MECHANICAL ENGINEERING

R2024

CURRICULUM
&
SYLLABI

GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY, Tiruttani

(An Autonomous Institution)

Accredited by NBA (ECE), NAAC with "A++" Grade & An ISO 9001:2015 Certified Institution

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai.

B.E - MECHANICAL ENGINEERING
<u>CURRICULUM REGULATIONS - 2024</u>
CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABI (SEMESTER I TO VIII)
(FOR THE STUDENTS ADMITTED DURING 2024)

SEMESTER - I

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS	EXT / INT
1	IP24101	Induction Programme	-	-	-	-	-	0	-
THEORY COURSES									
2	HS24101	Professional English	HS	3	-	-	3	3	60/40
3	MA24101	Algebra and Calculus	BS	3	1	-	4	4	60/40
4	PH24101	Engineering Physics	BS	3	-	-	3	3	60/40
5	CY24101	Engineering Chemistry	BS	3	-	-	3	3	60/40
6	GE24101	Problem Solving and Python Programming	ES	3	-	-	3	3	60/40
7	TA24101	Heritage of Tamils	HS	1	-	-	1	1	60/40
PRACTICAL COURSES									
8	GE24102	Problem Solving and Python Programming Laboratory	ES	-	-	4	4	2	40/60
9	PC24101	Physics and Chemistry Laboratory	BS	-	-	4	4	2	40/60
10	HS24102	English Laboratory	HS	-	-	2	2	1	0/100
TOTAL				16	1	10	27	22	

SEMESTER - II

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS	EXT / INT
THEORY COURSES									
1	MA24201	Statistics and Numerical Techniques	BS	3	1	-	4	4	60/40
2	GE24201	Engineering Graphics	ES	2	-	3	5	4	60/40
3	ME24201	Engineering Mechanics	PC	3	1	-	4	4	60/40
4	ME24202	Engineering Materials and Metallurgy	BS	3	-	-	3	3	60/40
5	TA24201	Tamils and Technology	HS	1	-	-	1	1	60/40
THEORY CUM PRACTICAL COURSES									
6	EE24203	Basic Electrical and Electronics Engineering	ES	3	-	2	5	4	50/50
PRACTICAL COURSES									
7	GE24202	Engineering Practices Laboratory	ES	-	-	4	4	2	40/60
8	HS24201	English Communication Laboratory	HS	-	-	4	4	2	40/60
TOTAL				15	2	13	30	24	

SEMESTER - III

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				PERIODS PER WEEK					
THEORY COURSES									
1	MA24302	Transforms and Partial Differential Equations	BS	3	1	-	4	4	60/40
2	ME24301	Engineering Thermodynamics	PC	3	-	-	3	3	60/40
3	ME24302	Manufacturing Processes	PC	3	-	-	3	3	60/40
4	GE24301	Environmental Science and Sustainability	BS	2	-	-	2	2	60/40
THEORY CUM PRACTICAL COURSES									
5	ME24303	Fluid Mechanics and Machinery	ES	3	-	2	5	4	50/50
PRACTICAL COURSES									
6	ME24304	Manufacturing Processes Laboratory	PC	-	-	4	4	2	40/60
7	ME24305	Machine Drawing	PC	-	-	4	4	2	40/60
8	GE24S01	Professional Development	EEC	-	-	2	2	1	0/100
TOTAL				**14**	**1**	**12**	**27**	**21**	

SEMESTER - IV

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				PERIODS PER WEEK					
THEORY COURSES									
1	ME24401	Kinematics of Machinery	PC	3	-	-	3	3	60/40
2	ME24402	Thermal Engineering	PC	3	-	-	3	3	60/40
3	ME24403	Strength of Materials	ES	3	1	-	4	4	60/40
4	ME24404	Hydraulics and Pneumatics	PC	3	-	-	3	3	60/40
THEORY CUM PRACTICAL COURSES									
5	ME24405	Manufacturing Technology	PC	3	-	2	5	4	50/50
PRACTICAL COURSES									
6	ME24406	Thermal Engineering Laboratory	PC	-	-	4	4	2	40/60
7	ME24407	Strength of Materials Laboratory	ES	-	-	4	4	2	40/60
TOTAL				**15**	**1**	**10**	**26**	**21**	

SEMESTER - V

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				PERIODS PER WEEK					
THEORY COURSES									
1	ME24501	Machine Design	PC	3	1	-	4	4	60/40
2	ME24502	Metrology and Measurements	PC	3	-	-	3	3	60/40
3		Open Elective - I	OE	3	-	-	3	3	60/40
4		Professional Elective - I	PE	3	-	-	3	3	60/40
5		Professional Elective - II	PE	3	-	-	3	3	60/40
6		Non-Credit Mandatory course I	MC	3	-	-	3	0	0/100
THEORY CUM PRACTICAL COURSES									
7	ME24503	Dynamics of Machines	PC	3	-	2	5	4	50/50
PRACTICAL COURSES									
8	ME24504	Metrology and Measurements Laboratory	PC	-	-	4	4	2	40/60
9	GE24S02	Soft Skills	EEC	-	-	2	2	1	0/100
TOTAL				**21**	**1**	**8**	**30**	**23**	

SEMESTER - VI

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				PERIODS PER WEEK					
THEORY COURSES									
1	ME24601	Finite Element Analysis	PC	3	1	-	4	4	60/40
2	ME24602	Additive Manufacturing	PC	3	-	-	3	3	60/40
3		Open Elective - II	OE	3	-	-	3	3	60/40
4		Professional Elective - III	PE	3	-	-	3	3	60/40
5		Professional Elective - IV	PE	3	-	-	3	3	60/40
6		Non-Credit Mandatory course II	MC	3	-	-	3	0	0/100
THEORY CUM PRACTICAL COURSES									
7	ME24603	Heat and Mass Transfer	PC	3	-	2	5	4	50/50
PRACTICAL COURSES									
8	ME24604	Simulation and Analysis Laboratory	PC	-	-	4	4	2	40/60
9	ME24605	Mini Project	EEC	-	-	4	4	2	40/60
TOTAL				**21**	**1**	**10**	**32**	**24**	

SEMESTER - VII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	GE24701	Human values and ethics	HS	2	-	-	2	2	60/40
2	GE24702	Industrial Management	HS	3	-	-	3	3	60/40
3		Open Elective - III	OE	3	-	-	3	3	60/40
4		Open Elective - IV	OE	3	-	-	3	3	60/40
5		Professional Elective - V	PE	3	-	-	3	3	60/40
6		Professional Elective - VI	PE	3	-	-	3	3	60/40
7	ME24701	Mechatronics and IOT	PC	3	-	2	5	4	50/50
PRACTICAL COURSES									
8	ME24702	Summer Internship*	EEC	-	-	-	0	2	0/100
TOTAL				20	-	2	22	23	

SEMESTER - VIII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
PRACTICAL COURSES									
1	ME24801	Project Work / Internship	EEC	-	-	20	20	10	40/60
TOTAL				-	-	20	20	10	

TOTAL CREDITS	168

SUMMARY

S.No	Subject Area	Credits per Semester								Total Credits
		1	2	3	4	5	6	7	8	
Name of the Programme: Mechanical Engineering										
1	HS	5	3					5		13
2	BS	12	7	6						25
3	ES	5	10	4	6					25
4	PC		4	10	15	13	13	4		59
5	PE					6	6	6		18
6	OE					3	3	6		12
7	EEC			1		1	2	2	10	16
8	Non-Credit Mandatory					✓	✓			
TOTAL		22	24	21	21	23	24	23	10	168

MANDATORY COURSE

NON-CREDIT MANDATORY COURSE I: SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	MX24C71	Introduction to Women and Gender Studies	MC	3	-	-	3	-
2	MX24C72	Elements of Literature	MC	3	-	-	3	-
3	MX24C73	Disaster Risk Reduction and Management	MC	3	-	-	3	-
4	MX24C74	Film Appreciation	MC	3	-	-	3	-

NON-CREDIT MANDATORY COURSE II: SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	MX24C75	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	3	-	-	3	-
2	MX24C76	History of Science and Technology in India	MC	3	-	-	3	-
3	MX24C77	Industrial Safety	MC	3	-	-	3	-
4	MX24C78	Political and Economic Thought for a Human Society	MC	3	-	-	3	-
5	MX24C79	State, Nation Building and Politics in India	MC	3	-	-	3	-

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Modern Mobility Systems	Vertical II Product and Process Development	Vertical III Robotics and Automation	Vertical IV Digital and Green Manufacturing	Vertical V Clean and Green Energy Technologies	Verticals VI Diversified Courses Group 1	Verticals VII Diversified Courses Group 2	Verticals VIII Diversified Courses Group 3
Automotive Materials, Components, Design &Testing	Value Engineering	Sensors and Instrumentation	Digital Manufacturing and IoT	Bio energy Conversion Technologies	Automobile Engineering	Turbo Machines	Computational Fluid Dynamics and Heat transfer
Conventional and Futuristic Vehicle Technology	Design of Experiments	Electrical Drives and Actuators	Lean Manufacturing	Carbon Foot print estimation and reduction techniques	Measurements and Controls	Non-traditional Machining Processes	Advanced Internal Combustion Engineering
Renewable Powered Off Highway Vehicles and Emission Control Technology	CAD/CAM	Embedded Systems and Programming	Modern Robotics	Energy Conservation in Industries	Composite Materials and Mechanics	Design of Pressure Vessels	Casting and Welding Processes
Vehicle Health Monitoring, Maintenance and Safety	Design For X	Robotics	Green Manufacturing Design and Practices	Energy Efficient Buildings	Dynamics of Ground Vehicles	Design Concepts in Engineering	Process Planning and Cost Estimation
CAE and CFD Approach in Future Mobility	Ergonomics in Design	Smart Mobility and Intelligent Vehicles	Environment Sustainability and Impact Assessment	Energy Storage Devices	Power Plant Engineering	Thermal Power Engineering	Surface Engineering
Hybrid and Electric Vehicle Technology	New Product Development	Haptics and Immersive Technologies	Energy Saving Machinery and Components	Renewable Energy Technologies	Refrigeration and Air Conditioning	Design for Manufacturing	Precision Manufacturing
Thermal Management of Batteries and Fuel Cells	Product Life Cycle Management	Drone Technologies	Green Supply Chain Management	Equipment for Pollution Control	Machine Learning for Intelligent Systems	Power Generation Equipment Design	Gas Dynamics and Jet Propulsion

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: MODERN MOBILITY SYSTEMS

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	ME24P01	Automotive Materials, Components, Design and Testing	PE	2	-	2	4	3
2	ME24P02	Conventional and Futuristic Vehicle Technology	PE	3	-	-	3	3
3	ME24P03	Renewable Powered Off Highway Vehicles and Emission Control Technology	PE	3	-	-	3	3
4	ME24P04	Vehicle Health Monitoring, Maintenance and Safety	PE	3	-	-	3	3
5	ME24P05	CAE and CFD Approach in Future Mobility	PE	2	0	2	4	3
6	ME24P06	Hybrid and Electric Vehicle Technology	PE	3	-	-	3	3
7	ME24P07	Thermal Management of Batteries and Fuel Cells	PE	3	-	-	3	3

VERTICAL II: PRODUCT AND PROCESS DEVELOPMENT

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	ME24P08	Value Engineering	PE	3	-	-	3	3
2	ME24P09	Design of Experiments	PE	3	-	-	3	3
3	ME24P10	CAD/CAM	PE	3	-	-	3	3
4	ME24P11	Design For X	PE	3	-	-	3	3
5	ME24P12	Ergonomics in Design	PE	3	-	-	3	3
6	ME24P13	New Product Development	PE	3	-	-	3	3
7	ME24P14	Product Life Cycle Management	PE	3	-	-	3	3

VERTICAL III: ROBOTICS AND AUTOMATION

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	MR24P15	Sensors and Instrumentation	PE	3	-	-	3	3
2	MR24P16	Electrical Drives and Actuators	PE	3	-	-	3	3
3	MR24P17	Embedded Systems and Programming	PE	3	-	-	3	3
4	MR24P18	Robotics	PE	3	-	-	3	3
5	MR24P19	Smart Mobility and Intelligent Vehicles	PE	3	-	-	3	3
6	ME24P20	Haptics and Immersive Technologies	PE	3	-	-	3	3
7	RA24P21	Drone Technologies	PE	3	-	-	3	3

VERTICAL IV: DIGITAL AND GREEN MANUFACTURING

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	ME24P22	Digital Manufacturing and IoT	PE	2	-	2	4	3
2	ME24P23	Lean Manufacturing	PE	3	-	-	3	3
3	ME24P24	Modern Robotics	PE	2	-	2	4	3
4	ME24P25	Green Manufacturing Design and Practices	PE	3	-	-	3	3
5	ME24P26	Environment Sustainability and Impact Assessment	PE	3	-	-	3	3
6	ME24P27	Energy Saving Machinery and Components	PE	3	-	-	3	3
7	ME24P28	Green Supply Chain Management	PE	3	-	-	3	3

VERTICAL V: CLEAN AND GREEN ENERGY TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	ME24P29	Bio energy Conversion Technologies	PE	-	-	3	3	3
2	ME24P30	Carbon Footprint Estimation and Reduction Techniques	PE	-	-	3	3	3
3	ME24P31	Energy Conservation in Industries	PE	-	-	3	3	3
4	ME24P32	Energy Efficient Buildings	PE	-	-	3	3	3
5	ME24P33	Energy Storage Devices	PE	-	-	3	3	3
6	ME24P34	Renewable Energy Technologies	PE	-	-	3	3	3
7	ME24P35	Equipment for Pollution Control	PE	-	-	3	3	3

VERTICAL VI: DIVERSIFIED COURSES GROUP 1

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	ME24P36	Automobile Engineering	PE	3	-	-	3	3
2	ME24P37	Measurements and Controls	PE	3	-	-	3	3
3	ME24P38	Composite Materials and Mechanics	PE	3	-	-	3	3
4	AU24P39	Dynamics of Ground Vehicles	PE	3	-	-	3	3
5	ME24P40	Power Plant Engineering	PE	3	-	-	3	3
6	ME24P41	Refrigeration and Air Conditioning	PE	3	-	-	3	3
7	RA24P42	Machine Learning for Intelligent Systems	PE	3	-	-	3	3

VERTICAL VII: DIVERSIFIED COURSES GROUP 2

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	AE24P43	Turbo Machines	PE	3	-	-	3	3
2	ME24P44	Non-traditional Machining Processes	PE	3	-	-	3	3
3	ME24P45	Design of Pressure Vessels	PE	3	-	-	3	3
4	ME24P46	Design Concepts in Engineering	PE	3	-	-	3	3
5	ME24P47	Thermal Power Engineering	PE	3	-	-	3	3
6	ME24P48	Design for Manufacturing	PE	3	-	-	3	3
7	ME24P49	Power Generation Equipment Design	PE	3	-	-	3	3

VERTICAL VII: DIVERSIFIED COURSES GROUP 3

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	ME24P50	Computational Fluid Dynamics and Heat transfer	PE	3	-	-	3	3
2	ME24P51	Advanced Internal Combustion Engineering	PE	3	-	-	3	3
3	ME24P52	Casting and Welding Processes	PE	3	-	-	3	3
4	ME24P53	Process Planning and Cost Estimation	PE	3	-	-	3	3
5	ME24P54	Surface Engineering	PE	3	-	-	3	3
6	ME24P55	Precision Manufacturing	PE	3	-	-	3	3
7	ME24P56	Gas Dynamics and Jet Propulsion	PE	3	-	-	3	3

OPEN ELECTIVES

OPEN ELECTIVE I AND II

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	AD24901	Artificial Intelligence and Machine Learning Fundamentals	OE	2	0	2	4	3
2	CS24902	IoT Concepts and Applications	OE	2	0	2	4	3
3	AD24905	Data Science Fundamentals	OE	2	0	2	4	3
4	CS24908	Augmented Reality / Virtual Reality	OE	2	0	2	4	3

OPEN ELECTIVE III

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
1.	MF24901	Reverse Engineering	OE	3	0	0	3	3
2.	PR24901	Sustainable Manufacturing	OE	3	0	0	3	3
3.	AU24902	Electric and Hybrid Vehicles	OE	3	0	0	3	3
4.	IE24908	Quality Engineering	OE	3	0	0	3	3
5.	AE24901	Fundamentals of Aeronautical Engineering	OE	3	0	0	3	3
6.	ML24901	Introduction to Non- Destructive Testing	OE	3	0	0	3	3
7.	EE24902	Electric Vehicle Technology	OE	3	0	0	3	3
8.	CH24901	Nano Technology	OE	3	0	0	3	3
9.	PE24902	Energy Conservation and Management	OE	3	0	0	3	3
10.	PT24901	Basics of Plastics Processing	OE	3	0	0	3	3
11.	EC24901	Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	3
12.	MA24902	Linear Algebra	OE	3	0	0	3	3

OPEN ELECTIVE IV

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
1.	HS24902	Project Report Writing	OE	3	0	0	3	3
2.	MA24903	Random Processes	OE	3	0	0	3	3
3.	MG24905	Production and Operations Management for Entrepreneurs	OE	3	0	0	3	3
4.	ME24903	Industrial Design & Rapid Prototyping Techniques	OE	3	0	0	3	3
5.	MF24902	Cost Management of Engineering Projects	OE	3	0	0	3	3
6.	IM24902	Production Planning and Control	OE	3	0	0	3	3
7.	ML24902	Nano material and applications	OE	3	0	0	3	3
8	MV24901	Elements of Marine Engineering	OE	3	0	0	3	3
9.	RA24904	Drone Technologies	OE	3	0	0	3	3
10.	AI24904	Agriculture Entrepreneurship Development	OE	3	0	0	3	3
11.	CH24902	Surface Science	OE	3	0	0	3	3
12.	PT24902	Plastic Materials for Engineers	OE	3	0	0	3	3
13.	PT24903	Properties and Testing of Plastics	OE	3	0	0	3	3

HS24101	**PROFESSIONAL ENGLISH**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:
- Improve the communicative competence of learners.
- Help learners use language effectively in academic /work contexts.
- Build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- Develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
- Use language efficiently in expressing their opinions via various media

UNIT I   INTRODUCTION OF EFFECTIVE COMMUNIATION   1

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

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION   8

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

UNIT II   NARRATION AND SUMMATION   9

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

UNIT III   DESCRIPTION OF PROCESS AND PRODUCT   9

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

UNIT IV   **CLASSIFICATION**   **9**

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

UNIT V   **EXPRESSION OF VIEWS**   **9**

Reading–Reading editorials; and Opinion Blogs; Writing–Minutes of Meeting, Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary-Cause & Effect Expressions–Content vs Function words.

Total: 45 Periods

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Use appropriate words in a professional context**.**

CO2: Gain understanding of basic grammatical structures and use them in right context.

CO3: Read and interpret and also infer information presented in tables, charts, denotative and connotative meanings of technical texts and other graphic forms.

CO4: Write definitions, descriptions, narrations and essays on various topics.

TEXTBOOKS:

1. English for Engineers & Technologists Orient Black Swan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology CambridgeUniversityPress,2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. K N. Shoba, and Dr. Lourdes Joevani Department of English, Anna University.

REFERENCEBOOKS:

1. Technical Communication– Principles and Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book on Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English for Technical Communication (With CD) By Aysha Viswa Mohan, McGraw Hill Education, ISBN: 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate–Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		2		2	2		3	3	2	2	1		
CO2		2		2		2	2		3	3	2	2	1		
CO3		2		2		2	2		3	3	2	3	1		
CO4		1		2		3	2		3	3	2	3	1		
Avg		1.75		2		2.25	2		3	3	2	2.5	1		

==1 - Low, 2 - Medium, 3 - High==

MA24101	ALGEBRA AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:
- ➢ To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- ➢ To familiarize the students with differential calculus.
- ➢ To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- ➢ To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
- ➢ To introduce integral ideas in solving areas, volumes and other practical problems in vector.

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

UNIT II   DIFFERENTIAL CALCULUS   9+3
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.

UNIT III   FUNCTIONS OF SEVERAL VARIABLES   9+3
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV   MULTIPLE INTEGRALS   9+3
Double integrals in Cartesian and polar coordinates - Change of order of integration in Cartesian coordinates - Area enclosed by plane curves - Change of variables in double integrals -Triple integrals - Volume of Solids. Applications: Moments and centres of mass, moment of inertia.

UNIT V   VECTOR CALCULUS   9+3
Gradient, divergence and curl (excluding vector identities) – Directional derivative –Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane and Gauss divergence theorem and Stoke's theorem (without proof) – Simple applications involving cubes and rectangular parallelopipeds.

Total: 60 Periods

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Demonstrate the matrix techniques in solving the related problems in engineering and technology.

CO2: Apply differential calculus tool to solve engineering applications.

CO3: Use differential calculus ideas on functions several variables.

CO4: Evaluate the area and volume by applying the concept of multiple integration.

CO5: Utilize the concept of vector calculus in evaluating integrals.

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition,
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCEBOOKS:

1. M. K. Venkataraman, "Engineering Mathematics", Volume I, 4th Edition, The National Publication Company, Chennai, 2003.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.
3. H. K. Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Limited, 3rd Edition 2014.
4. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2					2		2	3		1	1
CO2	3	3	1	2					2		2	3		1	1
CO3	3	3	2	2					2		2	3		1	1
CO4	3	3	1	1					2		2	3		1	1
CO5	3	3	2	2					2		2	3		1	1
Avg	3	3	1.6	1.6					2		2	3		1	1

1 - Low, 2 - Medium, 3 - High

PH24101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To make the students achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I   MECHANICS   9

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M. I – moment of inertia continuous bodies – M.I of a diatomic molecule- rotational energy state of a rigid diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum - gyroscope - torsional pendulum.

UNIT II   ELECTROMAGNETIC WAVES   9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - Source of electromagnetic waves. EM waves: Energy, momentum, intensity and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

UNIT III   OSCILLATIONS, OPTICS AND LASERS   9

Simple harmonic motion – resonance –analogy between electrical and mechanical oscillating systems – waves on a string – standing waves – traveling waves – Energy transfer of a wave – sound waves – Doppler effect. Reflection and refraction of light waves – total internal reflection – interference –Michelson interferometer – Theory of air wedge and experiment. Theory of laser – characteristics – Spontaneous and stimulated emission – Einstein's coefficients – population inversion – Nd-YAG laser, CO_2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV   BASIC QUANTUM MECHANICS   9

Photons and light waves – Electrons and matter waves –Compton effect – Schrodinger equation (Time dependent and time independent forms) – Physical meaning of wave function – particle in a infinite one dimensional (1D) potential well - Normalization, probabilities and the correspondence principle.

UNIT V   APPLIED QUANTUM MECHANICS   9

The harmonic oscillator (qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope – Resonant diode – Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Recognized the importance of mechanics.

CO2: Express their knowledge in electromagnetic waves.

CO3: Demonstrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Illustrate the importance of quantum physics.

CO5: Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXTBOOKS:

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

REFERENCEBOOKS:

1. R. Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K. Thyagarajan and A. Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. Halliday, R. Resnick and J. Walker. Principles of Physics, Wiley (Indian Edition), 2015.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	1	-	-	1	-	1	-	-	-	-	-
CO2	3	2	2	1	2	1	2	2	-	1	-	2	-	1	
CO3	3	2	1	1	2	1	1	1	-	1	-	2	-	1	-
CO4	3	3	2	2	2	-	1	2	-	1	-	2	-	1	1
CO5	2	3	2	1	1	1	-	2	-	1	-	2	-	-	-
Avg	2.8	2.6	1.75	1.25	1.6	1	1.3	1.6	-	1	-	2	-	1	1

1 - Low, 2 - Medium, 3 - High

CY24101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

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

UNIT I   WATER AND ITS TREATMENT   9

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

UNIT II   NANOCHEMISTRY   9

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

UNIT III   PHASE RULE AND COMPOSITES   9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV   FUELS AND COMBUSTION   9

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil – cetane number; Power alcohol and biodiesel. - natural gas- compressed natural gas (CNG)- liquefied petroleum gases(LPG).

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO_2 emission and carbon footprint.

UNIT V   ENERGY SOURCES AND STORAGE DEVICES   9
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor- environmental consequences of fossil fuel- Importance of renewable energy sources -Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Batteries: Types of batteries- lead acid battery- Solid Battery – Lithium Battery, Lithium-ion; Battery Electric vehicles-working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell.

Total: 45 Periods

COURSE OUTCOMES:
After completion of this course, the students should be able to
CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2: Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nonmaterial for engineering and technology applications.
CO3: Apply the knowledge of phase rule and composites for material selection.
CO4: Analyze the quality of fuel and its various uses.
CO5: Recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXTBOOKS:
1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd,   New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

REFERENCEBOOKS:
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.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1	2							
CO2	2		1	1	2	2	2	1				3		1	1
CO3	3	1				-	-	2				3			
CO4	3	1	1			1	3	2				2			
CO5	3	2	2	2		3	3	1				3			1
Avg	2.8	1.5	1.33	1.5	2	1.75	2.25	1.6				2.75		1	1

==1 - Low, 2 - Medium, 3 - High==

GE24101	**PROBLEM SOLVING AND PYTHON PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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

UNIT I   COMPUTATIONAL THINKING AND PROBLEM SOLVING   9
Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II   DATA TYPES, EXPRESSIONS, STATEMENTS   9
Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, operators, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III   CONTROL FLOW, FUNCTIONS, STRINGS   9
Conditionals: Boolean values and conditional (if), alternative (if-else), chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, GCD, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV   LISTS, TUPLES, DICTIONARIES   9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V   FILES, MODULES, PACKAGES   9
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, Predefined modules (Numpy Pandas, Matplotlib, Scipy, Django) packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

Total: 45 Periods

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Develop and execute simple Python programs.

CO3: Write simple Python programs using conditionals and loops for solving problems.

CO4: Represent compound data using Python lists, tuples, dictionaries etc.

CO5: Read and write data from/to files in Python programs.

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.
3. Python Data Science Handbook: Essential Tools for Working with Data, Second Edition (Grayscale Indian Edition) by Jake VanderPlas.

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.Comparison of Existing and Revised Syllabus

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		2							1	1		
CO2	3	3	3		2							1	1		
CO3	3	3	3		2							1	1	1	
CO4	3	3	3		2						1	1	1	1	
CO5	3	2	1		1						1	1	1	1	
Avg	3	2.8	2.6		1.8						0.5	1	1	1	

==1 - Low, 2 - Medium, 3 - High==

TA24101	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

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: 15 Periods

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலாறு மக்களும் பண்பாடு மற்றும் கல்வியியல் பணிகள் கழகம்.
2. கணினித் தமிழ் முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தோல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தோல்லியல் 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 C ivilization 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.

GE24102	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:
- ➢ To understand the problem-solving approaches.
- ➢ To learn the basic programming constructs in Python.
- ➢ To practice various computing strategies for Python-based solutions to real world problems.
- ➢ To use Python data structures - lists, tuples, dictionaries.
- ➢ To do input/output with files in Python.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)

4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)

5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)

6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)

7. Implementing programs using Strings. (Reverse, palindrome, character count, replacing characters)

8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)

9. Implementing real-time/technical applications using File handling. (Copy from one file to another, word count, longest word)

10. Implementing real-time/technical applications using Exception handling. (Divide by zero error, voter's age validity, student mark range validation)

11. Exploring Pygame tool.

12. Developing a game activity using Pygame like bouncing ball, car race etc.

Total: 60 Periods

COURSE OUTCOMES:

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

CO1 : Develop algorithmic solutions to simple computational problems

CO2 : Develop and execute simple Python programs.

CO3 : Implement programs in Python using conditionals and loops for solving problems.

CO4 : Process compound data using Python data structures.

CO5 : Utilize Python packages in developing software applications.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2						3	2	1		
CO2	3	3	3	3	2						3	2	1		
CO3	3	3	3	3	2						3		1	1	
CO4	1	2			1						1		1	1	
CO5	2	2			2						2		1	1	
Avg	2.4	2.6	3	3	1.8						2.4	2	1	1	

1 - Low, 2 - Medium, 3 - High

PC24101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

PHYSICS LABORATORY

COURSE OBJECTIVES:
- ➤ To learn the proper use of various kinds of physics laboratory equipment
- ➤ To learn how data can be collected, presented and interpreted in a clear and concise manner.
- ➤ To learn problem solving skills related to physics principles and interpretation of experimental data.
- ➤ To determine error in experimental measurements and techniques used to minimize such error.
- ➤ To make the student as an active participant in each part of all lab exercises.

EXPERIMENT TOPICS: (Any seven experiments to be conducted)
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
13. Michelson Interferometer.
14. Melde's string experiment
15. Experiment with lattice dynamics kit.

CHEMISTRY LABORATORY

COURSE OBJECTIVES:
- ➤ To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- ➤ To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- ➤ To demonstrate the analysis of metals and alloys.
- ➤ To demonstrate the synthesis of nanoparticles.

EXPERIMENT TOPICS: (Any seven experiments to be conducted)

1. Preparation of Na2CO3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.Split the first experiment into two
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. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

COURSE OUTCOMES:

Upon completion of the course, the students should be able to

CO1 : Analysis the Modulus of elasticity of materials.
CO2 : Illustrate the Laser and Optical fiber.
CO3 : Determine the wavelength of Ultrasonic wave in Liquid.
CO4 : Analyze the effect of chloride in water and DO present in sample water.
CO5 : Identify basicity acidity and pH of the materials

TEXT BOOKS:

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's, Textbook of Quantitative Chemical Analysis (2009).

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1			2	2	1				2			
CO2	3	1	2			1	2	2				1		1	1
CO3	3	2	1	1			1	1						1	1
CO4	2	1	2			2	2	2							
CO5	2	1	2		1	2	2	2				1	1		1
Avg	2.6	1.3	1.6	1	1	1.4	1.8	1.6				1.3	1	1	1

1 - Low, 2 - Medium, 3 - High

HS24102	ENGLISH LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English languages kills by engaging the listening, speaking and grammar learning activities that is relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I   INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION   6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions (filling out a bank application for example).

UNIT II   NARRATION AND SUMMATION   6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III   DESCRIPTION OF PROCESS/ PRODUCT   6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities (large & small)-talking about precautions.

UNIT IV   CLASSIFICATOIN AND RECOMMENDATIONS   6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V   DISCUSSION   6
Listening –Listening to debates/discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website- describing processes

Total: 30 Periods

COURSE OUTCOMES:

At the end of the course, learners will be able

CO1 : To listen and comprehend complex academic texts

CO2 : To speak fluently and accurately in formal and informal communicative contexts

CO3 : To express their opinions effectively in both oral and written medium of communication

Assessment Pattern

- Conduction of Assessment to test speaking and writing skills

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3		2	3		3	3	3	1	1		
CO2		2		3		2	3		3	3	3	1	1		
CO3		2		3		1	1		1	3	1	1	1		
Avg		2		3		1.6	2.3		2.3	3	2.3	1	1		

==1 - Low, 2 - Medium, 3 - High==

MA24201	STATISTICS AND NUMERICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:
The student should be made to:
- ➢ This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- ➢ To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- ➢ To introduce the basic concepts of solving algebraic and transcendental equations.
- ➢ To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- ➢ To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I   TESTING OF HYPOTHESIS   9+3
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II   DESIGN OF EXPERIMENTS   9+3
One way and two - way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

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

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

UNIT V   NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION 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 differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

Total: 60 Periods

COURSE OUTCOMES

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

CO1 : Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO2 : Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO3 : Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

CO4 : Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

CO5 : Solve the partial and ordinary differential equations with initial and boundary condition by using certain techniques with engineering applications.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1						2	2	1		
CO2	3	2	1	2	2						2	3	1	1	
CO3	2	2	1	1	1						2	2	1	1	
CO4	2	3	1	1	1						1	3	1	1	
CO5	2	3	1	1	1						2	2	1		
Avg	2.2	2.6	1	1.2	1.2						1.8	2.4	1	1	

1 - Low, 2 - Medium, 3 - High

GE24201	ENGINEERING GRAPHICS	L	T	P	C
		2	0	3	4

COURSE OBJECTIVES:
- ➢ To understand the importance of the drawing in engineering applications.
- ➢ To develop graphic skills for communication of concepts, ideas and design of engineering products.
- ➢ To expose them to existing national standards related to technical drawings.
- ➢ To improve their visualization skills so that they can apply this skill in developing new products.
- ➢ To improve their technical communication skill in the form of communicative drawings.

UNIT-I   PLANE CURVES AND PROJECTION OF POINTS   5+9

Importance of graphics in engineering applications–Use of drafting instruments– BIS conventions and specifications–size, layout and folding of drawing sheets– lettering and dimensioning. (Not for examination)
Curves used in engineering practices: Conics–construction of ellipse, parabola and hyperbola by eccentricity method, cycloidal curves–construction of cycloid, construction of involutes of square and circle–drawing of tangents and normal to the above curves. Orthographic projection – principles – principal planes – first angle projection – projection of points.

UNIT-II   PROJECTION OF LINES AND PLANE SURFACES   5+9

Projection of straight lines (only first angle projection) 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 AND SECTION OF SOLIDS   5+9

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.
Sectioning of solids in simple position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.

UNIT-IV   DEVELOPMENT OF SURFACE AND ISOMETRIC PROJECTIONS   5+9

Development of lateral surfaces of simple and sectioned solids – prisms, pyramids cylinders and cones.
Principles of isometric projection – isometric scale –isometric projections of simple solids and truncated solids –prisms, pyramids, cylinders, cones and combination of two solid objects in simple vertical positions.

UNIT-V   FREE HAND SKETCHING AND PERSPECTIVE PROJECTIONS   5+9

Visualization concepts–representation of three dimensional objects – layout of views–freehand sketching of multiple views from pictorial views of objects.
Principle of perspective projection – terminology –perspective projection of simple solids-prisms, pyramids, cylinder and cone by visual ray method.

UNIT-VI   COMPUTER AIDED DRAFTING (Not for examination)   5

Introduction to drafting packages: Initial Setup Commands, Coordinate system in AutoCAD, UCS, WCS, and MCS. Draw Commands, Modify Commands, View Commands, Annotation commands, 2D Drawings and 3D Models -Simple Exercises.

Total: 75 Periods

COURSE OUTCOMES

On successful completion of this course, the student will be able

CO1 : To construct different plane curves and to comprehend the theory of projection.

CO2 : To project orthographic projections of lines and plane surfaces.

CO3 : To draw the projection of simple solids and sectional solids.

CO4 : To draw the development of lateral surfaces of sectional solids and Isometric projections of solids.

CO5 : To perform freehand sketching of multiple views from pictorial viewand visualize perspective view of simple solids.

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 51th Edition, 2012.
2. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 31th Edition, 2018.

REFERENCE BOOKS:

1. Varghese P I., "Engineering Graphics", McGraw Hill Education (I) Pvt. Ltd., First Edition, 2013.
2. Venugopal K. and PrabhuRaja V., "Engineering Graphics", New Age International (P) Limited, 12th Edition, 2014.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 23th Edition, 2017.
4. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill Publishing Company Limited, New Delhi, 2nd Edition, 2008.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

ME24201	ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:
The students can be able to
- Understand the basics of mechanics and apply the concept of equilibrium of system of forces.
- Understand the concept of equilibrium and to solve problems of rigid bodies
- Learn about the centroid and centre of gravity of objects and moment of inertia
- Learn the principles of friction and frictional forces.
- Develop basic dynamics concepts – force, momentum, impulse, work and energy.

UNIT I   STATICS OF PARTICLES   9+3
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force. Equilibrium of a Particle- Space and Free-Body Diagrams – Equivalent systems of forces – Principle of transmissibility.

UNIT II   EQUILIBRIUM OF RIGID BODIES   9+3
Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Moment of a Force about an Axis, Couple - Moment of a Couple, Resolution of a Given Force into a Force - Couple system, Equilibrium in Two Dimensions - Reactions at Supports and Connections.

UNIT III   PROPERTIES OF SURFACES AND SOLIDS   9+3
Centroids of areas, Centroids of by Integration, Centroids of Composite Areas, Theorems of Pappus-Guldinus, Centre of Gravity, Centroid of a Volume, Centroids of Volumes by Integration. Moments of Inertia of Areas - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Moment of Inertia of a simple solids by Integration.

UNIT IV   FRICTION   9+3
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction, Belt friction.

UNIT V   DYNAMICS OF PARTICLES   9+3
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Law of Motion - Equations of Motions, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.

Total: 60 Periods

COURSE OUTCOMES
At the end of the course the students would be able to
CO1 : Analyze the forces in the system and to understand vectorial and scalar representation of forces and moments
CO2 : Study about the rigid body in equilibrium and to analyze the problems in engineering systems using the concept of static equilibrium

CO3 : Evaluate the properties of surfaces and solids by means of finding centroid, centre of gravity and moment of inertia.

CO4 : Determine the friction and the effects by the laws of friction.

CO5 : Apply the basic kinematic relationships between position, velocity, acceleration, time and kinetic relationship between force, momentum, impulse, work and energy.

TEXT BOOKS:
1. Beer Ferdinand P, Russell Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCES:
1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5th Edition, McGraw Hill Higher Education, 2013.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

ME24202	ENGINEERING MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

➢ To learn the constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.

➢ To learn selecting and applying various heat treatment processes and its microstructure formation.

➢ To illustrate the different types of ferrous and non-ferrous alloys and their uses in engineering field.

➢ To illustrate the different polymer, ceramics and composites and their uses in engineering field.

➢ To learn the various testing procedures and failure mechanism in engineering field.

UNIT-I   CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS   9

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

UNIT-II   HEAT TREATMENT   9

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

UNIT-III   FERROUS AND NON-FERROUS METALS   9

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

UNIT-IV   NON-METALLIC MATERIALS   9

Polymers – types of polymers, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers. Engineering Ceramics – Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON. Composites – Classifications - Metal Matrix and FRP- Applications of Composites.

UNIT-V   MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS   9

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

Total: 45 Periods

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.

CO2 : Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
CO3 : Clarify the effect of alloying elements on ferrous and non-ferrous metals
CO4 : Summarize the properties and applications of non-metallic materials.
CO5 : Explain the testing of mechanical properties.

TEXT BOOKS:
1. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th Edition, 2018.
2. Sydney H.Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1994

Reference Book(s):
1. A. Alavudeen, N. Venkateshwaran, and J. T.WinowlinJappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.
2. U.C.Jindal, Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012.
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. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, 2nd edition Re print 2019.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2	2								2	2		
CO2	3		2	1		2		1				2	2		
CO3	3		2									2	2		
CO4	3		2				2					2	2		
CO5	3		2	2	2							2	2		
Avg	3		2	1.6	2	2	2	1				2	2		

1 - Low, 2 - Medium, 3 - High

TA24201	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

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: 15 Periods

TA242001	தமிழரும் மற்றும் தொழில்நுட்பம்	L	T	P	C
		1	-	-	1

அலகு I **நெசவு மற்றும் பானை தொழில்நுட்பம்** **3**

சங்க காலத்தில் நெசவுத் தொழில் - பானை தொழில்நுட்பம் - கருப்பு மற்றும் சிவப்பு பாண்டங்கள் பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II **வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம்** **3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெரியகோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றிய அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ- சாரோசெனிக் கட்டிடக் கலை.

அலகு III **உற்பத்தி தொழில்நுட்பம்** **3**

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற் சாலை- இரும்பு உருகுதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சாடித்தல் - மணிகள் உருவக்கும் தொழிற் சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுங்கள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV **வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம்** **3**

அணை, ஏரி, குளங்கள், மதகு, - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக் குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு V **அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ்** **3**

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

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு மக்களும் பண்பாடு மற்றும் கல்வியியல் பணிகள் கழகம்.
2. கணினித் தமிழ் முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தோல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தோல்லியல் 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 C ivilization 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.

EE24201	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:
- ➢ To illustrate the basics of electric circuits and analysis of DC & AC circuits.
- ➢ To understand the knowledge in the basics of working principles and application of electrical machines.
- ➢ To evaluate the fundamentals of analog electronics and their characteristics.
- ➢ To demonstrate the fundamental concepts of digital electronics.
- ➢ To compute the functional elements and working of measuring instruments.

UNIT - I   BASIC ELECTRIC CIRCUITS   9

DC Circuits: Basic Circuit elements – Ohm's Law - Kirchhoff's Laws with Independent Sources – Resistors in Series and Parallel- Current division and Voltage division- Nodal Analysis, Mesh analysis with Independent sources only - Thevenin's and Norton's Theorem. Introduction to AC circuit Fundamentals: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor.

UNIT II   ELECTRICAL MACHINES   9

Construction and Working principle - DC Machines, EMF equation, Types and Applications. Construction and Working Principle of Transformers & Induction Motors, V/F drives.

UNIT III   ANALOG ELECTRONICS   9

PN Junction Diode, Zener Diode – V-I Characteristics & Applications, BJT, SCR, MOSFET, IGBT Types– Basics of Rectifier and Inverter.

UNIT IV   DIGITAL ELECTRONICS   9

Number system and its conversion, binary codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps.

UNIT V   MEASUREMENTS AND INSTRUMENTATION   9

Functional elements of an instrument, Standards, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers - CT and PT, DSO – Block diagram – Data Acquisition.

Total: 45 Periods

LIST OF EXPERIMENTS: Simulation   and   experimental verification of electrical circuit using Mesh analysis.
1. Simulation and experimental verification of electrical circuit using Nodal analysis.
2. Measurement of Three Phase Power using two Wattmeter method.
3. Load test on single-phase transformer.
4. Load test on DC shunt motor.
5. VI characteristic of PN junction diode.

6. VI characteristic of Zener Diode.
7. Study Of solar PV.

Total: 30 Periods

Total: 75 Periods

COURSE OUTCOMES

After completing this course, the students will be able to

CO1 : Compute the electric circuit parameters.
CO2 : Illustrate the working principle and applications of electrical machines.
CO3 : Plot the characteristics of analog electronics.
CO4 : Summarize the basic concepts of digital electronics.
CO5 : Interpret the operating principles of measuring instruments.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., Third Edition, 2015.
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. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 9th edition, 2021.
3. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 7th Edition 2017.
4. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 4th Edition, 2019.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

GE24202	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

- ➢ Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
- ➢ Welding various joints in steel plates using arc welding; machining various simple processes like turning, drilling, and tapping in parts.
- ➢ Wiring various electrical joints in common household electrical wire work.
- ➢ Soldering and testing simple electronic circuits; assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & MECHANICAL ENGINEERING)

PART I   CIVIL ENGINEERING PRACTICES   15

PLUMBING WORK:

- a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
- b. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- c. Preparation of plumbing line sketches for water supply.
- d. Laying pipe connection to the suction and delivery side of a pump
- e. Mixed pipe material connection – Pipe connections with different joining components.

WOOD WORK:

- a. Study of the joints in roofs, doors, windows and furniture.
- b. Making joints like Mortise and Tenon joint, T-Joint and Dovetail joint by sawing, planning and cutting.

PART II   MECHANICAL ENGINEERING PRACTICES   15

WELDING WORK:

- a. Welding of Butt joints, Lap joints and Tee joints using arc welding.
- b. Gas welding practice

BASIC MACHINING WORK:

- a. Simple step turning, taper turning
- b. Simple drilling.

ASSEMBLY WORK:

- a. Study of centrifugal pump
- b. Study of air conditioner
- c. Study of household mixer.

SHEET METAL WORK:
  a. Making models of a square/Rectangular tray and funnels.
FOUNDRY WORK:
  a. Demonstrating basic foundry operations.

GROUP B (ELECTRICAL & ELECTRONICS ENGINEERING)

PART III   ELECTRICAL ENGINEERING PRACTICES   15

  a. Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket.
  b. Staircase Wiring.
  c. Fluorescent Lamp wiring with introduction to CFL and LED types.
  d. Energy meter wiring and related calculations/ calibration.
  e. Study of Iron Box wiring and assembly.
  f. Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac).
  g. Study of emergency lamp wiring/Water heater.

PART IV   ELECTRONIC ENGINEERING PRACTICES   15

STUDY OF ELECTRONIC COMPONENTS
  a. Measurement of Resistance of a resistor using Color Coding.
  b. Measurement of AC signal parameters (Peak-Peak, RMS period, Frequency) using CRO.
SOLDERING WORK:
  a. Soldering simple electronic circuits and checking continuity.
ELECTRONIC ASSEMBLY AND TESTING WORK:
  a. Assembling and testing electronic components on a small PCB.
STUDY OF LOGIC GATES:
  a. Verification of logic gates - AND, OR, NOT, NAND, NOR, EXOR, EX-NOR.
ELECTRONIC EQUIPMENT STUDY:
  a. Study on elements of smart phone.
  b. Assembly and dismantle of LED TV.
  c. Assembly and dismantle of computer/ laptop.

Total = 60 Periods

*At end of the semester students should submit the prototypes of their stem projects.

COURSE OUTCOMES
On successful completion of this course, the student will be able to:
  CO1: draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
  CO2: weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, and tapping in parts.
  CO3: assemble simple mechanical assembly of common household equipment's; Make a simple model using sheet metal work.
  CO4: wiring of various electrical joints in common household electrical wire work.
  CO5: solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO6: understand the concept and verification of logic gates.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			1	1	1					2	2	2	1
CO2	3	2			1	1	1					2	2	2	1
CO3	3	2			1	1	1					2	2	2	1
CO4	3	2			1	1	1					2	2	1	
CO5	3	2			1	1	1					2	2	1	
CO6	3	2			1	1	1					2	2	1	
Avg	3	2			1	1	1					2	2	1.5	1

1 - Low, 2 - Medium, 3 - High

HS24202	ENGLISH COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I   SELF INTRODUCTION AND EMAIL DRAFTING   12

Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences-talking about events in life-discussing past events.
Writing: Writing emails (formal & semi-formal).

UNIT II   INDIVIDUAL DISCUSSION ON SOCIAL ISSUES   12

Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms.
Writing: Writing different types of emails.

UNIT III   PRESENTATION ON TECHNICAL AND NON-TECHNICAL TOPICS   12

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios-talking about purchasing-discussing advantages and disadvantages-making comparisons-discussing likes and dislikes-discussing feelings about experiences-discussing imaginary scenarios.
Writing: Short essays and reports-formal/semi-formal letters.

UNIT IV   IMPORTANCE OF DESCRIPTIVE WRITING & INSTRUCTIONS   12

Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-(example- discussing rental arrangements)- understanding technical instructions.
Writing: Writing instructions. Writing a short article.

UNIT V   GROUP DISCUSSION AND IMPORTANCE OF RESUME WRITING   12

Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions.
Writing: Job application (Cover letter+ Curriculum vitae)- product presentation)

Total: 60 Periods

COURSE OUTCOMES
After completion of this course, the students should be able to
CO1 : Speak effectively in group discussions held in a formal/semi formal contexts.
CO2 : Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions

CO3 : Write emails, letters and effective job applications.
CO4 : Write critical reports to convey data and information with clarity and precision.
CO5 : Give appropriate instructions and recommendations for safe execution of tasks.

Assessment Pattern
- Conduction of Assessment to test speaking and writing skills

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3		3		3	3		3	3	3	3	1		2
CO2	-	3		3		3	3		3	3	3	3	1		2
CO3	-	2		3		3	3		3	3	3	3	1		2
CO4	-	3		3		3	3		3	3	3	3	1		2
CO5	-	3		3		3	3		3	3	3	3	1		2
Avg	-	2.8		3		3	3		3	3	3	3	1		2

1 - Low, 2 - Medium, 3 - High

SEMESTER-III
B.E- BME, MECH

MA24302	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

➢ Understand the concepts of Fourier series, Transforms and formation of partial differential equations, which will enable them to model and analyze the physical phenomena.
➢ Implement the Fourier analysis, an elegant method in the study of heat flow, fluid mechanics and electromagnetic fields.
➢ Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

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

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

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

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

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

TOTAL PERIODS: 60

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1 : Exemplify the concepts of partial differential equations and able to apply them to solve real scenarios.

CO2 : Analyze the periodicity of a function and formulate the same as a combination of sine and cosine using Fourier series.

CO3 : Appreciate the physical significance of Fourier series techniques in solving one and two-dimensional heat flow problems and one-dimensional wave equations.

CO4 : Apply the Z-transform to convert a discrete-time signal, which is a sequence of real or complex numbers, into a complex frequency domain representation.

CO5 : Apply Fourier transform to convert the function in time domain into a sum of sine waves of different frequencies, each of which represents a frequency component.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 44thEdition, Khanna Publishers, New Delhi, 2018.
2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.
3. Sankara Rao. K, "Numerical Methods for Scientists and Engineers", PHI Learning Pvt Ltd., New Delhi, 2007. .

REFERENCES:

1. Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2015.
3. James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi,2016.
4. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi, 2016.
5. Peter V O Neil., Advanced Engineering Mathematics, 7th Edition, TBH Publishers, 2013.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1					2			2
CO2	2	3	1	1					2			3
CO3	3	2	1	1					2			3
CO4	3	2	1	1					2			3
CO5	2	3	2	2					2			2
AVG.	**2.6**	**2.6**	**1.2**	**1.2**					**2**			**2.6**

==1 - Low, 2 - Medium, 3 - High==

ME24301	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- ➢ Teach the fundamentals and practical applications of the zeroth and first laws of thermodynamics.
- ➢ Explain the applications of second law of thermodynamics and entropy of pure substance.
- ➢ Teach the various properties of steam through steam tables and Mollier chart.
- ➢ Impart knowledge on the macroscopic properties of ideal and real gases.
- ➢ Provide an understanding of the psychrometric process and air conditioning system.

UNIT-I   BASICS, ZEROTH AND FIRST LAW   9

Basic concepts of Thermodynamics - systems, properties and processes - Thermodynamic Equilibrium – Displacement work - P-V diagram. Thermal equilibrium – Temperature and Zeroth law –. First law – application to closed and open systems – steady flow processes.

UNIT-II   SECOND LAW AND ENTROPY   9

Heat Engine – Refrigerator - Heat pump. Statements of second law and their equivalence & corollaries. Carnot cycle - Reversed Carnot cycle - Performance - Clausius inequality. Concept of entropy - T-s diagram - Entropy change for a pure substance. Ideal gases undergoing different processes - principle of increase in entropy.

UNIT-III   PROPERTIES OF PURE SUBSTANCES AND VAPOUR POWER CYCLES   9

Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart. Basic Rankine Cycle, modified, reheat and regenerative cycles.

UNIT-IV   GAS MIXTURES AND THERMODYNAMIC RELATIONS   9

Properties of Ideal gas, real gas - comparison. Equations of state for ideal and real gases. Vander Waal's relation - Reduced properties - Compressibility factor - Principle of Corresponding states - Generalized Compressibility Chart. Maxwell relations - TdS Equations - heat capacities relations - Energy equation, Joule- Thomson experiment - Clausius-Clapeyron equation.

UNIT-V   PSYCHROMETRY AND AIR CONDITIONING   9

Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications. Air conditioning system - Processes, Types and Working Principles.(Description only).

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.

CO2 : Apply second law of thermodynamics to calculate the performance of thermal devices and entropy of Pure substance

CO3 : Calculate the thermodynamic properties for non-flow and flow processes using Steam Table and Mollier Chart.

CO4 : Calculate the properties of gas mixtures and understand the concept of simple thermodynamic relations of ideal and real gases.

CO5 : Analyze the properties of moist air, their application in psychrometric processes, and understand the working of air-conditioning systems.

TEXT BOOKS:

1. Nag. P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw Hill (2017), New Delhi.
2. Natarajan, E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition (2014), Anuragam Publications, Chennai.

REFERENCES:

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

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										3		
CO2	3	2	2										2		
CO3	3	2	2										3		
CO4	2	2	2										2		
CO5	3	2	2										3		
Avg.	2.8	2	2										2.6		

1 - Low, 2 - Medium, 3 - High

ME24302	MANUFACTURING PROCESSES	L	T	P	C
		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 learn the working principles of metal forming process.
- ➢ To study and practice the working principles of plastics molding.
- ➢ To understanding of composite materials and their various manufacturing processes.

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–Moulding Machines– Types and applications– Melting furnaces; Blast and Cupola Furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – Centrifugal Casting – CO_2 casting – Defects in Sand casting process- remedies, Solidification of metals and alloys.

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 - 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, Weld Defects: Types, Causes And Cure.

UNIT-III   METAL FORMING PROCESSES   9

Hot working and cold working of metals – Forging processes – Rolling of metals – Types of Rolling – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion–Sheet metal characteristics– Stretch forming operations– Hydro forming – Rubber pad forming– Introduction of Explosive and Super plastic forming

UNIT-IV   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 – Rotational molding – Film blowing –Thermoforming – Bonding of Thermoplastics- duff moulding, Polymer additive manufacturing.

UNIT-V   MANUFACTURING OF COMPOSITES   9

Introduction to Composites- Function of the Matrix and Reinforcement in Composites - Thermoset and Thermoplastic- Fiber Reinforcement, Composite manufacturing- Hand Lay-up processes, Spray up Process, Resin transfer moulding - Filament winding - sheet moulding. Metal and ceramic matrix composites, Metal matrix and reinforcement; Manufacturing processes for Metal Matrix Composites- Dispersion hardended and particle composite - Layer composites and inltration method, Metal additive manufacturing.

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able

CO1 : Explain the principle of different metal casting processes.
CO2 : Describe the various metal joining processes.
CO3 : Apply the various metals forming process.
CO4 : Apply suitable molding technique for manufacturing of plastics components.
CO5 : Demonstrate a practical understanding of composite materials and fabrication techniques

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 andII, Media promoters and Publishers Private Limited, Mumbai, 1997
5. Sharma, P.C., A TEXT BOOKS of production Technology, S.Chand and Co. Ltd., 2004
6. Balasubramanian, M. Composite Materials and Processing, CRC press (2017)

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

GE24301	**ENVIRONMENTAL SCIENCES AND SUSTAINABILITY**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES:
- ➢ To introduce ecological concepts and biodiversity, emphasizing conservation and public awareness.
- ➢ To understand pollution types, impacts, and waste management practices, with industrial safety focus.
- ➢ To expose students to various renewable energy technologies and their practical applications.
- ➢ To study how people harm the environment and learn ways to prevent and manage disasters.
- ➢ To promote sustainability awareness and application of sustainable practices in industry and society.

UNIT I   ENVIRONMENT AND BIODIVERSITY   6

Definition, scope, and importance of environment; need for public awareness. Ecosystem and energy flow with ecological succession. Types and values of biodiversity; India as a mega-diversity nation and biodiversity hotspots. Threats like habitat loss, poaching, man-wildlife conflict, impacts from industrial and infrastructure development. Endangered and endemic species of India and conservation methods (in-situ and ex-situ), Role of information technology in species monitoring.

UNIT II   ENVIRONMENTAL POLLUTION   6

Causes, Effects and Preventive measures of water, air, soil, noise, and radioactive pollution. Waste management covers municipal solid waste, hazardous waste, and E-Waste - gold extraction. Carbon Credit and Footprint concepts related to industry. Environmental protection acts. Case studies on OHASMS (Occupational health and safety management systems) emphasizing industrial safety practices and engineering risk management.

UNIT III   RENEWABLE SOURCES OF ENERGY   6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Case studies on bio-fuel production from agricultural waste.

UNIT IV   HUMAN POPULATION AND ENVIRONMENT IMPACT   6

Human population - Importance of value education, human rights. Land degradation and deforestation- Man-Made Disasters: Industrial Accidents-Nuclear Accidents-Oil Spills - Prediction and management. Science and technology of Carbon Sequestration - Ozone depletion and environmental responsibility. Case Study: A low-cost water purification project implemented in a densely populated village.

UNIT V   SUSTAINABILITY MANAGEMENT AND PRACTICES   6

Suitability Management - Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability and protocols Sustainable Development Goals-targets. Suitability Practices - Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment. Sustainable habitat: green buildings, green materials, energy efficiency, sustainable transports. Sustainable energy. Case studies on sustainable building design in industrial facilities.

TOTAL PERIODS: 30

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1 : Explore ecosystem functions, biodiversity, and the importance of species protection.

CO2 : Identify types of pollution, their effects, and preventive measures including waste management.

CO3 : Describe renewable energy sources and their applications in sustainable energy production.

CO4 : Analyze human impact the environment and propose on disaster management strategies.

CO5 : Apply sustainability concepts and practices in environmental and industrial systems.

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 "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1	1			1	3	2		1		1			
CO2	1	2	2		1	2	3	2		1		2			
CO3	1	1	2		2	3	3	2		1		2			
CO4	1					3	3	3		1		2			
CO5		1	2		1	3	3	3		1		2			
Avg	1.00	1.25	1.75		1.33	2.40	3.00	2.40		1.00		1.80			

1 - Low, 2 - Medium, 3 - High

ME24303	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

The course aims to:

➢ Introduce the fundamental properties of fluids and analyze their behavior under static and dynamic conditions, with a focus on real world engineering applications.

➢ Explain the characteristics of laminar and turbulent flow through circular conduits, and evaluate energy losses in pipe systems.

➢ Develop a solid understanding of dimensional analysis and model testing techniques for fluid systems.

➢ Analyze the performance of hydraulic turbines using velocity triangles and related calculations.

➢ Evaluate the performance of pumps and understand their practical applications in fluid systems.

UNIT I   FLUID PROPERTIES AND FLOW CHARACTERISTICS   10

Properties of fluids Hydrostatic Pressure & Measurements Flow characteristics Path line, Streak line and Streamline Pascal's law Eulerian and Lagrangian Principle of fluid flow – the concept of control volume and system – continuity equation, energy equation, Bernoulli's equation and Momentum Equation Applications

UNIT II   FLOW THROUGH PIPES AND BOUNDARY LAYER   9

Types of Flow, Laminar flow through circular conduits Darcy Weisbach equation – friction factor Moody diagram minor losses Hydraulic and energy gradient (theory) – Pipes in series and parallel Boundary layer concepts – types of boundary layer thickness.

UNIT III   DIMENSIONAL ANALYSIS AND MODEL STUDIES   8

Fundamental dimensions Dimensional homogeneity Rayleigh's method and Buckingham Pi theorem Dimensionless parameters Similitude and model studies Distorted and undistorted models.

UNIT IV   HYDRAULIC TURBINES   9

Introduction about Impact of jets Theory of roto dynamic machines Classification of turbines – Pelton wheel, Francis turbine (inward and outward), and Kaplan turbine Working principles Work done by water on the runner Efficiencies – Draft tube Specific speed Performance curves for turbines – Governing of turbines.

UNIT V   PUMPS   9

Classification of pumps Centrifugal pumps– working principle Heads and efficiencies– Velocity triangles Workdone by the impeller performance curves Reciprocating pump – indicator diagram and its variations (theory) – air vessels (concept basis).

TOTAL PERIODS: 45

LIST OF EXPERIMENTS
1. (a) Determination of coefficient of discharge of a Venturimeter
   (b) Determination of friction factor for flow through pipes
2. (a) Determination of metacentric height
   (b) Determination of forces due to impact of jet on a fixed plate
3. Characteristics of centrifugal pumps
4. Characteristics of reciprocating pump/ Gear pump
5. Characteristics of Pelton wheel turbine/ Francis turbine.

TOTAL PERIODS: 30

COURSE OUTCOMES
On successful completion of this course, the student will be able to:
CO1 : Determine the properties and behavior of fluids in motion
CO2 : Analyze fluid flow through circular pipes,
CO3 : Highlight the significance of dimensional and model analysis
CO4 : Evaluate the efficiency of hydraulic turbines
CO5 : Analyze the performance characteristics of pumps

TEXT BOOKS:
1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2019.
2. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P),Ltd., 2019

REFERENCES:
1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint,2018
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J. Pritchard, "Fluid Mechanics and Machinery", 2017.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2018
5. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2019. Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co. (2010).
6. S K Som, Gautam Biswas and Suman Chakraborty "Introduction to Fluid Mechanics and Fluid Machines", McGraw Hill Publishing Co. 2017

CO-PO MAPPING

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

==1 - Low, 2 - Medium, 3 - High==

ME24304	MANUFACTURING PROCESSES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:
➢ To Selecting appropriate tools, equipment's and machines to complete a given job.
➢ To Performing various welding process using Arc welding and fabricating gears using casting method.
➢ To Performing various machining process such as turning, drilling, and analyzing the defects in the cast and machined components.

LIST OF EXPERIMENTS
1. Perform taper turning operation on the given work piece using a lathe.
2. Perform eccentric turning on the given work piece using a lathe.
3. Perform knurling operation on the given work piece using a lathe.
4. Perform internal thread cutting operation on the given work piece using a lathe.
5. Perform external thread cutting operation on the given work piece using a lathe.
6. Perform drilling and tapping operations on the given work piece using a drilling machine and tap set.
7. Prepare a sand mould using the given solid gear pattern.
8. Prepare a sand mould using the given split dumbbell pattern.
9. Fabricate a sheet metal Tray and a Funnel from the given sheet metal.
10. Welding practice by using Arc welding.
11. Projects based on development of models for manufacturing methods. (Students should fabricate a project model based on any specific Manufacturing methods)

COURSE OUTCOMES
On successful completion of this course, the student will be able to
CO1 : Demonstrate the join two metals using Arc welding and casting the gear models.
CO2 : Make the work piece as per given shape and size using lathe machine.
CO3 : Make the tray and funnel using sheet metal and analyze the defects in the cast and machined components

TOTAL PERIODS: 60

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

		L	T	P	C
ME24305	**MACHINE DRAWING**	0	0	4	2

COURSE OBJECTIVES:
➢ To familiarize 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 using standard CAD packages.
➢ To Preparing standard drawing layout for modeled parts, assemblies with BoM.

PART I   DRAWING STANDARDS   9
Code of practice for Engineering Drawing, BIS specifications – Thread forms, welding symbols, riveted joints, keys, and fasteners Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.

PART II   DRAFTING AND MODELLING   45
Drawing, Editing, Dimensioning, Layering, Hatching, Detailing, Detailed Drawing.
Prepare a 2D assembly of machine components
    1. Bearings – Bush Bearing / Plummer Block
    2. Valves – Safety / Non-return Valves.
Prepare a drawing layout for modeled and assemblies components with BOM
  1. Machine Components – Flange / Oldham's, coupling, Universal / Knuckle joint, Gib & Cotter / Sleeve & Cotter joints Screw Jack, Machine Vice, Lathe Tail Stock / Lathe Chuck, Piston, Connecting Rod / Stuffing box.
  2. Project Student has to select a component and complete its parts, assembly and drawing layout of the model.

PART III   GEOMETRIC DIMENSIONING AND TOLERANCING   6
Conventional Dimensioning and Tolerancing, reason to use GD&T, Standard symbols of GD&T, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings.

TOTAL PERIODS: 60

COURSE OUTCOMES
At the end of the course the students would be able to
CO1 : Draw the different types of thread forms, welding symbols, types of Keys, Riveted joints and fasteners.
CO2 : Model the machine components and prepare standard drawing layout for modeled and assemblies with BoM.
CO3 : Demonstrate an understanding of all the symbols used in GDT.

TEXT BOOKS:

1. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore,2013.
2. Bhatt, N.D., Machine Drawing, 51th edition, Charotar Publishing House Pvt. Ltd., India, 2022.

REFERENCES:

1. Ajeet Singh, Machine drawing, 2nd edition, Tata McGraw Hill, India, 2012.
2. K.L. Narayana, Machine Drawing, 4th edition, New Age International publisher, India, 2014.
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri," Machine Drawing" , published by Tata McGrawHill,2006
4. S. Trymbaka Murthy, "A TEXT BOOKS of Computer Aided Machine Drawing", CBS Publishers, NewDelhi,2007
5. K.C. John, TEXT BOOKS on Machine Drawing, 2nd edition, PHI Learning Pvt, Ltd, India, 2010.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

GE24S01	PROFESSIONAL DEVELOPMENT	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWER POINT.

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

UNIT I   INTRODUCTION TO MS WORD   5

Create and format a document: Working with tables- Working with Bullets and Lists- Working with styles, shapes, smart art, charts-Inserting objects, charts and importing objects from other office tools-Creating and using document templates.

UNIT II   APPLICATIONS OF MS WORD   5

Inserting equations, symbols and special characters-Working with Table of contents and References, citations-Insert and review, comments-Create bookmarks, hyperlinks, endnotes footnote-Viewing document in different modes-Working with document protection and security-Inspect document for accessibility

UNIT III   INTRODUCTION TO MS EXCEL   5

Create worksheets-insert and format data-Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data-Sort and filter data-Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)-Work with Lookup and reference formulae-Create and Work with different types of charts.

UNIT IV   APPLICATIONS OF MS EXCEL   5

Use pivot tables to summarize and analyze data-Perform data analysis using own formulae and functions- Combine data from multiple worksheets using own formulae and built-in functions to generate, Results- Export data and sheets to other file formats-Working with macros-Protecting data and Securing the workbook.

UNIT V   INTRODUCTION TO MS POWERPOINT AND ITS APPLICATIONS   10

Select slide templates, layout and themes-Formatting slide content and using bullets and numbering-Insert and format images, smart art, tables, charts-Using Slide master, notes and handout master-Working with

animation and transitions-Organize and Group slides-Import or create and use media objects: audio, video, animation-Perform slideshow recording and Record narration and create presentable videos.

TOTAL PERIODS: 30

COURSE OUTCOMES

After completion of this course, the students should be able to

CO1 : Create document in MS word for technical requirements.

CO2 : Create document in MS word for academic requirements.

CO3 : Perform Data operation and analytics using MS Excel.

CO4 : Perform record creation and retrieving the data for academic requirements.

CO5 : Develop document for academic presentation using media objects in MS PowerPoint.

TEXT BOOKS:

1. "Microsoft Word Step by Step "Joan Lambert (Microsoft Press)the latest MS Word version (e.g., 2019 or Microsoft 365).

2. "Microsoft Office 365 – In practice (2021 Edition) by Randy Nordel, McGraw Hill Education.

REFERENCES:

1. MS Word

Book: Microsoft Word 2019 Step by Step by Joan Lambert (Microsoft Press), Covers document creation, formatting, templates, references, and collaboration. ISBN: 978-1509305845.

2. MS Excel

Book: Excel 2019 Bible by Michael Alexander, Richard Kusleika, and John Walkenbach (Wiley), Comprehensive coverage of Excel functions, data analysis, charts, pivot tables, macros., ISBN: 978-1119517948.

3. MS PowerPoint

Book: PowerPoint 2019 For Dummies by Doug Lowe (For Dummies Series)\, Clear instructions on templates, animations, media, slide masters, and presentations. ISBN: 978-1119514190.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

ME24401	KINEMATICS OF MACHINERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To discuss different kinds of mechanisms and how they can be generalized
- To impart skills to analyze velocity and acceleration of linkages in mechanisms
- To develop the cam profiles at various follower motions.
- To solve problems on gears and gear trains.
- To analyze the frictional effects in machine elements.

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, Universal Joint – rocker mechanisms.

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 Centers –Velocities and accelerations by Analytical method – Kinematic Analysis of Simple Mechanisms.

UNIT III   KINEMATICS OF CAM MECHANISMS   9

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, 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 gear trains – 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 successful completion of this course, the student will be able to

CO1 : Describe various types of mechanisms and generalize them based on kinematic link and pair configurations.

CO2 : Analyze the velocity and acceleration of different linkages in planar mechanisms.
CO3 : Design cam profiles for specified follower motions.
CO4 : Solve problems related to simple, compound, and epicyclic gear trains.
CO5 : Explain the fundamental concepts of friction and analyze the frictional effects in machine elements.

TEXT BOOKS:

1. Rattan, S.S, "Theory of Machines", 5th Edition, McGraw Hill Education (India) Limited,2020.
2. Uicker J.J, Pennock G.R and Shigley J.E."Theory of Machines and Mechanisms",4th Edition, Oxford University Press, 2023.

REFERENCES:

1. Robert L. Norton, "Kinematics and Dynamics of Machinery", McGraw Hill Education(India) Limited, 2017
2. Thomas Bevan, "Theory of Machines", 3rd Edition, Pearson Education, 2009 (2018).
3. R S Khurmi and J K Gupta, "Theory of Machines", 14th Edition, S.Chand Publishing, 2020.
4. V. P. Singh, "Theory of Machines" 6th Edition, Dhanpat Rai& Co (P) Limited, 2017.
5. Sadhu Singh, "Theory of Machines", 3rd Edition, Pearson Education, 2011 (2016).

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

ME24402	**THERMAL ENGINEERING**	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- ➢ To integrate the laws and concepts of thermodynamics into the analysis of gas power cycles.
- ➢ To analyzing the working of IC engines combustion and its auxiliary systems.
- ➢ To understand the working and performance of the steam nozzles and steam turbines.
- ➢ To understand the working of air compressors and to evaluate their performance.
- ➢ To understand the working of refrigeration and air conditioning systems.

UNIT I   GAS POWER CYCLES   9

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

UNIT II   INTERNAL COMBUSTION ENGINES AND AUXILIARY SYSTEMS   9

IC engine – Classification, working, components and their functions. Ideal and actual: Valve and port timing diagrams, p v diagrams two stroke & four stroke, and SI & CI engines – comparison. Combustion in SI & CI Engines. Performance and Emission Testing, Performance parameters and calculations. Morse and Heat Balance tests. Types of Fuel Injection system and Ignition systems. Types of Lubrication and Cooling systems. Concepts of Supercharging and Turbo charging.

UNIT III   STEAM NOZZLES AND TURBINES   9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and Reaction principles, compounding, velocity diagram for simple and multistage turbines, speed regulations –Governors.

UNIT IV   AIR COMPRESSOR   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 V   REFRIGERATION AND AIR CONDITIONING   9

Refrigerants Vapour compression refrigeration cycle super heat, sub cooling – Performance calculations working principle of vapour absorption system, Ammonia –Water, Lithium bromide – water systems. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations.

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Apply thermodynamic concepts to different air standard cycles and solve problems.

CO2 : Explain the functioning and features of IC engine combustion and auxiliary systems.

CO3 : Solve problems in steam nozzles and turbines

CO4 : Solve problems in single stage and multistage air compressors.

CO5 : Solve problems using refrigerant table / charts and psychrometric charts

TEXT BOOKS:

1. Rajput. R. K., ―Thermal Engineering‖, 10th Edition, Laxmi Publications, 2018.
2. Ganesan.V, " Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. Mahesh. M. Rathore, "Thermal Engineering", 1st Edition, Tata McGraw Hill, 2010.
2. Ballaney. P, "Thermal Engineering", 25th Edition, Khanna Publishers, 2017.
3. Domkundwar, Kothandaraman, &Domkundwar, "A Course in Thermal Engineering", 6th Edition, DhanpatRai& Sons, 2011.
4. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
5. Rudramoorthy, R, "Thermal Engineering ", Tata McGrawHill, New Delhi,2003

COPO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										3		
CO2	3	2	2										2		
CO3	3	2	2										3		
CO4	2	2	2										2		
CO5	3	2	2										3		
Avg.	2.80	2.00	2.00										2.60		

<mark>1 - Low, 2 - Medium, 3 - High</mark>

ME24403	STRENGTH OF MATERIALS	L	T	P	C
		3	1	0	4

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.

UNIT I   STRESS, STRAIN AND DEFORMATION OF SOLIDS   12

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   14

Beams – Types Transverse loading and types loads 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 (Study) – Shear stress distribution.

UNIT III   TORSION   12

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   13

Elastic curve – Governing differential equation Double integration method Macaulay's method – Theory of Columns Slenderness ratio, End Conditions, Equivalent length, Euler and Rankine's formula

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.

TOTAL PERIODS: 60

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.

CO2 : Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.

CO3 : Apply basic equation of torsion in designing of shafts and helical springs.

CO4 : Calculate slope and deflection in beams using different methods.

CO5 : Analyze thin and thick shells for applied pressures.

TEXT BOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand& company Ltd., New Delhi, 7th edition, 2018.
2. Bansal, R.K., "Strength of Materials", 6th edition, Laxmi Publications (P) Ltd., 2022.

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. Ramamurtham S and R Narayanan., "Strength of Materials", Dhanpat Rai publishing company, 2020.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1							2	3	2	1
CO2	3	3	2	2	1							2	3	2	1
CO3	3	3	3	2	2							2	3	2	1
CO4	3	3	3	3	2							2	3	2	1
CO5	3	3	2	2	2							2	3	2	1
Avg.	3	3	2.4	2.2	1.6							2	3	2	1

1 - Low, 2 - Medium, 3 - High

ME24404	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
➢ To provide the knowledge on the working principles of fluid power systems.
➢ To study the fluids and components used in modern industrial fluid power system.
➢ To develop the design, construction and operation of fluid power circuits.
➢ To learn the working principles of pneumatic power system and its components.
➢ To provide the knowledge of trouble shooting methods in fluid power systems.

UNIT I   FLUID POWER SYSTEMS   9
Introduction to Fluid power –Applications – Fluid power systems – Types of fluids Properties of fluids and selection – Basics of Hydraulics –Principles of flow Friction loss–Work, Power and Torque Problems, Sources of Hydraulic power: Pumping Theory Various pumps, Selection criteria of pumps –Fixed and Variable displacement pumps – Problems.

UNIT II   HYDRAULIC ACTUATORS AND CONTROL COMPONENTS   9
Hydraulic Actuators: Cylinders –Application, Hydraulic cushioning – Rotary ActuatorsHydraulic motors Control Components: Direction Control, Flow control and pressure control valves – Servo and Proportional valves–Applications–Accessories: Reservoirs, Pressure Switches – Filters –types and selection Applications – Fluid Power ANSI Symbols – Problems.

UNIT III   HYDRAULIC CIRCUITS AND SYSTEMS   9
Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, DoublePump, Pressure Intensifier, Air over oil, Sequence, Reciprocation, Synchronization, FailSafe, Speed Control. Deceleration circuits, Sizing of hydraulic systems, Hydrostatic transmission, Electro hydraulic circuits – Mechanical, hydraulic servo systems.

UNIT IV   PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS   9
Properties of air –Air preparation and distribution – FRL, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit –classification single cylinder and multi cylinder circuits Cascade method –Integration of fringe circuits, Electro Pneumatic System – Elements – Ladder diagram – timer circuits Problems, Introduction to fluidics and pneumatic logic circuits.

UNIT V   TROUBLE SHOOTING AND APPLICATIONS   9
Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Conditioning of hydraulic fluids Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications mobile hydraulics; Design of Pneumatic circuits for metal working, handling, clamping counter and timer circuits. – Low cost Automation – Hydraulic and Pneumatic power packs, IOT in Hydraulics and pneumatics.
Note: (Use of standard Design Data Book is permitted in the University Examination)
TOTAL PERIODS: 45

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Understand the concepts and applications of fluid power systems and operation of different types of pumps

CO2 : Summarize the features and functions of Hydraulic motors, control components and servo, proportional valves.

CO3 : Operate and control the different types of hydraulic circuits and systems.

CO4 : Operate and control the different types of pneumatic circuits, electro pneumatic system and pneumatic logic circuits.

CO5 : Understand the designing and layout of circuits, hydraulic power package and trouble shooting.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Prentice Hall, 2009.
2. James A. Sullivan, "Fluid Power Theory and Applications", Fourth Edition, Prentice Hall, 1997

REFERENCES:

1. Majumdar, S.R., "Oil Hydraulics Systems – Principles and Maintenance" TataMcGraw Hill, 2001.
2. Shanmugasundaram.K., "Hydraulic and Pneumatic Controls". Chand & Co, 2006.
3. Srinivasan.R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints, 3rd edition,2019.
4. Jagadeesha. T., "Pneumatics Concepts, Design and Applications ", Universities Press, 2015.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1		2	1				1	1			1
CO2	3	1	1	1					2		2	1	1	2	2
CO3	3	1	2	2					3		2	1	2	3	1
CO4	3	1	2	1	1				2			1	3	2	1
CO5	3	2	2	1			2		3	1	3	2	2	3	3
Avg	3	1.2	1.6	1.2	1	2	1.5		2.5	1	2	1.2	2	2.5	1.6

==1 - Low, 2 - Medium, 3 - High==

ME24405	MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

The students can be able to

- ➢ Understand the mechanism of chip formation in machining.
- ➢ Describe the basic principles of machine tools and processes.
- ➢ Elaborate principle of gear generation abrasive and finishing operations.
- ➢ Familiarize the students with constructional features of CNC machine tools
- ➢ Gain knowledge on manual part program and generation of CNC part program using CAM packages

UNIT I   METAL CUTTING   9

Mechanics of metal cutting –cutting tool nomenclature cutting tool materials, temperature, wear, and tool life considerations, geometry and chip formation, surface finish, cutting fluids and machinability.

UNIT II   BASIC MACHINE TOOLS   9

Lathe and its types   Constructional details including accessories and attachments, operations, types of lathe, Constructional and operational details of Shaping   Planning   Slotting – Drilling Boring – Reaming – Tapping – Broaching Milling Cutters   Milling operations   Indexing.

UNIT III   GEAR GENERATION AND ABRASIVE MACHINING PROCESSES   9

Gear generating principles Gear Hobber Gear finishing methods Bevel gear generator Operations and applications of surface, cylindrical and centreless grinding processes, dressing, truing and balancing of grinding wheels, grading and selection of grinding wheels, micro finishing (honing, lapping, super finishing).

UNIT IV   CNC MACHINES AND PROGRAMMING   9

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – Interchangeable tooling system – preset & qualified tools Machining center – Turning center – CNC EDM CNC wire cut EDM. Coordinates, axis and motion, 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.

UNIT V   SOLID STATE PROCESSING   9

Introduction to powder metallurgy, Powder manufacture Mechanical methods –chemical methods and Physical methods, powder conditioning, heat treatment, blending and mixing, types of mixing and Blending, Powder Compaction sintering. Additive manufacturing Need Development of AM systems – Principles of 3D printing/Rapid prototyping types: FDM, SLA, SLS, Binder Jetting Design for Additive Manufacturing (DFAM).

TOTAL PERIODS: 45

LIST OF EXPERIMENTS:
1. Determination of cutting force measurement using Lathe Tool / Milling Tool Dynamometer.
2. Machining a V block by using shaper.
3. Machining a keyway by using slotting machine.
4. Milling contours on plates using vertical milling machine.
5. Gear cutting using milling and gear hobbing machines.
6. Grinding components using cylindrical /centreless grinding machine and surface grinding machine.
7. CNC Machining centre
   i) Linear cutting,
   ii) Circular cutting, Canned cycle operations, and
   iii) Drilling and Tapping.
8. CNC Turning centre
   i) Straight, taper and radial turning,
   ii) Thread cutting,
   iii) Rough and finishing cycle.

TOTAL PERIODS: 30

COURSE OUTCOMES

At the end of the course the students would be able to
CO1 : Apply the mechanism of chip formation in machining identify the factors involved in improving machinability.
CO2 : Understand the various machining processes such as turning, drilling, boring, shaping, slotting, broaching and milling.
CO3 : Describe the principle of gear generation and abrasive finishing processes.
CO4 : Acquire knowledge on constructional features of CNC machine tools and identify drives and axis measuring system used in CNC machine tools.
CO5 : Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

TEXT BOOKS:
1. Serope Kalpakjian; Steven R. Schmid (2014), Manufacturing Engineering and Technology, 7th Edition, Publisher: Prentice Hall, ISBN10 0136081681, ISBN 9789810694067.
2. Michael Fitzpatrick, Machining and CNC Technology, McGrawHill Education; 4th edition, 2018.

REFERENCES:
1. P.N.Rao, Manufacturing Technology, McGraw Hill Education, New Delhi, 2013.
2. R.K. Rajput, A Textbook of Manufacturing Technology, Laxmi publications, New Delhi, 2015.
3. A. B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.
4. Peter Smid, CNC Programming Handbook, Industrial Press Inc.;Third edition, 2007.
5. P.N.Rao, CAD/CAM: Principles and Applications3rd Edition, Tata McGraw Hill, India, 2010.
6. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.

CO-PO MAPPING

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

ME24406	THERMAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:
- ➤ To study the valve and port timing diagram and performance characteristics of IC engines.
- ➤ To study the Performance of refrigeration cycle / components.
- ➤ To study the Performance and Energy Balance Test on a Steam Generator

PART I   **IC ENGINES LABORATORY**   **45**
LIST OF EXPERIMENTS:
1. Valve Timing and Port Timing diagrams.
2. Actual pv diagrams of IC engines.
3. Performance Test on four – stroke Diesel Engine.
4. Heat Balance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi Cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Determination of p-θ diagram and heat release characteristics of an IC engine.
8. Determination of Flash Point and Fire Point of various fuels / lubricants
9. Performance test on a two stage Reciprocating Air compressor
10. Determination of COP of a Refrigeration system.

PART II   **STEAM LABORATORY**   **15**
LIST OF EXPERIMENTS:
1. Study of Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

TOTAL PERIODS: 60

COURSE OUTCOMES
At the end of the course the students would be able to:
    CO1 : Construct the valve timing and port timing diagram of IC engines.
    CO2 : Evaluate the performance of IC engines.
    CO3 : Identify the performance of refrigeration cycle.
    CO4 : Evaluate the performance of reciprocating air compressor and determine properties of various fuels.
    CO5 : Evaluate the performance and energy balance on a Steam Generator and steam Turbine.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1					2	2		3	1	2
CO2	3	3	3	3	1					2	2	2	3	1	2
CO3	3	3	3	3	1					2	1	2	3	1	2
CO4	3	3	3	3	1					1	2	2	3	1	2
CO5	3	3	3	3	1					2	2	1	3	1	2
Avg.	3	3	3	2.8	1					1.8	1.8	1.75	3	1	2

1 - Low, 2 - Medium, 3 - High

ME24407	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:
- ➢ To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- ➢ To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS
1. Tension test on mild steel rod.
2. Izod Impact test on mild steel.
3. Charpy Impact test on mild steel.
4. Torsion test on mild steel rod.
5. Deflection test on beams.
6. Compression test on open coiled helical spring.
7. Tensile test on closed coiled helical spring.
8. Rockwell hardness test on metal.
9. Brinell hardness test on metal.
10. Double shear test on Mild steel and Aluminium rods.

TOTAL PERIODS: 60

COURSE OUTCOMES
On completion of the course, the student is expected to be able to
CO1 : Perform tensile and double shear tests on metals to evaluate strength and failure modes.
CO2 : Conduct impact and torsion tests on mild steel to assess toughness and shear behavior.
CO3 : Analyze deflection in beams and springs and evaluate hardness of metals.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PsO1	PSO2	PSO3
CO1	3	3	2	3	2						1	2	3	3	
CO2	3	3	2	3	2						1	2	3	3	
CO3	3	2	2	2	3						1	2	2	3	2
Avg.	3	2.7	2	2.7	2.3						1	2	2.7	3	2

<mark>1 - Low, 2 - Medium, 3 - High</mark>