Shri Balasaheb Mane Shikshan Prasarak Mandal's,
ASHOKRAO MANE GROUP OF INSTITUTIONS
NH – 4, Vathar Tarf Vadgaon, Tal: -Hatkanangale, Dist: - Kolhapur-416112
Website: www.amgoi.edu.in
An Autonomous Institute

Curriculum Structure and Evaluation Scheme for B. Tech. in Mechanical Engineering with Honors and Multidisciplinary Minor

(To be implemented for 2025-2029 Batch)

(As per NEP 2020)

Head of Department	Dean Academics	Director
Prof. M. A. Sutar	Dr. S. S. Patil	Dr. Mrs. S. R. Chougule

HOD
DEPT. OF MACHANICAL ENGINEERING
SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S
ASHOKRAO MANE GROUP OF INSTITUTIONS

Dr. Mrs. S. R. Chougule
DIRECTOR
Shri Balasaheb Mane Shikshan Prasarak Mandal's
Ashokrao Mane Group Of Institutions
Vathar Tarf Vadgaon, Tal. Hatkanangale
Dist. Kolhapur, Maharashtra - 416112

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Mechanical Engg.

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Tal. Hatkanangale Dist. Kolhapur Vathar Tarf Vadgaon

ABBREVIATIONS

- **L:** Lecture
- **T:** Tutorial
- **P:** Practical
- **ISE-** In Semester Evaluation
- **MSE:** Mid Semester Examination
- **ESE:** End Semester Exam
- **BSC -**Basic Science Courses
- **ESC:** Engineering Science Course
- **VEC-** Value Education Course
- **AEC:** Ability Enhancement Course
- **IKS:** Indian Knowledge System
- **VSEC:** Vocational and skill Enhancement Course
- **PCC:** Program Core Course
- **PEC:** Program Elective Course
- **CC:** Co-curricular Course
- **MDM-** Multidisciplinary Minor
- **CEP-** Community Engagement Project
- **FP-** Field Project

Department: Applied Science & Humanities **Semester: I**

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH101	Engineering Mathematics- I	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH103	Engineering Chemistry	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH106	Fundamentals of Electronics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH107	Engineering Graphics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
IKS	25ASH109	Architecture and Town Planning	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ASH111C	Power Plant Engineering	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH113	Engineering Chemistry Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH116	Fundamentals of Electronics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
ESC	25ASH117	Engineering Graphics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSEC	25ASH119	Workshop Practices	-	-	2	1	ISE	50	20	
CC	25ASH121	Social Life Skills	1	-	-	1	ISE	50	20	
	Total		**17**	**01**	**08**	**21**		**950**		
Total Contact Hours- 26							**Total Credits- 22**			

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Mechanical Engg.

Department: Applied Science & Humanities **Semester: II**

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH201	Engineering Mathematics- II	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH202	Engineering Physics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH204	Basic Electrical Engineering	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH205	Engineering Mechanics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25ASH208	Programming in C	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
AEC	25ASH210	Communication Skills	1	-	-	1	ISE-I	5		20
							MSE	15		
							ISE-II	5		
							ESE	25	10	
BSC	25ASH212	Engineering Physics Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH214	Basic Electrical Engineering Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH215	Engineering Mechanics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSEC	25ASH218	Programming in C Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
CC	25ASH220	Yoga & Meditation	-	-	2	1	ISE	50	20	
AEC	25ASH222	Communication Skills Laboratory	-	-	2	1	ISE	50	20	
	Total		**15**	**01**	**12**	**22**		**950**		
Total Contact Hours- 28							**Total Credits- 22**			

Department: Department of Mechanical Engineering
Semester: III

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME301	Applied Thermodynamics	3	-	-	3	ISE-I	10		
							MSE	30		
							ISE-II	10		40
							ESE	50	20	
PCC	25ME302	Material Science & Metallurgy	3	-	-	3	ISE-I	10		
							MSE	30		
							ISE-II	10		40
							ESE	50	20	
PCC	25ME303	Applied Mathematics	3	1	-	4	ISE-I	10		
							MSE	30		
							ISE-II	10		40
							ESE	50	20	
MDM	25ME304	Multidisciplinary Minor – I	3	-	-	3	ISE-I	10		
							MSE	30		
							ISE-II	10		40
							ESE	50	20	
Entre./ Econo./ Manag	25ME305	Professional Skill Development	2	-	-	2	ISE-I	25		
							ISE-II	25	20	
VEC	25ME306	Universal Human Values	2	-	-	2	ISE-I	10		
							MSE	30		40
							ISE-II	10		
							ESE	50	20	
CEP/FP	25ME307	Mini Project – I	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
PCC	25ME308	Mechanical Engineering Lab-I	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
PCC	25ME309	Machine Drawing Lab	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
	Total		**16**	**1**	**06**	**20**		**800**		
Total Contact Hours- 23							**Total Credits- 20**			

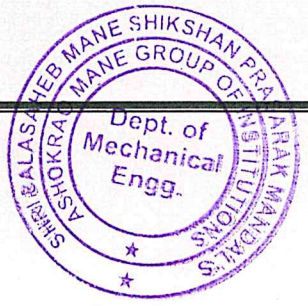
SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Mechanical Engg.

Department: Department of Mechanical Engineering
Semester: IV

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME401	Theory of Machines	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME402	Fluid Mechanics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME403	Strength of Materials	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25ME404	Multidisciplinary Minor – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25ME405	Open Elective – I	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25ME406	AI in Mechanical Engineering	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
AEC	25ME407	Quantitative Aptitude & Logical Reasoning- I	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
Entre./ Econo./ Manag	25ME408	Entrepreneurship Development	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
VEC	25ME409	Constitution of India	2	-	-	2	ISE-I	25	20	
							ISE-II	25		
PCC	25ME410	Mechanical Engineering Lab-II	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
PCC	25ME411	CAD Lab- I	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
	Total		**18**	**1**	**06**	**22**		**900**		
Total Contact Hours- 25					**Total Credits- 22**					

Department: Department of Mechanical Engineering **Semester: V**

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME501	Machine Design- I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME502	Heat Transfer	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME503	Metrology & Quality Control	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25ME504	Program Elective - I	4	-	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25ME505	Multidisciplinary Minor – III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25ME506	Open Elective – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
AEC	25ME507	Quantitative Aptitude & Logical Reasoning - II	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
CEP/FP	25ME508	Mini Project – II	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
PCC	25ME509	Mechanical Engineering Lab-III	-	-	4	1	ISE	50	40	
							ESE(POE)	50		
PCC	25ME510	CAD Lab- II	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
	Total		**19**	**-**	**08**	**22**		**900**		



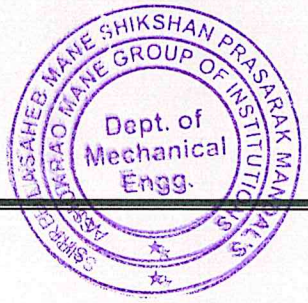
Department: Department of Mechanical Engineering

Semester: VI

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME601	Machine Design- II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME602	I. C. Engine	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25ME603	Program Elective - II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25ME604	Program Elective - III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25ME605	Multidisciplinary Minor – IV	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25ME606	Open Elective – III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25ME607	Project Phase-I	-	-	4	2	ISE-I	25	20	
							ISE-II	25		
PCC	25ME608	Mechanical Engineering Lab-IV	-	-	4	1	ISE	50	40	
							ESE(POE)	50		
PEC	25ME609	Program Elective - II Lab	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
	Total		**18**	**-**	**10**	**22**		**800**		
Total Contact Hours- 28					**Total Credits- 22**					

Department: Department of Mechanical Engineering
Semester: VII

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME701	Refrigeration & Air Conditioning	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME702	Mechanical System Design	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25ME703	Program Elective - IV	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25ME704	Program Elective - V	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25ME705	Multidisciplinary Minor – V	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME706	Mechanical Engineering Lab-V	-	-	4	1	ISE	50	40	
							ESE(POE)	50		
PCC	25ME707	ANSYS Lab	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
Project	25ME708	Project Phase-II	-	-	8	4	ISE	50	20	60
							ESE(POE)	100	40	
	Total		**14**	**-**	**14**	**20**		**850**		
Total Contact Hours- 28					**Total Credits- 20**					



Department: Department of Mechanical Engineering
Semester: VIII

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME801	Project Management	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25ME802	Program Elective – VI	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
RM	25ME803	Research Methodology	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Intern. / OJT	25ME804	Internship/On Job Training	-	-	24	12	ISE	100	40	80
							ESE(POE)	100	40	
	Total		**9**	**1**	**24**	**22**		**500**		
Total Contact Hours- 34							**Total Credits- 22**			

MULTIDISCIPLINARY MINOR (MDM) BASKET

Important Note:

1. Students should select **any one basket** for the award of Minor Degree of their interest from the table below.
2. The student must complete **all five courses under the selected MDM Basket** to qualify for the Minor.
3. The credits earned under the Multidisciplinary Minor shall form part of the total **172 Credits** required for award of the degree.

MDM Basket Name	Sr. No.	Course Code	Course Name	Semester	Offered by the Department
Data Analyst	1	25MDM304A	Data Structure	III	**Artificial Intelligence & Machine Learning** (To all UG Programs except UG AIML, AIDS, CSE, E&C Engg.)
	2	25MDM404A	R-programming	IV	
	3	25MDM505A	DBMS	V	
	4	25MDM605A	Big Data Technologies	VI	
	5	25MDM705A	Introduction to Machine Learning	VII	
Prompt Engineering	1	25MDM304B	R-programming	III	**Artificial Intelligence & Machine Learning** (To all UG Programs except UG AIML, AIDS, CSE, E&C Engg.)
	2	25MDM404B	Introduction to AI and ML	IV	
	3	25MDM505B	IOT	V	
	4	25MDM605B	Introduction to Blockchain Technology	VI	
	5	25MDM705B	Prompt Engineering	VII	
Intelligent Data Systems	1	25MDM304C	Computer Organization Architecture	III	**Artificial Intelligence & Data Science** (To all UG Programs except UG AIDS, AIML CSE, E&C Engg.)
	2	25MDM404C	R-programming	IV	
	3	25MDM505C	Data Manipulation, Analysis and Visualization	V	
	4	25MDM605C	DBMS	VI	
	5	25MDM705C	Big Data Technologies	VII	

Cognitive Computing	1	25MDM304D	Computer Organization Architecture	III	**Artificial Intelligence & Data Science** (To all UG Programs except UG AIDS, AIML CSE, E&C Engg.)
	2	25MDM404D	Introduction to Data Science	IV	
	3	25MDM505D	Introduction to Machine Learning	V	
	4	25MDM605D	Social Network Analysis	VI	
	5	25MDM705D	Natural Language Processing	VII	
Essentials of Software Development	1	25MDM304E	Data Structures	III	**Computer Science & Engineering** (To all UG Programs except UG CSE, AIML, AIDS, E&C Engg.)
	2	25MDM404E	Python Programming	IV	
	3	25MDM505E	Computer Algorithms	V	
	4	25MDM605E	Database Management System	VI	
	5	25MDM705E	Software Engineering	VII	
Modern Computing Systems	1	25MDM304F	Data Structures	III	**Computer Science & Engineering** (To all UG Programs except UG CSE, AIML, AIDS, E&C Engg.)
	2	25MDM404F	Python Programming	IV	
	3	25MDM505F	Java Programming	V	
	4	25MDM605F	Artificial Intelligence & Machine Learning	VI	
	5	25MDM705F	Cloud Computing	VII	
Smart Energy Systems and Sustainability	1	25MDM304G	Fundamentals of Energy Systems	III	**Electrical Engineering** (To all UG Programs except UG Electrical Engg.)
	2	25MDM404G	Solar and Wind Energy Technologies	IV	
	3	25MDM505G	Fundamentals of Energy Management Systems	V	
	4	25MDM605G	Energy Storage Systems	VI	
	5	25MDM705G	Renewable Energy Integration in	VII	

			Smart Grids		
Intelligent Electrical Systems	1	25MDM304H	Introduction to Intelligent Electrical Systems	III	**Electrical Engineering** (To all UG Programs except UG Electrical Engg.)
	2	25MDM404H	IoT and IOV for Electrical Systems	IV	
	3	25MDM505H	AI Applications in Electrical Systems	V	
	4	25MDM605H	Automation and Control in Energy Systems	VI	
	5	25MDM705H	Smart Grid and Intelligent Monitoring Systems	VII	
Communication System	1	25 MDM304I	Principles of Communication	III	**Electronics & Computer Engineering** (To all UG Programs except UG E&C & E&TC Engg.)
	2	25 MDM404I	Wireless and Mobile Communication	IV	
	3	25 MDM505I	Wireless Sensor Networks	V	
	4	25 MDM605I	Information theory and Coding	VI	
	5	25MDM705I	Satellite and Radar Communication	VII	
Computing Solutions for Industry	1	25MDM304J	Python programming	III	**Electronics & Computer Engineering** (To all UG Programs except UG E&C, AIML, AIDS, CSE Engg.)
	2	25MDM404J	Industry Analytics	IV	
	3	25MDM505J	Cloud Computing	V	
	4	25MDM605J	Industrial Internet of Things (IIoT)	VI	
	5	25MDM705J	Power BI	VII	
Internet of Things (IoT)	1	25MDM304K	Fundamentals of IoT	III	**Electronics & Telecommunication Engineering** (To all UG Programs except UG E&TC Engg.)
	2	25MDM404K	Technologies Enabling IoT	IV	
	3	25MDM505K	IoT System Design	V	
	4	25MDM605K	Industrial IoT	VI	
	5	25MDM705K	IoT Security and	VII	

			Privacy		
Embedded Systems	1	25MDM304L	Digital Design	III	**Electronics & Telecommunication Engineering** (To all UG Programs except UG E&TC Engg.)
	2	25MDM 404L	Microcontroller & Interfacing Techniques	IV	
	3	25MDM 505L	Embedded Systems Design	V	
	4	25MDM 605L	Real-Time Operating Systems	VI	
	5	25MDM 705L	Advanced Embedded Systems & Product Development	VII	
Product Development	1	25MDM 304M	Design Thinking Approach	III	**Mechanical Engineering** (To all UG Programs except UG Mech Engg.)
	2	25MDM 404M	Engineering Design Process	IV	
	3	25MDM 505M	Rapid Prototyping and Testing	V	
	4	25MDM 605M	Product Development	VI	
	5	25MDM 705M	Commercialization and Sustainability	VII	
Refrigeration and Air Conditioning	1	25MDM 304N	Fundamentals of Refrigeration	III	**Mechanical Engineering** (To all UG Programs except UG Mech Engg.)
	2	25MDM 404N	Refrigeration Components and Low Temperature Cycles	IV	
	3	25MDM 505N	Psychrometry and Air Conditioning Process	V	
	4	25MDM 605N	HVAC Systems and Emerging Technologies	VI	
	5	25MDM705N	Application Based System Design	VII	
Planning and Execution of Projects	1	25MDM304P	Building Construction Materials	III	**Civil Engineering** (To all UG Programs except UG Civil Engg.)
	2	25MDM404P	Engineering Management	IV	
	3	25MDM505P	Resource	V	

			Management		
	4	25MDM605P	Optimization Technique	VI	
	5	25MDM705P	Engineering Economics	VII	
Building Interior Design and Home Automation	1	25MDM304R	Introduction to Buildings and Spaces	III	**Civil Engineering** (To all UG Programs except UG Civil Engg.)
	2	25MDM404R	Basics of Interior Building Design	IV	
	3	25MDM505R	Building Interior Materials and Finishes	V	
	4	25MDM605R	Smart Devices and Sensors for Home Automation	VI	
	5	25MDM705R	Recent Techniques for Home Automation	VII	

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS
Dept. of Mechanical Engg.

OPEN ELECTIVE COURSES

(Students have to select any one Open Elective course, for each applicable semester, of their interest (other than open electives offered by his/her department) from the table below)

Open Elective – I

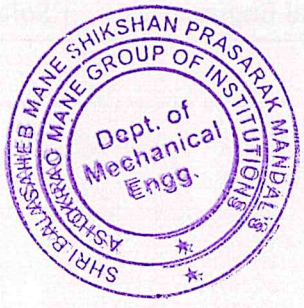
Sr. No.	Course Code	Course Name	Offered by Department
1	25OE405A	E Commerce	Artificial Intelligence & Machine Learning **&** Artificial Intelligence & Data Science
2	25OE405B	Environmental Science	Civil Engineering
3	25OE405C	Human Computer Interaction (HCI)	Computer Science & Engineering
4	25OE405D	Electrical Safety & Standards	Electrical Engineering
5	25OE405E	Sensor Technology	Electronics & Computer Engineering **&** Electronics & Telecommunication Engineering
6	25OE405F	Project Management	Mechanical Engineering

Open Elective – II

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE506A	Design Thinking	Artificial Intelligence & Machine Learning **&** Artificial Intelligence & Data Science
2	25OE506B	Disaster Management	Civil Engineering
3	25OE506C	Cyber Security	Computer Science & Engineering
4	25OE506D	Energy Audit	Electrical Engineering
5	25OE506E	Drone Technology	Electronics & Computer Engineering **&** Electronics & Telecommunication Engineering
6	25OE506F	Startup and Business Strategy	Mechanical Engineering

Open Elective – III

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE606A	Recommender System	Artificial Intelligence & Machine Learning **&** Artificial Intelligence & Data Science
2	25OE606B	Environmental Impact Assessment	Civil Engineering
3	25OE606C	Cyber Laws	Computer Science & Engineering
4	25OE606D	E-Mobility	Electrical Engineering
5	25OE606E	Engineering Economics	Electronics & Computer Engineering **&** Electronics & Telecommunication Engineering
6	25OE606F	Industrial Automation	Mechanical Engineering



PROGRAM ELECTIVE CORE

(Students have to select any one Program Elective Core course out of 03, for each applicable semester, of their interest, offered by the Department from the table below)

Program Elective Core - I

Sr.	Course Code	Domain	Course Name	Semester
1	25ME505A	Design Engineering	Product Design & Development	V
2	25ME505B	Production Engineering	Design for Manufacturing & Assembly	
3	25ME505C	Thermal Engineering	Fluid and Turbo Machinery	

Program Elective - II

Sr.	Course Code	Domain	Course Name	Semester
1	25ME604A	Design Engineering	Optimization Techniques	VI
2	25ME604B	Production Engineering	Operational Research	
3	25ME604C	Thermal Engineering	Electric Vehicles	

Program Elective - III

Sr.	Course Code	Domain	Course Name	Semester
1	25ME605A	Design Engineering	Finite Element Analysis	VI
2	25ME605B	Production Engineering	Mechatronics	
3	25ME605C	Thermal Engineering	Solar Energy	

Program Elective – IV

Sr.	Course Code	Domain	Course Name	Semester
1	25ME703A	Design Engineering	Fracture Mechanics	VII
2	25ME703B	Production Engineering	Manufacturing Technology	
3	25ME703C	Thermal Engineering	Energy Conservation & Management	

Program Elective – V

Sr.	Course Code	Domain	Course Name	Semester
1	25ME804A	Design Engineering	Noise & Vibration	VII
2	25ME804B	Production Engineering	Enterprise Resource Planning	
3	25ME804C	Thermal Engineering	Renewable Energy Sources	

Program Elective – VI

Sr.	Course Code	Domain	Course Name	Semester
1	25ME805A	Design Engineering	Experimental Stress Analysis	VIII
2	25ME805B	Production Engineering	Supply Chain Management	
3	25ME805C	Thermal Engineering	Power Plant Engineering	

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B.Tech. (Hons) in Robotics & Automation

Department: Mechanical Engineering

Course Code	Name of the Course	Credit
25ME3H	Introduction to Robotics	3
25ME4H	Sensors and Actuators for Automation	3
25ME5H	Industrial Automation and PLC	3
25ME6H	Robot Kinematics and Dynamics	3
25ME7H	Mechatronics Systems Design	3
25ME8H	Artificial Intelligence in Robotics	3
	Total	**18**

Guidelines for Honor Certification Courses

1. Students are required to complete six courses (each carrying 3 credits) through an online platform to earn a total of 18 credits under the Honor Certification scheme.
2. All six courses must be completed starting from the Second Year First Semester (Semester III) to the Final Year Second Semester (Semester VIII).
3. The student has to obtain all 18 credits by the last semester of the program.
4. While selecting the course platform, first preference must be given to SWAYAM/NPTEL.
5. Registration on platforms such as Coursera or Udemy is permitted only under the following conditions:
   a. The SWAYAM/NPTEL course schedule does not align with the academic calendar.
   b. The subsequent course in the learning sequence is not available on SWAYAM/NPTEL.
   c. Any other unavoidable circumstances arise.
   d. About 80% of the contents of the course should match with the SWAYAM/NPTEL courses.
6. Course selection must strictly adhere to the recommendations of the Chairman of Board of Studies (BOS).
7. Credits for the respective Honor courses will be awarded under the following conditions:
   a. For NPTEL courses, students must complete all assignments on time, pass the examination, and obtain the certificate.
   b. For Coursera or Udemy courses, students must obtain the course certificate and appear for the Online examination which will be conducted under the supervision of the Institute by Examination Cell.

While selecting an online course, the following criteria must be ensured:

a. The course should be of an advanced level, not basic or introductory.
b. The course content must not overlap with subjects already included in the regular curriculum or listed under elective courses.
c. The duration of each course must be:
   - Minimum 8/12 weeks for SWAYAM/NPTEL courses
   - At least 30+ hours for Coursera/Udemy courses

Course Code	Name of the Course and SWAYAM/NPTEL Links	Credit
25ME3H	Introduction to Robotics Robotics – NPTEL+ 1. NPTEL Robotics Course 2. Basics of Robotics (Coursera) 3. Robotics Foundations	3
25ME4H	Sensors and Actuators Mechatronics - Course 1. NPTEL Sensors Course 2. Mechatronics Sensors 3. Industrial Sensors	3
25ME5H	Industrial Automation & PLC Mechatronics - Course 1. NPTEL PLC Course 2. Automation Systems 3. PLC Programming	3
25ME6H	Robot Kinematics & Dynamics Robotics – NPTEL+ 1. NPTEL Robotics Kinematics 2. Robot Motion Analysis 3. Dynamics of Machines	3
25ME7H	Mechatronics System Design Mechatronics - Course 1. NPTEL Mechatronics 2. Embedded Systems 3. Control Systems	3
25ME8H	AI in Robotics Mechatronics - Course 1. NPTEL AI 2. Machine Learning for Robotics 3. Intelligent Systems	3
	Total	**18**

Exit Courses for Mechanical Engineering (As per NEP Guidelines)

A. After First Year:

The candidate should pass following skill-based courses to qualify for Certification.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25ME225	Computer Aided Drafting (2D)	3	-	2	4	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25ME226	Hands-on Training in any workshop (4 Weeks)	-	-	8	4	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
Total		**3**	**-**	**10**	**8**		**200**		
Total Contact Hours- 13						**Total Credits- 8**			

B. After Second Year:

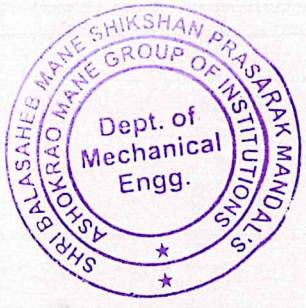
The candidate should pass following skill-based courses to qualify for Diploma.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25ME412	CNC Programming	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25ME413	Smart Materials	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25ME414	Internship	-	-	4	2	ISE	50		40
						ESE	50	20	
Total		**6**	**-**	**4**	**8**		**300**		
Total Contact Hours- 10						**Total Credits- 8**			

C. After Third Year:

The candidate should pass following skill-based courses to qualify for B. Voc.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25ME610	Application of CAD	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25ME611	Application of Advance Materials	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25ME612	Internship	-	-	4	2	ISE	50		40
						ESE	50	20	
Total		**6**	**-**	**4**	**8**		**300**		
Total Contact Hours- 10						**Total Credits- 8**			



Department: Department of Mechanical Engineering
Semester: III

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME301	Applied Thermodynamics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME302	Material Science & Metallurgy	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME303	Applied Mathematics	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25ME304	Multidisciplinary Minor – I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Entre./ Econo./Manag	25ME305	Professional Skill Development	2	-	-	2	ISE-I	25		
							ISE-II	25	20	
VEC	25ME306	Universal Human Values	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
CEP/FP	25ME307	Mini Project – I	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
PCC	25ME308	Mechanical Engineering Lab-I	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
PCC	25ME309	Machine Drawing Lab	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
	Total		**16**	**1**	**06**	**20**		**800**		
Total Contact Hours- 23							**Total Credits- 20**			

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Title of the Course Name: **Applied Thermodynamics** Course Code: 25ME301	**L**	**T**	**P**	**Credits**
	3		--	3
Evaluation Scheme:	ISE	MSE	ESE	Total
Marks:	**20**	**30**	**50**	**100**

Pre-Requisite: Applied Thermodynamics

Course Objectives: The course aims to:

1. To study basic concepts of thermodynamics and its applications.
2. To study physical significance of entropy term and its application.
3. To study application of first and second law of thermodynamics to various thermodynamic devices like Steam generator, Condenser, Nozzles and Turbines.
4. To study different types of turbines and corresponding velocity diagrams.

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

CO1	Define and describe various laws of Thermodynamics and its corollaries, steam properties.
CO2	Formulate and solve problems on various thermodynamic cycles, steam nozzle, turbines and condensers.
CO3	Design the steam nozzle and turbines.
CO4	Analyze the properties of steam and performance of steam turbines.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	2	-	-	-	-	-	-	-	-	-	2	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO 3	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO 4	2	3	-	1	-	-	-	-	-	-	-	-	3	-

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Laws of Thermodynamics and Entropy** Zeroth law, first law and Second law of thermodynamics, Statement of third law of thermodynamics. Equivalence of Kelvin plank and Clausius statement, Numerical treatment on second law, Entropy: Inequality of Clausius, Entropy changes in reversible process and irreversible process, Principal of increase of entropy, Applications, Entropy change of an ideal gas.	**08**
2	**Properties of Pure Substances and Vapour Power Cycles** Properties of steam, Use of steam table and Mollier chart, Carnot cycle using steam, Limitations of Carnot cycle Rankine cycle, Representation on T-s and H-s planes, Thermal efficiency, Specific steam consumption.	**08**
3	**Steam Condensers** Functions, Elements of condensing plant, Types of steam condensers, surface and jet condensers, Comparison, Vacuum efficiency, Condenser efficiency, Loss of vacuum, Sources of air leakages, Estimation of cooling water required.	**08**
4	**Steam Nozzles** Functions, Shapes, Critical pressure ratio, Maximum discharge condition, Effect of faction, Design of throat and exit areas, Nozzle efficiency, Numerical on nozzles.	**07**
5	**Impulse Turbines** Principles of operation, Classification, Impulse and reaction steam turbine, compounding of steam turbines. Flow through impulse turbine blades, Velocity diagrams, Work done, Efficiencies, End thrust, Blade friction, Influence of ratio of blade speed to steam speed on efficiency of single stage turbines and its condition curve and reheat factors	**07**
6	**Reaction Turbines** Flow through impulse reaction blades, Velocity diagram, and degree of reaction, Parson's reaction turbine, Back pressure and pass out turbine. Governing of steam turbines. Losses in steam turbines, Performance of steam turbines. Function of diaphragm, Glands, Turbine troubles like Erosion, Corrosion, Vibration, Fouling etc.	**07**

Text Books:

1 "Thermal Engineering", R. K. Rajput, Laxmi Publications, 3rd Edition
2 "Thermal Engineering", Ballaney P.L, Khanna Publishers, New Delhi, 27th Ed.
3 "Thermal Engineering", Mathur and Mehta, Jain Bros. Publishers, Delhi,3rd Ed..

Reference Books:

1 "Engineering Thermodynamics", P.K. Nag., Tata McGraw Hill, New Delhi, 4th Ed.
2 "Thermal Engineering", Kumar and Vasandani, D.S. Publisher Metropolitan Book Co, Delhi, 3rd Ed.
3 "Thermodynamics: an Engineering Approach", Congel and Boles, Tata McGraw-Hill, New Delhi, 3rd Edition.

Course Name: **Material Science and Metallurgy** Course Code: **25ME302**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Physics, Chemistry Fundamentals, Introductory Mechanical Engineering Courses.

Course Objective: The course aims to:

1. Provide a strong foundation in material science, focusing on the relationship between structure, properties, and applications of engineering materials.
2. Familiarize students with material testing methods for evaluating mechanical properties and defects.
3. Introduce equilibrium diagrams of ferrous systems and their role in alloy design and industrial applications.
4. Impart knowledge of heat treatment processes and material selection for engineering design and manufacturing.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Analyze crystal structures, defects, and solidification to interpret equilibrium diagrams and micro structural evolution.
CO2	Evaluate mechanical properties using destructive and non-destructive testing methods.
CO3	Design and select suitable heat treatment processes using TTT and CCT diagrams.
CO4	Justify material selection based on metallurgical requirements for specific engineering applications.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	–	–	–	-	–	2	2	1
CO2	3	2	-	3	2	–	–	–	–	-	–	2	-	-
CO3	3	2	3	-	2	-	–	–	-	-	-	3	-	-
CO4	2	3	3	2	-	-	-	-	-	-	-	3	3	-

Course Content		
Unit No.	**Description**	**Hrs**
1	**Structure of Materials :** Classification of Engineering Materials, Crystal structure in metals (BCC, FCC, HCP) Crystal systems and Bravis Lattices ,Atomic Packing Factor of SC, BCC,FCC and HCP structures, Imperfection in crystals, nucleation, solidification and growth, cooling curves, Solid solutions and intermediate phases, Construction of equilibrium diagrams from cooling curves, components of different solubility in liquid and solid state, Lever arm principles, dendritic structure and coring.	07
2	**Metallurgical Testing and Evaluation of Properties :** **Destructive Testing methods:** Tensile, Compressive, Impact, Fatigue, Creep, Hardness. **Non-Destructive Testing:** Dye Penetrant, magnetic particles , ultrasonic, Radiography, Eddy Current testing.	07
3	**Equilibrium Diagrams :** Hume – Rothery's rule of solid solubility, Gibb's phase rule, Types of cooling curves, plotting of equilibrium diagrams, Fe – Fe_3C diagram, phase, reactions, Critical Temperatures, Classification and application of steels, specification of steels, Effect of alloying elements on properties of steel ,Transformation products of Austenite.	07
4	**Heat Treatment Processes of Steels :** TTT Diagram and CCT Diagram, Effect of alloying dements on TTT diagram and its significance, Annealing, Normalizing, Hardening and tempering, Mechanism of quenching Surface hardening, Flame hardening and other heat treatment processes, Heat treatment defects and remedies.	07
5	**Non Ferrous and Advanced Materials :** Alloys of Copper, Aluminium, Magnesium, Titanium, Other alloys of lead, tin, zinc, nickel, manganese, white metals and bearing alloys, Polymers, ceramics, Composites, smart materials, Nano materials, Bio materials.	07
6	**Powder Metallurgy & Material Selection :** Introduction to Powder Metallurgy and its applications. Relationship between material selection, material properties and material processing, Criteria for selection of engineering materials, Selection of materials for strength, toughness, fatigue and creep, Case studies in material selection	07

Text Books:

1. V.D. Kodgire, Material Science and Metallurgy, Everest Publishers Pune.
2. T.V. Rajan& C.P. Sharma, Heat Treatments Principles and Practices, PHI Publications.

Reference Books :

1. William D. Callister, Materials Science and Engineering an Introduction, John Wiley &Sons.
2. S. H. Avner, Physical Metallurgy, Tata McGraw-Hill publication.
3. F.A.A. Cranes & J.A. Charles, Selection and Uses of Engineering Materials, Butterworth &Com.Ltd., London.

Title of the Course Name: **Applied Mathematics** Course Code: **25ME303**	**L**	**T**	**P**	**Credits**
	3	1	--	4
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Engineering Mathematics, Engineering Physics, Engineering Mechanics

Course Objectives: The course aims to:

1. To develop strong mathematical foundations required for mechanical engineering analysis.
2. To apply differential and integral calculus in solving engineering problems.
3. To use linear algebra and transforms in modeling mechanical systems.
4. To enhance problem-solving skills through mathematical methods used in engineering applications.

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

CO1	Apply differential and integral calculus to solve mechanical engineering problems.
CO2	Analyze systems of linear equations and matrix operations relevant to engineering applications.
CO3	Use ordinary differential equations and transforms to model and solve engineering systems.
CO4	Apply numerical and statistical methods for data analysis and engineering decision-making.

CO-PO Mapping:

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

Course Content		
Unit	**Unit title and Content**	**Hrs**
1	**Laplace Transform** Definition – Laplace Transform, conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n property, scale change property, transforms of functions divided by t property, transforms of integral of functions property, transforms of derivatives ; Evaluation of integrals by using Laplace transform and Examples on Laplace Transformation Properties.	07
2	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations and Examples.	07
3	**Partial Differential Equations and their Applications :** Formation of Partial differential equations by eliminating arbitrary constants and functions; heat Equations solvable by direct integration; Method of separation of variables – applications to find solutions of one dimensional flow equation i.e. $(\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial t^2})$ and one dimensional wave equation i.e. $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$	07
4	**Functions of Complex Variables :** Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).	07
5	**Correlation** Introduction to types of correlation, correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient and its examples, Spearman's rank correlation and its examples.	07
6	**Linear Regression Analysis** Introduction, Linear and non-linear regression, Lines of regression, Derivative of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression and its examples.	07

Texts Books:

1. B. S. Grewal – Higher Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig – Advanced Engineering Mathematics, Wiley India.
3. W. Bolton, Programmable Logic Controllers, Newnes Publications.

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Reference Books:

1. K. A. Stroud – Engineering Mathematics, Palgrave Macmillan.
2. Peter V. O'Neil – Advanced Engineering Mathematics, Cengage Learning.
3. Ramakrishna Rao & Mathews – Engineering Mathematics, PHI Learning.
4. S. S. Sastry – Introductory Methods of Numerical Analysis, PHI Learning.

Title of the Course Name: **Design Thinking Approach** Course Code: **25ME304A**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of mechanical engineering fundamentals, problem-solving skills, and openness to creative and user-centered thinking.

Course Objectives: The course aims to:

1. Understand the principles of Design Thinking as a creative, solution-oriented approach to problem solving.
2. Develop a user-centric mindset for designing innovative and effective solutions.
3. Enable learners to frame design challenges and generate solutions through ideation, prototyping, and iteration.
4. Develop the ability to analyze problems and apply Design Thinking principles to real-world applications.

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

CO1	Understand the principles and role of Design Thinking in innovation and engineering practice.
CO2	Apply the Design Thinking process to real-world problems and develop visual representations or prototypes.
CO3	Analyze problems using diverse methods to create user-centric solutions through Design Thinking stages.
CO4	Develop creative thinking skills and apply the Design Thinking innovation cycle for product development.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Design Thinking for Engineers** Introduction, Essential design thinking skills, Core principles of design thinking, Foundations of design thinking, Building an effective design thinking team, Features of design thinking, Process of thinking, Creative thinking, Lateral thinking	07
2	**Stages of Design Thinking** Empathy: Difference between empathy and sympathy, Empathy techniques, Empathy maps, Identification of problem, Defining and refining of problem statement, Process of ideation, Prototyping, Testing..	07
3	**Exploring Design Thinking in Innovation:** Understanding the role of design thinking in product and process innovation, Art of innovation, Difference between innovation and creativity, Role of creativity and innovation in organizations- creativity to innovation, Differentiating engineering design and design thinking, Contrasting approaches: engineering design vs. Design thinking	07
4	**Problem Fixing and Process of Product Design** Problem formation, Product strategies, Product value, Product Planning, Product specifications, Innovation towards product design- case studies, Understanding problem solving, Testing problem, Process of engineering product design, Design thinking approach, Examples of best product designs and functions	07
5	**Design Thinking & Customer Centricity** Problem identification and framing (design challenges), Practical examples of customer challenges, Use of design thinking to enhance customer experience, Parameters of product experience, Alignment of customer expectations with product design, Testing, feedback, and iterative improvement	07
6	**Design Challenge - Prototyping & Testing** Design challenge: Define the design challenge, Introduction to prototype, Need of prototyping, Rapid prototype development process, Prototyping & iteration-feasibility study, Testing and documentation, Sample example.	07

Text Books:

1. Soni, P., *Design Your Thinking: The Mindsets, Toolsets, and Skill Sets for Creative Problem-Solving*, Penguin Random House India Private Limited, 2020.
2. Cross, N., *Design Thinking*, Berg Publishers, 2011.
3. Balarara, S., *Thinking Design*, Sage Publications, 2011.

Reference Books:

1. Brown, T., *Change by Design: How Design Thinking Transforms Organizations*, HarperCollins, 2009.
2. Lewrick, M., Link, P., and Leifer, L., *The Design Thinking Toolbox*, John Wiley & Sons, 2020.
3. Lewrick, M., Link, P., and Leifer, L., *The Design Thinking Playbook*, John Wiley & Sons, 2018.

Title of the Course Name: **Fundamentals of Refrigeration** Course Code: **25ME304B**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of thermodynamic, heat energy and work

Course Objectives: The course aims to:

1. To introduce fundamental concepts and terminology related to refrigeration.
2. To develop a strong foundation in thermodynamic principles applicable to refrigeration cycles.
3. To provide comprehensive knowledge of refrigerants used in refrigeration systems.
4. To enable understanding and comparison of vapour compression and vapour absorption refrigeration systems.

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

CO1	Explain basic refrigeration concepts, applications, and system classifications.
CO2	Apply thermodynamic principles to analyze refrigeration cycles and systems.
CO3	Identify suitable refrigerants based on performance, safety, and environmental criteria.
CO4	Analyze the working and performance of vapour compression and absorption refrigeration systems.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO 2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO 3	2	2	-	-	-	-	2	-	-	-	-	-	2	-
CO 4	3	3	-	2	-	-	-	-	-	-	-	-	3	-

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Thermodynamic Principles for Refrigeration:** Laws of thermodynamics, heat pump, heat engine, refrigerator. Properties of working fluids and pure substances. Concept of heat, work, entropy, and enthalpy, Gas laws, Thermodynamic processes.	07
2	**Basics of Refrigeration:** Definition, Unit, COP, applications in domestic, commercial, medical, food processing, and industrial sectors. Classification of refrigeration systems., standard performance parameters.	07
3	**Thermodynamic Refrigeration Cycles:** Reversed Carnot cycle and its limitations. Ideal refrigeration cycles. Reversed Brayton cycle. Comparison of theoretical and actual performance.	07
4	**Refrigerants** Definition. Thermodynamic, physical, chemical, and environmental properties of refrigerants. Classification of refrigerants. Refrigerant nomenclature technique, Selection criteria for refrigerants. ODP and GWP. Leak detection.	07
5	**Vapor Compression Refrigeration System (VCRS)** Working of VCRS P-h and T-s diagram, Refrigeration System Components. Theoretical VCRS, actual VCRS. Effect of suction pressure and discharge pressure on COP. Suction superheating, liquid sub-cooling. Numerical. liquid-vapour heat exchanger. Waste heat recover opportunities.	07
6	**Vapour Absorption Refrigeration System (VARS)** Comparison between VCRS and VARS. Detailed study of aqua-ammonia system. Practical aqua-ammonia system Three fluid system. Lithium Bromide vapor absorption. Advantages, limitations, and industrial applications of VAR systems. Solar refrigeration system.	07

Text Books:

1. R. S. Khurmi and J. K. Gupta, "A Textbook of Refrigeration and Air Conditioning", S. Chand and Company Ltd., 15th edition, 2018.
2. C. P. Arora and S. C. Domkundwar, "Refrigeration and Air Conditioning", Dhanpat Rai Publications, 3rd edition, 2017.
3. R. C. Arora, "Refrigeration and Air Conditioning", PHI Learning Private Limited, 2nd edition, 2015.

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Reference Books:

1. Yunus A. Çengel, Michael A. Boles and Mehmet Kanoğlu, "Thermodynamics: An Engineering Approach", McGraw-Hill Education, 9th edition, 2019.
2. W. F. Stoecker and J. W. Jones, "Refrigeration and Air Conditioning", McGraw-Hill International Editions, 2nd edition, 2013.
3. A. R. Trott and T. Welch, "Refrigeration and Air-Conditioning", Butterworth-Heinemann, 4th edition, 2017.

Professional Skill Development

Course Name: **Professional Skill Development** Course Code: **25EE305**	**L**	**T**	**P**	**Credits**
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Pre-Requisite: Basic concepts of

Course Objective: The course aims to:	
1	Students learn to acknowledge themselves, develop confidence, and take action without fear.
2	Students understand that dreams are realized through process, not talent or luck.
3	Acquiring Practical Task Management Skills
4	Students learn how to break goals into tasks, manage time, and sustain effort.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Demonstrate self-awareness, self-esteem, and confidence through reflection and inner dialogue practices.
CO2	Formulate a clear personal vision and long-term goals by converting abstract dreams into structured plans.
CO3	Apply goal-setting, task breakdown, and time management techniques to plan and execute personal and academic tasks effectively.
CO4	Evaluate personal progress through reflection, feedback, and process improvement methods to develop resilience and continuous improvement habits.

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	-	-	-	-	-	3	1	1	-	-	-	-
CO2	1	2	-	-	-	-	-	2	-	1	-	-	-	-
CO3	2	2	2	-	1	-	-		1	2	-	-	-	-
CO4	1	2	2	2	-	-	-	2	2	2	1	-	-	-

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Self-Esteem and Inner Dialogue** What is self-esteem, and why does it matter? The power of writing and reflection (core philosophy of KAMI-MEMO) Self-awareness and value clarification exercises	5
2	**Visualizing the Future** Designing a personal vision (5-year / 10-year future) Turning abstract dreams into concrete descriptions	5
3	**Goal Setting and Task Breakdown** Translating dreams into goals SMART goals and milestone design Weekly planning and prioritization	5
4	**Execution and Reflection** Monitoring progress through written reflection Understanding success and failure as data Peer feedback and discussion	5
5	**Process Improvement** Reviewing and redesigning action plans Strengthening problem-solving and resilience Creating a personal improvement cycle (PDCA)	5
6	**Final Presentation** Presentation of personal growth portfolio Reflection on mindset, behavior, and outcomes	5

Reference books:

1. KAMI-MEMO Successful future will be ahead for you with the method of writing notes on a piece of paper (English Edition) Kindle Edition English Edition by Kunio Hara (Author) Format: Kindle Edition

Title of the Course Name: **Universal Human Values** Course Code: **25ME306**	**L**	**T**	**P**	**Credits**
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of management, Communication Skill

Course Objectives: The course aims:

1. Develop clarity of human values to enable students to understand harmony at individual, family, society, and nature levels.
2. Help students identify their aspirations related to happiness and prosperity.
3. Enable students to evaluate ethical and moral issues in personal and professional life.
4. Promote responsible behavior, social commitment, and holistic development among engineering students.

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

CO1	Understand the concept of human values and the need for value-based education.
CO2	Analyze the relationship between self, family, society, and nature for achieving harmony.
CO3	Apply universal human values in personal, social, and professional decision-making.
CO4	Demonstrate ethical conduct, social responsibility, and sustainable thinking as an engineer.

CO-PO Mapping:

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

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Course Content		
Unit No.	**Contents**	**Hrs.**
1	**Introduction to Universal Human Values** Introduction to Value Education, Need and importance of Universal Human Values, Self-exploration and self-awareness, Natural acceptance, Right understanding, Relationship between values, skills, and knowledge.	05
2	**Understanding Happiness and Prosperity** Concept of happiness and prosperity, Difference between happiness and pleasure, Short-term vs long-term happiness, Continuous happiness and prosperity, Role of values in achieving sustainable happiness.	05
3	**Harmony in the Individual (Self)** Human aspirations, Co-existence of self and body, Understanding needs of self and body, Right utilization of physical facilities, Holistic development of individual.	05
4	**Harmony in Family and Society** Family as a basic unit of society, Values in family: trust, respect, affection, care, guidance, Reverence, Social harmony, Justice, equality, and mutual cooperation, Ethical human conduct.	05
5	**Harmony in Nature and Existence** Relationship between human beings and nature, Mutual enrichment, Sustainable development, Environmental responsibility, Concept of co-existence, Role of engineers in environmental protection.	04
6	**Professional Ethics and Value-Based Engineering** Ethical responsibilities of engineers, Professional ethics, Social accountability, Case studies related to ethical dilemmas in engineering practice, Value-based decision making.	04

Text Books:

1. Gaur, R. R., Sangal, R., and Bagaria, G. P., A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi.
2. Tripathi, A. N., Human Values, New Age International Publishers.

Reference Books:

1. Universal Human Values, AICTE Model Curriculum.
2. Ethics in Engineering, Mike Martin and Roland Schinzinger, McGraw Hill.
3. 3. Professional Ethics and Human Values, R. Subramanian, Oxford University Press.

MOOC/NPTEL Platform:

1. Sharma, A. K., Exploring Human Values: Visions of Happiness and Perfect Society, NPTEL, IIT Kanpur. https://nptel.ac.in/courses/109104068
2. Kapur, N. S., and Sreesailam, V., Applied Ethics, SWAYAM. https://onlinecourses.swayam2.ac.in/nou26_ge38/preview
3. Pandey, A., Essential Values and Ethics: Cultivating Professional Excellence and Career Advancement, SWAYAM. https://onlinecourses.swayam2.ac.in/imb26_mg88/preview

Course Name: **Mechanical Engineering Lab-I**	**L**	**T**	**P**	**Credits**
Course Code: 25ME308	--	--	2	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	50

Pre-Requisite: Basic concepts of Basic Physics, Chemistry Fundamentals, Introductory Mechanical Engineering Courses.

Course Objective: The course aims :	
1	To study types of boiler and its mountings and accessories and understand steam generation process.
2	To study various properties of lubricants.
3	To provide practical exposure to material testing techniques, including both destructive and non-destructive methods.
4	To study heat treatment processes and microstructures.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain types of boilers, differentiate between water-tube and fire-tube designs, and demonstrate boiler mountings, accessories, and the steam generation process.
CO2	Perform experiments individually or in teams to evaluate and analyze the properties of lubricants for engineering applications.
CO3	Apply testing methods and analyze mechanical and microstructural features to correlate properties with performance..
CO4	Evaluate material suitability and demonstrate specimen preparation, microscopy, and heat treatment to interpret behaviour.

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	–	2	–	-	-	-	–	-	-	-	3	-
CO2	–	2	–	3	2	-	-	-	3	-	-	-	3	1
CO3	2	3	–	3	2	-	-	-	–	-	-	3	-	2
CO4	2	2	3	3	2	-	-	-	–	-	-	2	-	3

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List of Experiment		
Expt. No.	**Description**	**Hrs**
1.	Study of properties of various lubricants.	02
2.	Study of construction, working and various types of steam boiler.	02
3.	Study and Demonstration of Water Tube and Fire Tube Boiler.	02
4.	Study and Demonstration of Boiler Mountings.	02
5.	Study and Demonstration of Boiler Accessories.	02
6.	Report on Industrial Visit to a steam power plant.	02
7.	Tensile test on mild steel.	02
8.	Brinell and Rockwell hardness test on various metals.	02
9.	Impact test (Charpy and Izod).	02
10.	Demonstration of Non-destructive testing methods.	02
11.	Examination of microstructures of different alloys.	02
12.	Spark characteristic test.	02

Note- Any 5 experiments to be conducted out of 01 to 06 and Any 5 experiments to be conducted out of 07 to 12

Reference Books :

1) P. K. Nag, Engineering Thermodynamics, 4th ed. New Delhi, India: Tata McGraw Hill, 2008.
2) C. Borgnakke and R. E. Sonntag, Fundamentals of Thermodynamics. Hoboken, NJ, USA: John Wiley & Sons, 2012.
3) M. J. Moran, H. N. Shapiro, D. D. Boettner, and M. B. Bailey, Principles of Engineering Thermodynamics, 8th ed. Hoboken, NJ, USA: Wiley, 2015.
4) T. D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, 5th ed. Essex, UK: Pearson Education, 1993.
5) W. D. Callister and D. G. Rethwisch, *Materials Science and Engineering: An Introduction*, 10th ed., Hoboken, NJ, USA: Wiley, 2020.
6) S. Kalpakjian and S. R. Schmid, *Manufacturing Engineering and Technology*, 7th ed., Upper Saddle River, NJ, USA: Pearson, 2014.
7) V. Raghavan, *Materials Science and Engineering*, 6th ed., New Delhi, India: PHI Learning, 2015.

Title of the Course Name: **Machine Drawing Lab** Course Code: **25ME309**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	50

Pre-Requisite: Engineering Graphics

Course Objectives: The course aims to:
1. To familiarize students with BIS conventions and enable accurate free-hand sketches of standard machine elements.
2. To develop 3D visualization skills through drawing interpenetration of solids and sectional views as per standards.
3. To impart knowledge of limits, fits, tolerances, surface roughness, and GD&T for clear manufacturing specifications.
4. To train students to prepare and interpret detailed, assembly, and production drawings of mechanical components.

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

CO1	Apply BIS standards to prepare free-hand and instrument drawings of machine elements and power transmission components.
CO2	Construct accurate drawings of interpenetration of solids.
CO3	Specify limits, fits, tolerances, surface roughness, and GD&T as per BIS and international standards.
CO4	Prepare and interpret part, assembly, and production drawings with proper dimensioning and tolerancing.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**BIS conventions and Free Hand Sketches** BIS conventions and Free hand Sketches of screwed fasteners, Keys, cotters and pin joints, shaft couplings, pipe joints, pulleys, riveted joints, welded joints, bearings, chain and gears.	04
2	**Interpenetration of Solids** Interpenetration of Solids – prism with cylinder (prism limited up to rectangular base), cylinder with cylinder	04
3	**Limits, Fits, Tolerances and Machining Symbols** Limits, Fits Tolerancing of individual dimensions Specification of Fits -Manual, Actual profile, reference profile, Datum Profile, Peak to valley height, mean roughness index, surface roughness number, Machining Symbols, Indication of surface roughness.	06
4	**Geometric Dimensioning and Tolerances** Introduction, Features and Rules of GD&T, Datum's Control, Adding GD&T to a Design, Form Tolerances, Orientation Tolerances, Profile Tolerances, Location Tolerances, Run out Tolerances.	04
5	**Details and Assembly Drawing** Detailed drawings of following machine parts are given to students to assemble and draw the sectional or plain elevations/plans/ and side views with Dimensioning and Tolerancing. Sleeve & Cotter joint, Spigot & Cotter joint, knuckle joint, Stuffing Box, Screw Jack, Foot step bearing, Universal Coupling, Plummer Block, Swivel Bearing, Simple Eccentric, Machine Vice, protected type flanged coupling, Connecting Rod, Tail Stock	08
6	**Production Drawings** Preparation of production drawings and reading of part and assembly drawings	04

List of Experiments

Sr. No.	Experiment Name	Hrs
1.	Sheet on BIS conventions and Free hand Sketches of machine elements	04
2.	Sheet on Interpenetration of Solids	04
3.	Sheet on Limits, Fits, Tolerances and Machining Symbols	04
4.	Sheet on Geometric Dimensioning and Tolerances	04
5.	Sheet on Details and Assembly Drawing	04
6.	Sheet on Preparation of production drawings	04

Text Books:

1. K. L. Narayana, "Machine Drawing", New Age International Publisher, 06th edition, 2019.
2. K. C. John, "Textbook of Machine Drawing", PHI, 2009.
3. R. K. Dhawan, "A Textbook of Machine Drawing", S. Chand, 2015.

Reference Books:

1. N. D. Bhat, V M Panchal, "Machine Drawing", Charotar Publication House, 50th edition, 2014.
2. N. D. Bhat, V M Panchal, "Engineering Drawing", Charotar Publication House, 50th edition, 2011.
3. Junnarkar N. D., "Machine Drawing", Pearson Education India, 2007.

Department: Department of Mechanical Engineering
Semester: IV

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25ME401	Theory of Machines	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME402	Fluid Mechanics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ME403	Strength of Materials	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25ME404	Multidisciplinary Minor – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25ME405	Open Elective – I	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25ME406	AI in Mechanical Engineering	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
AEC	25ME407	Quantitative Aptitude & Logical Reasoning-I	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
Entre./ Econo./Manag	25ME408	Entrepreneurship Development	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
VEC	25ME409	Constitution of India	2	-	-	2	ISE-I	25	20	
							ISE-II	25		
PCC	25ME410	Mechanical Engineering Lab-II	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
PCC	25ME411	CAD Lab- I	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
	Total		**18**	**1**	**06**	**22**		**900**		
Total Contact Hours- 25							**Total Credits- 22**			

Title of the Course Name: **Theory of Machines** Course Code: **25ME401**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Engineering Mathematics, Engineering Physics, Engineering Mechanics

Course Objectives: The course aims to:
1. To introduce fundamentals of mechanisms, kinematic chains, constraints, and degrees of freedom.
2. To develop skills in graphical analysis of velocity and acceleration in mechanisms.
3. To impart knowledge of gears, cams, governors, flywheels, balancing, and gyroscopic effects.
4. To enable application of machine theory to practical engineering problems.

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

CO1	Identify and classify mechanisms and kinematic chains, and determine degrees of freedom using standard criteria.
CO2	Analyze velocity and acceleration of mechanisms using graphical methods.
CO3	Explain gearing principles and calculate speed ratios of various gear trains.
CO4	Analyze balancing, gyroscopic effects, cams, governors, and flywheels for machine performance and stability.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Basic Concept of Mechanisms** Introduction, Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Degree of freedom, Grubbler's criterion, Kutzbach criterion, Inversions of four bar chain, slider crank chain, Double slider crank chain.	07
2	**Velocity and Acceleration in Mechanisms** Graphical analysis of Velocity and acceleration for different mechanisms using relative velocity and acceleration method, Coriolis' component of acceleration.	07
3	**Gear and Gear Trains** Introduction, Classification of gears, gear terminology, Law of gearing, forms of teeth, path of contact and arc of contact, interference in involute gears. Types of Gear trains- Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in gear train	07
4	**Balancing and Gyroscope** Introduction, Static and Dynamic balancing of rotary and reciprocating masses. Introduction Gyroscopic couple, spinning and Processional motion, gyroscopic couple and its effect on Aero plane and Ship.	07
5	**Cams and follower** Introduction, Types of cams and followers, Cam terminology, undercutting, Follower displacement diagrams, Motions of the follower, Layout of cam profiles, Graphical construction of cam profile.	07
6	**Governor & Flywheel** Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors. Flywheel: Turning moment diagram, Energy stored in the flywheel, Fluctuation of energy and speed, Determination of mass of flywheel for four stroke single cylinder IC Engine	07

Text Books:

1. Rattan S.S., "Theory of Machines", Tata McGraw Hill, 3rd Edition
2. Dr. V. P. Singh, "Theory of Machines", Dhanpat Rai Publications
3. Ballaney, "Theory of Machines", Khanna Publication.

Reference Books:

1. Shigley, "Theory of Machines and Mechanisms", Tata McGraw Hill.
2. Thomas Beven, "Theory of machines", Pearson Education, 3rd Edition.
3. Wilson, Sadler, "Kinematics, Dynamics of Machinery", Pearson Education.

Title of the Course Name: **Fluid Mechanics** Course Code: **25ME402**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of Engineering Mathematics, Physics, and fundamental concepts of mechanics and thermodynamics.

Course Objectives: The course aims to:

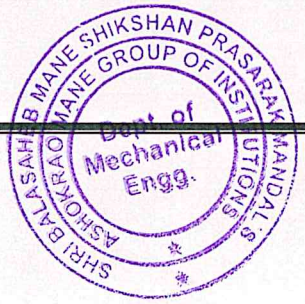
5. To introduce fundamental concepts of fluid properties, fluid statics, and the behavior of fluids at rest and in motion.
6. To develop understanding of fluid kinematics and dynamics for analyzing different types of fluid flow.
7. To provide knowledge of laminar and turbulent flow through pipes, losses in flow systems, and forces acting on immersed bodies.
8. To familiarize students with boundary layer theory and dimensional analysis for modeling and analyzing practical fluid flow problems.

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

CO1	Explain fluid properties, fluid statics principles, and equilibrium conditions of floating and submerged bodies.
CO2	Analyze fluid flow using kinematic and dynamic principles, including continuity and Bernoulli's equations.
CO3	Evaluate laminar and turbulent flow in pipes, calculate energy losses, and analyze forces on immersed bodies.
CO4	Apply boundary layer concepts and dimensional analysis techniques to solve practical fluid mechanics problems.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	1	2	-	-	-	-	-	-	-	-	2	-	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO 3	2	3	-	2	-	-	-	-	-	-	-	2	-	-
CO 4	2	3	-	1	-	-	-	-	-	-	-	3	-	-



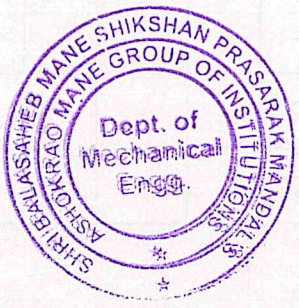
Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Fluid Properties and Fluid Statics.** Fluid Properties: Definition of fluid, Fluid as a continuum, Properties of fluid, Viscosity, Types of fluid, Compressibility, Surface tension, Capillarity and vapour pressure. Fluid Statics: Pascal's law, Hydrostatic law of pressure, Total Pressure, Centre of Pressure, Buoyancy, Meta center, Condition of Equilibrium of floating and submerged bodies.	07
2	**Fluid Kinematics.** Eulerian and Langragian approach of fluid flow, Types of flow, Definition of steady, Unsteady, Uniform, Non-uniform, Laminar, Turbulent, Compressible, incompressible, rotational, Irrotational flow, 1D-2D flows, Stream line, Streak line, Path line, concept of Velocity, potential & stream function flow net, Continuity equation for steady, Unsteady, Uniform, non-uniform, Compressible, incompressible.	07
3	**Fluid Dynamics.** Euler's equation, Bernoulli's equation along a streamline for incompressible flow, Practical applications of Bernoulli's equation - Pitot tube, Venturi meter, Orifice meter.	07
4	**Laminar Flow and Turbulent Flow** Laminar Flow: Introduction to flow of viscous fluid through circular pipes, two parallel plates derivation and numerical. Turbulent Flow: Major and minor losses. Loss of energy due to friction. Minor energy losses in transition, expansion and contraction. Concept of HGL and TEL, flow through syphon, flow through pipes in series or compound pipes, equivalent pipe, parallel pipes, branched pipes, Power transmission through pipes. Moody's Diagram.	07
5	**Forces on Immersed Bodies and Boundary Layer Theory** Forces on Immersed Bodies: Lift and Drag, Drag on a flat plate and on aerofoil. Types of drags, Development of lift. (Magnus effect) stalling condition of aerofoil. Boundary Layer Theory: Boundary layer thickness, its characteristics, laminar and turbulent boundary layers, separation, boundary layer control.	07
6	**Dimensional Analysis** Introduction to dimensional analysis, dimensional homogeneity, methods of dimensional analysis- Rayleigh's method, Buckingham's π-theorem, dimensionless numbers.	07

Text Books:

1. P. N. Modi and S. M. Seth, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, 10th edition, 1991.
2. Dr. R. K. Rajput, "Fluid Mechanics", S. Chand and Company Ltd., 3rd edition, 2014.
3. Dr. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, Delhi, 2005.

Reference Books:

1. V. L. Streeter, K. W. Bedford and E. B. Wylie, "Fluid Dynamics", Tata McGraw-Hill, 9th edition, 1998.
2. S. K. Som and G. Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2nd edition, 2003.
3. Frank M. White, "Fluid Mechanics", McGraw-Hill Education, 8th edition, 2016.



Title of the Course Name: **Strength of Materials** Course Code: **25ME403**	**L**	**T**	**P**	**Credits**
	3	1	--	4
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Engineering Mathematics, Engineering Mechanics

Course Objectives: The course aims to:

1. Understand the fundamental principles required for the analysis and preliminary design of mechanical elements.
2. Explain various types of stresses, strains, and deformations induced in mechanical components due to external loads.
3. Analyze the distribution of stresses in mechanical elements subjected to different loading conditions.

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

CO1	Understand various types of stresses and strains and their effects in engineering applications.
CO2	Analyze different types of beams subjected to static loading.
CO3	Compute principal stresses and principal strains using analytical and graphical methods.
CO4	Analyze bending and buckling behavior of columns under different end conditions.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Stresses and Strains** Mechanical properties of materials, concept of stress and strain (linear, lateral, shear, and volumetric), stress–strain diagram, Hooke's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, bulk modulus, principle of superposition, stresses in bars of varying cross-section, interrelationship between elastic constants.	07
2	**Torsion, Shear Force and Bending Moment** Basic assumptions in torsion, torsion equation, torsion of solid and hollow circular shafts, ASME code for shaft design, types and design of keys. Concept and determination of shear force and bending moment in statically determinate beams subjected to concentrated loads, uniformly distributed loads (UDL), uniformly varying loads (UVL), and couples.	07
3	**Bending Stresses and Shear Stresses in Beams** Theory of simple bending, flexure formula, moment of resistance, bending stresses in symmetrical and unsymmetrical sections, built-up sections, distribution of shear stress in beams of rectangular, circular, I, T, and L sections.	07
4	**Principal Stresses and Strains** Normal and shear stresses on oblique planes, principal planes and principal stresses, maximum shear stress, analytical determination of principal stresses and strains, Mohr's circle for plane stress, combined effect of bending and shear stresses.	07
5	**Columns** Columns under axial and eccentric loading, Euler's theory of columns for different end conditions, limitations of Euler's theory, equivalent length of columns, Rankine's formula.	07
6	**Fundamentals of Machine Design** Concept of machine design, types of loads acting on machine elements, factor of safety and its significance, basic design procedure, factors affecting selection of engineering materials, theories of elastic failure and their applications.	07

Text Books:

1. Bansal, R. K., *Strength of Materials*, Laxmi Publications, Latest Edition.
2. Ramamrutham, S., *Strength of Materials*, Dhanpat Rai & Sons, New Delhi.
3. Khurmi, R. S. and Gupta, J. K., *Strength of Materials*, S. Chand & Company.

Reference Books:

1. Rajput, R. K., *Strength of Materials*, S. Chand & Company.
2. Bhandari, V. B., *Design of Machine Elements*, Tata McGraw Hill, 2021.
3. Timoshenko, S. and Young, D. H., *Elements of Strength of Materials*, CBS Publishers.

Title of the Course Name: **Engineering Design Process** Course Code: **25ME404A**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Design Thinking Approach, CAD

Course Objectives: The course aims to:

1. Understand the systematic stages of the engineering design process to identify and define engineering problems..
2. Apply analytical, creative, and user-centered approaches to generate and evaluate multiple design solutions.
3. Develop feasible design concepts using modeling, simulation, and prototyping techniques.
4. Evaluate and refine designs based on performance, constraints, sustainability, safety, and ethical considerations.

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

CO1	Apply engineering design principles to identify and formulate mechanical engineering problems.
CO2	Generate and evaluate design concepts considering materials, manufacturing, and sustainability.
CO3	Use CAD tools and analytical methods to develop and optimize mechanical designs
CO4	Develop prototypes, test designs, and prepare professional design documentation.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Engineering Design** Introduces the fundamentals of engineering design, Definitions, Scope, and importance in mechanical engineering. Types of design, Design constraints, Design objectives, Creativity in design, Systematic design process including problem identification, Need analysis, Formulation of design specifications.	07
2	**Concept Generation and Evaluation** Concept of generation techniques such as brainstorming, Mind mapping, Morphological charts, TRIZ. Concept screening and selection methods including Pugh's method and decision matrices. Emphasis on feasibility, Functionality, Innovation in mechanical system design.	07
3	**Materials and Manufacturing Considerations in Design** Material selection based on mechanical properties, material selection process, Cost, availability and sustainability. Design for Manufacturing (DFM) and Design for Assembly (DFA) pprinciples. manufacturing processes influence design decisions and product quality.	07
4	**Computer-Aided Design and Analysis** Introduces CAD tools used in mechanical design, 2D drafting, 3D modeling, assemblies, Introduction to engineering analysis using CAD-integrated tools such as stress and deformation analysis. Importance of digital design validation is emphasized.	07
5	**Design Optimization and Reliability** Design optimization techniques, Factor of safety, Reliability-based design, Failure modes, Risk assessment. Basics of value engineering and cost optimization, Improve performance and reduce product cost.	07
6	**Prototyping, Testing, and Design Documentation** Rapid prototyping methods, Testing and validation of designs, Iterative design improvements, Final design documentation, Engineering drawings, Standards, Teamwork in design projects, Ethical considerations.	07

Text Books:

1. Haik, Yousef, Sivaloganathan, Sangarappillai, and Shahin, Tamer M., *Engineering Design Process*, Cengage Learning, 3rd Edition, 2018.
2. Pahl, Gerhard, Beitz, Wolfgang, Feldhusen, Jörg, and Grote, Karl-Heinrich, *Engineering Design: A Systematic Approach*, Springer (Springer Science & Business Media), 3rd Edition, 2007.

Reference Books:

1. Samuel, Andrew, and Weir, John, *Introduction to Engineering Design: Modelling, Synthesis and Problem Solving Strategies*, Butterworth-Heinemann (Elsevier), 1999.
2. Eder, W. Ernst, and Hosnedl, Stanislav, *Design Engineering: A Manual for Enhanced Creativity*, CRC Press (Taylor & Francis Group), 2007.
3. Jack, Hugh, *Engineering Design, Planning, and Management*, Elsevier, 2nd Edition, 2021.
4. Suh, Nam Pyo, Cauvique, Miguel, and Foley, Joseph, *Engineering Design: Understanding, Approaches and Tools*, Springer Cham, 1st Edition, 2021.

Title of the Course Name: **Refrigeration Components and Low Temperature Cycles** Course Code: **25ME404B**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of thermodynamic and refrigeration cycles, refrigerant, heat, energy.

Course Objectives: The course aims to:

1. To provide comprehensive knowledge of advanced refrigeration system components and configurations.
2. To develop understanding of multistage, multi-evaporator and cascade refrigeration systems for specialized applications.
3. To introduce special and low-temperature refrigeration cycles used in cryogenic and aerospace fields.
4. To enable students to analyze and select appropriate refrigeration systems based on application requirements and performance criteria.

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

CO1	Explain the working and selection of advanced refrigeration system components.
CO2	Analyze multistage, multi-evaporator, and cascade refrigeration systems.
CO3	Understand low-temperature and cryogenic refrigeration cycles and their applications.
CO4	Evaluate aircraft refrigeration and air conditioning systems and compare them with conventional systems.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO 2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO 3	2	2	-	-	-	-	-	-	-	-	-	-	3	-
CO 4	2	3	-	2	-	-	-	-	-	-	-	-	2	-

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Components of Refrigeration Systems** Overview of advanced refrigeration systems. Detailed study of compressors, condensers, evaporators, and expansion devices. Refrigeration accessories receivers, driers, filters, oil separators, and controls. Selection criteria of components.	07
2	**Multistage Refrigeration Systems** Need for multistage refrigeration systems. Methods of intercooling. Thermodynamic significance. Performance analysis, advantages, limitations, and Industrial applications.	07
3	**Multi-Evaporator Refrigeration Systems** Concept, necessity of multi-evaporator systems. Design considerations. Capacity control methods. Pressure and temperature regulation techniques. Applications in cold storage, food processing, and commercial refrigeration systems.	07
4	**Low-Temperature Refrigeration Cycles** Principles of low-temperature refrigeration. Joule–Thomson effect in gas liquefaction. Linde cycle, Claude cycle. Cryogenic refrigeration systems, principal working, components and applications.	07
5	**Cascade Refrigeration Systems** Working principle of cascade refrigeration systems. Two stage cascade system, four stage cascade system. Selection of refrigerant pairs. Performance characteristics, advantages, limitations, and industrial applications.	07
6	**Aircraft Refrigeration systems.** Cooling requirements of aircraft cabins and equipment. Air cycle refrigeration systems. Simple aircraft refrigeration cycle Bootstrap refrigeration cycle. Reduced ambient air cooling system. Regenerative air cycle system. Merits, limitations, and applications of aircraft refrigeration.	07

Text Books:

1. R. S. Khurmi and J. K. Gupta, "A Textbook of Refrigeration and Air Conditioning", S. Chand and Company Ltd., 15th edition, 2018.
2. C. P. Arora and S. C. Domkundwar, "Refrigeration and Air Conditioning", Dhanpat Rai Publications, 3rd edition, 2017.
3. R. C. Arora, "Refrigeration and Air Conditioning", PHI Learning Private Limited, 2nd edition, 2015.

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Reference Books:

1. Yunus A. Çengel, Michael A. Boles and Mehmet Kanoğlu, "Thermodynamics: An Engineering Approach", McGraw-Hill Education, 9th edition, 2019.
2. W. F. Stoecker and J. W. Jones, "Refrigeration and Air Conditioning", McGraw-Hill International Editions, 2nd edition, 2013.
3. A. R. Trott and T. Welch, "Refrigeration and Air-Conditioning", Butterworth-Heinemann, 4th edition, 2017.

Title of the Course Name: **Project Management** Course Code: **25ME405**	**L**	**T**	**P**	**Credits**
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Pre-Requisite: Engineering Mathematics, Engineering Physics, Engineering Mechanics

Course Objective: The course aims to:

1 Understand fundamentals of project management including project life cycle, stakeholders, and organizational structures.
2 Develop planning and scheduling skills using tools like WBS, CPM, and PERT.
3 Apply cost, quality, risk, and resource management techniques for effective project execution.
4 Enhance decision-making and leadership skills required for monitoring, controlling, and successful project completion.

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

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain project management concepts, project life cycle, and roles of stakeholders. *U*
CO2	Prepare project plans using scheduling and network techniques such as CPM and PERT. *A*
CO3	Analyze project costs, risks, quality, and resources for effective control. *A*
CO4	Evaluate project performance and apply modern tools for successful project closure. *m's: E*

CO-PO Mapping:

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

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Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Project Management** Definition of project and project management, Characteristics of a project, Project life cycle phases, Project vs operations, Role of project manager, Project stakeholders, Project organization structures (functional, matrix, projectized)	07
2	**Project Identification and Selection** Project identification methods, Feasibility study (technical, economic, financial, social), Project selection techniques, Cost–benefit analysis, Project charter, Project scope definition, Work Breakdown Structure (WBS)	07
3	**Project Planning and Scheduling** Project planning process, Bar charts and milestone charts, Network techniques, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Time estimation, Float and slack analysis.	07
4	**Project Cost and Resource Management** Project cost estimation techniques, Budgeting and cost control, Earned Value Analysis (EVA), Resource planning and allocation, Resource leveling, Project procurement management.	07
5	**Project Risk and Quality Management** Concept of project risk, Risk identification and classification, Risk analysis (qualitative and quantitative), Risk mitigation strategies, Quality planning and assurance, Total Quality Management (TQM), Six Sigma concepts in projects.	07
6	**Project Monitoring, Control, and Closure** Project monitoring techniques, Performance measurement, Project control systems Project communication management, Project documentation, Project audit Project termination and closure, Introduction to project management software (MS Project)	07

Text Books:

1. K.K. Chitkara, *Project Management: Planning, Implementation and Control*, Tata McGraw-Hill Education.
2. P. K. Ghosh, *Project Management*, Oxford University Press.
3. Prasanna Chandra, *Projects: Planning, Analysis, Selection, Implementation and Review*, Tata McGraw-Hill.

Reference Books :

1. Harold Kerzner, *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, Wiley Publications.
2. Jack R. Meredith & Samuel J. Mantel Jr., *Project Management: A Managerial Approach*, Wiley India.
3. Gray, Clifford & Larson, *Project Management: The Managerial Process*, McGraw-Hill Education.

Title of the Course Name: **AI in Mechanical Engineering Lab** Course Code: **25ME406**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basics of Programming Concepts, Computer Technology

Course Objectives: The course aims to:

1. Introduce fundamentals of AI and ML and their applications in mechanical engineering.
2. Use Python and basic ML libraries for handling, visualization, and analysis of mechanical data.
3. Apply basic ML algorithms for prediction and decision-making in mechanical engineering problems.
4. Analyze real-world mechanical data and implement mini-projects using AI/ML techniques.

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

CO1	Explain basic concepts of AI and ML and identify their applications.
CO2	Use Python and standard ML libraries to prepare, process, and visualize mechanical engineering datasets.
CO3	Apply basic ML techniques for prediction and decision-making in mechanical engineering problems.
CO4	Analyze mechanical datasets and develop a mini-project or case study.

CO-PO Mapping:

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

Conduct any 10 experiments.

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Experiment List:		Hours
1	Introduction to AI & ML Tools	2
2	Python Basics for ML	2
3	Python Libraries for ML	2
4	Data Collection & Dataset Understanding	2
5	Data Pre-processing	2
6	Data Visualization	2
7	Simple Linear Regression	2
8	Multiple Linear Regression	2
9	Classification Algorithm (Basic)	2
10	Introduction to Artificial Neural Network (ANN)	2
11	ML Application in Mechanical Engineering	2
12	Mini Project / Case Study	2

Text Books:

1. Shaw, A. K., Python Programming and Machine Learning for Engineers, TechWorld Publications, 2021.
2. Chauhan, D. S., Machine Learning with Python for Mechanical Engineers, McGraw Hill Education, 2022.
3. Russell, S., and Norvig, P., Artificial Intelligence: A Modern Approach, Pearson, 4th Edition, 2020.

Reference Books:

1. Salaria, R. S., Machine Learning Using Python, Khanna Publishing House, 2020.
2. Mitchell, T., Machine Learning, McGraw Hill, 1st Edition, 2017.
3. Grus, Joel, Data Science from Scratch: First Principles with Python, O'Reilly Media, 2nd Edition, 2021.

Course Name: **Quantitative Aptitude and Logical Reasoning - I** Course Code: **25ME407**	**L**	**T**	**P**	**Credits**
	1	--	--	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Pre-Requisite: Basic concepts of Basic Mathematical Knowledge, Language Proficiency and Analytical Readiness.

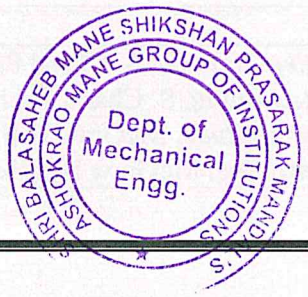
Course Objective: The course aims to:
1. Recall and explain fundamental principles to build a strong foundation in quantitative and reasoning skills.
2. Apply methods and techniques to solve structured problems accurately and confidently.
3. Develop analytical thinking to examine patterns, relationships, and validate decisions.
4. Integrate approaches and create strategies to support innovation and adaptability in real-world contexts.

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

CO1	Recall key concepts of Mathematics for placements and business applications.
CO2	Apply quantitative methods to solve structured numerical problems in exams and entrepreneurial contexts.
CO3	Analyse logical reasoning problems to identify patterns and enhance reasoning skills.
CO4	Evaluate alternative solution approaches for efficiency and create integrated solutions supporting innovation and adaptability.

CO-PO Mapping:

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



Course Content		
Unit No.	**Description**	**Hrs**
1	**Foundations of Quantitative Aptitude :** **Number Systems-** Basics, Base System, Exponents, Numerical Analogy-Basics, Relation between two numbers. **Percentage-**numerical Percentage Understand Conversion, Single change, Successive change, Product Stability, Applications of percentage. **Ratios and Fractions-**Comparison of Ratio & fraction, Properties of Ratio & Proportion, Mean Proportion., Joint ratio.	3
2	**Averages, Profit & Loss, and Interest Calculations:** **Average** -Average, Allegations Weighted average, Concept of average speed & allegation, Applications of Average & mixture allegation. **Profit & Loss** - Same selling price different Cost Price, Same cost price different selling price, Concept of false scale. **Simple and Compound Interest-**Basics, Difference between SI CI, Conversion Periods, Depreciation.	3
3	**Advanced Quantitative Methods :** **LCM and HCF-**LCM and HCF, Factors, Cyclicity, Different Methods to find LCM-HCF, HCF-LCM relation, Applications of HCF-LCM. **TRW-**Time, Rate and Work-Unitary Method, LCM Method, Calculation of remuneration. **Pipes & Cisterns-**Concept of negative work, LCM Method.	3
4	**Logical Reasoning Essentials :** **Blood Relations** -Symbols, generation of tree diagram, types of questions-pointing towards person, tree based, coded blood relation. **Coding Decoding** -Letter-Letter, Letter- Number, Number-Number, Letter-Symbol, Mixed Coding. **Direction Sense and Time Numericals-**Basics, shadow-based concept, Concept of local time zone (IST, GMT, Longitude, Latitude), Problems on local time difference, Coded direction sense.	3
5	**Pattern Recognition and Analytical Series :** **Series Completion** - Types of series, Number series pattern, Letter series, Alphanumeric series. **Pattern, Step Completion** - Image completion, Mirror images, Water images, input-Output. **Syllogism-** Basics, Types of Statements, Different diagram for different statements, Types of Questions-Based on Conclusion, Based on Statements.	3

Reference books:

1. Aggarwal, R. S., *Quantitative Aptitude*, S. Chand Publishing, New Delhi.
2. Aggarwal, R. S., *Logical Reasoning*, S. Chand Publishing, New Delhi.
3. Sharma, Arun, *Quantitative Aptitude*, McGraw Hill Publishing, New Delhi.
4. Sharma, Arun, *Logical Reasoning*, McGraw Hill Publishing, New Delhi.

Title of the Course Name: Entrepreneurship Development Course Code:25ME408	L	T	P	Credits
	1	--	--	1
Evaluation Scheme-	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks-	25	--	25	--

Pre-Requisite: Basic knowledge of management

Course Objectives: The course aims:

1. To introduce the concept of entrepreneurship and its significance in economic development.
2. To develop entrepreneurial competencies and motivation.
3. To familiarize with business planning and project management.
4. To create awareness about startup ecosystem, government schemes, and legal frameworks.

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

CO	Course Outcomes	Bloom's Level
CO1	Understand entrepreneurship concepts, startup ecosystem, and ethical responsibilities in engineering enterprises.	U
CO2	Analyze market opportunities and feasibility of technology-driven business ideas.	AN
CO3	Develop a basic business plan considering sustainability, project planning, and teamwork.	C

U=Understand, R=Remember, A=Apply, AN=Analyze, E=Evaluate, C=Create

CO-PO Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	–	–	–	–	–	2	–	3	–	–	2	–	–	2
CO2	–	3	2	–	–	–	–	–	–	–	–	–	2	2
CO3	–	–	3	–	–	–	2	–	2	2	–	–	–	3

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Course Content		
Unit No.	**Contents**	**Hrs.**
1	**Introduction to Entrepreneurship:** Definition, Importance, Entrepreneur vs. Manager, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship.	**3**
2	**Corporate Entrepreneurship**: Introduction, Flavors of corporate entrepreneurship, corporate venturing, Intrapreneurship, organizational transformation, Industry rule bending, Need for corporate entrepreneurship, domain of corporate entrepreneurship	**4**
3	**Business Plan and Project Management:** Idea generation, Screening and Project Identification, Creative Performance, feasibility study, market survey, business plan elements.	**4**
4	**Family and Non-Family Entrepreneur & Women entrepreneurs:** Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Factors influencing women entrepreneur, Challenges for women entrepreneurs, Growth and development of women entrepreneurs in India	**4**

Text Books:

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing.
2. S.S. Khanka, Entrepreneurial Development, S. Chand.
3. P. Saravanavel, Entrepreneurship Development, Ess Pee Kay Publishing House.

Reference Books:

1. C.B. Gupta & N.P. Srinivasan, Entrepreneurial Development, Sultan Chand & Sons.
2. Hisrich, Peters & Shepherd, Entrepreneurship, McGraw Hill.
3. David H. Holt, Entrepreneurship: New Venture Creation, Prentice Hall of India.

MOOC/NPTEL Platform:

1. **Entrepreneurship Prof. S. S. S. Kumar (IIT Madras)**
   https://nptel.ac.in/courses/110106141
2. **Entrepreneurship and Innovation Prof. V. Gopal (IIT Roorkee)**
   https://nptel.ac.in/courses/110107094
3. **Developing Soft Skills and Personality Prof. T. Ravichandran (IIT Kanpur)**
   https://nptel.ac.in/courses/109104115

Course Name: **Constitution of India**	**L**	**T**	**P**	**Credits**
Course Code: **25ME409**	2	-	-	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Pre-Requisite: Basic knowledge of Indian History

Course Objective: The course aims to:	
1	Introduction to the historical and legal foundations of the Indian Constitution and its key features.
2	Understanding of the structure and functioning of Union, State, and local governments.
3	Familiarization with fundamental rights, duties, directive principles, and constitutional bodies.
4	Promotion of responsible citizenship and active participation in a democratic society.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Understand the historical and legal foundations of the Indian Constitution and its key features.
CO2	Explain the structure and functions of government at Union, State, and local levels.
CO3	Describe fundamental rights, duties, directive principles, and the roles of constitutional bodies and governance mechanisms.
CO4	Understand responsibility of citizenship and active participation in a democratic society.

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	–	–	–	–	–	2	2	–	1	–	1	–	–	–
CO2	–	–	–	–	–	2	2	–	1	–	1	–	–	–
CO3	–	–	–	–	–	3	3	–	1	–	1	–	–	–
CO4	–	–	–	–	–	3	3	–	2	–	2	–	–	–

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Course Content		
Unit No.	**Contents**	**Hrs**
1	**Introduction to the Constitution:** Historical background of the Indian Constitution, Framing of the Constitution and the Constituent Assembly, Features of the Indian Constitution, Preamble and its significance, Citizenship: Types and constitutional provisions	**5**
2	**Fundamental Rights and Duties** Fundamental Rights: Definition, types, and limitations, Directive Principles of State Policy (DPSP), Fundamental Duties of Indian citizens Relationship between Fundamental Rights and DPSP	**5**
3	**Union Government Structure** Parliament: Lok Sabha and Rajya Sabha – composition and functions President: Powers, election, and role, Prime Minister and Council of Ministers, Judiciary: Supreme Court – structure, powers, and independence	**5**
4	**State Government and Local Governance** State legislature and Governor, Chief Minister and State Council of Ministers, High Courts and Subordinate Courts, Panchayati Raj System and Municipalities – 73rd & 74th Amendments	**5**
5	**Constitutional Bodies and Amendments** Different types of Constitutional Bodies, Constitutional amendment process (Article 368),Major constitutional amendments (42nd, 44th, 73rd, 74th, 86th)	**4**
6	**Important Provisions and Current Developments** Emergency provisions: National, State, and Financial, Official language and special provisions, Center-State relations: Legislative, administrative, financial, Recent constitutional and legal developments, Role of citizens and engineers in democracy and governance	**5**

Text Books:

1. M. Laxmikanth,Indian Polity, McGraw-Hill Education
2. D.D. Basu, Introduction to the Constitution of India, LexisNexis
3. J.N. Pandey, Constitutional Law of India, Central Law Agency

Reference Books:

1. Subhash C. Kashyap ,Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust
2. V.N. Shukla ,Constitution of India, Eastern Book Company
3. Brij Kishore Sharma, Introduction to the Constitution of India, Pearson Education

MOOC/NPTEL Platform:

1. NPTEL Course: Constitution of India,Prof. M.K. Bhandari (Rajasthan Technical University) https://nptel.ac.in/courses/109/104/109104074
2. Indian Government and Politics,Prof. R. Sudarshan (IIT Delhi) https://nptel.ac.in/courses/109/104/109104068

Title of the Course Name: **Mechanical Engineering Lab II** Course Code: **25ME410**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	50

Pre-Requisite: Engineering Mathematics, Engineering Physics, Engineering Mechanics

Course Objectives: The course aims to,

1. Analyze mechanical kinematics and dynamics by solving velocity, acceleration, and cam design problems.
2. Experimentally verify and apply principles of angular velocity, mass balancing, and gyroscopic effects to real machinery
3. Understanding of fundamental fluid mechanics principles through experimental verification and measurements.
4. Develop skills in using fluid mechanics laboratory equipment for analysis of flow behavior and pressure characteristics.

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

CO1	Analyze kinematic relationships of mechanisms, including velocity and acceleration, using relative motion methods.
CO2	Evaluate and apply dynamic balancing and gyroscopic principles to industrial machinery and case studies.
CO3	Verify Bernoulli's theorem and determine flow parameters such as Reynolds number and flow measurement coefficients.
CO4	Evaluate pressure losses in pipes and fittings and determine stability characteristics of floating bodies.

CO-PO Mapping:

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

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Mechanical Engg.

List of Experiments

Sr. No.	Experiment Title	Hrs.
1.	Verification of ratio of angular velocities of shafts connected by Hooks joint.	02
2.	One A3 size sheet of Velocity problems by relative velocity method and relative acceleration method	02
3.	Demonstration and Torque Measurement in Epicyclic Gear Train and Industrial case study on gear train	02
4.	Dynamic Balancing of rotary masses and Industrial case study on dynamic balancing	02
5.	Verification of gyroscopic principle and determination of gyroscopic couple.	02
6.	Construction of cam profile by considering different follower motion	02
7.	Experiment on Governor and Industrial case study on governor	02
8.	Verification of Bernoulli's theorem.	02
9.	Determination of Critical Reynolds number using Reynolds Apparatus	02
10.	Determination of various flow measuring coefficients.	02
11.	Determination of pressure drop in pipes of various cross-sections.	02
12.	Determination of pressure drops in pipes with various pipe fittings.	02
13.	Determination of metacentric height of a floating body.	02

Text Books:

1. *Rattan S.S.,* "Theory of Machines", *Tata McGraw Hill, 3rd Edition*
2. *Dr. V. P. Singh,* "Theory of Machines", *Dhanpat Rai Publications*
3. P. N. Modi and S. M. Seth, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, 10th edition, 1991.
4. Dr. R. K. Rajput, "Fluid Mechanics", S. Chand and Company Ltd., 3rd edition, 2014.

Reference Books:

1. Shigley, "Theory of Machines and Mechanisms", Tata McGraw Hill.
2. Thomas Beven "Theory of machines", Pearson Education, 3rd Edition.
3. S. K. Som and G. Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2nd edition, 2003.

Title of the Course Name: **CAD Lab - I** Course Code: **25ME411**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	50

Pre-Requisite: Engineering Drawing, Basics of Computer Applications

Course Objectives: The course aims to:
1. To introduce the fundamentals of Computer-Aided Design (CAD) and its applications in mechanical engineering.
2. To develop skills in 2D drafting and 3D modeling using AutoCAD software.
3. To apply dimensioning, annotations, and layer management in technical drawings and create assembly drawings and basic solid models for mechanical components.
1. 4. To prepare students for advanced CAD/CAM/CAE courses and industry practices.

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

CO1	Apply AutoCAD interface and commands efficiently for 2D drafting
CO2	Create and edit 2D engineering drawings with proper dimensioning and annotations.
CO3	Develop 3D solid models of mechanical components and Prepare assembly drawings and layouts suitable for presentation and manufacturing
CO4	Apply CAD skills in subsequent courses like Machine Drawing, CAD/CAM, and project work.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to AutoCAD** -Overview of CAD and its applications in mechanical engineering - AutoCAD interface: Workspace, toolbars, command line, status bar - File operations: New, open, save, export etc. - Basic drawing settings: Units, limits, grid, snap - Coordinate systems: Absolute, relative, polar coordinates	**04**
2	**2D Drafting – Basic Commands** - Drawing commands: Line, Circle, Arc, Rectangle, Polygon, Ellipse etc. - Modify commands: Move, Copy, Rotate, Mirror, Offset, Trim, Extend, Fillet, Chamfer etc. - Object selection methods - Practice: Drawing simple geometric shapes and mechanical profiles etc.	**04**
3	**2D Drafting – Advanced Features** - Layers: Creation, properties, management - Text: Single line, multiline text, text style - Dimensioning: Linear, aligned, angular, radial, diameter, tolerance etc. - Hatching and gradients - Blocks: Create, insert, edit, attributes - Practice: Orthographic projections of simple machine parts	**06**
4	**3D Modeling Basics** - Introduction to 3D modeling workspace - Viewports and views in 3D - Solid primitives: Box, Cylinder, Sphere, Cone, Wedge, Torus - Extrude, Revolve, Sweep, Loft commands - Boolean operations: Union, Subtract, Intersect	**06**
5	**3D Modeling – Advanced** - User Coordinate System (UCS) manipulation - Solid editing: Press/Pull, Fillet, Chamfer, Shell, Slice - Mesh modeling basics - Surface modeling basics - Practice: 3D models of mechanical components (flange, bracket, pulley, simple assembly)	**06**

6	**Plotting, Presentation and Projects** - Layouts and viewports - Page setup and plot settings - Creating drawing sheets with title block - Rendering basics: Materials, lighting, shadows - Final project: Complete working drawing of a mechanical assembly with 2D and 3D representation	**04**

List of Experiments

Perform any 10 experiments

Sr. No.	Experiment Name	Hrs
7.	Study of AutoCAD Interface and Drawing Environment	02
8.	Drawing simple 2D geometries using coordinate systems.	02
9.	Editing and modifying 2D drawings using modify commands.	02
10.	Object Selection and Precision Drawing Techniques	02
11.	Creating a detailed orthographic view of a mechanical part with layers.	02
12.	Adding dimensions, annotations, and hatching to a drawing.	02
13.	Creating and using blocks in a drawing.	02
14.	Creating 3D model using extrude and revolve commands.	02
15.	3D Modeling of Mechanical Components	02
16.	Advanced 3D Solid Editing and UCS Manipulation	02
17.	Preparing layout for printing and creating title block.	02
18.	Mini-project: Complete 2D and 3D drawing of a any assembly	02

Text Books:

1. Tickoo, Sham, AutoCAD 2024: A Problem-Solving Approach – Basic and Intermediate, CADCIM Technologies.
2. Kulkarni, D. M., Rastogi, A. P., and Sarkar, A. K., Engineering Drawing with AutoCAD, PHI Learning, 2021.
3. Tickoo, Sham, AutoCAD 2024 for Engineers and Designers, 3D and Advanced, BPB Publications 2024

Reference Books:

1. Shumaker, Terence M., and Madsen, David A., *AutoCAD and Its Applications – Basics*, Goodheart-Willcox, 2022.
2. Pohit, Goutam, and Ghosh, Goutam, Machine Drawing with AutoCAD, Pearson Education, 2019.
3. George Omura and Brian C. Benton, Mastering AutoCAD 2024 and AutoCAD LT 2024, Sybex