ARUNAI

Engineering College

Tiruvannamalai,Tamil Nadu

AN AUTONOMOUS INSTITUTION

DEPARTMENT OF MECHANICAL ENGINEERING

B.E-Mechanical Engineering

Regulation 2024

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABUS

ARUNAI ENGINEERING COLLEGE

(An Autonomous Institution)

Affiliated to Anna University Chennai

DEPARTMENT OF MECHANICAL ENGINEERING
REGULATION 2024
CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABUS

DEPARTMENT VISION:

- To produce multi-skilled and ethical Mechanical Engineers with global perspectives and National ethos.
- To serve the needs of the National and International Industries.
- To impart training and technology transfer appropriate to the rural areas and industries.

DEPARTMENT MISSION:

- Providing suitable teaching methods and adequate high quality focused education in thrust areas of Mechanical Engineering like Energy, Materials and CAE.
- Training in problem solving, assisting in analytical skills and developing technical competence with practical exposure to the students to meet the challenges of new millennium.

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

PEO3: Contribute towards technological development through academic research and industrial practices.

PEO4: Practice their profession with good communication, leadership, ethics and social responsibility.

PEO5: Graduates will adapt to evolving technologies through life-long learning.

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PROGRAMME OUTCOMES (POS):

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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Washington Accord Knowledge and Attitude Profile (WKs)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Design components of products and development systems using CAD/CAM/CAE tools.

PSO2: Provide manufacturing solutions, including material, process (es), process plans and inspect products and their components.

PSO3: Design and analysis heat power (thermal) devices/system. Develop simulation models of thermal and manufacturing systems using computer aided analysis tools.

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ARUNAI ENGINEERING COLLEGE

(AUTONOMOUS)

TIRUVANNAMALAI

REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

B.E. MECHANICAL ENGINEERING

CURRICULUM AND SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	IP24101	Induction Programme	-	-	-	-	-	0
THEORY								
2	HS24101	Professional English-I	HSMC	3	0	0	3	3
3	MA24101	Matrices and Calculus	BSC	3	1	0	4	4
4	PH24101	Engineering Physics	BSC	3	0	0	3	3
5	CY24101	Engineering Chemistry	BSC	3	0	0	3	3
6	GE24101	Problem Solving and Python Programming	ESC	3	0	0	3	3
7	GE24102	Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8	GE24111	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9	BS24111	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10	GE24112	English Laboratory($)	EEC	0	0	2	2	1
TOTAL				**16**	**1**	**10**	**27**	**22**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS24201	Professional English - II	HSMC	2	0	0	2	2
2	MA24201	Statistics and Numerical Methods	BSC	3	1	0	4	4
3	PH24201	Materials Science	BSC	3	0	0	3	3
4	BE24201	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
5	GE24201	Engineering Graphics	ESC	2	0	4	6	4
6	GE24202	Tamils and Technology	HSMC	1	0	0	1	1
7		NCC Credit Course Level 1(#)	-	2	0	0	2	2
PRACTICALS								
8	GE24211	Engineering Practices Laboratory	ESC	0	0	4	4	2
9	BE24212	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2

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10	GE24212	Communication Laboratory / Foreign Language ($)	EEC	0	0	4	4	2
TOTAL				**14**	**1**	**16**	**31**	**23**

 # NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

$ Skill Based Course

SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA24303	Fourier Series And Boundary Value Problems	BSC	3	1	0	4	4
2.	ME24301	Engineering Mechanics	ESC	3	0	0	3	3
3.	ME24302	Engineering Thermodynamics	PCC	3	0	0	3	3
4.	ME24303	Fluid Mechanics and Machinery	ESC	3	1	0	4	4
5.	ME24304	Engineering Materials and Metallurgy	PCC	3	0	0	3	3
6.	ME24305	Manufacturing Technology-I	PCC	3	0	0	3	3
PRACTICALS								
7.	ME24311	Computer Aided Machine Drawing Laboratory	ESC	0	0	4	4	2
8.	ME24312	Manufacturing Technology Laboratory	PCC	0	0	4	4	2
9.	GE24903	Professional Development	EEC	0	0	2	2	1
		TOTAL		**18**	**2**	**10**	**30**	**25**

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA24404	Probability And Linear Programming Problems	BSC	3	1	0	4	4
2.	ME24401	Mechanics of Machines	PCC	3	0	0	3	3
3.	ME24402	Thermal Engineering	PCC	4	0	0	4	3
4.	ME24403	Strength of Materials for Mechanical Engineers	PCC	3	0	0	3	3
5.	ME24404	Manufacturing Technology-II	PCC	3	0	0	3	3
6.	GE24901	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
PRACTICALS								
7.	ME24411	Strength Materials and Fluid Mechanics Laboratory	PCC	0	0	4	4	2
8.	ME24412	Thermal Engineering Laboratory	PCC	0	0	4	4	2
9.	ME24413	Kinematics and Dynamics Laboratory	PCC	0	0	4	4	2
		TOTAL		**18**	**1**	**12**	**31**	**24**

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SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24501	Design of Machine Elements	PCC	4	0	0	4	4
2.	ME24502	Metrology and Measurements	PCC	3	0	0	3	3
3.	GE24902	Human Values and Ethics	HSMC	2	0	0	2	2
4.		Professional Elective -I	PEC	3	0	0	3	3
5.		Professional Elective –II	PEC	3	0	0	3	3
6.		Open Elective – I	OEC	3	0	0	3	3
7.		Mandatory Course-I	MC	3	0	0	3	0
PRACTICALS								
8.	ME24511	Metrology and Measurements laboratory	PCC	0	0	4	4	2
9.	ME24512	Summer Internship	EEC	0	0	0	0	1
			TOTAL	**21**	**0**	**4**	**25**	**21**

SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	ME24601	Heat and Mass Transfer	PCC	3	1	0	4	4
2	ME24602	Fluid Power Engineering	PCC	3	0	0	3	3
3		Professional Elective -III	PEC	3	0	0	3	3
4		Professional Elective – IV	PEC	3	0	0	3	3
5		Professional Elective – V	PEC	3	0	0	3	3
6		Open Elective-II	OEC	3	0	0	3	3
7		Mandatory Course-II	MC	3	0	0	3	0
PRACTICALS								
8.	ME24611	Heat and Mass Transfer Laboratory	PCC	0	0	4	4	2
9.	ME24612	CAD/CAM Laboratory	PCC	0	0	4	4	2
			TOTAL	**21**	**1**	**8**	**30**	**23**

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SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	ME24701	Mechatronics and IoT	PCC	3	0	0	3	3
2	ME24702	Computer Integrated Manufacturing	PCC	3	0	0	3	3
3		Professional Elective-VI	PEC	3	0	0	3	3
4		Professional Elective-VII	PEC	3	0	0	3	3
5		Open Elective-III	OEC	3	0	0	3	3
PRACTICALS								
6	ME24711	Mechatronics and IoT Laboratory	PCC	0	0	4	4	2
7	ME24712	Simulation and Analysis Laboratory	PCC	0	0	4	4	2
			TOTAL	**15**	**0**	**8**	**23**	**19**

SEMESTER VIII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24811	Project Work	EEC	0	0	20	20	10
			TOTAL	**0**	**0**	**20**	**20**	**10**

TOTAL CREDITS :167

SUMMARY

Name of the Programme: B.E. MECHANICAL ENGINEERING										
S.No	**Subject Area**	**Credits per Semester**								**Total Credits**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	
1	**HSMC**	**4**	**3**			**2**				**9**
2	**BSC**	**12**	**7**	**4**	**6**					**29**
3	**ESC**	**5**	**11**	**9**						**25**
4	**PCC**			**11**	**18**	**9**	**11**	**10**		**59**
5	**PEC**					**6**	**9**	**6**		**21**
6	**OEC**					**3**	**3**	**3**		**9**
7	**EEC**	**1**	**2**	**1**		**1**			**10**	**15**
8	**Non-Credit /(Mandatory)**					√	√			
Total		**22**	**23**	**25**	**24**	**21**	**23**	**19**	**10**	**167**

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MANDADTORY COURSE - I

.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MX24101	Introduction to women and gender studies	MC	3	0	0	3	0
2	MX24102	Elements of literature	MC	3	0	0	3	0
3	MX24103	Disaster risk reduction and management	MC	3	0	0	3	0
4	MX24104	History of science and technology in india	MC	3	0	0	3	0
5	MX24105	State, nation building and politics in india	MC	3	0	0	3	0
6	MX24106	Political and economic thought for a humane society	MC	3	0	0	3	0
7	MX24107	Understanding Society & Culture through Lireature	MC	3	0	0	3	0
8	MX24108	Work Ethics & Social Responsibilty	MC	3	0	0	3	0
9	MX24109	Technology & Society	MC	3	0	0	3	0
10	MX24110	Social Innovation & Entrepreneurship	MC	3	0	0	3	0
11	MX24111	Education & Social Change	MC	3	0	0	3	0

MANDADTORY COURSE - II

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MX24201	Industrial Safety	MC	3	0	0	3	0
2	MX24202	Well Being with Traditional Practices - Yoga, Ayurveda and siddha	MC	3	0	0	3	0
3	MX24203	Application of Psychology in Everyday Life	MC	3	0	0	3	0
4	MX24204	Stress Management & Well Being	MC	3	0	0	3	0
5	MX24205	Health & WellBeing in Education	MC	3	0	0	3	0
6	MX24206	Physical fitness & Mental Resilience	MC	3	0	0	3	0
7	MX24207	Food, Nutrition and Health	MC	3	0	0	3	0
8	MX24208	Life style diseases	MC	3	0	0	3	0

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PROFESSIONAL ELECTIVE COURSES VERTICALS

VERTICAL 1	VERTICAL 2	VERTICAL 3	VERTICAL 4	VERTICAL 5	VERTICAL 6	VERTICAL 7
Advanced Mechanical Design and Analysis	**Manufacturing and Materials Engineering**	**Automotive and Energy Engineering**	**Emerging Technologies**	**Advanced Manufacturing and Industry 4.0**	**Diversified Courses Group 1**	**Diversified Courses Group 2**
Design of Transmission System	Production Planning and Control	Automobile Engineering	Value Engineering	Digital Manufacturing and IoT	Product Life Cycle Management	Mechanical Vibration
Design of Jigs, Fixtures And Press Tools	Process Planning and Cost Estimation	Power Plant Engineering	Robotics	Energy Conservation In Industries	New Product Development	Electrical Drives and Control
Power Generation Equipment Design	Material Handling and Solid Processing Equipment	Gas Dynamics And Jet Propulsion	Composite Materials and Mechanics	Lean Manufacturing	Principles of Management	Micro Electro Mechanical System
Design Concepts In Engineering	Surface Engineering	Advanced Internal Combustion Engineering	Non Destructive Testing And Evaluation	Green Supply Chain Management	Engineering Economics and Financial Accounting	Operation Research
Design of Pressure Vessels	Casting and Welding Processes	Hybrid and Electric Vehicle Technology	Nano Materials Nano Technology	Additive Manufacturing	Intellectual Property Rights	Energy Technology
Finite Element Analysis	Materials Testing and Characterization Techniques	Thermal Power Engineering	Renewable Energy Technologies	Fundamental of Industry 4.O	Entrepreneurship and Development	Computational Fluid Dynamics
-	-	-	-	Non-Traditional Machining Processes	-	Total Quality Management

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (rowwise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Mino degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2024.

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PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL1 : ADVANCED MECHANICAL DESIGN AND ANALYSIS

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24001	Design of Transmission System	PEC	3	0	0	3	3
2.	ME24002	Design of Jigs, Fixtures And Press Tools	PEC	3	0	0	3	3
3.	ME24003	Power Generation Equipment Design	PEC	3	0	0	3	3
4.	ME24004	Design Concepts In Engineering	PEC	3	0	0	3	3
5.	ME24005	Design of Pressure Vessels	PEC	3	0	0	3	3
6.	ME24006	Finite Element Analysis	PEC	3	0	0	3	3

VERTICAL 2: MANUFACTURING AND MATERIALS ENGINEERING

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24007	Production Planning and Control	PEC	3	0	0	3	3
2.	ME24008	Process Planning and Cost Estimation	PEC	3	0	0	3	3
3.	ME24009	Material Handling and Solid Processing Equipment	PEC	3	0	0	3	3
4.	ME24010	Surface Engineering	PEC	3	0	0	3	3
5.	ME24011	Casting and Welding Processes	PEC	3	0	0	3	3
6.	ME24012	Materials Testing and Characterization Techniques	PEC	3	0	0	3	3

VERTICAL 3: AUTOMOTIVE AND ENERGY ENGINEERING

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24013	Automobile Engineering	PEC	3	0	0	3	3
2.	ME24014	Power Plant Engineering	PEC	3	0	0	3	3
3.	ME24015	Gas Dynamics And Jet Propulsion	PEC	3	0	0	3	3
4.	ME24016	Advanced Internal Combustion Engineering	PEC	3	0	0	3	3
5.	ME24017	Hybrid and Electric Vehicle Technology	PEC	3	0	0	3	3
6.	ME24018	Thermal Power Engineering	PEC	3	0	0	3	3

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VERTICAL 4: EMERGING TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24019	Value Engineering	PEC	3	0	0	3	3
2.	ME24020	Robotics	PEC	3	0	0	3	3
3.	ME24021	Composite Materials and Mechanics	PEC	3	0	0	3	3
4.	ME24022	Non Destructive Testing And Evaluation	PEC	3	0	0	3	3
5.	ME24023	Nano Materials Nano Technology	PEC	3	0	0	3	3
6.	ME24024	Renewable Energy Technologies	PEC	3	0	0	3	3

VERTICAL 5: ADVANCED MANUFACTURING AND INDUSTRY 4.0

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24025	Digital Manufacturing and IoT	PEC	3	0	0	3	3
2.	ME24026	Energy Conservation In Industries	PEC	3	0	0	3	3
3.	ME24027	Lean Manufacturing	PEC	3	0	0	3	3
4.	ME24028	Green Supply Chain Management	PEC	3	0	0	3	3
5.	ME24029	Additive Manufacturing	PEC	3	0	0	3	3
6.	ME24030	Fundamental of Industry 4.O	PEC	3	0	0	3	3
7.	ME24031	Non-Traditional Machining Processes	PEC	3	0	0	3	3

VERTICAL 6: DIVERSIFIED COURSES GROUP 1

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24032	Product Life Cycle Management	PEC	3	0	0	3	3
2.	ME24033	New Product Development	PEC	3	0	0	3	3
3.	ME24034	Principles of Management	PEC	3	0	0	3	3
4.	ME24035	Engineering Economics and Financial Accounting	PEC	3	0	0	3	3
5.	ME24036	Intellectual Property Rights	PEC	3	0	0	3	3
6.	ME24037	Entrepreneurship and Development	PEC	3	0	0	3	3

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VERTICAL 7: DIVERSIFIED COURSES GROUP 2

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME24038	Mechanical Vibration	PEC	3	0	0	3	3
2.	ME24039	Electrical Drives and Control	PEC	3	0	0	3	3
3.	ME24040	Micro Electro Mechanical System	PEC	3	0	0	3	3
4.	ME24041	Operation Research	PEC	3	0	0	3	3
5.	ME24042	Energy Technology	PEC	3	0	0	3	3
6.	ME24043	Computational Fluid Dynamics	PEC	3	0	0	3	3
7.	ME24044	Total Quality Management	PEC	3	0	0	3	3

OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

OPEN ELECTIVE I (EMERGING TECHNOLOGIES)

To be offered other than Faculty of Information and Communication Engineering

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	OCS2401	Artificial Intelligence and Machine Learning fundamentals	OEC	2	0	2	4	3
2	OCS2402	Data science fundamentals	OEC	2	0	2	4	3
3	OCS2403	Augmented Reality/ Virtual Reality	OEC	2	0	2	4	3
4	OCS2404	IOT and its applications	OEC	2	0	2	4	3
5	OCS2405	Deep Learning Techniques	OEC	2	0	2	4	3
6	OEC2401	Introduction to ASIC design	OEC	2	0	2	4	3
OPEN ELECTIVE II (INDUSTRIAL)								
1	OME2401	Applied design thinking	OEC	3	0	0	3	3
2	OME2402	Introduction to industrial automation systems	OEC	3	0	0	3	3
3	OME2403	Industrial Management	OEC	3	0	0	3	3
4	OME2404	Quality Engineering	OEC	3	0	0	3	3
5	OME2405	Sustainable Manufacturing	OEC	3	0	0	3	3
6	OME2406	Industrial design and rapid prototyping techniques	OEC	3	0	0	3	3
7	OEE2401	Industrial IOT and industry 4.0	OEC	3	0	0	3	3
8	OEC2402	Robotics and Industrial Automation	OEC	3	0	0	3	3

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OPEN ELECTIVE III (OTHER DEPARTMENT)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	OAG2401	Urban agriculture	OEC	3	0	0	3	3
2	OAG2402	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3
3	OBT2401	Basics of Biomolecules	OEC	3	0	0	3	3
4	OBT2402	Basics of Microbial Technology	OEC	3	0	0	3	3
5	OBT2403	Biotechnology for Waste Management	OEC	3	0	0	3	3
6	OBT2404	Food Processing Technology	OEC	3	0	0	3	3
7	OEC2403	VLSI Design	OEC	3	0	0	3	3
8	OEC2404	Remote Sensing Concepts	OEC	3	0	0	3	3
9	OEC2405	Drone technologies	OEC	3	0	0	3	3
10	OEE2402	Baiscs of Electric Vehicle Technology	OEC	3	0	0	3	3
11	OEE2403	Introduction To Control Systems	OEC	3	0	0	3	3
12	OEE2404	Integrated energy planning for sustainable development	OEC	3	0	0	3	3
13	OHS2401	Nano technology	OEC	3	0	0	3	3
14	OHS2402	Operations research	OEC	3	0	0	3	3
15	OME2407	Additive Manufacturing	OEC	3	0	0	3	3

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Subject Code	Subject Name	Category	L	T	P	C
IP24101	INDUCTION PROGRAMME		0	0	0	0

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character''.

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) (ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

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(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering /Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References: Guide to Induction program from AICTE

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Subject Code	Subject Name	Category	L	T	P	C
HS24101	PROFESSIONAL ENGLISH- I	HSMC	3	0	0	3

Course Objectives:

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs,

UNIT – I	INTRODUCTION TO EFFECTIVE COMMUNICATION	1

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

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 A PROCESS / PRODUCT	9

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

UNIT – IV	CLASSIFICATION AND RECOMMENDATIONS	9

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

UNIT – V	EXPRESSION	9

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

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	To use appropriate words in a professional context.
CO2	To gain understanding of basic grammatical structures and use them in right context.
CO3	To read and infer the denotative and connotative meanings of technical texts
CO4	To read and interpret information presented in tables, charts and other graphic forms.
CO5	To write definitions, descriptions, narrations and essays on various topics.

Textbooks:

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

Reference books/other materials/web resources:

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 Viswamohan, 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											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO2	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO3	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO4	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO5	2	3	3	3	-	3	3	2	3	-	3	-	-	-
Average:	1.6	2.2	1.8	2.2	1.5	3	3	1.6	3	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
MA24101	MATRICES AND CALCULUS	BSC	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 make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT – I	MATRICES	9+3

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

UNIT – II	DIFFERENTIAL CALCULUS	9+3

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	INTEGRAL CALCULUS	9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT – V	MULTIPLE INTEGRALS	9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use the matrix algebra methods for solving practical problems.
CO2	Apply differential calculus tools in solving various application problems.
CO3	Able to use differential calculus ideas on several variable functions.
CO4	Apply different methods of integration in solving practical problems.
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.

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Textbooks:	
1.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition,2018.
3.	James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].
Reference books/other materials/web resources:	
1.	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4.	Narayanan. S. and Manicavachagom Pillai: T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6.	Srimantha Pal and Bhunia. S.C, "Engineering Mathematics" Oxford University Press, 2015.
7.	Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus ", 14th Edition, Pearson India, 2018.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	0	0	0	2	0	2	3	-	-	-
Average:	3	3	1	1	0	0	0	2	0	2	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
PH24101	ENGINEERING PHYSICS	BSC	3	0	0	3

Course Objectives:

- To make the students effectively to 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 be 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 system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum – Introduction to nonlinear oscillations.

UNIT – II	ELECTROMAGNETIC WAVES	9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum 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 - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT – V	APPLIED QUANTUM MECHANICS	9

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

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the importance of mechanics.
CO2	Express their knowledge in electromagnetic waves.
CO3	Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4	Understand 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.
Reference books/other materials/web resources:	
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.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5.	N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag,2012.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1	-	-	-	-	-			
CO2	3	3	2	1	2	1	-	-	-	-	-			
CO3	3	3	2	2	2	1	-	-	-	-	1			
CO4	3	3	1	1	2	1	-	-	-	-	-			
CO5	3	3	1	1	2	1	-	-	-	-	-			
Average:	3	3	1.6	1.2	1.8	1	-	-	-	-	1			

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Subject Code	Subject Name	Category	L	T	P	C
CY24101	ENGINEERING CHEMISTRY	BSC	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, flouride 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, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT – III	PHASE RULE AND COMPOSITES	9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT – IV	FUELS AND COMBUSTION	9

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

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

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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. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles – working principles; Fuel cells: H2-O2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2	To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3	To apply the knowledge of phase rule and composites for material selection requirements.
CO4	To recommend suitable fuels for engineering processes and applications.
CO5	To 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.

Reference books/other materials/webresources:	
1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2.	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4.	ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	1	-	-	-	-	1			
CO2	2	-	-	1	-	2	-	-	-	-	-			
CO3	3	1	-	-	-	-	-	-	-	-	-			
CO4	3	1	1	-	-	1	-	-	-	-	-			
CO5	3	1	2	1	-	2	-	-	-	-	2			
Average:	2.8	1.3	1.6	1	-	1.5	-		-	-	1.5			

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Subject Code	Subject Name	Category	L	T	P	C
GE24101	PROBLEM SOLVING AND PYTHON PROGRAMMING	ESC	3	0	0	3

Course Objectives:

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

UNIT – I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9

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

UNIT – II	DATA TYPES, EXPRESSIONS, STATEMENTS	9

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

UNIT – III	CONTROL FLOW, FUNCTIONS, STRINGS	9

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

UNIT – IV	LISTS, TUPLES, DICTIONARIES	9

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

UNIT – V	FILES, MODULES, PACKAGES	9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should 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 looping for solving problems.
CO4	Decompose a Python program into functions.
CO5	Represent compound data using Python lists, tuples, dictionaries etc.
CO6	Read and write data from/to files in Python programs.

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Textbooks:	
1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "*Python for Programmers*", 1st Edition, Pearson Education, 2021.
2.	G. Venkatesh and MadhavanMukund, "*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*", 3rd 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.	Martin C. Brown, "*Python: The Complete Reference*", 4th Edition, McGraw-Hill, 2018.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	2	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	2	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
Average:	2.4	2.6	1.8	2.2	1.8	-	-	-	-	1.6	2	2.8	3	

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Subject Code	Subject Name	Category	L	T	P	C
GE24102	தமிழர் மரபு (HERITAGE OF TAMILS)	HSMC	1	0	0	1

UNIT – I	**LANGUAGE AND LITERATURE**	**3**
Language Families in India - Dravidian Languages – Tamil as aClassical 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 Nayanmarş - 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 THE 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 Contact Hours : 15

Text – Cum Reference books/other materials/web resources:

1. தமிழக வரலாறு – மக்களும்பண்பாடும் – க.க. பிள்ளை (தொகுப்பு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முனைவர் இள. சுந்தரம் (விகடன்பிரசுரம்).
3. கீழடி – வழிகாட்டும் நிழல்களில் சங்ககால நகர நாகரிகம் (தொகுப்பு: தொல்லியல் துறை, தமிழ்நாடு அரசு).
4. பொருநை – ஆற்றங்கரையிலான நாகரிகம் (தொகுப்பு: தொல்லியல்துறை, தமிழ்நாடு அரசு).
5. *Social Life of Tamils* – Dr. K.K. Pillay (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).

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8.	*The Contributions of the Tamils to Indian Culture* – Dr. M. Valarmathi (Published by: International Institute of Tamil Studies).
9.	*Keeladi: Sangam City Civilization on the Banks of River Vaigai* (Joint Publication: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation).
10.	*Studies in the History of India with Special Reference to Tamil Nadu* – Dr. K.K. Pillay (Published by: The Author).
11.	*Porunai Civilization* (Joint Publication: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation).
12.	*Journey of Civilization: Indus to Vaigai* – R. Balakrishnan (Published by: RMRL) – Reference Book.

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Subject Code	Subject Name	Category	L	T	P	C
GE24102	தமிழர் மரபு (HERITAGE OF TAMILS)	HSMC	1	0	0	1

அலகு- 1	மொழி மற்றும் இலக்கியம்	3

இந்திய மொழிக்குடும்பங்கள்– திரொவிடமொழிகள்– தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச்சார்பற்றதன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் –தமிழ்க்காப்பியங்கள் , தமிழகத்தில் சமண-பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள்– சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

அலகு- 2	மரபு பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை சிற்பக்கலை	3

நடுகல் முதல் நவீன சிற்பங்கள் வரை– ஐம்பொன்சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள் , பொம்மைகள் – தேர்வு செய்யும்கலை– சுடுமண்சிற்பங்கள்– நாட்டுப்புறத்தெய்வங்கள்– குமரிமுனையில்திருவள்ளுவர்சிலை– இசைகருவிகள்– மிருதங்கம் , பறை , வீணை , யாழ் , நாதஸ்வரம்– தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு- 3	நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள்	3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம் , தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்விளையாட்டுகள்.

அலகு- 4	தமிழர்களின் திணைக்கோட்பாடுகள்	3

தமிழகத்தின் தாவரங்களும் , விலங்குகளும்- தொல்காப்பியம் மற்றும் சங்கஇலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள்- தமிழர்கள் போற்றிய அறக்கோட்பாடு- சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும்- சங்ககாலநகரங்களும் துறைமுகங்களும்- சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி- கடல் கடந்தநாடுகளில் சோழர்களின் வெற்றி

அலகு- 5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு- இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம்- சுயமரியாதையை இயக்கம்- இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு- கல்வெட்டுகள் கையழுத்துப்படிகள்- தமிழ் புத்தகங்களின் அச்சுவரலாறு

Total Contact Hours : 15

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Text – Cum Reference books/other materials/web resources:	
1.	**தமிழக வரலாறு – மக்களும்பண்பாடும்** – க.க. பிள்ளை (தொகுப்பு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	**கணினித்தமிழ்** – முனைவர் இள. சுந்தரம் (விகடன்பிரசுரம்).
3.	**கீழடி – வழிகாட்டும் நிழல்களில் சங்ககால நகர நாகரிகம்** (தொகுப்பு: தொல்லியல் துறை, தமிழ்நாடு அரசு).
4.	**பொருநை – ஆற்றங்கரையிலான நாகரிகம்** (தொகுப்பு: தொல்லியல்துறை, தமிழ்நாடு அரசு).
5.	*Social Life of Tamils* – Dr. K.K. Pillay (Joint Publication of TNTB&ESC and RMRL – in print).
6.	*Social Life of the Tamils – The Classical Period* – Dr. S. Singaravelu (Published by: International Institute of Tamil Studies).
7.	*Historical Heritage of the Tamils* – Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu (Published by: International Institute of Tamil Studies).
8.	*The Contributions of the Tamils to Indian Culture* – Dr. M. Valarmathi (Published by: International Institute of Tamil Studies).
9.	*Keeladi: Sangam City Civilization on the Banks of River Vaigai* (Joint Publication: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation).
10.	*Studies in the History of India with Special Reference to Tamil Nadu* – Dr. K.K. Pillay (Published by: The Author).
11.	*Porunai Civilization* (Joint Publication: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation).
12.	*Journey of Civilization: Indus to Vaigai* – R. Balakrishnan (Published by: RMRL) – Reference Book.

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Subject Code	Subject Name	Category	L	T	P	C
GE24111	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	ESC	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.

EXPERIMENTS:

Note:

The examples suggested in each experiment are only indicative.
The lab instructor is expected to design other problems on similar lines.
The Examination shall not be restricted to the sample experiments listed here.

EXPERIMENTS	LABORATORY / PRACTICAL ACTIVITIES	60

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 Contact Hours : 60

Course Outcomes:	Upon completion of the course students should 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	Deploy functions to decompose a Python program.
CO5	Process compound data using Python data structures.
CO6	Utilize Python packages in developing software applications.

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Textbooks:	
1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "*Python for Programmers*", 1st Edition, Pearson Education, 2021.
2.	G. Venkatesh and MadhavanMukund, "*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*", 3rd 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, McGraw-Hill, 2018.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	-	3	2	3	3	-
CO2	3	3	3	3	3	-	-	-	-	3	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	3	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	-	-	-	2	-	-	-	-	1	-	2	-	-
Average:	**2**	**3**	3	**3**	**2**	-	-	-	-	**2**	**2**	**3**	**3**	-

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Subject Code	Subject Name	Category	L	T	P	C
BS24111	PHYSICS AND CHEMISTRY LABORATORY	BSC	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.

EXPERIMENTS **30**
(Any Seven Experiments)

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
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the functioning of various physics laboratory equipment.
CO2	Use graphical models to analyze laboratory data.
CO3	Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4	Access, process and analyze scientific information.
CO5	Solve problems individually and collaboratively.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO5	3	2	3	1	1	-	-	-	-	-	-	-	-	-
Average:	3	2.4	2.6	1	1	-	-	-	-	-	-	-	-	-

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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 electroanalytical 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

EXPERIMENTS: (Any SEVEN Experiments) **30**

1. Preparation of Na_2CO_3 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 (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel.
15. Proximate analysis of Coal.

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2	To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3	To analyse and determine the composition of alloys.
CO4	To learn simple method of synthesis of nanoparticles.
CO5	To quantitatively analyse the impurities in solution by electroanalytical techniques.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	1	-	-	2	-	-	-	-	2	-	-	-
CO2	3	1	2	-	-	1	-	-	-	-	1	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	2	-	-	-	-	-	-	-	-
CO5	2	1	2	-	1	2	-	-	-	-	1	-	-	-
Average:	2.6	1.3	1.6	1	1	1.4	-	-	-	-	1.3	-	-	-

Textbooks:

1. J. Mendham.,R.C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogfel's Textbook of Qualitative Chemical Anaysis, 2009.

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Subject Code	Subject Name	Category	L	T	P	C
GE24112	ENGLISH LABORATORY	EEC	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 language skills by engaging them in listening, speaking and grammar learning activities that are 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 A 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	**CLASSIFICATION 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	**EXPRESSION**	**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 Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To listen to and comprehend general as well as complex academic information.
CO2	To listen to and understand different points of view in a discussion.
CO3	To speak fluently and accurately in formal and informal communicative contexts.
CO4	To describe products and processes and explain their uses and purposes clearly and accurately.
CO5	To express their opinions effectively in both formal and informal discussions.

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ASSESSMENT PATTERN	
1.	One online / app based assessment to test listening /speaking
2.	End Semester **ONLY** listening and speaking will be conducted online.
3.	Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	1	3	3	3	3	3	3	-	-	-
Average:	3	3	3	3	1	3	3	3	3	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
HS24201	PROFESSIONAL ENGLISH – II	HSMC	2	0	0	2

Course Objectives:

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT – I	**MAKING COMPARISONS**	**6**

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

UNIT – II	**EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING**	**6**

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds.

UNIT – III	**PROBLEM SOLVING**	**6**

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

UNIT – IV	**REPORTING OF EVENTS AND RESEARCH**	**6**

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions.

UNIT – V	**THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY**	**6**

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To compare and contrast products and ideas in technical texts
CO2	To identify and report cause and effects in events, industrial processes through technical texts
CO3	To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
CO4	To present their ideas and opinions in a planned and logical manner
CO5	To draft effective resumes in the context of job search.

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Textbooks:	
1.	English for Engineers &Technologists(2020edition)Orient Blackswan P rivate Ltd. Department of English, Anna University
2.	English for Science & Technology Cambridge University Press 2021
3.	Authored by Dr. Veena Selvam, Dr.Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference books/other materials/web resources:	
1.	Raman.Meenakshi,Sharma.Sangeeta(2019).ProfessionalEnglish.Oxfordunive rsitypress. New Delhi.
2.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3.	Learning to Communicate–Dr.V.Chellammal. Allied Publishers,NewDelhi,2003
4.	Business Correspondence and Report Writing by Prof. R.C. Sharma Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5.	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students' reading and writing skills along with their grammatical and lexical competence.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO2	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO4	3	3	3	3	2	3	3	2	3	3	3	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	3	-	-	-
Average:	3	3	3	3	2.75	3	3	2.2	3	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
MA24201	STATISTICS AND NUMERICAL METHODS	BSC	3	1	0	4

Course Objectives:

- 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 - 22 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 EQUATIONS**	**9+3**

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

Total Contact Hours : 60

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Course Outcomes:	Upon completion of the course 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 conditions by using certain techniques with engineering applications.

Textbooks:

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.

Reference books/other materials/web resources:

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											CO-PSO Mapping		
PO& PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	-	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	-	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	-	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	-	0	2	0	2	3	-	-	-
Average:	3	3	1	1	1	-	0	2	0	2	3	-	-	-

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Subject Code:	Subject Name	Category	L	T	P	C
PH24201	MATERIALS SCIENCE	BSC	3	0	0	3

Course objectives:

- To make the students to understand the basics of crystallography and its importance in studying materials properties.
- To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials..
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT – I	CRYSTALLOGRAPHY	9

Crystal structures: BCC, FCC and HCP – directions and planes - linear and planar densities – crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burgers vector and elastic strain energy- Slip systems, plastic deformation of materials - Polymorphism – phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.

UNIT – II	ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS	9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory :Tunneling – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – paramagnetism in the conduction electrons in metals – exchange interaction and ferromagnetism – quantum interference devices – GMR devices.

UNIT – III	SEMICONDUCTORS AND TRANSPORT PHYSICS	9

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode

UNIT – IV	OPTICAL PROPERTIES OF MATERIALS	9

Classification of optical materials – Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain. Optical processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – laser diode - optical processes in organic semiconductor devices –excitonic state – Electro-optics and nonlinear optics: Modulators and switching devices – plasmonics.

UNIT – V	NANOELECTRONIC DEVICES	9

Quantum confinement – Quantum structures – quantum wells, wires and dots – Zener-Bloch oscillations – Resonant tunneling – quantum interference effects - mesoscopic structures - Single electron phenomena – Single electron Transistor. Semiconductor photonic structures – 1D, 2D and 3D photonic crystal. Active and passive optoelectronic devices – photo processes – spintronics – carbon nanotubes: Properties and applications.

Total Contact Hours : 45

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Course Outcomes:	At the end of the course, the students should be able to:
CO1	Know basics of crystallography and its importance for varied materials properties
CO2	Gain knowledge on the electrical and magnetic properties of materials and their applications
CO3	Understand clearly of semiconductor physics and functioning of semiconductor devices
CO4	Understand the optical properties of materials and working principles of various optical devices
CO5	Appreciate the importance of functional nanoelectronic devices

Textbooks:	
1.	V.Raghavan. Materials Science and Engineering: A First Course, Prentice Hall India Learning Private Limited, 2015.
2.	S.O. Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 2018.
3.	Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley (India), 2007.
4.	Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, Mc-Graw Hill India(2019)
5.	G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition), 2009.

Reference books/other materials/webresources:	
1.	R.Balasubramaniam, Callister's Materials Science and Engineering. Wiley (Indian Edition), 2014
2.	Wendelin Wright and Donald Askeland, Essentials of Materials Science and Engineering, CL Engineering, 2013
3.	Robert F.Pierret, Semiconductor Device Fundamentals, Pearson, 2006
4.	Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Pearson, 2017
5.	Ben Rogers, Jesse Adams and Sumita Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2017

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	-	-	-	-	-	-	-	-
CO2	3	2	1	1	2	1	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	1	-	-	-	-	-	-	-	-
CO4	3	2	2	1	2	2	-	-	-	-	1	-	-	-
CO5	3	2	2	1	2	1	-	-	-	-	-	-	-	-
Average:	3	2	1.6	1.4	1.8	1.2	-	-	-	-	1	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
BE24201	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	ESC	3	0	0	3

Course Objectives:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT – I	ELECTRICAL CIRCUITS	6

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor–Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources–Simple problems- Nodal Analysis, Mesh analysis with In dependent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits(Simple problems only)

UNIT – II	ELECTRICAL MACHINES	9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor

UNIT – III	ANALOG ELECTRONICS	9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium–PNJunctionDiodes,ZenerDiode–CharacteristicsApplications–BipolarJunction Transistor-Biasing, JFET, SCR, MOSFET,IGBT –Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT – IV	DIGITAL ELECTRONICS	9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

UNIT – V	MEASUREMENTS AND INSTRUMENTATION	9

Functional elements of an instrument, Standards and calibration, 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 Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Compute the electric circuit parameters for simple problems
CO2	Explain the working principle and applications of electrical machines
CO3	Analyze the characteristics of analog electronic devices
CO4	Explain the basic concepts of digital electronics
CO5	Explain the operating principles of measuring instruments

Textbooks:	
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 text book book of Applied Electronics", S. Chand & Co., 2008
4.	James A. Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5.	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

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

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	1	-	-	-	2	-	-	1
CO2	2	1	1	-	-	-	1	-	-	-	2	-	-	1
CO3	2	1	1	-	-	-	1	-	-	-	2	-	-	1
CO4	2	1	1	-	-	-	1	-	-	-	2	-	-	1
CO5	2	1	1	-	-	-	1	-	-	-	2	-	-	1
Average:	2	1	1	-	-	-	1	-	-	-	2	-	-	1

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Subject Code	Subject Name	Category	L	T	P	C
GE24201	ENGINEERING GRAPHICS	ESC	2	0	4	4

COURSE OBJECTIVES:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

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

UNIT I	PLANE CURVES	6+12Hrs

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

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

Orthographic projection- principles-Principal planes-First angle projection-projection of points.Projection of straight lines (only First angle projections) inclined to both the principal planes -Determination of true lengths and true inclinations by rotating line method 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 FREEHAND SKETCHING	6+12Hrs

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination).

UNIT IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	6+12Hrs

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination).

UNIT V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	6+12Hrs

Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

Total Contact Hours : 90 (L = 30; P = 60)

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use BIS conventions and specifications for engineering drawing.
CO2	Construct the conic curves, involutes and cycloid.
CO3	Solve practical problems involving projection of lines
CO4	Draw the orthographic, isometric and perspective projections of simple solids.
CO5	Draw the development of simple solids

Textbooks:	
1.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2.	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3.	Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

Reference books/other materials/webresources:	
1.	Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2 nd E d i t io n, 2019.
2.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3.	Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4.	Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:	
1.	IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2.	IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3.	IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4.	IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5.	IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO5	3	1	2	-	2	-	-	-	3	-	2	2	2	-
Average:	3	1	2	-	2	-	-	-	3	-	2	2	2	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24202	TAMILS AND TECHNOLOGY தமிழரும் தொழில்நுட்பமும்	HSMC	1	0	0	1

UNIT – I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during the 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 Contact Hours : 15

Text – Cum Reference books/other materials/web resources:

1. **Dr. K.K. Pillay**, "தமிழக வரலாறு - மக்களும் பண்பாடும்", தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்.
2. **இல. சுந்தரம்**, "கணினித்தமிழ்", விகடன்பிரசுரம்.
3. **அறுவைத்துறை - தொல்லியல்துறை**, "கீழடி - வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்", தமிழ்நாடு தொல்லியல் துறை & தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம் (தொல்லியல் துறை வெளியீடு).
4. **அறுவைத்துறை - தொல்லியல் துறை**, "பொருணை - ஆற்றங்கரை நாகரிகம்", தமிழ்நாடு தொல்லியல் துறை.
5. **Dr. K.K. Pillay**, "Social Life of Tamils", TNTB & ESC and RMRL (Joint Publication).
6. **Dr. S. Singaravelu**, "Social Life of the Tamils – The Classical Period", International Institute of Tamil Studies,
7. **Dr. S.V. Subramanian &Dr. K.D. Thirunavukkarasu**, "Historical Heritage of the

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	Tamils", International Institute of Tamil Studies
8.	**Dr. M. Valarmathi**, "The Contributions of the Tamils to Indian Culture", International Institute of Tamil Studies
9.	**Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation**, "Keeladi – Sangam City Civilization on the banks of river Vaigai", Joint Publication,
10.	**Dr. K.K. Pillay**, "Studies in the History of India with Special Reference to Tamil Nadu", Self Published by the Author,
11.	**Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation**, "Porunai Civilization", Joint Publication,
12.	**R. Balakrishnan**, "Journey of Civilization: Indus to Vaigai", RojaMuthiah Research Library (RMRL),

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Subject Code	Subject Name	Category	L	T	P	C
GE24202	TAMILS AND TECHNOLOGY தமிழரும் தொழில்நுட்பமும்	HSMC	1	0	0	1

அலகு- I	நெசவு மற்றும் செராமிக்தொழில்நுட்பம்	3

சங்ககால நெசவுதொழில் - செராமிக்தொழில்நுட்பம் - கருநிறமும் சிவப்பும் கலந்த பானைகள் (BRW) – பானைகளில் கறுப்புகுறியீடுகள்

அலகு -II	வடிவமைப்பு மற்றும் கட்டுமானநுட்பம்	3

சங்ககால வீடுகள் மற்றும் வீட்டு உபகரணங்களின் வடிவமைப்பு - கட்டுமானப்பொருட்கள் மற்றும் வீரக்கற்கள் - சிலப்பதிகாரத்தில் மேடைக்கட்டுமானம் - மாமல்லபுரம் சிற்பங்கள் மற்றும் கோவில்கள் - சோழர் மகாகோவில்கள் மற்றும் பிறவழிபாட்டு தலங்கள் - நாயக்கர்காலக்கோவில்கள் - **விவரஆய்வு**: மதுரை மீனாட்சியம்மன் கோவில், திருமலை நாயக்கர்மஹால், செட்டிநாடு வீடுகள், பிரிட்டிஷ் கால மதராசில் இஸ்லாமிய-ஐரோப்பிய கலப்புகட்டிடக்கலை.

அலகு -III	உற்பத்தி தொழில்நுட்பம்	3

கப்பல்கட்டும்கலை - உலோகம்குறித்தஆய்வுகள்: இரும்பு, உருகுதல், ஸ்டீல், வெள்ளி, தங்கம் - வரலாற்று ஆதாரமாகநாணயங்கள் - நாணயங்களை உற்பத்தி செய்வது - மணிக்கலன் தொழில்கள்: கல், கண்ணாடி, டெர்ராக்கோட்டா, சிப்பி/எலும்புமணிகள் - தொல்லியல் ஆதாரங்கள் - சிலப்பதிகாரத்தில் குறிப்பிடப்பட்ட ரத்தினக்கற்கள்.

அலகு- IV	வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம்	3

தண்ணீர் மேலாண்மை: அணைகள், ஏரிகள், குளங்கள், மதகு - சோழர்கால 'குமிழித்தூம்பு' - மாடுகள் பராமரிப்பு: மாடுகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் விவசாய இயந்திரங்கள் - கடல் அறிவு: மீன்வளம், முத்து மற்றும் சிப்பிக்கற்கள் - கடலியல் அறிவு கொண்டசமூகம்.

அலகு -V	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்	3

அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் - தமிழ்நூல்களை மின்மயமாக்கல் - தமிழ்மென் பொருட்கள் உருவாக்கம் - தமிழ்மெய்நிகர் கல்விக்கழகம் - தமிழ் மின்நூலகம் - இணையதமிழ் அகராதிகள் - சொற்குவைத்திட்டம்.

Total Contact Hours : 15

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Text – Cum Reference books/other materials/web resources:	
1.	**Dr. K.K. Pillay**, "தமிழக வரலாறு - மக்களும் பண்பாடும்", தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்.
2.	**இல. சுந்தரம்**, "கணினித்தமிழ்", விகடன்பிரசுரம்.
3.	**அறுவைத்துறை - தொல்லியல்துறை**, "கீழடி - வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்", தமிழ்நாடு தொல்லியல்துறை & தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம் (தொல்லியல் துறைவெளியீடு).
4.	**அறுவைத்துறை - தொல்லியல் துறை**, "பொருணை - ஆற்றங்கரை நாகரிகம்", தமிழ்நாடு தொல்லியல்துறை.
5.	**Dr. K.K. Pillay**, "Social Life of Tamils", TNTB & ESC and RMRL (Joint Publication), [In Print].
6.	**Dr. S. Singaravelu**, "Social Life of the Tamils – The Classical Period", International Institute of Tamil Studies.
7.	**Dr. S.V. Subramanian &Dr. K.D. Thirunavukkarasu**, "Historical Heritage of the Tamils", International Institute of Tamil Studies
8.	**Dr. M. Valarmathi**, "The Contributions of the Tamils to Indian Culture", International Institute of Tamil Studies
9.	**Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation**, "Keeladi – Sangam City Civilization on the banks of river Vaigai", Joint Publication,
10.	**Dr. K.K. Pillay**, "Studies in the History of India with Special Reference to Tamil Nadu", Self Published by the Author,
11.	**Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation**, "Porunai Civilization", Joint Publication,
12.	**R. Balakrishnan**, "Journey of Civilization: Indus to Vaigai", RojaMuthiah Research Library (RMRL),

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	NCC CREDIT COURSE LEVEL 1* (ARMY WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2
UNIT I	**NCC GENERA**				6Hrs
NCC 1 Aims, Objectives & Organization of NCC				1	
NCC 2 Incentives				2	
NCC 3 Duties of NCC Cadet				1	
NCC 4 NCC Camps: Types & Conduct				2	
UNIT II	**NATIONAL INTEGRATION AND AWARENESS**				4Hrs
NI 1 National Integration: Importance & Necessity				1	
NI 2 Factors Affecting National Integration				1	
NI 3 Unity in Diversity & Role of NCC in Nation Building				1	
NI 4 Threats to National Security				1	
UNIT III	**PERSONALITY DEVELOPMENT**				7Hrs
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving				2	
PD 2 Communication Skills				3	
PD 3 Group Discussion: Stress & Emotions				2	
UNIT IV	**LEADERSHIP**				5Hrs
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code				3	
L 2 Case Studies: Shivaji, Jhasi Ki Rani				2	
UNIT V	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**				8Hrs
SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth				3	
SS 4 Protection of Children and Women Safety				1	
SS 5 Road / Rail Travel Safety				1	
SS 6 New Initiatives				2	
SS 7 Cyber and Mobile Security Awareness				1	
	Total Contact Hours : 30				

	NCC CREDIT COURSE LEVEL 1* (NAVAL WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2
UNIT I	**NCC GENERAL**				6Hrs
NCC 1 Aims, Objectives & Organization of NCC				1	
NCC 2 Incentives				2	
NCC 3 Duties of NCC Cadet				1	
NCC 4 NCC Camps: Types & Conduct				2	
UNIT II	**NATIONAL INTEGRATION AND AWARENESS**				4Hrs
NI 1 National Integration: Importance & Necessity				1	
NI 2 Factors Affecting National Integration				1	
NI 3 Unity in Diversity & Role of NCC in Nation Building				1	
NI 4 Threats to National Security				1	

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UNIT III	PERSONALITY DEVELOPMENT	7Hrs
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2	
PD 2 Communication Skills	3	
PD 3 Group Discussion: Stress & Emotions	2	
UNIT IV	LEADERSHIP	5Hrs
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3	
L 2 Case Studies: Shivaji, Jhasi Ki Rani	2	
UNIT V	SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	8Hrs
SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth	3	
SS 4 Protection of Children and Women Safety	1	
SS 5 Road / Rail Travel Safety	1	
SS 6 New Initiatives	2	
SS 7 Cyber and Mobile Security Awareness	1	
	Total Contact Hours : 30	

	NCC CREDIT COURSE LEVEL 1* (AIR FORCE WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2
UNIT I	**NCC GENERAL**				6Hrs
NCC 1 Aims, Objectives & Organization of NCC					1
NCC 2 Incentives					2
NCC 3 Duties of NCC Cadet					1
NCC 4 NCC Camps: Types & Conduct					2
UNIT II	**NATIONAL INTEGRATION AND AWARENESS**				4Hrs
NI1National Integration: Importance & Necessity					1
NI2Factors Affecting National Integration					1
NI3Unity in Diversity & Role of NCC in Nation Building					1
NI4 Threats to National Security					1
UNIT III	**PERSONALITY DEVELOPMENT**				7Hrs
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving				2
PD 2	Communication Skills				3
PD 3	Group Discussion: Stress & Emotions				2
UNIT IV	**LEADERSHIP**				5Hrs
UNIT V	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**				8Hrs
SS 1	Basics, Rural Development Programmes, Contribution of Youth				3
SS 4	Protection of Children and Women Safety				1
SS 5	Road / Rail Travel Safety				1
SS 6	New Initiatives				2
SS 7	Cyber and Mobile Security Awareness				1
	Total Contact Hours : 30				

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Subject Code	Subject Name	Category	L	T	P	C
GE24211	ENGINEERING PRACTICES LABORATORY	ESC	0	0	4	2

Course Objectives:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in commonhousehold wood work
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP–A (CIVIL & ELECTRICAL)

UNIT – I	CIVIL ENGINEERING PRACTICES	15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,

b) Planning and

c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture

b) Studying common industrial trusses using models.

UNIT – II	ELECTRICAL ENGINEERING PRACTICES	15

a) Introduction to switches, fuses, indicators and lamps - Basic switch 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 Diac/Triac/quadrac)

g) Study of emergency lamp wiring/Water heater

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GROUP – B (MECHANICAL AND ELECTRONICS)		
UNIT – III	**MECHANICAL ENGINEERING PRACTICES**	**15**
WELDING WORK: a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. b) Practicing gas welding. **BASIC MACHINING WORK:** a) (Simple) Turning. b) (Simple) Drilling. c) (Simple) Tapping. **ASSEMBLY WORK:** a) Assembling a centrifugal pump. b) Assembling a household mixer. c) Assembling an air conditioner. **SHEET METAL WORK:** Making of a square tray **FOUNDRY WORK:** Demonstrating basic foundry operations.		
UNIT – IV	**ELECTRONIC ENGINEERING PRACTICES**	**15**
SOLDERING WORK: a) Soldering simple electronic circuits and checking continuity. **ELECTRONIC ASSEMBLY AND TESTING WORK:** Assembling and testing electronic components on a small PCB. **ELECTRONIC EQUIPMENT STUDY:** a) Study an element of smart phone. b) Assembly and dismantle of LED TV. c) Assembly and dismantle of computer/ laptop		
Total Contact Hours : 60		

Course Outcomes:	Upon completion of the course students should 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	Wire various electrical joints in common household electrical wire work.
CO3	Weld various joints in steel plates using arc welding work; Machine various simple processeslike turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
CO4	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	-	1	1	-	-	-	-	2	2	2	1
CO2	3	2	2	-	1	1	-	-	-	-	2	2	2	1
CO3	3	2	2	-	1	1	-	-	-	-	2	2	2	1
Average:	3	2	2	-	1	1	-	-	-	-	2	2	2	1

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Subject Code	Subject Name	Category	L	T	P	C
BE24212	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	ESC	0	0	4	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS **60Hrs**

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

Total Contact Hours : 60

COURSE UTCOMES:	At the end of the course, learners will be able
CO1	Use experimental methods to verify the Ohm's and Kirchhoff's Laws.
CO2	Analyze experimentally the load characteristics of electrical machines
CO3	Analyze the characteristics of basic electronic devices
CO4	Use DSO to measure the various parameters

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	-	1.5	2	-	-	-	-	-	1
CO2	3	3	2	1	1	-	1.5	2	-	-	-	-	-	1
CO3	3	3	2	1	1	-	1.5	2	-	-	-	-	-	1
CO4	3	3	2	1	1	-	1.5	2	-	-	-	-	-	1
CO5	3	3	2	1	1	-	1.5	2	-	-	-	-	-	1
AVG	3	3	2	1	1	-	1.5	2	-	-	-	-	-	1

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Subject Code	Subject Name	Category	L	T	P	C
GE24212	COMMUNICATION LABORATORY	EEC	0	0	4	2

Course Objectives:

- To identify and apply group discussion skills to participate effectively in professional discussions.
- To analyse concepts and problems and deliver clear, concise, and effective presentations.
- To communicate proficiently through both formal and informal writing.
- To use appropriate language structures to write emails, reports, and essays.
- To give instructions and recommendations that is clear, contextually appropriate, and purposeful.

UNIT – I	**PROFESSIONAL INTERACTIONS AND WORKPLACE COMMUNICATION**	**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	**TRAVEL, NEWS AND DAILY COMMUNICATION**	**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	**EXPRESSING OPINIONS AND MAKING COMPARISONS**	**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	**ENVIRONMENT AND TECHNICAL DESCRIPTIONS**	**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	**DESCRIPTIONS, RECOMMENDATIONS, AND APPLICATIONS**	**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)-writing recommendations.		
	Total Contact Hours : 60	

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Speak effectively in group discussions held in 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	
1.	One online / app based assessment to test speaking and writing skills
2.	Proficiency certification is given on successful completion of speaking and writing.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	2	2	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	3	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Average:	2.4	2.8	3	3	1.8	3	3	3	3	3	3	-	-	-

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Subject Code:	Subject Name	Category	L	T	P	C
MA24303	FOURIER SERIES AND BOUNDARY VALUE PROBLEMS	BSC	3	1	0	4

Course Objectives:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To introduce the effective mathematical tools for the solutions of partial differential equations in various situations.
- To acquaint the student with Fourier series techniques in solving wave equations used in various situations.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Non- Parametric tests problems used in various situations.

UNIT – I	**FOURIER SERIES**	**9+3**
Dirichlet's conditions – General Fourier series – Odd and Even functions – Half range sine series–Half range cosine series–Parseval's identity –Harmonic Analysis.		
UNIT – II	**PARTIAL DIFFERENTIAL EQUATIONS**	**9+3**
Formation of PDE - Eliminating arbitrary constants- Eliminating arbitrary functions – First order nonlinear PDE: $f(p , q)= 0, f(z ,p ,q)= 0, f (x, p)= g(y , q)$, Clairaut's equation - Lagrange's linear equation – Homogeneous linear PDE of Higher order with constant coefficients.		
UNIT – III	**WAVE EQUATION**	**9+3**
Classification of second order Quasi linear partial differential equation - Solution of one dimensional wave equation with one non-zero boundary conditions – one dimensional wave equation by explicit method		
UNIT – IV	**HEAT EQUATION**	**9+3**
.One dimensional heat equation – Steady of state solution of two dimensional heat equation (Insulated edge excluded).		
UNIT – V	**NON-PARAMETRIC TESTS**	**9+3**
Sign test for paired data. Rank sum test. Kolmogorov-Smirnov test –Mann – Whitney U test and Kruskal Wallis test. One sample run test.		
		Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO2	Solve differential equations using Partial differential equations which plays a vital role inengineering applications.
CO3	Appreciate the physical significance of Fourier series techniques in solving onedimensional wave equations.
CO4	Appreciate the physical significance of Fourier series techniques in solving one dimensional heat flow problems
CO5	Appreciate the physical significance of Non-Parametric tests techniques in solving problems in Engineering field.

HoD/BOS Chairman

Principal

Textbooks:	
1.	GrewalB.S.,"Higher Engineering Mathematics", 44th Edition, Khanna Publishers, NewDelhi, 2018
2.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016

Reference books/other materials/webresources:	
1.	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt.Ltd, 2015.
2.	Narayanan. S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3.	Ramana.B.V.,"Higher Engineering Mathematics",McGraw Hill Education Pvt.Ltd, New Delhi, 2018.
4.	Conover, W.J. (1971). Practical Non-Parametric Statistics. David, H.A. (1970). Order Statistics. Fraser, D.A.S. (1957). Nonparametric Methods in Statistics.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO2	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO3	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO4	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO5	3	3	1	1	-	-	-	-	2	-	3	-	-	-
Average:	3	3	1	1	-	-	-	-	2	-	3	-	-	-

HoD/BOS Chairman

Principal

Subject code	Subject Name	Category	L	T	P	C
ME24301	ENGINEERING MECHANICS	ESC	3	0	0	3

Course Objectives:

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

UNIT I	STATICS OF PARTICLES	9

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

UNIT II	EQUILIBRIUM OF RIGID BODIES	9

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

UNIT III	DISTRIBUTED FORCES	9

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes By Integration. Moments of Inertia of Areas and Mass – 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, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV	FRICTION	9

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

UNIT V	DYNAMICS OF PARTICLES	9

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

Total Contact Hours : 45

HoD/BOS Chairman **Principal**

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Illustrate the vector and scalar representation of forces and moments.
CO2	Analyze the rigid body in equilibrium.
CO3	Evaluate the properties of distributed forces.
CO4	Determine the friction and the effects by the laws of friction.
CO5	Calculate dynamic forces exerted in rigid body.

Textbooks:

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

Reference books/other materials/webresources:

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 SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	2	3	1	1
CO2	3	2	2	1	2	-	-	-	-	-	2	3	1	1
CO3	3	2	3	1	2	-	-	-	-	-	2	3	1	2
CO4	3	2	3	1	2	-	-	-	-	-	2	3	1	2
CO5	3	2	3	1	2	-	-	-	-	-	2	3	1	2
AVG	3	2	2.6	1	2	-	-	-	-	-	2	3	1	1.6

HoD/BOS Chairman

Principal

Subject Code	Subject Name	Category	L	T	P	C
ME24302	ENGINEERING THERMODYNAMICS	PCC	3	0	0	3

Course Objectives:

- Impart knowledge on the basics and application of zeroth and first law of thermodynamics.
- Impart knowledge on the second law of thermodynamics in analyzing the performance of thermal devices.
- Impart knowledge on availability and applications of second law of thermodynamics.
- Teach the various properties of steam through steam tables and Mollier chart.
- Impart knowledge on the macroscopic properties of ideal and real gases.

UNIT I	BASICS, ZEROTH AND FIRST LAW	9

Review of Basics – Thermodynamic systems, Properties and processes Thermodynamic Equilibrium - Displacement work - P-V diagram. Thermal equilibrium - Zeroth law- First Law- Concept of temperature and Temperature Scales, Steady flow energy equation-problems.

UNIT II	HEATING AND EXPANSION OF GASES	9

Expressions for work done, Internal energy and heat transfer for Constant Pressure, ConstantVolume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.

UNIT III	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 – Tds Equations - Entropy change for a pure substance.

UNIT IV	COMPOSITION OF PURE SUBSTANCES	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.

UNIT V	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, Clausius-Clapeyronequation.

Total Contact Hours : 45

HoD/BOS Chairman **Principal**

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply the zeroth and first law of thermodynamics by formulating temperature scales and calculating the property changes in closed and open engineering systems.
CO2	Understand the various processes with its derivation and gaining knowledge of various processes in Mechanical Industries.
CO3	Apply the second law of thermodynamics in analyzing the performance of thermal devices through energy and entropy calculations.
CO4	Apply the second law of thermodynamics in evaluating the various properties of steam through steam tables and Mollier chart.
CO5	Apply the properties of gas mixtures in calculating the properties of gas mixtures and applying various thermodynamic relations to calculate property changes.

Textbooks:	
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.

Reference books/other materials/webresources:	
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 IndiaPvt. Ltd, 2006.
4.	Claus Borgnakke and Richard E. Sonntag, "Fundamentals of Thermodynamics", 10th Edition, WileyEastern, 2019.
5.	Venkatesh. A, "Basic Engineering Thermodynamics", Universities Press (India) Limited, 2007.

CO, PO & PSO Mapping:

CO/PO/PSO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1							2			
CO2	3	3	2	1							2			
CO3	3	3	2	1				1		1	2	3		3
CO4	3	3	2	1		1		2		1	2	3	2	
CO5	3	3	2	1		1		2		1	2	3	2	3
AVERAGE	3	3	2	1		1		1.4		1	2	3	2	3

HoD/BOS Chairman

Principal

Subject Code	Subject Name	Category	L	T	P	C
ME24303	FLUID MECHANICS AND MACHINERY	ESC	3	1	0	4

Course Objectives:

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

UNIT I	FLUID PROPERTIES AND FLOW CHARACTERISTICS	10+3

Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation – Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold's transportation theorem - Continuity equation, energy equation and momentum equation - Applications.

UNIT II	FLOW THROUGH PIPES AND BOUNDARY LAYER	9 + 3

Reynold's Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.

UNIT III	DIMENSIONAL ANALYSIS AND MODEL STUDIES	8+3

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

UNIT IV	TURBINES	9+3

Impact of jets - Velocity triangles - Theory of rotodynamic machines - Classification of turbines – Working principles - Pelton wheel - Modern Francis turbine - Kaplan turbine - Work done - Efficiencies - Draft tube - Specific speed - Performance curves for turbines - Governing of turbines.

UNIT V	PUMPS	9+3

Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies– Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and it's variations - Work saved by fitting air vessels - Rotary pumps.

Total Contact Hours: 60

HoD/BOS Chairman **Principal**

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the properties and behavior in static conditions. Also, to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
CO2	Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also, to understand the concept of boundary layer and its thickness on the flat solid surface.
CO3	Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.
CO4	Explain the working principles of various turbines and design the various types of turbines.
CO5	Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps.

Textbooks:

1.	Modi P.N. and Seth, S.M. Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 22nd edition (2019).
2.	Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
3.	Kumar K. L., Engineering Fluid Mechanics, Eurasia Publishing House(p) Ltd. New Delhi, 2016.

Reference books/other materials/web resources:

1.	Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2011.
2.	Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
3.	Cengel Y A and Cimbala J M, Fluid Mechanics, McGraw Hill Education Pvt. Ltd., 2014.
4.	S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., 2012.
5.	Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co., 2010.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	1	2	1	1	2	3	2	3
CO2	3	3	3	2	1	2	1	2	1	1	2	3	2	3
CO3	3	3	3	3	1	2	1	2	1	1	2	3	3	3
CO4	3	3	3	3	1	2	1	2	1	1	3	3	2	2
CO5	3	3	3	3	1	2	1	2	1	1	3	3	2	2
AVG	3	3	2.8	2.6	1	2	1	2	1	1	2	3	2.2	2.6

HoD/BOS Chairman

Principal

Subject Code	Subject Name	Category	L	T	P	C
ME24304	ENGINEERING MATERIALS AND METALLURGY	PCC	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 – Thermo-mechanical treatments- elementary ideas on sintering.

UNIT III	FERROUS AND NON-FERROUS METALS	9

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

UNIT IV	NON-METALLIC MATERIALS	9

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

UNIT V	MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS	9

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

Total Contact Hours: 45

HoD/BOS Chairman

Principal

Course Outcomes:	Upon completion of the course students should 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.

Textbooks:

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

Reference books/other materials/webresources:

1.	A. Alavudeen, N. Venkateshwaran, and J. T.WinowlinJappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.
2.	Amandeep Singh Wadhwa, andHarvinder Singh Dhaliwal, A Textbook of Engineering Material and Metallurgy, University Sciences Press, 2008.
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											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	2	-	-	-	-	-	-	2	2	1	2
CO2	3	1	3	1	-	2	1	-	-	-	2	2	1	2
CO3	3	1	3	-	-	-	-	-	-	-	2	2	1	2
CO4	3	1	3	-	-	-	-	-	-	-	2	2	1	2
CO5	3	1	3	2	2	-	-	-	-	-	2	2	1	2
AVG	3	1	3	1	0.4	0.4	1	-	-	-	2	2	1	2

HoD/BOS Chairman

Principal

Subject Code	Subject Name	Category	L	T	P	C
ME24305	MANUFACTURING TECHNOLOGY-I	PCC	3	0	0	3

Course Objectives:

- To illustrate the working principles of various metal casting processes.
- To learn and apply the working principles of various metal joining processes.
- To analyze the working principles of bulk deformation of metals.
- To learn the working principles of sheet metal forming process.
- To study and practice the working principles of plastics molding.

UNIT I	METAL CASTING PROCESSES	9

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

UNIT II	METAL JOINING PROCESSES	9

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

UNIT III	BULK DEFORMATION PROCESSES	9

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

UNIT IV	SHEET METAL PROCESSES	9

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

UNIT V	MANUFACTURE OF PLASTIC COMPONENTS	9

Types and characteristics of plastics – Molding of thermoplastics & Thermosetting polymers– working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – introduction to blow molding – Rotational molding – Filmblowing – Extrusion – Thermoforming – Bonding of Thermoplastics- duff moulding.

Total Contact Hours: 45

HoD/BOS Chairman **Principal**

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Explain the principle of different metal casting processes.
CO2	Describe the various metal joining processes.
CO3	Illustrate the different bulk deformation processes.
CO4	Apply the various sheet metals forming process.
CO5	Apply suitable molding technique for manufacturing of plastics components.

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

Reference books/other materials/webresources:	
1.	Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2.	S. Gowri P. Hariharan, A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.
3.	Paul Degarma E, Black J.T and Ronald A. Kosher, Eligth Edition, Materials and Processes, in Manufacturing, Eight Edition, Prentice – Hall of India, 1997.
4.	Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997.
5.	Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2000.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	2	1	1	-	-	1	3	1	2
CO2	3	-	2	-	-	2	1	1	-	-	1	3	1	2
CO3	3	-	2	-	-	2	1	1	-	-	1	3	1	2
CO4	3	-	2	-	-	2	1	1	-	-	1	3	1	2
CO5	3	-	2	-	2	2	1	1	-	-	1	3	1	2
AVG	3	-	2	-	0.4	2	1	1	-	-	1	3	1	2

HoD/BOS Chairman

Principal

Subject Code	Subject Name	Category	L	T	P	C
ME24311	COMPUTER AIDED MACHINE DRAWING LABORATORY	ESC	0	0	4	2

Course Objectives:

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

PART I	DRAWING STANDARDS & FITS AND TOLERANCES	12

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

PART II	2D DRAFTING	48

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.

1. Bearings – Bush Bearing,
2. Valves – Safety and Non-return Valves.
3. Couplings – Flange, Oldham's, Muff, Gear couplings.
4. Joints – Universal, Knuckle, Gib& Cotter, Strap, Sleeve &Cotter joints.
5. Engine parts – Piston, Connecting Rod, Stuffing box.
6. Machine Components – Screw Jack, Machine Vice, Lathe Tail Stock, Plummer Block.

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

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software.

The above tasks can be performed manually and using standard commercial 2D CAD software.

Total Contact Hours: 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Prepare standard drawing layout for modelled assemblies with BoM.
CO2	Model orthogonal views of machine components.
CO3	Prepare standard drawing layout for modelled parts.

Textbooks:

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

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

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	-	-	3	-	-	3	2	-	3	2	2	2
CO2	1	2	-	-	3	-	-	3	2	-	3	2	2	2
CO3	1	2	-	-	3	-	-	3	2	-	3	2	2	2
AVG	1	2	-	-	3	-	-	3	2	-	3	2	2	2

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Subject Code	Subject Name	Category	L	T	P	C
ME24312	MANUFACTURING TECHNOLOGY LABORATORY	PCC	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 GMAW and fabricating gears using gear making Machines.
- To Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling and analyzing the defects in the cast and machined components.

LIST OF EXPERIMENTS	60

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Taper Turning and Eccentric Turning on circular parts using lathe machine.
4. Knurling, external and internal thread cutting on circular parts using lathe machine.
5. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
6. Drilling and Reaming using vertical drilling machine.
7. Milling contours on plates using vertical milling machine.
8. Cutting spur and helical gear using milling machine.
9. Generating gears using gear hobbing machine.
10. Generating gears using gear shaping machine.
11. Grinding components using cylindrical and centerless grinding machine.
12. Grinding components using surface grinding machine.
13. Cutting force calculation using dynamometer in milling machine
14. Cutting force calculation using dynamometer in lathe machine

Total Contact Hours: 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Demonstrate the safety precautions exercised in the mechanical workshop and join two metals using GMAW.
CO2	The students able to make the work piece as per given shape and size using machining process such as rolling, drawing, turning, shaping, drilling and milling.
CO3	The students become make the gears using gear making machines and analyze the defects in the cast and machined components

Textbooks:

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

	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	2	-	-	1	1	2	2
CO2	3	-	-	-	-	-	-	2	-	-	1	1	2	2
CO3	3	-	-	-	-	-	-	2	-	-	1	1	2	2
AVG	3	-	-	-	-	-	-	2	-	-	1	1	2	2

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Subject Code	Subject Name	Category	L	T	P	C
GE24903	PROFESSIONAL DEVELOPMENT	EEC	0	0	2	1

Course Objectives:

- 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 present ability 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.

MS WORD	10
Create and format a document Working with tables Working with Bullets and Lists Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools Creating and Using document templates Inserting equations, symbols and special characters Working with Table of contents and References, citations Insert and review comments Create bookmarks, hyperlinks, endnotes footnote Viewing document in different modes Working with document protection and security Inspect document for accessibility	

MS EXCEL	10
Create worksheets, insert and format data Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae Create and Work with different types of charts Use pivot tables to summarize and analyse data Perform data analysis using own formulae and functions Combine data from multiple worksheets using own formulae and built-in functions to generate results Export data and sheets to other file formats Working with macros Protecting data and Securing the workbook	

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MS POWERPOINT	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 Contact Hours : 30	

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
CO2	Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
CO3	Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	2	1	2	3	2	1	1	2	2
CO2	3	3	3	3	3	2	1	2	3	2	2	1	2	2
CO3	3	3	2	2	3	2	1	3	3	2	2	1	2	2
AVG	3	3	2.6	2.6	3	2	1	2.3	3	2	1.6	1	2	2

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Subject Code:	Subject Name	Category	L	T	P	C
MA24404	PROBABILITY AND LINEAR PROGRAMMING PROBLEMS	BSC	3	1	0	4

Course Objectives:

- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of Special distribution.
- To introduce the basic concepts of classifications of design of experiments.
- To apply quantitative techniques in modelling.
- To solving business related problems.

UNIT – I	**PROBABILITY AND RANDOM VARIABLES**	**9+3**

Axioms of Probability - Conditional Probability-Baye's Theorem- One dimensional Discrete and Continuous random variables -Moments - Moment generating functions.

UNIT – II	**SPECIAL DISTRIBUTIONS**	**9+3**

Discrete distributions : Binomial, Poisson, Geometric – Continuous distributions: Uniform, Exponential and Normal distribution.

UNIT – III	**STATISTICAL QUALITY CONTROL**	**9+3**

Control charts for Measurements ($\bar{x}$ and R Charts))- Control charts for Attributes (p, c, and np charts)- Tolerance limits- Acceptance Sampleng.

UNIT – IV	**LINEAR PROGRAMMING PROBLEMS**	**9+3**

Linear Programming formulation, Solution by Graphical method - Simplex methods –Big-M method.

UNIT – V	**TRANSPORTATION AND ASSIGNMENT PROBLEMS**	**9+3**

Transportation Models – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI. Assignment Problems– Balanced and Unbalanced Problems-Hungarian Method.

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the basic concepts of Probability and Random variables and apply in Engineering applications.
CO2	Understand he fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
CO3	Apply the basic concepts of classifications of design of experiments in the field ofAgriculture and statistical quality control.
CO4	Understand the Linear programming in product mix decisions.
CO5	Apply the Transportation and assignment in logistics and job allocation scenarios

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Textbooks:	
1.	Johnson. R.A., Miller. I.RandFreund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia,9th Edition, 2016.
2.	JohnE.Freund, "Mathematical Statistics",Prentice Hall,5thEdition,1992.
3.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007
4.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018
5	N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.

Reference books/other materials/webresources:	
1.	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand &Sons, New Delhi, 12th Edition, 2020
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Walpole.R.E.,Myers.R.H.,Myers.S.L.andYe.K.,"Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9thEdition, 2010.
4.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	2	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	2	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	2	-	-	-
Average:	3	2.8	2.6	2	1.6	-	-	-	-	-	1.6	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
ME24401	MECHANICS OF MACHINES	PCC	3	0	0	3

Course Objectives:

- To study the basic components of mechanisms, analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and design cam mechanisms for specified output motions.
- To study the basic concepts of toothed gearing and kinematics of gear trains.
- To analyzing the effects of friction in machine elements.
- To Analyzing the force-motion relationship in components subjected to external forces and analyzing of standard mechanisms.
- To analyzing the undesirable effects of unbalances resulting from prescribed motions in mechanism and the effect of dynamics of undesirable vibrations.

UNIT I	KINEMATICS OF MECHANISMS	9

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons– Analytical methods – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

UNIT II	GEARS AND GEAR TRAINS	9

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

UNIT III	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 aspects in brakes– Friction in vehicle propulsion and braking.

UNIT IV	FORCE ANALYSIS	9

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members

UNIT V	BALANCING AND VIBRATION	9

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines. Free vibrations – Equations of motion – natural Frequency – Damped Vibration – Torsional vibration – Forced vibration.

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Discuss the basics of mechanism.
CO2	Solve problems on gears and gear trains.
CO3	Examine friction in machine elements.
CO4	Calculate static and dynamic forces of mechanisms.
CO5	Calculate the balancing masses and their locations of reciprocating and rotating masses. Computing the frequency of free vibration, forced vibration and damping coefficient.

Textbooks:	
1.	Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 3rd edition 2019.
2.	Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017
3.	James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education,New Delhi, 2016

Reference books/other materials/webresources:	
1.	AmitabhaGhosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1988.
2.	Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 5th edition 2019.
3.	J.K. Gupta & R.S. Khurmi, *Theory of Machines*, S. Chand & Co. published in 2022.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	-	1	-	-	-	1	3	-	1
CO2	3	2	2	-	2	-	1	-	-	-	1	3	-	1
CO3	3	2	2	-	2	-	1	-	-	-	1	3	-	1
CO4	3	2	2	-	2	-	1	-	-	-	1	3	-	1
CO5	3	2	2	-	2	-	1	-	-	-	1	3	-	1
AVG:	3	2	2	-	2	-	1	-	-	-	1	3	-	1

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Subject Code	Subject Name	Category	L	T	P	C
ME24402	THERMAL ENGINEERING	PCC	4	0	0	3

Course Objectives:

- To learn the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles and performance of Internal Combustion(IC) engines and Gas Turbines.
- To analyzing the performance of steam nozzle, calculate critical pressure ratio.
- To Evaluating the performance of steam turbines through velocity triangles, understand the need for governing and compounding of turbines.
- To analyzing the working of IC engines and various auxiliary systems present in IC engines.
- To evaluating the various performance parameters of IC engines.

UNIT I	**THERMODYNAMIC CYCLES**	**12**
Air Standard Cycles – Carnot, Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison, Basic Rankine Cycle, modified, reheat and regenerative cycles.		
UNIT II	**STEAM NOZZLES AND INJECTOR**	**12**
Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.		
UNIT III	**STEAM AND GAS TURBINES**	**12**
Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing. Gas turbine cycle analysis – open and closed cycle. Performance and its improvement - Regenerative, Intercooled, Reheated cycles and their combination.		
UNIT IV	**INTERNAL COMBUSTION ENGINES**	**12**
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. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.		
UNIT V	**INTERNAL COMBUSTION ENGINE PERFORMANCE**	**12**
Performance and Emission Testing, Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common rail direct injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms		
	Total Contact Hours : 60	

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply thermodynamic concepts to different air standard cycles and solve problems.
CO2	To solve problems in steam nozzle and calculate critical pressure ratio.
CO3	Explain the flow in steam turbines, draw velocity diagrams, flow in Gas turbines and solve problems.
CO4	Explain the functioning and features of IC engine, components and auxiliaries.
CO5	Calculate the various performance parameters of IC engines.

Textbooks:	
1.	Mahesh. M. Rathore, "Thermal Engineering", 1st Edition, Tata McGraw Hill, 2010.
2.	Ganesan.V, " Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2012.
3.	R.K. Rajput, —Thermal Engineering‖ Lakshmi Publishers, 2017

Reference books/other materials/webresources:	
1.	Ballaney. P, "Thermal Engineering", 25th Edition, Khanna Publishers, 2017.
2.	Domkundwar, Kothandaraman, &Domkundwar, "A Course in Thermal Engineering", 6th Edition, DhanpatRai& Sons, 2011.
3.	Gupta H.N, "Fundamentals of Internal Combustion Engines", 2nd Edition Prentice Hall of India, 2013.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	1	2	1	-
CO2	3	2	2	1	-	-	-	-	-	-	1	2	1	-
CO3	3	2	2	1	-	-	-	-	-	-	1	2	1	-
CO4	3	2	1	1	-	-	-	-	-	-	1	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	1	2	1	-
AVG:	3	2	1.4	1	-	-	-	-	-	-	1	2	1	-

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Subject Code	Subject Name	Category	L	T	P	C
ME24403	STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS	PCC	3	0	0	3

Course Objectives:

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

UNIT I	STRESS, STRAIN AND DEFORMATION OF SOLIDS	9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simple and compound bars – Thermal stresses – Elastic constants - Volumertric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

UNIT II	TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM	9

Beams – Types - Transverse loading on beams – Shear force and Bending moment in beams – Cantilever, Simply supported and over hanging beams. Theory of simple bending – Bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III	TORSION	9

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.

UNIT IV	DEFLECTION OF BEAMS	9

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

UNIT V	THIN CYLINDERS, SPHERES AND THICK CYLINDERS	9

Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Thick cylinders - Lame's theory

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the concepts of stress and strain in simple and compound bars, the important of principal stresses and principal planes.
CO2	Understand the load transferring mechanism in beams and stress distribution due 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.

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

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

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	1	2	3	1	3	3	2	3
CO2	3	3	3	3	2	3	1	2	3	1	3	3	2	3
CO3	3	3	3	3	2	3	1	2	3	1	3	3	2	3
CO4	3	3	3	3	2	3	1	2	3	1	3	3	2	3
CO5	3	3	3	3	2	3	1	2	3	1	3	3	2	3
AVG	3	3	3	3	2	3	1	2	3	1	3	3	2	3

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Subject Code	Subject Name	Category	L	T	P	C
ME24404	MANUFACTURING TECHNOLOGY-II	PCC	3	0	0	3

Course Objectives:

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

UNIT I	MECHANICS OF METAL CUTTING	9

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

UNIT II	TURNING MACHINES	9

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

UNIT III	RECIPROCATING MACHINE TOOLS	9

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

UNIT IV	CNC MACHINES	9

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

UNIT V	PROGRAMMING OF CNC MACHINE TOOLS	9

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

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply the mechanism of metal removal process and to identify the factors involved in improving machinability.
CO2	Describe the constructional and operational features of centre lathe and other special purpose lathes.
CO3	Describe the constructional and operational features of reciprocating machine tools.
CO4	Apply the constructional features and working principles of 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.

Textbooks:	
1.	Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,7th Edition, 2018.
2.	Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; 4th edition, 2018.

Reference books/other materials/webresources:	
1.	Rao. P.N "Manufacturing Technology," Metal Cutting and Machine Tools, Tata McGraw-Hill, New Delhi, 2009.
2.	Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", McGraw Hill, 1984.
3.	A. B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	1	3	-	3	-	2	3	3	2
CO2	3	3	3	1	1	1	3	-	3	-	2	3	2	2
CO3	3	3	3	1	1	1	3	-	3	-	2	3	2	2
CO4	3	3	2	1	1	1	3	-	3	-	2	3	2	2
CO5	3	3	3	1	1	1	3	-	3	-	2	3	2	3
AVG:	3	3	2.8	1	1	1	3	-	3	-	2	3	2.2	2.2

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Subject Code	Subject Name	Category	L	T	P	C
GE24901	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	BSC	2	0	0	2

Course Objectives:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyzes the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND BIODIVERSITY	6

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

UNIT II	ENVIRONMENTAL POLLUTION	6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

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.

UNIT IV	SUSTAINABILITY AND MANAGEMENT	6

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

UNIT V	SUSTAINABILITY PRACTICES	6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cyclescarbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socioeconomical and technological change.

Total Contact Hours : 30

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5	To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

Textbooks:	
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.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
6.	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

Reference books/other materials/webresources:	
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											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	3	-	-	-	2	-	-	-
CO2	3	2	-	-	-	3	3	-	-	-	2	-	-	-
CO3	3	-	1	1	-	2	2	-	-	-	2	-	-	-
CO4	3	2	1	-	-	2	2	-	-	-	2	-	-	-
CO5	3	2	1	1	-	2	2	-	-	-	1	-	-	-
AVG	3	1.4	0.6	0.4	-	2.2	2.4	-	-	-	1.8	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
ME24411	STRENGTH OF MATERIALS AND FLUID MECHANICS LABORATORY	PCC	0	0	4	2

Course Objectives:

- To study the mechanical properties of metals, wood and spring by testing in laboratory.
- To verify the principles studied in fluid mechanics and machinery theory by performing experiments in laboratory.

PART I	STRENGTH OF MATERIALS	30

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal (Rockwell and Brinell Hardness)
4. Compression test on helical spring
5. Deflection test on carriage spring

PART II	FLUID MECHANICS AND MACHINES	30

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
5. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Determine the tensile, torsion and hardness properties of metals by testing.
CO2	Determine the stiffness properties of helical and carriage spring.
CO3	Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe.
CO4	Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet
CO5	Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	3	3	1	1	3	1	1	2	2	2	1
CO2	3	2	1	3	3	1	1	3	1	1	2	3	2	1
CO3	3	3	2	3	2	1	1	3	1	1	2	3	2	1
AVG	3	2.3	1.3	3	2.3	1	1	3	1	1	2	2.7	2	1

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Subject Code	Subject Name	Category	L	T	P	C
ME24412	THERMAL ENGINEERING LABORATORY	PCC	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 p-v 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: 60 PERIODS

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Conduct tests to evaluate performance characteristics of IC engines.
CO2	Conduct tests to evaluate the performance of refrigeration cycle.
CO3	Conduct tests to evaluate Performance and Energy Balance on a Steam Generator.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1				1			1	1	1	1
CO2	2	2	1	1				1			1	1	1	1
CO3	2	2	1	1				1			1	1	1	1
AVG	2	2	1	1				1			1	1	1	1

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Subject Code	Subject Name	Category	L	T	P	C
ME24413	KINEMATICS AND DYNAMICS LABORATORY	PCC	0	0	4	2

Course Objectives:

- To provide practical knowledge on the working principles of various mechanisms and machine elements.
- To understand the dynamics of different mechanical systems through experimentation..
- To analyze different types of gear trains and their applications.
- To study balancing of rotating and reciprocating masses.
- To evaluate the performance characteristics of governors, gyroscopes, and cam-follower mechanisms.

LIST OF EXPERIMENTS	60

List of Experiments:

1. To study and analyze Four Bar Mechanism and its inversions.
2. Determination of velocity and acceleration in mechanisms using graphical methods.
3. Study and experimental analysis of different types of gear trains.
4. Experimental verification of static and dynamic balancing principles.
5. Analysis and performance study of flywheel.
6. Determination of critical speed of shaft.
7. Experiment on the working principle of cam and follower mechanism.
8. Study of different types of governor mechanisms and determination of their characteristics.
9. Gyroscopic couple experiment to study the effect of gyroscopic forces.
10. To conduct an experiment on the determination of torque and power using a dynamometer.
11. Study of free and forced vibrations in mechanical systems.
12. Determination of the coefficient of friction using a friction apparatus.
13. Demonstration of belt and rope drive for power transmission.
14. Study and performance evaluation of clutches and brakes.

TOTAL: 60 PERIODS

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Identify and analyze various mechanisms used in machines.
CO2	Apply knowledge of kinematics and dynamics to solve machine element problems.
CO3	Experimentally determine the characteristics of governors and gyroscopes.
CO4	Evaluate the performance of mechanical systems like gears, flywheels, and cam-follower mechanisms
CO5	Implement practical knowledge for balancing and vibration analysis

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	1	-	1	2	1	-	3	2	2
CO2	3	3	2	3	3	2	1	2	2	1	-	3	3	2
CO3	2	2	3	3	3	2	-	2	2	2	-	2	2	3
CO4	3	2	3	3	3	2	1	1	3	2	1	3	2	3
CO5	3	3	3	3	3	2	1	1	2	2	1	3	3	3
AVG	2.8	2.4	2.6	3	2.8	1.8	0.6	1.4	2.2	1.6	0.4	2.2	2.4	2.6

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