machine
- Resin based AM machine
- Mechanical design software
- Open-source AM software for STL editing, manipulation and slicing.

Course Outcomes:

On completion of the course, the students will be able to

1. Students will be able to Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
2. Students will be able to acquire knowledge on process of transforming a concept into the final product in AM technology.
3. Students will be able to Elaborate the vat polymerization and direct energy deposition processes and its applications.
4. Students will be able to acquire knowledge on process and applications of powder bed fusion and material extrusion.
5. Students will be able to Evaluate the advantages, limitations, applications of binder jetting, material jetting and sheet lamination processes.
6. Students will be able to Create aesthetic models having market appeal

Text 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. 2. Andreas Gebhardt and Jan-Steffen Hötter "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing", Hanser publications, United States, 2015, ISBN: 978-1-56990-582-1.

References:

- Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing", Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.

- Milan Brandt, “Laser Additive Manufacturing: Materials, Design, Technologies, and Applications”, Woodhead Publishing., United Kingdom, 2016, ISBN: 9780081004333.
- Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590.
- Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and Practice”, Springer., United States ,2006, ISBN: 978-1-4614-9842-1.
- Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press., United States, 2011, ISBN: 9780849334092.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	-	1	1	1	-	-	-	-	-	1	1	2	-	-
CO2	2	-	2	1	1	-	-	-	-	-	1	2	3	-	-
CO3	2	-	1	1	-	-	-	-	-	-	1	2	2	-	-
CO4	2	-	1	1	-	-	-	-	-	-	1	2	2	-	-
CO5	2	-	1	1	-	-	-	-	-	-	1	2	2	-	-
CO6	2	-	1	1	1	-	-	-	-	-	1	2	2	-	-
Avg.	2	-	1	1	1	-	-	-	-	-	1	2	2	-	-

MEP2416	**NON-TRADITIONAL MACHINING PROCESSES**	**Category**	**L**	**T**	**P**	**C**
		PEC	**3**	**0**	**0**	**3**

Course Objectives:

- To classify non-traditional machining processes and describe mechanical energy based non traditional machining processes.
- To differentiate chemical and electro chemical energy-based processes.
- To describe thermo-electric energy-based processes
- To explain nano finishing processes.
- To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Introduction - Need for non-traditional machining processes - Classification of non-traditional machining processes - Applications, advantages and limitations of non-traditional machining processes - Abrasive jet machining, Abrasive water jet machining, Ultrasonic machining their principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9

Principles, equipments, effect of process parameters, applications, advantages and limitations of Chemical machining, Electro-chemical machining, Electro-chemical honing, Electro-chemical grinding, Electro chemical deburring

UNIT III THERMO-ELECTRIC ENERGY BASED PROCESSES 9

Principles, equipment, effect of process parameters, applications, advantages and limitations of Electric discharge machining, Wire electric discharge machining, Laser beam machining, Plasma arc machining, Electron beam machining, Ion beam machining.

UNIT IV NANO FINISHING PROCESSES 9

Principles, equipment, effect of process parameters, applications, advantages and limitations of Abrasive flow machining – Chemo mechanical polishing, Magnetic abrasive finishing, Magnetorheological finishing, Magneto rheological abrasive flow finishing.

UNIT V HYBRID NON-TRADITIONAL MACHINING PROCESSES 9

Introduction - Various hybrid non-traditional machining processes, their working principles, equipment, effect of process parameters, applications, advantages and limitations. Selection and comparison of different non traditional machining processes.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Formulate different types of non-traditional machining processes and evaluate mechanical energy-based non-traditional machining processes

CO2: Illustrate chemical and electrochemical energy-based processes

CO3: Evaluate thermo-electric energy-based processes.

CO4: Interpret nano finishing processes.

CO5: Analyzes hybrid non-traditional machining processes and differentiates non-traditional machining processes.

CO6: Assess the suitability of non-traditional machining techniques for advanced materials and complex geometries in industrial applications. The suitability of non-traditional machining techniques for advanced materials and complex geometries in industrial applications.

Text Books:

4. Adithan. M., "Unconventional Machining Processes", Atlantic, New Delhi, India, 2009. ISBN 13: 9788126910458
5. Anand Pandey, "Modern Machining Processes", Ane Books Pvt. Ltd., New Delhi, India, 2019.

References:

5. Benedict, G.F., "Non-traditional Manufacturing Processes", Marcel Dekker Inc., New York 1987. ISBN-13: 978-0824773526.
6. Carl Sommer, "Non-Traditional Machining Handbook", Advance Publishing., United States, 2000, ISBN-13: 978-1575373256.
7. Golam Kibria, Bhattacharyya B. and Paulo Davim J., "Non-traditional Micromachining Processes: Fundamentals and Applications", Springer International Publishing., Switzerland, 2017, ISBN:978-3 319-52008-7.
8. Jagadeesha T., "Non-Traditional Machining Processes", I.K. International Publishing House Pvt. Ltd., New Delhi, India, 2017, ISBN-13: 978-9385909122.
9. Kapil Gupta, Neelesh K. Jain and Laubscher R.F., "Hybrid Machining Processes: Perspectives on Machining and Finishing", 1st edition, Springer International Publishing., Switzerland, 2016, ISBN 13: 978-3319259208.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	1	-	1	-	1	-	1	1	-	2	2	2	2	2
CO2	2	-	1	-	1	-	1	-	1	1	-	2	2	2	2	2
CO3	2	-	1	-	1	-	1	-	1	1	-	2	2	2	2	2
CO4	2	-	1	-	1	-	1	-	1	1	-	2	2	2	2	2
CO5	2	-	1	-	2	-	1	-	1	1	-	2	2	2	2	2
CO6	2	-	1	1	-	-	-	-	-	-	2	2	2	2	2	2
Avg.	2.0		1.0	1.0	1.2		1.0		1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0

VERTICAL 4

		Category	L	T	P	C
MEP2426	**LEAN MANUFACTURING**	**PEC**	**3**	**0**	**0**	**3**

Course Objectives:

- Introduce the fundamental concepts, principles, and philosophy of Lean Manufacturing and its origins in the Toyota Production System (TPS).
- Equip students with the ability to identify and analyze the eight forms of waste (Muda), overburden (Muri), and unevenness (Mura) in a manufacturing system.

- Provide practical knowledge of core Lean tools and techniques, including Value Stream Mapping (VSM), 5S, Just-in-Time (JIT), Jidoka, Poka-Yoke, and Kanban.
- Develop the capability to design and analyze cellular manufacturing systems and implement pull-based production.
- Foster an understanding of the cultural and management changes required for continuous improvement (Kaizen) and successful Lean transformation.

UNIT I FOUNDATIONS OF LEAN MANUFACTURING | 9

Introduction: Conventional manufacturing vs. Lean manufacturing. Historical Context: Henry Ford, Toyota Production System (TPS), Taiichi Ohno, Shigeo Shingo. Lean Thinking: The 5 Principles (Specify Value, Map the Value Stream, Create Flow, Establish Pull, Seek Perfection). The 3 M's: Muda (The 8 Wastes - Defects, Overproduction, Waiting, Non-Utilized Talent, Transportation, Inventory, Motion, Extra-Processing), Mura (Unevenness), Muri (Overburden). Key Concepts: Gemba, Genchi Genbutsu, and the importance of observation.

UNIT II VALUE STREAM MAPPING (VSM) | 9

Identifying Value: Value-Added (VA), Non-Value-Added (NVA), and Business-Non-Value-Added (BNVA) activities. Process Mapping: Standard symbols, information flow, and material flow. Key Metrics: Takt Time, Cycle Time (C/T), Lead Time (L/T), Overall Equipment Effectiveness (OEE). Mapping: Constructing the Current State Map (CSM). Analysis: Identifying waste and bottlenecks from the CSM. Design: Creating the Future State Map (FSM) based on Lean principles. Case Study 1: VSM analysis of a simple assembly or machining process.

UNIT III CREATING FLOW AND STABILITY | 9

5S System: Sort, Set in Order, Shine, Standardize, Sustain. Visual Management: Andon systems, production boards, and visual controls. Workplace Design: Cellular manufacturing (U-shaped cells), one-piece flow, and balancing the line. Total Productive Maintenance (TPM): 8 Pillars of TPM, preventative vs. predictive maintenance, and autonomous maintenance. Quick Changeover (SMED): Single-Minute Exchange of Die, internal vs. external setup activities. Case Study 2: SMED implementation in a press shop or CNC machining center.

UNIT IV ESTABLISHING PULL AND QUALITY | 9

Just-in-Time (JIT): Principles, benefits, and implementation challenges. Pull Systems: Push vs. Pull production. Kanban: Types of Kanban (production, withdrawal), Kanban calculations, and a two-bin system. Heijunka (Production Leveling): Leveling by volume and mix, the Heijunka box. Jidoka (Autonomation): Building quality into the process, stopping the line, Poka-Yoke (Mistake-Proofing) principles and examples.Case Study 3: Design of a Kanban system for a sub-assembly line or a Poka-Yoke device for an inspection process.

UNIT V CONTINUOUS IMPROVEMENT AND LEAN CULTURE | 9

Kaizen: The philosophy of continuous improvement, Kaizen events (Blitz). Problem Solving: PDCA Cycle (Plan-Do-Check-Act), Root Cause Analysis (5 Whys, Fishbone Diagram). Standardized Work: Importance, elements, and documentation. Lean Leadership: The role of management, Hoshin Kanri (Policy Deployment), and respect for people. Lean Supply Chain: Extending Lean principles to

suppliers and customers. Emerging Trends: Lean and Industry 4.0, Lean Six Sigma.Case Study 4: A comprehensive look at a company's Lean transformation

Total Periods: 45

Course Outcomes:

1. Explain the basic principles and statistical tools of Six Sigma for quality improvement.
2. Apply lean tools like FMEA, APQP, PPAP and Six Sigma methodologies such as DMAIC and DMEDI in process improvement.
3. Analyze different process management models and compare DMAIC and DMEDI for continuous improvement.
4. Illustrate the concepts of lean manufacturing such as in-built quality, lead time reduction, and zero-defect philosophy.
5. Design quality control frameworks and apply process audits and dashboards to monitor lean implementations.
6. Evaluate the challenges in implementing lean systems and propose corrective mechanisms for sustainable quality management.

Text Books:

- Liker, Jeffrey K. The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer. McGraw-Hill.
- Rother, Mike, and Shook, John. Learning to See: Value Stream Mapping to Add Value and Eliminate Muda. Lean Enterprise Institute.
- Askin, Ronald G., and Goldberg, Jeffrey B. Design and Analysis of Lean Production Systems. John Wiley & Sons.

References:

- Womack, James P., and Jones, Daniel T. Lean Thinking: Banish Waste and Create Wealth in Your Corporation. Free Press.
- Shingo, Shigeo. A Study of the Toyota Production System. Productivity Press.
- Hirano, Hiroyuki. 5 Pillars of the Visual Workplace. Productivity Press

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2													2	
CO2	2	3	3	2	2					1				2	
CO3	2		3		2	1								2	
CO4	2	3	2	2	3									2	
CO5						1	2	1	2		3			2	
Avg.	2	3	3	2	2	1	2	1	2	1	3			2	

		Category	L	T	P	C
MEP2430	**RENEWABLE ENERGY TECHNOLOGIES**	**PEC**	**3**	**0**	**0**	**3**

Course Objectives:

- To know the Indian and global energy scenario
- To learn the various solar energy technologies and its applications.
- To educate the various wind energy technologies.
- To explore the various bio-energy technologies.
- To study the ocean and geothermal technologies.

UNIT I ENERGY SCENARIO 9

Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status- Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans

UNIT II SOLAR ENERGY 9

Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT III WIND ENERGY 9

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics - Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Off-shore wind energy- Hybrid systems – Environmental issues - Applications.

UNIT IV BIO-ENERGY 9

Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

UNIT V OCEAN AND GEOTHERMAL ENERGY 9

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations –Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Discuss the Indian and global energy scenario.

CO2: Illustrate chemical and electrochemical energy-based processes

CO3: Explain the various wind energy technologies.

CO4: Explore the various bio-energy technologies.

CO5: Discuss the ocean and geothermal technologies

Text Books:

- Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN-10 : 9390385636
- Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 8120344707
- Solar Photovoltaics: Fundamentals, Technologies and Applications by Solanki and Chetan Singh

References:

1. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.
2. Rai.G.D., "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2014.
3. Sukhatme.S.P., "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4. Tiwari G.N., "Solar Energy – Fundamentals Design, Modelling and applications", Alpha Science Intl Ltd, 2015.
5. Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2						1	2	1	2					
CO2	2						1	2	1	2				1	
CO3	2						1	2	2	2					
CO4	2						1	2	1	2					
CO5	2						1	2	1	2					
CO6	2						1	2	1	2				1	
Avg.	2						1	2	1	2				1	

VERTICAL 5

		Category	L	T	P	C
MEP2442	**COMPOSITE MATERIALS AND MECHANICS**	**PEC**	**3**	**0**	**0**	**3**

Course Objectives:

- To study the fundamentals of composite material strength and its mechanical behavior

- To study the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- To study Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- To Implementation of Classical Laminate Theory (CLT) to study and analyze residual stresses in an isotropic layered structure such as electronic chips.
- To study the fundamentals of composite material strength and its mechanical
- To integrate the knowledge of composite material behavior and laminate analysis to design and evaluate advanced composite structures for engineering applications

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 9

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramicand Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing:Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 9

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS 9

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS 9

Assumption of Constant C.T. E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T. E's. C.T. E's for special Laminate Configurations –Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates.

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 9

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

1. Summarize the types, properties, and applications of fibers, matrices, and composite materials, and explain various composite manufacturing processes.
2. Derive Flat plate Laminate equations.
3. Analyze Lamina strength.
4. Analyze the thermal behavior of Composite laminates.
5. Analyze Laminate flat plates
6. Design and evaluate composite structures by integrating lamina and laminate analysis for specific engineering applications

Text Books:

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, CRC press in progress, 1994.
2. Hyer, M.W., “Stress Analysis of Fiber – Reinforced Composite Materials”, McGraw Hill, 1998

References:

1. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
2. Halpin, J.C., “Primer on Composite Materials, Analysis”, Technomic Publishing Co., 1984
3. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press-2006, First Indian Edition - 2007
4. Mallick, P.K., Fiber,” Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.
5. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1								1	2	1	-	-
CO2	3	3	3	2	1						2	2	2	-	-
CO3	3	3	3	3	2						2	3	3	1	-
CO4	2	3	3	2	-						1	2	3	2	-
CO5	2	3	3	2	2						1	2	2	3	-
CO6	3	3	3	3	3	1	1			1	3	3	3	3	-
Avg.	2	3	3	2	2	1	1			1	2	2	2	2	-

		Category	L	T	P	C
MEP2443	**SUPPLY CHAIN AND MANAGEMENT**	**PEC**	**3**	**0**	**0**	**3**

Course Objectives:

- To provide a fundamental understanding of the role of supply chain management in a competitive global engineering environment.
- To introduce mathematical models and engineering fundamentals for designing efficient supply chain networks.
- To develop analytical skills for managing inventory, uncertainty, and sourcing decisions within a manufacturing context.
- To familiarize students with modern IT tools and technologies like ERP and Blockchain used in complex engineering activities.
- To instill an understanding of the impact of logistics on society and the environment, emphasizing sustainable development.
- To prepare students for professional engagement in industries or as entrepreneurs by applying modern management practices.

UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT 9

Evolution of SCM; Difference between Logistics and SCM; Decision phases in a supply chain; Process views (Push/Pull); Competitive and supply chain strategies; Achieving strategic fit.

UNIT II SUPPLY CHAIN NETWORK DESIGN 9

Factors influencing network design; Models for facility location and capacity allocation; Impact of globalization on supply chain networks; Risk management in network design.

UNIT III PLANNING AND MANAGING INVENTORIES 9

Role of inventory in SCM; Cycle inventory (EOQ models); Safety inventory; Managing uncertainty; Impact of lead time on safety inventory; Sourcing decisions: In-house vs. Outsource.

UNIT IV LOGISTICS, TRANSPORTATION, AND IT IN SCM 9

Modes of transportation and their performance; Design options for a transportation network; Tailored transportation; Role of IT in supply chain; Use of ERP, Big Data, and Blockchain in SCM.

UNIT V COORDINATION AND SUSTAINABILITY IN SCM 9

Supply chain coordination and the Bullwhip effect; Obstacles to coordination; Collaborative Planning, Forecasting, and Replenishment (CPFR); Sustainable supply chains and Triple Bottom Line; Green logistics.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Apply knowledge of mathematics and engineering specialization to define and analyze the strategic fit of a supply chain for a specific product.

CO2: Design solutions for complex network problems by identifying optimal facility locations and capacity allocations.

CO3: Conduct investigations and interpret data to optimize cycle and safety inventory levels in a manufacturing setting.

CO4: Select and apply modern IT tools and modeling techniques to enhance coordination and reduce the Bullwhip effect in a multidisciplinary team.

CO5: Assess the societal, health, and environmental impact of professional engineering solutions through green logistics and sustainable supply chain practices.

CO6: Design and evaluate composite structures by integrating lamina and laminate analysis for specific engineering applications

Books:

- **Textbook:** Chopra, S., and Meindl, P., Supply Chain Management: Strategy, Planning, and Operation.
- **Reference**: Simchi-Levi, D., Designing and Managing the Supply Chain.
- **Case Studies**: Local manufacturing scenarios (e.g., Automotive clusters in Tamil Nadu) to meet

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2													
CO2		3	3	2									2		
CO3	2	2		3											2
CO4					3			2	2	2					
CO5						3	2	-	-	-	2				
CO6								2	3	3	2				
Avg.	2	2	3	2	3	3	2	2	2	2	2		2		2

		Category	L	T	P	C
MEP2444	**POWER PLANT ENGINEERING**	**PEC**	**3**	**0**	**0**	**3**

Course Objectives:

- To study the coal based thermal power plants.
- To study the diesel, gas turbine and combined cycle power plants.

- To learn the basic of nuclear engineering and power plants.
- To learn the power from renewable energy
- To study energy, economic of power plants
- To study environmental issues of power plants

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - Advanced configurations, Binary Cycle. Layout of modern coal power plant, Construction and Working principle. Modern Boilers, Turbines, Condensers, Feed pumps. Subsystems of coal power plant: Fuel and ash handling systems, Draught system, Cooling system, Feed water treatments system. Cogeneration concepts.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Layout of modern Diesel power plant, Construction and Working principle. Layout of modern Gas Turbine power plant, Components and Working principle. Special materials for gas turbines. Combined Cycle Power Plants, Integrated Gasifier based Combined Cycle system.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout of Nuclear Power Plants, Types of Nuclear Reactors and its working: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Fast Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV RENEWABLE ENERGY BASED POWER PLANTS 9

Hydro Electric Power Plants – Classification, Typical layouts, Constructions and Working principles. Layout, construction and working principle of Wind energy, Tidal energy, Solar light energy, Solar thermal energy, Geo-thermal energy, Biogas based power generations.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curves. Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Explain the layout, construction and working of the components inside a thermal power plant.

CO2: Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.

CO3: Explain the layout, construction and working of the components inside nuclear power plants.

CO4: Explain the layout, construction and working of the components inside Renewable energy power plants

CO5: Explain the applications of power plants while extending their knowledge to power plant economics.

CO6: Explain the environmental hazards and estimate the costs of electrical energy production.

Text Books:

- 1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.
- 2. A Textbook of Power Plant Engineering by R.K. Rajput, 2016

Reference:

- El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
- Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
- Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.
- Power Plant Engineering by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, 2019
- Power Plant Engineering, As per AICTE: Theory and Practice by Dipak Kumar Mandal, Somnath Chakrabarti, et al., 2019

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2						1	2	1	2					
CO2	2						1	2	1	2				1	
CO3	2						1	2	2	2					
CO4	2						1	2	1	2					
CO5	2						1	2	1	2					
CO6	2						1	2	1	2				1	
Avg.	2						1	2	1	2					

MEP 2445	REFRIGERATION AND AIR CONDITIONING	Category	L	T	P	C
		PEC	3	0	0	3

Course Objectives:

- To provide fundamental knowledge on R&AC systems and components.
- To provide knowledge on design aspects of VCR systems.
- To study the Vapour absorption and other refrigeration systems.

- To learn the psychrometric properties and processes.
- To provide knowledge on design aspects of Air conditioning systems.

UNIT I INTRODUCTION 6

Introduction to Refrigeration - Unit of Refrigeration and C.O.P.— Ideal cycles- Refrigerants Desirable properties — Classification - Nomenclature - ODP & GWP.

UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM 12

Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle — subcooling and super heating- effects of condenser and evaporator pressure on COP- Mult pressure system -low temperature refrigeration Cascade systems — problems. Equipment: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III OTHER REFRIGERATION SYSTEMS 6

Working principles of Vapour absorption systems and adsorption cooling systems — Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic-Vortex and Pulse tube refrigeration systems..

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES 9

Properties of moist Air, Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature. Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

UNIT V HEAT LOAD ESTIMATION AND AIR CONDITIONING SYSTEMS 12

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart. Calculation of summer & winter air conditioning load; Air Conditioning System classifications, layouts and working. Safety systems in AC.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to
CO1: Explain the basic concepts of Refrigeration
CO2: Explain the Vapor compression Refrigeration systems and to solve problems.
CO3: Discuss the various types of Refrigeration systems.
CO4: Calculate the Psychrometric properties and its use in psychrometric processes
CO5: Explain the concepts of Air conditioning and to solve problems.

CO6: Analysis and solve a R&AC real time problems towards the benefit of the society.

Text Books:

- Arora, C.P., "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010
- Textbook of Refrigeration And Air-Conditioning by R.S. Khurmi, 2019.

Reference:

- ASHRAE Hand book, Fundamentals, 2010
- JonesW.P., "Air conditioning engineering", Cth edition, Elsevier Butterworth-Heinemann, 2007
- Roy J. Dossat, "Principles of Refrigeration™, 4th edition, Pearson Education Asia, 2009.
- Stoecker,W.F. and Jones J.W., "Refrigeration and Air Conditioning", McGraw Hill, New DeIhi,1986.
- A Textbook of Refrigeration and Air-Conditioning by R.K. Rajput 1 January 2013

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	-	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	1	-	-	-	1	-	-	3	-	-
CO2	3	2	2	-	-	-	-	-	-	-	1	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	1	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	1	-	-	3	-	-
CO5	3	2	2	-	-	-	-	-	-	-	1	-	-	3	-	-
CO6	3	2	2	-	-	-	1	-	-	-	1	-	-	3	-	-
Avg.	3.0	2.0	2.0	-	-	-	1	-	-	-	1.0	-	-	3.0	.	0.0