Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Curriculum Structure

MECHANICAL ENGINEERING

SEMESTER I - VIII

w.e.f. 2025-26

Department of Mechanical Engineering

Established: 1999

Annasaheb Dange College of Engineering and Technology

Ashta - 416301, Dist. : Sangli, Maharashtra

(An Empowered Autonomous Institute)

Department : **Mechanical Engineering**

Programme : **B.Tech. – ME**

Curriculum Revision : **Revision 03, with effect from the AY 2025 – 26 to the students of UG Programme.**

Course Category	Acronym	I	II	III	IV	V	VI	VII	VIII	Total	% of Category
Basic Science Course	BS	8	8	0	0	0	0	0	0	16	9
Engineering Science Course	ES	10	6	2	0	0	0	0	0	18	10
Programme Core Course	PC	0	4	16	8	13	5	11	0	57	32
Programme Elective Course	PE	0	0	0	2	4	5	3	3	17	10
Open Elective (other than particular program)	OE	0	0	0	2	2	2	0	0	06	3
Multidisciplinary Minor	MDM	0	0	0	4	3	4	3	0	14	8
Vocational and Skill Enhancement Course	VSEC	2	0	1	1	0	2	0	0	06	3
Humanities Social Science and Management	HSSM	0	2	0	2	0	0	0	0	15	9
Indian Knowledge System	IKS	2	0	0	0	0	0	0	0		
Value Education Course (VAC)	VEC	0	0	3	3	1	2	0	0		
Research Methodology	RM	0	0	0	1	0	0	0	0	19	11
Experiential Learning (Internship, Project)	EL	0	0	0	1	1	0	4	12		
Community Engagement Activity / Field Project	CEA	0	0	0	0	0	2	0	0	02	1
Co-curricular & Extracurricular Activities	CCA	1	1	0	0	0	0	0	0	02	1
Self Study	SS	0	0	0	0	0	0	2	2	04	2
	Total	23	21	22	24	24	22	23	17	176	100

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College of Engg. & Tech. Annasaheb Dange ASHTA 416 301

Annasaheb Dange College of Engineering and Technology

Established: 1999

Ashta - 416301, Dist.: Sangli, Maharashtra

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F. Y. B. Tech.–Mechanical Engineering

[Level 4.5, UG Certificate] Semester -I

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	BS	T1	3MEBS101	Applied Mathematics-I	3	1	-	4	4	40	20	40	--	--
02	BS	LIT2	3MEBS102	Applied Chemistry	3	-	2	3	4	40	20	40	50	--
03	ES	LIT1	3MEES103	Engineering Graphics with CAD	3		2	3	4	40	20	40	50	50
04	ES	LIT2	3MEES104	Basic Electrical & Electronics Engineering	3	-	2	3	4	40	20	40	50	--
05	ES	L1	3MEES105	Computer Programming	1	-	2	1	2	--	--	--	50	50
06	IKS	T1	3MEIKS106	Indian Knowledge System	2	-	-	2	2	--	50	--	--	--
07	VS	LIT2	3MEVS107	IDEA Laboratory	1	-	2	1	2	--	--	--	50	--
08	CC	L2	3BSCCXXX	Liberal Learning Course - I	-	-	2	0	1	--	--	--	50	--
				Total	16	1	12	17	23					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory) : ≥8/20	MSE + ESE (Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50

CC Bouquet:

3BSCC121 - Introduction to Yoga and Mindfulness	3BSCC123 - Six-Sigma Happiness and Mind Mechanics	3BSCC125 - Community Engagement through NSS
3BSCC122 - Physical Fitness and Lifestyle Management	3BSCC124 - Creativity through Visual Arts	3BSCC126 - Cultural Exploration & Heritage
3BSCC127- Leadership and Team management	3BSCC128- Self Management and Purposeful Living,	3BSCC129- Business Communication
3BSCC130- Mathematical Reasoning	3BSCC131- Introduction to Dance and Movement	3BSCC132- Introduction to Music and Singing
3BSCC133-Happiness and Well-Being	3BSCC134- Financial Literacy & Investment Awareness	3BSCC135-Cyber Awareness and Ethics

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F. Y. B. Tech.–Mechanical Engineering

[Level 4.5, UG Certificate] Semester -II

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	BS	T1	3MEBS109	Applied Mathematics-II	3	1	-	4	4	40	20	40	--	--
02	BS	LIT2	3MEBS110	Applied Physics	3	-	2	3	4	40	20	40	50	--
03	ES	T1	3MEES111	Applied Mechanics	3	-	-	3	3	40	20	40	--	--
04	PC	LIT2	3MEPC112	Fundamentals of Mechanical Engineering	3	-	2	3	4	40	20	40	50	--
05	ES	T1	3MEES113	Introduction to Emerging Technologies	2	-	-	2	2	40	20	40	--	--
06	HS	L2	3MEHS114	Communication Skills	-	-	4	0	2	--	--	--	50	--
07	ES	L2	3MEES115	Design Thinking Laboratory	-	-	2	0	1	--	--	--	50	--
08	CC	L2	3BSCCXXX	Liberal Learning Course - II	-	-	2	0	1	--	--	--	50	--
				Total	14	1	12	15	21					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE(Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50

CC Bouquet:

3BSCC121 - Introduction to Yoga and Mindfulness	3BSCC123 - Six-Sigma Happiness and Mind Mechanics	3BSCC125 - Community Engagement through NSS
3BSCC122 - Physical Fitness and Lifestyle Management	3BSCC124 - Creativity through Visual Arts	3BSCC126 - Cultural Exploration & Heritage
3BSCC127- Leadership and Team management	3BSCC128- Self Management and Purposeful Living,	3BSCC129- Business Communication
3BSCC130- Mathematical Reasoning	3BSCC131- Introduction to Dance and Movement	3BSCC132- Introduction to Music and Singing
3BSCC133-Happiness and Well-Being	3BSCC134- Financial Literacy & Investment Awareness	3BSCC135-Cyber Awareness and Ethics

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Exit after **F. Y. B. Tech. – Mechanical Engineering**

Additional Credits to qualify for UG Certificate

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
1	VS	L2	3MEVS151	Computer Aided Drafting	-	-	4	1	2	C	-	-	50	-
2	VS	L2	3MEVS152	Welding and Fabrication	-	-	4	1	2	-	-	-	50	-
3	VS	L2	3MEVS153	Machinist	-	-	4	1	2	-	-	-	50	-
4	VS	L2	3MEVS154	Pattern Making	-	-	4	1	2	-	-	-	50	-
5	VS	L2	3MEVS155	Assembly Technician	-	-	4	1	2	-	-	-	50	-
				Total	**0**	**0**	**20**	**5**	**10**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory) : ≥8/20	MSE + ESE(Theory): ≥32/80	TA (Theory) / CIA (Lab) : ≥20/50	ESE (Lab) : ≥20/50

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S. Y. B. Tech.–Mechanical Engineering

[Level 5, UG Certificate] Semester -III

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT1	3MEPC201	Fluid Mechanics	2	-	2	2	3	40	20	40	50	50
02	PC	LIT2	3MEPC202	Material Science and Metallurgy	2	-	2	2	3	40	20	40	50	-
03	ES	T1	3MEES203	Engineering Mathematics- III	2	-	-	2	2	40	20	40	--	-
04	PC	T1	3MEPC204	Kinematics of Machines	2	1	-	3	3	40	20	40	--	--
05	PC	T1	3MEPC205	Applied Thermodynamics	2	-	-	2	2	40	20	40	--	--
06	PC	T1	3MEPC206	Strength of Materials	2	1	-	3	3	40	20	40	--	--
07	PC	L1	3MEPC207	Machine Drawing Laboratory	-	-	2	-	1	--	--	--	50	50
08	PC	L2	3MEPC208	Microcontroller Laboratory	-	-	2	-	1	--	--	--	50	--
09	VS	L2	3MEVS209	Python Programming Laboratory	-	-	2	-	1	--	--	--	50	--
10	HS	T2	3MEHS210	Indian Constitution	1	-		1	1	--	50	--	--	--
11	HS	T2	3MEHS211	Universal Human Values	2	-		2	2	--	50	--	--	--
12	MA	T2	3MEMA212	Aptitude and Reasoning -I	2	-	--	2	-	--	50	--	--	--
				Total	17	02	10	19	22					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE(Theory): ≥32/80	TA (Theory) / CIA(Lab): ≥20/50	ESE (Lab): ≥20/50

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Established: 1999

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S. Y. B. Tech.–Mechanical Engineering
[Level 5, UG Certificate] Semester -IV

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT1	3MEPC215	Manufacturing Processes and Machine Tools	2	-	2	2	3	40	20	40	50	50
02	PC	LIT2	3MEPC216	Dynamics of Machines	2	-	2	2	3	40	20	40	50	--
03	MM	LIT2	3MEXX2XX	Multidisciplinary Minor - I	3	-	2	3	4	40	20	40	50	--
04	PC	T1	3MEPC219	Machine Design-I	2	-	-	2	2	40	20	40	--	--
05	PE	T1	3MEPE2XX	Professional Elective - I	2	-	-	2	2	40	20	40	-	-
06	OE	T1	3ILOEXX	Open Elective – I	2	-	-	2	2	--	--	100	--	--
07	VS	L1	3MEVS226	CAD Laboratory	-	-	2	-	1	--	--	--	50	50
08	HS	T2	3MEHS2XX	Foreign Language	2	-	-	2	2	--	50	--	--	--
09	HS	T2	3MEHS229	Psychology	1	-	-	1	1	--	50	--	--	--
10	RM	L2	3MERM230	Research Methodology	-	-	2	-	1	--	--	--	50	--
11	HS	T2	3MEHS231	Environment Studies	2	-	-	2	2	--	50	--	--	--
12	EL	L2	3MEEL232	Innovation and Product Development	-	-	2	-	1	-	--	-	50	-
13	MA	T2	3MEMA233	Aptitude and Reasoning -II	2	-	-	2	-	-	50	--	--	--
				Total	20	-	12	20	24					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Summer Internship (in Industry, R&D organization, or Academic Institute) shall be undertaken after the IV Semester during the summer vacation. The evaluation of the internship will be conducted during the V Semester

Minimum Passing Criteria	TA(Theory): ≥8/20	MSE + ESE (Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50	ESE (Theory) : ≥40/100

Foreign Language - Bouquet

3MEHS227- Foreign Language - German	3MEHS228- Foreign Language - Japanese

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Exit Criteria after **S. Y. B.Tech. – Mechanical Engineering**

(As per AICTE Guidelines)

Eligibility Criteria

- All conditions applicable to the Exit Option After First Year shall also apply. In addition, the following criteria must be met:
- Students will have the option to exit the Mechanical Engineering Program after successfully completing the second year.
- To qualify this exit option students must complete Internship of minimum 8 weeks in Mechanical Engineering related field, aimed at enhancing practical knowledge and industry exposure. Students must submit **internship** report in accordance with the schedule and guidelines provided.

Outcome:

- Upon exit, they will be awarded an **Undergraduate Diploma in Mechanical Engineering.**

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Chairman -BoS

Member Secretary-AC

Chairman-AC

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T. Y. B.Tech.–Mechanical Engineering

[Level 5.5, UG B. Voc. Certificate] Semester - V

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT1	3MEPC301	Turbo Machinery	3	-	2	3	4	40	20	40	50	50
02	PC	LIT1	3MEPC302	Measurement and Quality Control	2	-	2	2	3	40	20	40	50	50
03	PC	LIT2	3MEPC303	Machine Design - II	2	1	-	3	3	40	20	40	-	--
04	PC	LIT2	3MEPC304	Tool Engineering	2	-	2	2	3	40	20	40	50	--
05	PE	LIT2	3MEPE3XX	Professional Elective - II	3	-	2	3	4	40	20	40	50	--
06	MM	T1	3MEXX3XX	Multidisciplinary Minor – II	3	-	-	3	3	40	20	40	--	--
07	OE	T1	3ILOEXX	Open Elective – II	2	-	-	2	2	--	--	100	--	--
08	HS	L2	3MEHS312	Entrepreneurship	-	-	2	-	1	--	--	--	50	--
09	EL	L2	3MEEL313	Summer Internship	-	-	-	-	1	--	--	--	50	--
10	MA	T2	3MEMA314	Aptitude and Reasoning - III	2	-	-	2	-	--	50	--	-	
				Total	19	1	10	20	24					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE (Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50	ESE (Theory): ≥40/100

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T. Y. B.Tech.–Mechanical Engineering

[Level 5.5, UG B. Voc. Certificate] Semester - VI

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT1	3MEPC316	Heat and Mass Transfer	2	-	2	2	3	40	20	40	50	50
02	PE	LIT2	3MEPE3XX	Professional Elective - III	2	-	2	2	3	40	20	40	50	--
03	PE	T1	3MEPE3XX	Professional Elective - IV	2	-	-	2	2	40	20	40	--	--
04	PC	T1	3MEPC328	Industrial Management and Operation Research	2	-	-	2	2	40	20	40	--	-
05	MM	T1	3MEXX3XX	Multidisciplinary Minor – III	3	-	2	3	4	40	20	40	50	--
06	OE	T1	3ILOEXX	Open Elective – III	2	-	-	2	2	--	--	100	--	--
07	VS	L2	3MEVS332	Control Engineering Laboratory	-	-	2	-	1	--	--	--	50	50
08	VS	L2	3MEVS333	Computer Aided Manufacturing (CAM) Laboratory	-	-	2	-	1	--	--	--	50	--
09	HS	T2	3MEHS334	Project Management and Finance	2	-	-	2	2	-	50	-	--	--
10	CEA	L2	3MECE335	Mini Project	-	-	4	-	2	--	--	--	50	--
11	MA	T2	3MEMA336	Aptitude and Reasoning - IV	2	-	-	2	-		50		--	
				Total	**17**	**00**	**14**	**17**	**22**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE (Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50	ESE (Theory): ≥40/100

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Exit Criteria after **T.Y.B.Tech. – Mechanical Engineering**

(As per AICTE Guidelines)

Eligibility Criteria:

- Completion of all core courses in the first three years of the engineering curriculum.
- Demonstration of both theoretical understanding and practical application through:
  - Industry-Relevant Practical Training: Including internships or apprenticeships.
  - Advanced Skill-Based Course: Aligning with current industry needs.
  - Internship/Apprenticeship: At least 8 weeks in a relevant engineering field.
  - Community Engagement Project: Real-world problem-solving with societal benefit.
  - Capstone Project (Optional): Integration and application of learning outcomes across three years.

Outcome:

Students will be awarded a **B. Voc. Degree in Mechanical Engineering**, signifying a strong foundation in engineering concepts, technical proficiency, and vocational readiness.

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Final Year B.Tech.–Mechanical Engineering

[Level 6, UG B. Tech. Certificate] Semester - VII

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT1	3MEPC401	Refrigeration and Air Conditioning	3	-	2	3	4	40	20	40	50	50
02	PC	LIT1	3MEPC402	Finite Element Analysis	3	-	2	3	4	40	20	40	50	50
03	PC	LIT2	3MEPC403	Fluid Power and Automation	2	-	2	2	3	40	20	40	50	--
04	PE	T1	3MEPEXXX	Professional Elective – V	3	-		3	3	40	20	40	--	--
05	MM	T1	3MEXX4XX	Multidisciplinary Minor – IV	3	-	-	3	3	40	20	40	--	--
06	EL	L1	3MEEL412	Project	-	-	8	-	4	--	--	--	50	50
07	SS	T1	3MESS413	Self-Study Course -I	-	-	-	-	2	--	--	100	--	--
				Total	**14**	**-**	**14**	**14**	**23**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE (Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50	ESE (Theory): ≥40/100

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Final Year B.Tech.–Mechanical Engineering

[Level 6, UG B. Tech. Certificate] Semester - VIII

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PE	T1	3MEPE4XX	Professional Elective – VI	3	-	-	3	3	40	20	40	--	--
02	SS	T2	3MESS422	Self-Study Course – II	-	-	-	-	2	--	--	100	--	--
03	EL	L2	3MEEL423	Internship	-	-	-	-	12	--	--	--	50	--
				Total	3	-	-	3	17					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE (Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50	ESE (Theory): ≥40/100

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Professional Electives/Honor's Track (20 Credits)

Track Name	Program Elective –I (2 - 0 – 0)	Program Elective –II (3 -0 -2)	Program Elective –III (2 -0 -2)	Program Elective –IV (2-0 -0)	Program Elective -V (3 -0 -0)	Program Elective –VI (3 -0 -0)
Class	S.Y.B. Tech.	T.Y.B. Tech.	T.Y.B. Tech.	T.Y.B. Tech.	Final Year. B. Tech.	Final Year. B. Tech.
Semester	IV	V	VI	VI	VII	VIII
Design	**3MEPE220** Engineering Tribology	**3MEPE305** Noise and Vibration	**3MEPE317** Condition Monitoring	**3MEPE321** Reliability Engineering	**3MEPE404** Mechanical System Design	**3MEPE415** Failure Analysis
	3MEPE221 Vehicle Engineering			**3MEPE322** Machine Tool Design	**3MEPE405** Process Equipment Design	**3MEPE416** Fracture Mechanics
						3MEPE417 Design of Transmission System
Thermal	**3MEPE222** Sustainable and Renewable Energy Technology	**3MEPE306** I.C. Engines and Electric Vehicles	**3MEPE318** Computational Fluid Dynamics	**3MEPE323** Power Plant Engineering	**3MEPE406** Solar Technology	**3MEPE418** Heating Ventilation and Air Conditioning (HVAC)
				3MEPE324 Green Engineering	**3MEPE407** Design of Thermal Systems	**3MEPE419** Energy Management
Manufacturing & Industrial Engineering	**3MEPE223** Non-conventional Machining Processes	**3MEPE307** Non-Destructive Techniques	**3MEPE319** Additive Manufacturing	**3MEPE325** Total Quality Management	**3MEPE408** Industrial Engineering	**3MEPE420** Manufacturing Automation
				3MEPE326 Supply Chain Management		
Machine Intelligence and Robotics	**3MEPE224** Iotics	**3MEPE308** Mechatronics Systems	**3MEPE320** Industrial Robotics	**3MEPE327** Fundamentals of AI and Machine Learning	**3MEPE409** Industrial Revolution 4.0/5.0	**3MEPE421** Digital Twin

- Students may choose Professional Elective courses from a single track or across multiple tracks, based on their academic interests and career aspirations.
- Only one Professional Elective course may be selected from a given column in a semester. Additional courses from the same column may be taken in subsequent semesters, but not concurrently.
- Students opting for the Honors Degree shall complete all Honors courses from a single track, which shall be different from the track chosen for their Professional Elective courses.

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(An Empowered Autonomous Institute)

Multidisciplinary Minor (14 Credits)

1] Minor Stream: Industrial Engineering (IE)

Sr. No.	SEM	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
											Theory			Laboratory	
											MSE	TA	ESE	CIA	ESE
01	IV	MM	LIT2	3MEIE217	Industrial Engineering	3	-	2	3	4	40	20	40	50	--
02	V	MM	T1	3MEIE309	Supply Chain Management	3	-	-	3	3	40	20	40	--	--
03	VI	MM	LIT2	3MEIE329	Industrial Management and Operation Research	3	-	2	3	4	40	20	40	50	--
04	VII	MM	T1	3MEIE410	Total Quality Management	3	-	-	3	3	40	20	40	--	--
					Total	**12**	**00**	**04**	**12**	**14**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE(Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50

2] Minor Stream: Manufacturing System (MS)

Sr. No.	SEM	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
											Theory			Laboratory	
											MSE	TA	ESE	CIA	ESE
01	IV	MM	LIT2	3MEMS218	Engineering Materials	3	-	2	3	4	40	20	40	50	--
02	V	MM	T1	3MEMS310	Machines and Mechanisms	3	-	-	3	3	40	20	40	--	--
03	VI	MM	LIT2	3MEMS330	Manufacturing Process	3	-	2	3	4	40	20	40	50	--
04	VII	MM	T1	3MEMS411	Thermal Engineering	3	-	-	3	3	40	20	40	--	--
					Total	**12**	**00**	**04**	**12**	**14**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA – Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE(Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50

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Emerging Specialization Minor (18 Credits)

Minor Stream: Industrial Robotics (IR)

Sr. No.	SEM	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
											Theory			Laboratory	
											MSE	TA	ESE	CIA	ESE
01	IV	SM	LIT2	3MEIR240	Sensor Technology and Application	3	-	2	3	4	40	20	40	50	--
02	V	SM	T1	3MEIR340	Automation in Manufacturing	3	-	-	3	3	40	20	40	--	--
03	VI	SM	LIT2	3MEIR345	Robotics for Industrial Applications	3	-	2	3	4	40	20	40	50	--
04	VII	SM	T1	3MEIR430	Mechatronics System Design	3	-	-	3	3	40	20	40	--	--
05	VIII	SM	L2	3MEIR435	Minor Project	-	-	8	-	4	--	--	--	50	--
					Total	**12**	**00**	**12**	**12**	**18**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE(Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50

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Honors with Research (20 Credits)

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
VII	EL	L1	3MEEL432	Research Project - I	-	-	20	-	10	--	--	--	50	50
VIII	EL	L1	3MEEL437	Research Project - II	-	-	20	-	10	--	--	--	50	50
				Total	**-**	**-**	**40**	**-**	**20**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory): ≥8/20	MSE + ESE (Theory): ≥32/80	TA (Theory) / CIA (Lab): ≥20/50	ESE (Lab): ≥20/50

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Bridge Course: (DSY – Lateral Entry Students)

Sr. No.	Semester	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
											Theory			Laboratory	
											MSE	TA	ESE	CIA	ESE
01	I	VS	LIT2	3MEVS107	IDEA Laboratory	1	-	2	1	2	--	--	--	50	--
02	II	ES	L1	3MEES115	Design Thinking Laboratory	-	-	2	0	1	--	--	--	50	--
03	II	ES	T1	3MEES113	Introduction to Emerging Technologies	2	-	-	2	2	--	--	100	--	--
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination															
					Minimum Passing Criteria				CIA (Lab): ≥20/50				ESE (Theory): ≥40/100		

*Note: All Direct Second Year students admitted to the B.Tech. Mechanical Engineering programme shall compulsorily undergo the prescribed bridge courses. Students admitted from diploma programmes other than the parent discipline shall additionally complete bridge courses as prescribed by the designated committee.

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Bridge Course: Changes in Curriculum Revision R2 to R3

Sr. No.	Semester	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
											Theory			Laboratory	
											MSE	TA	ESE	CIA	ESE
01	I	VS	LIT2	3MEVS107	IDEA Laboratory	1	-	2	1	2	--	--	--	50	--
02	II	PC	LIT2	3MEPC112	Fundamentals of Mechanical Engineering	3	-	2	3	4	--	--	100	--	--
03	II	ES	T1	3MEES113	Introduction to Emerging Technologies	2	-	-	2	2	--	--	100	--	--
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination															
Minimum Passing Criteria											CIA (Lab): ≥20/50			ESE (Theory): ≥40/100	

Students shall complete the prescribed Semester I Bridge Courses during Semester III (Odd Semester) and the prescribed Semester II Bridge Courses during Semester IV (Even Semester).

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Second Year
Curriculum Content

MECHANICAL ENGINEERING

SEMESTER III - IV

w.e.f. 2026-27

Department of Mechanical Engineering

Annasaheb Dange College of Engineering and Technology
Ashta - 416301, Dist. : Sangli, Maharashtra
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Department of Mechanical Engineering
Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - III					**Category**	**PC**
Course Code, Course Title	**3MEPC201, Fluid Mechanics**					**Type**	**LIT1**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	2	-	2	2	3		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Explain the fluid properties, static, kinematic and dynamic behaviour of fluid, boundary layer phenomenon, and forces acting on the body for a given fluid/fluid system by using principles of fluid flows.
CO2	Classify the fluids, fluid flows, and flow measuring devices to analyze its behaviour by using various instruments and fluid mechanics principles.
CO3	Compute the fluid flow parameters and fluid properties like velocity, pressure, discharge, viscosity, capillarity, head loss, drag, lift etc. for a given application by using the governing equation and fluid flow principles.
CO4	Analyze fluid flow characteristics by performing experiments, using flow measuring devices, collecting and interpreting experimental data, analytical methods and validating the results with computational tools.

Syllabus:

Module	Contents	Lecture Hours
I	**Fluid Properties and Fluid Statics:** **A) Fluid Properties:** Definition of fluid, Properties of fluid, Viscosity, Types of fluid, Surface tension, Capillarity and vapour pressure. **B) Fluid Statics:** Pascal's law, Hydrostatic law of pressure. (Only theoretical treatment on part B)	5
II	**Fluid Kinematics:** Types of flow, Streamline, Path line, Streak line, Stream tube, Discharge, Continuity equation in Cartesian coordinates and for three dimensional flows, Velocity and Acceleration of fluid particles.	5
III	**Fluid Dynamics:** Forces acting on fluid, Euler's equation of motion, Bernoulli's equation, Venturimeter, Orifice meter, notches.	5
IV	**Flow Through Pipes:** Major and Minor Energy losses in pipes, flow through Syphon, flow through pipes in Series and pipes in Parallel. Conceptual prediction of major/minor losses using ML models.	6
V	**Boundary Layer Theory** Laminar and turbulent boundary layer, Boundary layer thicknesses, its characteristics, Boundary layer separation, boundary layer control.	4
VI	**Forces on Immersed Bodies:** Lift and Drag, Drag on a flat plate and on aerofoil. Types of drags, Magnus effect, Stalling condition of an aerofoil. Aerodynamic optimization using AI(Introduction).	5
	Total Lecture Hours	30

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Flow visualization by Heleshaw's apparatus.	1,2
2	To identify the type of flow by using Reynolds's experiment.	1, 2, 3, 4
3	Verification of Bernoulli's theorem	1, 2, 3, 4

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4	Determination of coefficient of discharge for given Venturimeter.	1, 2, 3, 4
5	Determination of coefficient of discharge for given Orifice meter.	1, 2, 3, 4
6	Determination of coefficient of discharge for given Triangular Notch.	1, 2, 3, 4
7	Orifice under steady flow condition to determine hydraulic coefficients and verify python.	1, 3, 4
8	Determination of velocity profile through circular pipes for laminar flow.	1, 3, 4
9	Determination of coefficient of friction for different pipes and verify using python.	1, 3, 4
10	Determination of friction coefficient of pipes of various diameters.	1, 3, 4
	Total Practical Hours	**30**

Text Books

1. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, 11th Edition, Laxmi Publications, 2025.
2. R. K. Rajput, Fluid Mechanics and Hydraulic Machines, 10th Edition, S. Chand Publication, 2019.
3. P. N. Modi, S.M.Seth, Fluid Mechanics and Hydraulic Machines, 23rd Edition, Standard Book House, 2022
4. K. L. Kumar, Fluid Mechanic, 5th Edition, S. Chand Publication, 2022

References:

1. V. L. Streeter and E. B. Wylie, Fluid Mechanics, 9th Edition, Tata McGraw- Hill, 2016
2. Edward J. Shaughnessy, Introduction to fluid Mechanics, 5th Edition, Oxford university press, 2018
3. Y. A. Cengel, Fluid Mechanics, 5th Edition, McGraw-Hill, 2025
4. White, Fluid Mechanics, 9th Edition, Tata McGraw-Hill, New Delhi, 2022
5. Munson Young, Fundamentals of Fluid Mechanics, 9th Edition, Wiley India Pvt. Ltd, 2021

Online Learning Resources

1. NPTEL Course on Introduction to Fluid Mechanics, by Prof. Suman Chakraborty, IIT Kharagpur https://nptel.ac.in/courses/112105269
2. Udemy Course on Fundamentals of Fluid Mechanics, by Dr. Mohammed Hasan Almughalles, https://www.udemy.com/course/fluid-mechanics-n
3. edX Course on Advanced Fluid Mechanic, by Gareth McKinley, Bavand Keshavarz, John Liu, Emily Welsh. https://www.edx.org/learn/fluid-mechanics

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	Determination of Friction Coefficient of pipes of various diameters.	https://fm-iitk.vlabs.ac.in/exp/friction-coefficients/

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B.Tech, Semester – III					**Category**	**PC**
Course Code, Course Title	**3MEPC202, Materials Science and Metallurgy**					**Type**	**LIT2**
Prerequisites	**3MEBS102, 3MEBS110, 3MEPC112**						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	2	-	2	2	3		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the properties, processing methods, and applications of engineering and advanced materials.
CO2	Interpret crystal structures, defects, cooling curves, and phase diagrams to relate microstructure with material properties.
CO3	Select suitable heat treatment processes to achieve desired properties in metals and alloys.
CO4	Analyze material behavior and performance using destructive and non-destructive testing techniques.

Syllabus:

Module	Contents	Lecture Hours
I	**Engineering materials and their properties:** Classification of engineering materials: Metals, Polymers, Ceramics, Composites, Metallic Materials: Types, Properties and Applications, Ferrous alloys- Carbon steels, Cast iron, Alloy steels, Stainless steels- types, Tool steels- types, Non-ferrous alloys- Copper and aluminum based alloys. Classification and applications of polymers, ceramics, composites; Comparison of physical and thermomechanical properties of metals, polymers, and ceramics	5
II	**Material Testing:** Destructive Testing methods: Hardness, Tensile, Compressive, Impact, Fatigue, and Creep testing Non- Destructive Testing: Visual inspection, Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing	5
III	**Crystallography and Phase Diagram:** Crystal Structure of Metals and ceramics, Polymers, Crystal Defects, Gibbs phase rule, Cooling curves of Pure Metal and Binary alloys, Isomorphous System, Lever arm principles, Fe- Fe3C equilibrium diagram,	5
IV	**Principles of Heat Treatment:** Transformation of Pearlite into austenite upon heating, Transformation of austenite into Pearlite, Bainite and Martensite on cooling. TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its Significance.	5
V	**Heat Treatment Processes:** Heat treatment of steels, Annealing and Normalizing; Hardening- types, Purposes, Mechanism of quenching and Quenching media, Hardenability- Grossmans critical diameter method and Jominy end quench test; Tempering; Surface hardening- Carburizing, Nitriding, Heat treatment defects and remedies.	5
VI	**Advanced Manufacturing & Materials:** Powder Metallurgy: Advantages, Limitations and Applications, Process, defects and remedies; Hot isostatic pressing (HIP)Additive manufacturing of metallic materials: Types, Advantages, Applications; Smart materials: Types, Piezoelectric, Magnetostrictive, Shape memory alloys. Introduction to computational materials science, application to Industry 4.0.; Materials Informatics, Machine learning for design of materials (concepts only)	5
	Total Lecture Hours	**30**

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List of Experiments with CO Mapping

S.No	Title of the Experiment	CO Mapped
1	Hardness testing of engineering materials by Brinell and Rockwell tester	4
2	Tensile testing of engineering materials	4
3	Impact strength testing of engineering materials using impact test	4
4	Surface damage analysis using dye-penetration test	4
5	Crack detection in metal components using Ultrasonic testing	4
6	Hardenability testing by Jominy end quench test	3
7	Specimen Preparation & its Microscopic examination.	2
8	Microstructure of Various Steels	2,3
9	Tailoring Microstructure with Various Heat Treatments	2,3
10	Industrial visit	1,2,3,4
	Total Practical Hours	**30**

Text Books

1. V. D. Kodgire, Material Science and Metallurgy for Engineers, 12th Edition, Everest Publishers, Pune, 2009.
2. S. H. Avner, Introduction to Physical Metallurgy, 2nd Edition, McGraw Hill Book Company Inc., 1988.
3. R. A. Higgins, Engineering Metallurgy Part-I, 6th Edition, ELBS with Edward Arnold, 1994.
4. V. Raghavan, Material Science and Engineering, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.

References:

1. W. Callister, Materials Science & Engineering, 2nd Edition, John Wiley & Sons, Reprint 2017.
2. T. V. Rajan and C. P. Sharma, Heat Treatments: Principles and Practices, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1994.
3. R. Balasubramaniam, Callister's Materials Science and Engineering, 3rd Edition, Wiley India Pvt. Ltd., 2008.
4. K. Bhargava, Mechanical Behaviour and Testing of Materials, 2nd Edition, PHI Publications, 2011.

Online Learning Resources

1. NPTEL Course on *Materials Science and Engineering*, by Prof. Vivek Pancholi, IIT Roorkee https://onlinecourses.nptel.ac.in/noc24_mm12/preview
2. NPTEL Course on *Mechanical Behavior of Materials*, by Prof. Sankaran S., IIT Madras https://onlinecourses.nptel.ac.in/noc22_mm25/preview
3. Interactive Phase Diagram Southampton https://www.southampton.ac.uk/~pasr1/index.htm
4. Materials Project - AI-driven material properties database, https://next-gen.materialsproject.org/

Experiments that may be performed through virtual labs:

S. No	Experiment Name	Experiments Links
1.	Microstructure of Various Steels	https://spm-iitk.vlabs.ac.in/exp/microstructure-various-steels/
2.	Tailoring Microstructure With Various Heat Treatments	https://spm-iitk.vlabs.ac.in/exp/tailoring-microstructure/procedure.html

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester – III					**Category**	**ES**
Course Code, Course Title	**3MEES203, Engineering Mathematics-III**					**Type**	**T1**
Prerequisites	3MEBS101, 3MEBS109						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	2	-	-	2	2		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		---	---

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Determine solutions of linear and partial differential equations using analytical methods.
CO2	Apply Euler's formulae to construct the Fourier series expansion of periodic functions over standard and arbitrary intervals.
CO3	Apply vector calculus concepts such as gradient, divergence, curl, and line integrals to solve engineering problems.
CO4	Calculate Laplace Transforms for elementary functions using fundamental integral definitions.

Syllabus:

Module	Contents	Lecture Hours
I	**Linear Differential Equations:** Definitions, Complete solution, Operator D, Rules for finding Complementary function, Inverse operator, Rules for finding the Particular integral	5
II	**Fourier Series:** Introduction, Euler's Formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd or even periodic functions, Half Range cosine and sine series	5
III	**Partial Differential Equations and its Application:** Introduction –Formation of partial differential equations, linear equation of the first order (Lagrange's equation), Method of separation of variables, one dimensional wave equation (using separation of variables)	5
IV	**Vector Calculus:** Introduction, Scalar and vector point functions - vector operator del, Del applied to scalar point functions - gradient, directional derivative, Del applied to vector point functions - Divergence and curl, Line integral	5
V	**Laplace Transform:** Introduction, Laplace transform of elementary functions. Properties of Laplace Transforms, Laplace Transforms of derivatives, Laplace Transforms of integrals, Multiplication by t^n, Division by t, Evaluation of integrals by Laplace Transforms.	5
VI	**Inverse Laplace Transform:** Definition, Inverse transforms of some elementary functions, Inverse Laplace transforms - Method of Partial Fractions, convolution Theorem, Applications of Laplace transform to solve linear differential equations.	5
	Total Lecture Hours	30

Text Books:

1. N.P. Bali and Manish Goyal , A text book of Engineering Mathematics , 8th Edition, Laxmi Publications ,2011.
2. H. K. Das , Advanced Engineering Mathematics , 22th Edition, S. Chand ,2018.
3. B. V. Ramana, Higher Engineering Mathematics, 6th Edition, Tata McGraw Hill Publ., 2010
4. Erwin Kreyszig , Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,Inc ., 2007

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References:
1. Dr. B. S. Grewal , Higher Engineering Mathematics , 44th Edition, Khanna Publishers ,2018.
2. N. P. Bali, Manish Goyal , Advanced Engineering Mathematics , 7th Edition, Infinity science press ,2010.
3. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Vol-I, 9th Edition Pune Vidyarthi Griha Prakashan,1984
4. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Vol-II, 7th Edition Pune Vidyarthi Griha Prakashan,1988.
Online Learning Resources
1. NPTEL Course on Advanced Engineering Mathematics, by Prof. H.K. Dass, IIT Delhi https://nptel.ac.in/courses/111105121
2. NPTEL Course on Transform Techniques for Engineers, Prof. Srinivasa Rao Manam, IIT Madras https://nptel.ac.in/courses/111106111
3. NPTEL Course on Mathematics-III, by Prof. Durga C Dalal, Dr. M. Guru Prem Prasad, IIT Guwahati https://nptel.ac.in/courses/122103012
4. NPTEL Course on Advanced Engineering Mathematics, by Prof. Hari Shankar Mahato, IIT Kharagpur https://nptel.ac.in/courses/111105167
5. NPTEL Course on Engineering Mathematics-II, by Prof. Jitendra Kumar, IIT Kharagpur https://nptel.ac.in/courses/111105134

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Established:

Course Information:

Class, Semester	SY. B. Tech, Semester - III					**Category**	**PC**
Course Code, Course Title	**3MEPC204, Kinematics of Machines**					**Type**	**T1**
Prerequisites	---						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**		**Credits**	
	2	1	-	3		3	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the terminology associated with different mechanisms, governor, gears, cam using theory of kinematics.
CO2	Compute different parameters related to mechanisms, power transmitting devices and cam and follower using analytical or graphical approaches.
CO3	Apply the principles of governors, flywheels, gears, and gear trains to evaluate their operating performance.
CO4	Analyse kinematic behaviour of complex mechanisms using velocity and acceleration diagrams and cam profiles.

Syllabus:

Module	Contents	Lecture Hours
I	**Basics of Kinematics and Mechanisms** Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach criterion, Grubler's criterion, Inversion, Four bar chain and its inversions, Grashoff's law, Slider crank chain and its inversions, Double slider crank chain and its inversions, Robot Kinematics, AI applications.	4
II	**Analysis of Mechanisms** Velocity and Acceleration Analysis in Mechanism: (Graphical analysis- Velocity and acceleration for different mechanisms using relative velocity and acceleration method), Instantaneous centre method (Up to 6 IC), Kennedy's theorem. Analytical analysis- Approximate analytical method for Velocity and acceleration of the piston.	6
III	**Governor Mechanism and Energy Storing Devices** 1)Governors- Comparison between governors and flywheel. Types-centrifugal governors, inertia governors. Force analysis - gravity loaded governors- Porter, Spring loaded governors-Hartnell 2) Flywheel- Turning moment diagrams, fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel	5
IV	**Theory of Gears** Classification of gears, Types of gears, Spur gears - terminology, fundamental law of toothed gearing, involute and cycloidal profile, contact ratio, minimum number of teeth, interference and undercutting. Helical gears: Nomenclatures, center distance, force analysis	6
V	**Theory of Gear Trains** Types of gear trains, simple, compound, reverted, epicyclic gear train, tabular method for finding the speeds of elements in epicyclic gear trains, torques in the epicyclic gear train, differential gearbox.	5
VI	**Kinematics of Cams and Follower** Classification of cams, Classification of followers, Terminologies of cam and follower, Motions of Follower a) Uniform Velocity b) Simple harmonic motion c) Uniform acceleration and retardation d) Cycloidal motions, Displacement diagram of follower, Velocity and acceleration diagram of Follower, Construction of cam profile, Computational programming for generation of cam profiles for radial cam.	4
	Total Lecture Hours	30

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List of Tutorials with CO Mapping

S. No.	Title / Topic of the Tutorial	CO Mapped
1	To study the fundamentals of kinematic links, pairs, chains, mechanisms, inversions of four-bar, slider-crank, and double slider-crank mechanisms.	1
2	To determine the degree of freedom of planar mechanisms using Kutzbach and Grubler's criteria.	2
3	To perform velocity analysis of mechanisms using the relative velocity method.	2, 4
4	To perform acceleration analysis of mechanisms using the relative acceleration method.	2, 4
5	To determine instantaneous centers of a mechanism and verify Kennedy's theorem.	2, 4
6	Study and numerical Analysis of Centrifugal Governors .	3
7	To study the turning moment diagram and determine fluctuation of energy in a flywheel.	1
8	To carry comparative study of different mechanical systems and power transmission devices based on their functional characteristics.	1, 3
9	To determine different parameters related to gears.	2
10	To determine speed and torque relationships in simple and epicyclic gear trains using the tabular method.	2
11	To construct displacement, velocity, and acceleration diagrams for different cam follower motions.	2, 4
12	To study the application of artificial intelligence techniques in mechanism analysis	1
Total Tutorial Sessions	**15**	

Text Books

1. Ratan S.S, Theory of Machines, 3rd Edition, Tata McGraw Hill New Delhi.,2012.
2. R.S.Khurmi & G.K.Gupta, Theory of Machines, 14th Edition, S. Chand, 2020
3. P.L.Ballany Theory of Machines,25th Edition, Khanna Publication New Delhi, 2012
4. V.P. Singh, Theory of Machines, 7th Edition, Dhanpat Rai and Sons. 2020
5. Sadhu Singh,Theory of mechanism and machines, 2nd Edition, Pearson, 2006

References:

1. George Martin, Kinematics & Dynamics of Machines, 2nd Edition, Waveland Press, Inc.,2002
2. Thomas Bevan, Thomas Beven, 3rd Edition, CBS Publishers, New Delhi.,2005
3. Shigley, Theory of Machines and Mechanism, 3rd Edition, Oxford International,2009
4. Jagdish Lal, Theory of machines and Mechanism, 1st Edition, Metropolitan Book Company, 2011
5. Gosh And Mallik, Mechanism and Machines, 3rd Edition, East West Press, 1998

Online Learning Resources

1. NPTEL Course on *Kinematics of Mechanism and Machines*, by Prof. Anirvan DasGupta, IIT Kharagpur https://nptel.ac.in/courses/112105268
2. Digital document library, https://www.scribd.com/document/996736569/thoery-of-machines-syllabus

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
-	-	-

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Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Mechanical Engineering
Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - III					**Category**	**PC**
Course Code, Course Title	**3MEPC205 Applied Thermodynamics**					**Type**	**T1**
Prerequisites	3MEBS107, 3MEPC112						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	2	-	-	2	2		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the fundamentals of thermodynamics like laws, concepts etc. for a given system using diagrams, plots etc.
CO2	Apply the First and Second Laws of Thermodynamics to analyze engineering systems using mathematical equations, including the Steady Flow Energy Equation (SFEE) and evaluate system performance.
CO3	Determine the thermodynamic properties of pure substances, such as enthalpy and entropy, using steam tables / Mollier chart /mathematical equations.
CO4	Evaluate the performance of gas turbines and steam turbines using thermodynamic principles, P–V–T diagrams, velocity diagrams, and compounding diagrams.

Syllabus:

Module	Contents	Lecture Hours
I	**First Law of Thermodynamics** Thermodynamic systems, properties of a system, state and equilibrium, processes and cycles, temperature and the zeroth law of thermodynamics, heat and work transfer, the first law of thermodynamics, limitations of first law of thermodynamics, energy- a property of system, The first law of thermodynamics for a control volume, The steady-flow process; numerical treatment of SFEE processes	4
II	**Second Law of Thermodynamics** Kelvin–Planck statement, Clausius statement, refrigerators, and heat pumps, the equivalence of the two statements, perpetual-motion machines, Clausius theorem, inequality, useful work, dead state, entropy-property of system, Clausius principle of increase of entropy, available energy referred to cycle, law of degradation of energy	5
III	**Properties of Pure Substance** Definition of pure substance, the phase change of pure substances, p-T, p-v-T Surface and the triple point of water, Ideal gas equation of state and van der Waals equation of state, phase rule formation and properties of steam, quality of steam, Superheated steam & Characteristics of superheated steam, steam calorimeters, h-s chart or Mollier chart, use of steam table and Mollier chart., Study of AI-based regression models to predict steam state and properties based on real-time temperature and pressure data	6
IV	**Impulse turbines** Rankine and modified Rankine cycle, reheat cycle, regenerative heating, 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. Introduction to Predictive Maintenance in Steam Turbines: Condition monitoring and anomaly detection using AI/ML concepts	6
V	**Reaction turbines** Flow through impulse reaction blades, velocity diagram, 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 and different methods of improving performance, function of the diaphragm, glands, and turbine troubles like erosion, corrosion, vibration, fouling.	5

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VI	**Gas Turbines and Jet Propulsion** Classification, Merits, Constant pressure combustion, Constant volume combustion, methods of improving thermal efficiency of gas turbine, applications and uses, Fuels, Jet propulsion engine, Gas turbine Blade cooling	4
	Total Lecture Hours	30

Text Books

1. Yunus A. Cengel, Thermodynamics: An Engineering Approach,8th Edition, McGraw Hill,2015.
2. P. K. Nag, Engineering Thermodynamics, 5th Edition, McGraw Hill, 2013.
3. Onkar Singh, Applied Thermodynamics, 3rd Edition, New Age International, 2009.
4. M. Achuthan, Engineering Thermodynamics, 2nd Edition, PHI Learning Pvt. Ltd., 2009.

References:

1. Richard E. Sonntag, Claus Borgnakke, Fundamentals of Thermodynamics, Seventh Edition, New Age International, 2009.
2. Richard E. Sonntag, Claus Borgnakke, Fundamentals of Thermodynamics, Seventh Edition, Wiley Publication, 2009.
3. M. J. Moran, H. N. Shapiro, B. R. Munson, D. P. DeWitt, Introduction to Thermal System Engineering, Tenth Edition, Wiley Publication, 2013.
4. Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, Fundamentals of Engineering Thermodynamics, Eighth Edition, John Wiley & Sons, Inc., 2014.

Online Learning Resources

1. NPTEL–SWAYAM online course titled Engineering Thermodynamics, offered by Prof. Jayant K. Singh, IIT Kanpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ch27
2. NPTEL–SWAYAM online course on Applied Thermodynamics, offered by Prof. V. Raghavan, IIT Madras. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_me61
3. NPTEL–SWAYAM online course titled *Steam and Gas Power Systems*, offered by Prof. Ravi Kumar, IIT Roorkee https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_me79
4. Course-specific YouTube Playlist **https://www.youtube.com/@siddhanath.nishandar/playlists?app=desktop**

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - III					**Category**	**PC**
Course Code, Course Title	**3MEPC206, Strength of Material**					**Type**	**T1**
Prerequisites	**3MEES111, 3MEPC112**						
Teaching Scheme (per week)	**Lecture**	**Tutorial**		**Practical**	**Self Study**	**Credits**	
	2	1		-	3	3	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Solve problems on stress, strain, and material response in structural members subjected to mechanical and thermal loads.
CO2	Compute stresses and internal force distributions in structural elements under static loading conditions.
CO3	Determine load-carrying capacity and structural adequacy of engineering members through stress distribution analysis.
CO4	Evaluate deformation, stability, and strain energy of structural members using analytical methods.

Syllabus:

Module	Contents	Lecture Hours
I	**Stresses and Strain:** Stress, strain, normal and shear stresses, Factor of safety, Hooke's Law, Elastic constants (E, G, K, σ and their inter-relationship. Stresses in varying sections of normal and composite bars, thermal stresses. Concept of Stress Concentration.	4
II	**Principal Stresses and Strains (2D):** Normal and shear stresses on oblique planes, Principal stresses and maximum shear stress, Mohr's circle of stresses (Graphical method). Theories of failures (Rankine, Guest & Tresca, Von Mises). Introduction to 3D stress tensor. Introduction to AI/ML-assisted stress visualization tools (conceptual).	5
III	I) **Shear Force and Bending Moment**: Shear force and bending moment diagram for simply supported, cantilever and overhanging beam subjected to point load, inclined load, UDL, UVL and couple. II) **Torsion:** Theory of torsion, assumptions, derivation of torsion equation, Polar modulus, stresses in solid and hollow circular shaft, power transmitted by shaft.	6
IV	**Stresses in Beams** I) Bending stresses: Pure bending of beams, flexural formula, moment of inertia, bending stresses in beams of various commonly used sections such as I, T, C and cut-out sections. II) Shear stresses: Shear stress for different cross-section of beams, distribution of shear stress in beams of various commonly used sections.	6
V	**Deflection of Beams** Concept of slope and deflection, Strain curvature and moment curvature relation, Methods for determining deflections, Solution of beam deflection problem by Double integration method. (Simply supported, cantilever subjected to point load, UDL). Use of Python/MATLAB scripts or AI-assisted tools for numerical computation and verification of beam deflection results (conceptual).	4
VI	**Columns & Strain Energy:** I) Columns: Euler's formula for buckling load (various end conditions), limitations, Rankine's formula. II) Strain Energy: Strain energy due to axial, bending, and torsional loads.	5
	Total Lecture Hours	**30**

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List of Tutorials with CO Mapping		
S.No	**Title / Topic of the Tutorial**	**CO Mapped**
1	Problems on axial stresses, strains, and computation of elastic constants using Hooke's Law.	1
2	Problems on stresses in stepped bars, composite bars and determination of thermal stresses.	1
3	Determination of principal stresses, principal planes and maximum shear stress using analytical methods.	1
4	Graphical determination of principal stresses using Mohr's Circle; Application of theories of failure.	1
5	Construction of Shear Force and Bending Moment diagrams for simply supported and overhanging beams under various loads.	2
6	Problems on torsion of solid and hollow circular shafts; computation of power transmitted.	2
7	Problems on bending stresses in beams of I, T, C, and cut-out cross-sections using flexural formula.	3
8	Problems on shear stress distribution in beams of rectangular, circular and I-cross-sections.	3
9	Problems on slope and deflection of simply supported and cantilever beams using double integration method.	4
10	Problems on beam deflection using Macaulay's method; Verification of results using Python/MATLAB (AI-assisted computation). [AI-Integrated Tutorial]	4
11	Problems on design and safe load computation in columns using Euler's formula and Rankine's formula.	4
12	Problems on strain energy stored in members under direct stress, bending and torsion.	4
Total Tutorial Sessions	**15**	

Text Books

1. Ferdinand P. Beer & E.R. Johnston, Mechanics of Materials, 7th Edition, McGraw Hill Education, 2014.
2. R.K. Bansal, Strength of Materials, 6th Edition, Laxmi Publications, 2018.
3. S. Ramamrutham, Strength of Materials, 18th Edition, Dhanpat Rai Publishing, 2014.

References:

1. R.C. Hibbeler, Mechanics of Materials, 10th Edition, Pearson Education, 2018.
2. Gere & Timoshenko, Mechanics of Materials, 6th Edition, CBS Publishers.
3. Robert Norton, Machine Design: An Integrated Approach, Pearson.

Online Learning Resources

1. NPTEL Course: "Strength of Materials" by Prof. S.K. Bhattacharyya, IIT Kharagpur.
2. NPTEL Course: "Mechanics of Materials" by Prof. U. Saravanan, IIT Madras.

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	Tensile Test on Mild Steel	http://sm-nitk.vlabs.ac.in/exp1/index.html
2.	Torsion Test on Mild Steel	http://sm-nitk.vlabs.ac.in/exp6/index.html
3.	Deflection of Cantilever Beam	http://sm-nitk.vlabs.ac.in/exp13/index.html

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - III	**Category**	**PC**
Course Code, Course Title	**3MEPC207, Machine Drawing Laboratory**	**Type**	**L1**
Prerequisites	**3MEES103**		

Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**
	-	-	2	-	1

Examination Scheme (Marks)	**Theory**				**Practical**		
	MSE	**TA**	**ESE**		**CIA**	**ESE**
	-	-	-		50	50

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Draw BIS conventions and freehand sketches for the given machine components by referring to relevant BIS standards & with standard empirical design relations.
CO2	Construct the curves of interpenetration for the given solids by applying the fundamental principles of solid interpenetration.
CO3	Prepare the orthographic, sectional views & dimensions for the given machine components using computer aided drafting software.
CO4	Develop detailed and assembly drawings from the given machine component drawings using computer-aided drafting software in accordance with standard drawing practices.
CO5	Interpret production drawing requirements to select suitable limits, fits, tolerances and machining symbols in accordance with GD&T standards/principles.

Syllabus:

Module	**Contents**	**Lecture Hours**
I	**BIS Conventions & Free Hand Sketches:** BIS conventions for sectioning, type of sections. BIS methods of linear and angular dimensioning. BIS Conventions & Free hand sketches of fasteners such as nuts like square nuts, hexagonal nuts, flanged nuts, lock nut, dome nuts & bolts like square headed bolt, cup headed bolt, T-headed bolt etc. Various types of keys. Various types of joints like knuckle joint, pipe joints, riveted & welded joints. Types of bearings & gears.	-
II	**Interpenetration of solids:** Prism with Cylinder, Cylinder with cylinder & Cone with cylinder	-
III	**Details & Assembly Drawing:** Detailed drawings of machine parts are given to students for assemble. Details & Assembly drawing with part list, Stack-up analysis.	-
IV	**Geometric Dimensioning, Fits, Tolerances & Surface Finish Symbols:** Significance of system of limits and fit & its types. Tolerances & its types, Symbols, datum's and applications of Geometric Tolerances. Surface Textures, Roughness values and Roughness Grades, Machining symbols as per BIS. Assigning limits, fits, tolerances and machining symbols on production drawing,	-

List of Experiments with CO Mapping

S.No	**Title / Topic of the Experiment**	**CO Mapped**
1	Study and Application of BIS Conventions for Engineering and Machine Component Drawings	1
2	Freehand Sketching of Engineering and Machine Components with Dimensions as per BIS Standards	1
3	Drawing of Interpenetration of Various Combinations of Solids.	2
4	Preparation of 2D Drawings of Simple Machine Components Using Computer-Aided Drafting (CAD) Software	3
5	Preparation of 2D Industrial Machine Component Drawings with Geometrical Dimensioning and Tolerancing (GD&T) using Computer Aided Drafting Software	3,5

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6	Preparation of Detailed Drawings (Dis-Assembly) from Given Assembly with geometrical dimensions & tolerances using Computer Aided Drafting software.	4,5
7	Preparation of assembly drawings from given detail drawings with part list and geometrical dimensions & tolerances using Computer Aided Drafting software.	4,5
8	Preparation of Production drawing of a given machine components by assigning dimensional limits, tolerances and surface roughness symbols using Computer Aided Drafting software.	5
	Total Practical Hours	**30**

Text Books

1. N. D. Bhatt, Machine Drawing, 15th Edition, Charotor Publication House, Bombay, 2007.
2. R.K. Dhavan, Machine Drawing, 1st Edition, S. Chand and Company, 2007.
3. Narayana, Kannaiah and Venkata reddy, Production Drawing, 3rd Edition, New Age International, 2008
4. Warren Luzadder, Machine Drawing, 11th Edition, Prentice Hall, India, 1999.

References:

1. P.S. Gill, Machine Drawing, 17th Edition, S.K. Kataria and Sons, Delhi, 2008.
2. Sham Tickoo, AutoCAD 2014 for Engineers and Designers, 1st Edition, Dreamtech Publisher, 2013.
3. Robert M. Thomas, Advanced AutoCAD, 3rd Edition, Tech Publication, 1993.
4. Cheryl R. Shrock, Exercise Workbook for Advanced AutoCAD 2006, 1st Edition, New Age International Publication, 2006.

Online Learning Resources

1. NPTEL Course *on Engineering Drawing and computer graphics,* by Prof. RajaramLakkaraju, IIT Kharagpur https://nptel.ac.in/courses/112105294
2. NPTEL Course *on Engineering Graphics and Design*, by Prof. NareshDatla, Prof. S. R. Kale, IIT Delhi https://nptel.ac.in/courses/112102304
3. Introduction to AutoCAD, https://thesourcecad.com/AutoCAD-tutorials/
4. https://www.coursera.org/projects/autocad-for-beginners-drafting-blueprints-and-schematics

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	Interpenetration of Various Combinations of Solids. (Projection of Solids)	https://eg-dei.vlabs.ac.in/exp/projection-of-solids/
2.	Geometrical Dimensioning & Tolerances Symbols	https://mechsimulator.com/tools/gdt-trainer/

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Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Mechanical Engineering
Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - III					**Category**	**PC**
Course Code, Course Title	**3MEPC208, Microcontroller Laboratory**					**Type**	**L2**
Prerequisites	3MEES105						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	-	-	2	-	1		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the architecture, features, applications, and communication protocols of microcontrollers, sensors, and embedded platforms used in IoT systems.
CO2	Analyze communication protocols and data transmission methods used in microcontroller-based embedded systems.
CO3	Integrate sensors and actuators with microcontrollers for real-time data acquisition, communication, and control.
CO4	Develop embedded programs for monitoring, controlling, and transmitting physical parameters using microcontrollers and IoT platforms.

Syllabus:

Module	Contents	Lecture Hours
I	**Introduction to Microcontroller:** Microcontroller Basics: Difference between microprocessor and microcontroller, architectural considerations, CPU, memory sub system, I/O sub system, control logic. Architecture of different microcontroller. Memory structure, different registers (SFR's), addressing modes.	-
II	**Types of Sensors and Peripherals:** Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators, Displays, Motors, couplers/isolators, relays. Peripherals: Control and Status Registers, Device Driver, Timer Driver.	-
III	**Design and Development:** Embedded system development Environment – IDE, types of file generated on cross compilation, disassembler/ de-compiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.	-
IV	**Introduction to Internet of Things (IOT):** Understanding IOT fundamentals, IOT Architecture and protocols, Various Platforms for IOT, Real time Examples of IOT, Overview of IOT components and IoT Communication Technologies, Challenges in IOT.	-
	Total Lecture Hours	-

List of Experiments with CO Mapping

Sr.No	Title / Topic of the Experiment	CO Mapped
1	Comparative Study of Architecture and Features of Arduino, NodeMCU, PIC, and STM32 Microcontrollers	1
2	Identify and classify sensors used for internet of things (IOT) and automation applications.	1
3	Study of Communication Protocols Used in Microcontroller-Based Embedded Systems	2

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4	Implementation of ultrasonic sensor interfacing with Arduino for distance measurement applications	3, 4
5	Development of a Temperature and Humidity Sensing System Using Arduino Platform	3, 4
6	Integrating pulse width modulation principal for DC motor speed using microcontroller	4
7	IoT-Based Light Intensity Monitoring and Data Transmission System	3, 4
8	Implementation of an IoT-Enabled Vibration Monitoring System Using NodeMCU	4
9	Development of an IoT-Enabled Control System for AC and DC Loads	4
10	AI-Based Gear Fault Detection System Using Raspberry Pi	1,3,4
	Total Practical Hours	**30**

Text Books

1. Turner, Ryan, Arduino Programming, 2nd Edition, Nelly B.L. International Consulting Limited, 2020.
2. Blum, Jeremy, Exploring Arduino: Tools and Techniques for Engineering Wizardry, 1st Edition, Wiley, 2019.
3. Lakhwani, Kamlesh, Internet of Things (IoT), 1st Edition, BPB Publications, 2020.
4. McManus, Sean, Raspberry Pi For Dummies, 3rd Edition, Wiley, 2017.

References:

1. Hughes, J. M., Arduino: A Technical Reference, 1st Edition, O'Reilly Media, 2016.
2. Morton, John, The PIC Microcontroller, 3rd Edition, Elsevier Science, 2005.
3. Gay, Warren, Beginning STM32, 1st Edition, Apress, 2018.
4. Monk, Simon, Raspberry Pi Cookbook, 1st Edition, O'Reilly Media, 2013.

Online Learning Resources

1. ACM India Summer School on IoT and Embedded Systems, IIT Madras-https://nptel.ac.in/courses/128108016
2. Blynk IoT Platform – Mobile app-based IoT control and monitoring https://blynk.io
3. Arduino Project Hub – Hands-on projects and experiments for beginners to advanced users https://projecthub.arduino.cc
4. Raspberry Pi Projects – Beginner to advanced projects for laboratory practice https://projects.raspberrypi.org

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	Programming for I/O interfacing (LED and Switch interfacing)	https://esd-coep.vlabs.ac.in/exp/io-interfacing-led-switch/

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - III					**Category**	**VS**
Course Code, Course Title	**3MEVS209, Python Programming Laboratory**					**Type**	**L2**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	-	-	2	-	1		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		25	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain fundamental Python syntax, variables, and data types (integer, float, string) to set up basic engineering calculations.
CO2	Utilize conditional and iterative control structures (loops, if/else) to automate computational and repetitive engineering processes.
CO3	Organize structured data effectively using Python's data structures (lists, tuples, strings, and dictionaries) for data management.
CO4	Construct reusable, modular programs using user-defined functions and by integrating built-in and external modules.

Syllabus:

Module	Contents	Practical Sessions
I	**Introduction to Python:** Overview of Python and its applications in engineering. Installation and Working with, Versions of Python, Python installation and development environments (Anaconda, Spyder, Jupyter, VS Code), Coding conventions Structure of Python programs; Interactive and script mode execution; Variables and dynamic typing; Identifiers, keywords, and literals; Python operators (arithmetic, relational, logical, assignment).	-
II	**Python Data Types:** Classification of data types; Mutable and immutable data types; Numeric data types (int, float, complex); Type conversion and type checking; String data type and basic string operations; List definition, indexing and slicing; Tuple definition and basic operations; Use of data types in engineering calculations.	-
III	**String and Tuple Manipulations:** String slicing, formatting and built-in string methods; String manipulation for data processing; Tuple indexing, slicing and operations; Comparison between list and tuple; Applications of strings and tuples in data handling.	-
IV	**List, Set and Dictionary Manipulations:** List manipulation using built-in methods; Nested lists; Set data type—creation, methods and set operations; Dictionary data type—key–value pairs, creation, access and built-in methods; Use of functions with Python data structures for structured data management.	-
V	**Flow Control and Iterative Statements:** Decision-making statements: if, if–else, if–elif–else, nested if; Looping constructs: for loop, range(), iteration over strings, lists, tuples and dictionaries; while loop; Loop control statements: break, continue, pass; Programming using conditional and looping blocks for repetitive engineering computations.	-
VI	**Defining and calling user-defined functions;** Function parameters and return values; Types of arguments; Scope and namespaces;	-
	Total Lecture Hours	-

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List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	To study Python data types and variables and perform basic operations using them	1
2	To study the String data type in Python and perform various string operations using built-in string methods	3
3	To study the List data type in Python and perform various operations using built-in list methods.	3
4	To study the Tuple data type in Python and perform various operations using built-in tuple methods and functions	3
5	To study the Set data type in Python and perform various set operations using built-in methods and operators	3
6	To study the Dictionary data type in Python and perform various operations using built-in dictionary methods	3
7	To study the use of if, if-else, if-elif-else, and nested if statements in Python for decision-making and control flow	2
8	To study the for loop in Python and perform repetitive operations using different looping techniques	2
9	To study the while loop in Python and perform repetitive operations using different looping techniques	2
10	To study user-defined and built-in functions in Python and understand the concepts of function definition, function calling.	4
	Total Practical Hours	**30**

Text Books

1. R. Nageswara Rao, Core Python Programming, 2nd Edition, Dreamtech Press, 2018.
2. Barry Paul, Head First Python, First Edition, Shroff Pub Distrib Pvt Ltd, 2010
3. Barth,T.J. (Ed.), Texts in Computational Science and Engineering Programming, First Edition, Springer Pvt Ltd,2016
4. Reema Thareja, Python Programming Using Problem Solving Approach, 2nd Edition, Oxford University Press, 2019.

References:

1. Rao,R.N., Machine Learning in Data Science Using Python, First Edition, Dreamtech Press,New Delhi,2022
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media, 2016
3. Paul Barry, Head First Python, 2nd Edition, O'Reilly Media, 2016
4. Guido van Rossum et al., The Python Tutorial, Latest Edition, Python Software Foundation, 2023.

Online Learning Resources

1. **NPTEL (SWAYAM – Government of India)**, Programming, Data Structures and Algorithms using Python, IIT Madras, https://nptel.ac.in
2. SWAYAM Portal, Python for Data Science, Government of India, https://swayam.gov.in
3. GeeksforGeeks, Python Programming Language, https://www.geeksforgeeks.org/python-programming-language
4. W3Schools, *Python Tutorial*, https://www.w3schools.com/python

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	In this experiment the Student will be able to understand the flow of controls and types of loops used in Python programming language with the help of an iterative simulator.	https://python-iitk.vlabs.ac.in/exp/loops/index.html

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Course Information:

Class, Semester	SY. B. Tech, Semester –III					**Category**	**HS**
Course Code, Course Title	**3MEHS210, Indian Constitution**					**Type**	**T2**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	1	-	-	1	1		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	**50**	-		-	-

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Describe the evolution and salient features of the Indian Constitution using the Government of India Acts of 1935 and 1947.
CO2	Illustrate the philosophy of the Indian Constitution using the Preamble, Fundamental Rights, Fundamental Duties, and Directive Principles of State Policy
CO3	Explain the constitutional amendment process, principles of the Basic Structure, and emergency provisions under the Indian Constitution
CO4	Summarize the structure and functioning of the Union and State Governments using the parliamentary and legislative systems.

Syllabus:

Module	Contents	Lecture Hours
I	**Constitution: Basic Structure & Making of Constitution** Meaning of the constitution law and constitutionalism, Historical perspective of the constitution of India, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Meaning and importance of Constitution, Making of Indian Constitution – Sources, Salient features of Indian Constitution, Preamble.	4
II	**Fundamental Rights & Fundamental Duties** Fundamental Rights – Features and characteristics, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles-Definition and Meaning, 42nd Constitutional Amendment Act, List and Importance of Fundamental Duties.	6
III	**Amendments of Constitution and Emergency Provisions:** Meaning and need of Constitutional Amendments, Procedure of Amendment under Article 368, Types of Amendments, Important Constitutional Amendments (42nd, 44th, 73rd, 74th, 86th and 101st Amendments), Basic Structure Doctrine. Emergency Provisions – Meaning and Objectives, National Emergency (Article 352), State Emergency/President's Rule (Article 356), Financial Emergency (Article 360), Effects of Emergency on Fundamental Rights and Centre-State Relations, Safeguards introduced by 44th Constitutional Amendment.	3
IV	**Government of The Union and States:** President of India – Election and Powers, Prime Minister of India - Election and Powers, Loksabha - Structure, Rajyasabha – Structure, Governor of State, Chief Minister and Council of Ministers in a state.	2
	Total Lecture Hours	**15**

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Text Books
1. M. Laxmikanth, Indian Polity, 7th Edition, McGraw Hill Publications Delhi, 2023.
2. P. M. Bakshi, The Constitution of India, 19th Edition, Lexis Nexis, 2023.
3. Durga Das Basu, Introduction to the Constitution of India, 26th Edition, Lexis Nexis, 2022.
4. M. Laxmikanth, Governance in India, 3rd Edition, McGraw Hill Publications Delhi, 2021.
5. J. N. Pandey, The Constitutional Law of India, 59th Edition, Allahabad: Central Law Agency, 2022.
References:
1. V. N. Shukla, Constitution of India, 14th Edition, EBC, 2022.
2. V. N. Tripathi, Constitution of India, 9th Edition, Premier Publishing Company, 2021.
3. M. V. Pylee, India's Constitution, 18th Edition, S. Chand Publications, New Delhi, 2020.
Online Learning Resources
https://legislative.gov.in/constitution-of-india/
https://onlinecourses.nptel.ac.in/noc23_lw03/preview

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Course Information:

Class, Semester	SY. B. Tech, Semester - III					**Category**	**HS**
Course Code, Course Title	**3MEHS211, Universal Human Values**					**Type**	**T2**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	2	-	-	2	2		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	50	-		-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the concept, significance, and need of Universal Human Values and their role in achieving harmony in personal, social, and professional life.
CO2	Apply the principles of harmony, social responsibility, and environmental sustainability in day-to-day life and professional situations.
CO3	Classify ethical issues in engineering, society, and emerging technologies using ethical principles and professional guidelines.
CO4	Demonstrate value-based behaviour and ethical decision-making for personal growth and professional practice through self-reflection and case-based situations.

Syllabus:

Module	Contents	Lecture Hours
I	Evolution and Need of Universal Human Values: Meaning and concept of Universal Human Values, Historical evolution of value systems, Impact of Industrial Revolution on society and lifestyle, Consequences of World War II and global conflicts, Emergence of global value frameworks, Role of United Nations and UNESCO, Introduction of UHV in Indian education system by AICTE, Present-day challenges: stress, lack of purpose, environmental issues	5
II	Understanding the Human Being: Human being as a combination of self and body, Distinction between self (consciousness) and body (physical entity), Needs of self vs needs of body, Happiness vs physical pleasure, Harmony in the self (thoughts, feelings, actions), Self-exploration and self-awareness	5
III	Harmony in Relationships: Meaning and importance of relationships, Values in relationships (Trust, Respect, Affection, Care, Guidance, Reverence, Love), Mutual fulfillment in relationships, Role of family in value development, Interpersonal conflicts and resolution, Relationship in professional environment	5
IV	Harmony in Society and Nature: Individual → Family → Society → Nation → World, Concept of undivided society, social harmony and responsibility, Coexistence in nature, Human-nature relationship, Environmental degradation and its causes, Sustainable living and resource utilization, Local and global environmental issues	5
V	Universal Human Values in Engineering and Technology: Professional ethics in engineering, Role of engineers in society, Guidelines by IEEE, Ethical issues in modern technology, Role of institutions like OpenAI, Core Framework to Assess Values: Self-Reflection Model, Value-Action Gap Model, Emotional Intelligence (EQ) Framework (The Nine Values (Bhavas) Assessment Model)	5
VI	Application of UHV in Personal and Professional Life: Self-reflection and personal development, Value-based decision making, Goal setting with values, Fulfilling Basic Human Aspirations Application of UHV in career and workplace, Development of holistic and responsible lifestyle, Core Framework to Assess Values: Emotional Intelligence (EQ) Framework, (Human-AI Value Alignment) Ikigai Model	5
	Total Lecture Hours	**30**

Text Books

1.Human Values and Professional Ethics:R. R. Gaur, R. Sangal, G. P. Bagaria,Excel Books, New Delhi, 2010
2. Engineering Ethics: Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2013
3. Understanding Human Being, Nature and Existence Comprehensively: UHV Team, UHV, 2022.

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4. Life 3.0, Max Tegmark, Knopf, 2017
References:
1. AICTE Universal Human Values Course Material, 2017 onwards
2.IEEE Code of Ethics
3. Engineering Ethics: Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins,Cengage Learning, 2013
Online Learning Resources
1. TED Talks on ethics, happiness, human behaviour 2. NPTEL Courses on UHV and Engineering Ethics 3. MIT: AI Ethics lectures (OpenCourseWare)

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Course Information:

Class, Semester	S. Y. B. Tech. Semester – III					**Category**	**MA**
Course Code, Course Title	**3MEMA212, Aptitude and Reasoning -I**					**Type**	**T2**
Prerequisites							
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	2	-	-	2	-		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	50	-		-	-

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Apply quantitative aptitude concepts such as HCF & LCM, Vedic Mathematics, Ages, Percentage, Profit & Loss to solve numerical and real-time problem-solving tasks efficiently.
CO2	Analyze and solve logical reasoning problems based on Number Series, Alphabet Series, Coding-Decoding, Cubes & Dice by applying systematic analytical approaches.
CO3	Develop professional and career readiness skills through SWOT Analysis, understanding of Engineering Ecosystem, effective email writing, and essay writing techniques.
CO4	Demonstrate logical thinking, decision-making ability, and personality development skills to enhance employability and professional effectiveness.

Syllabus:

Module	Contents	Lecture Hours
I	HCF & LCM Vedic Math	5
II	Number Series, Alphabet Series (Quant) Percentage	5
III	Profit & Loss Coding-Decoding	5
IV	Cubes & Dice SWOT Analysis	5
V	Introduction to Engineering Ecosystem Ages	5
VI	Email writing, Essay writing Logical Thinking Basics	5
	Total Lecture Hours	**30**

Text Books

1. R.S. Agarwal S Chand, Quantitative Aptitude 2019
2. R.S. Agarwal S Chand, Verbal & Non-verbal Reasoning 2010
3. P.C. Wren S Chand, Wren & Martin (Verbal, Grammar) 2017

Reference Books

1. Face Wiley APTIPEDIA (Quantitative, Logical, Verbal Aptitude) 2017
2. P.A. Anand Maestro Wiley (Quantitative Aptitude) 2015
3. Arun Sharma (Verbal Ability) Meenakshi Upadhyay McGraw Hill 2020

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Course Information:

Class, Semester	SY. B. Tech, Semester - IV					**Category**	**PC**
Course Code, Course Title	**3MEPC215, Manufacturing Processes and Machine Tools**					**Type**	**LIT1**
Prerequisites	3MEPC112, 3MEVS115, 3MEPC202, 3MEPC207						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**		**Credits**	
	2	-	2	2		3	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	50

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the fundamentals of casting, forming, joining, advanced manufacturing processes, and machine tools, for given problems or industrial scenarios, with clear understanding and logical interpretation.
CO2	Apply concepts of casting, forming, joining, and advanced manufacturing processes, for given industrial problems or case scenarios, to select appropriate processes and parameters with correct justification.
CO3	Apply principles of machine tools (lathe, grinding, shaping, planning, drilling, boring, and milling), for given industrial problems or practical scenarios, to select appropriate machines, machine-accessories, and operations with correct justification.
CO4	Demonstrate hands-on skills in foundry, welding, and conventional machining by preparing casting patterns, and Moulds, testing moulding sand properties and operating conventional machine tools while following standard procedures, safety practices and acceptable accuracy.

Syllabus:

Module	Contents	Lecture Hours
I	**Fundamentals of Casting** Different types of castings, design of patterns, moulds and cores; riser and gating design, fundamentals of hot and cold working processes, introduction and types of patterns, Types of sands used in moulding and core making, gating system, types of casting processes, plastic moulding, various casting defects, application of artificial intelligence in casting.	5
II	**Forming and Joining Processes** Metal forming operations, hot and cold working processes, classification of joining processes - Arc welding, SMAW, TIG, MIG welding, Resistance welding, Soldering and Brazing, adhesive bonding.	5
III	**Advance Manufacturing Processes** Need of nonconventional machining, Electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining, additive manufacturing, introduction to special machine tools.	5
IV	**Fundaments of Lathe Machine** Introduction, working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations.	5
V	**Fundaments of Grinding Shaping and Planning machines Grinding machines** Introduction, types of grinding, classification of grinding machines, principle of grinding operations, grinding wheel. **Shaping and Planning machines** Crank shaper, hydraulic shaper, Table feed mechanism, various operations on shaper. Standard double housing planner, table drive and feed mechanism, various operations on planner.	4
VI	**Drilling, Boring, and Milling machine** **Drilling machine** Classifications, construction & working of Radial drilling machine, Various operations on drilling machines. **Boring machine** Horizontal and vertical boring machine, boring tools and bars used, Jig boring machine. **Milling machine** Classification of milling machines, construction and working of column and knee type milling	6

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Course Information:

Class, Semester	SY. B. Tech, Semester - IV					**Category**	**PC**
Course Code, Course Title	**3MEPC216 Dynamics of Machines**					**Type**	**LIT2**
Prerequisites	**3MEPC202**						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	2	-	2	2	3		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the principles of gyroscopic effects, balancing of rotating and reciprocating masses, and vibration fundamentals.
CO2	Compute MI of given bodies and different parameters related to gyroscope, balancing, dynamics of mechanisms, vibration using analytical approaches.
CO3	Determine the unbalanced forces and couples in different mechanical systems through graphical approach.
CO4	Analyze the dynamic behavior of vibration systems and rotating machinery using vibration characteristics and AI-based techniques.

Syllabus:

Module	Contents	Lecture Hours
I	**Gyroscope:** Introduction, Angular Acceleration, Gyroscopic Couple, Effect of Gyroscopic couple on an Aeroplane, Naval Ship, Stability of Four-Wheelers, Gyroscope sensors, Gyroscopic Stabilisation	5
II	**Balancing of Rotary Masses:** Static and dynamic Balancing, Balancing of a single rotating mass by a single mass rotating in the same plane, Balancing of a single mass by two masses rotating in different planes, Balancing of several masses rotating in the same plane, Balancing of several masses rotating in different planes.	5
III	**Balancing of Reciprocating Masses:** Primary forces, Secondary forces and a couple in reciprocating machines, Balancing of single cylinder, Balancing of multi-cylinder inline engine, Balancing of radial engines, Direct and reverse crank methods of Balancing.	5
IV	**Static and Dynamic Force Analysis of Mechanisms:** Static and dynamic force analysis of mechanisms; velocity and acceleration of the slider-crank mechanism by analytical methods; inertia force and torque; D'Alembert's principle; dynamically equivalent system.	5
V	**Fundamentals of Vibration and Single Degree of Freedom Systems:** Basic concepts and definitions, Vibration measuring parameters – displacement, velocity and acceleration, Free and forced vibrations, Equivalent springs, Types of damping. Single Degree of freedom systems: Free vibrations with and without damping (rectilinear, torsional and transverse), Degree of damping, Logarithmic decrement.	6
VI	**Forced Vibrations:** Forced Vibration with harmonic excitation, Equation of motion, Steady state response, Amplitude and phase angle, Magnification factor and resonance, Effect of damping, Frequency ratio. Forced Vibration due to rotating and reciprocating unbalance, Force transmissibility, Vibration isolation and applications. Introduction to AI Applications in Vibration Engineering: Use of Machine Learning, Neural Networks, and Adaptive Control for vibration analysis, fault diagnosis, imbalance detection, and predictive maintenance of rotating machinery.	4
	Total Lecture Hours	**30**

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	machine, milling operations, application of artificial intelligence in machine tools.	
	Total Lecture Hours	**30**

List of Experiments with CO Mapping

S. No	Title / Topic of the Experiment	CO Mapped
1.	Preparation of pattern for solid casting with allowances.	1, 2, 4
2.	Determination of grain fineness number of moulding sand.	1, 2, 4
3.	Preparation and testing of standard specimen for green compressive strength.	1, 2, 4
4.	Preparation of green sand mould for mould hardness testing.	1, 2, 4
5.	Hands on practice on TIG/MIG welding process for different material.	1, 3, 4
6.	Hands on practice on lathe machine	1, 3, 4
7.	Hands on practice on surface grinding and shaping machine machine	1, 3, 4
8.	Hands on practice on milling machine radial drilling machine.	1, 3, 4
9.	Virtual lab on casting simulation.	1, 3, 4
10.	Industrial Visit	1
	Total Practical Hours	**30**

Text Books

1. P. N. Rao, Manufacturing Technology- Foundry, 2nd Edition, Tata Mc Graw Hill Publication, 2009.
2. O. P. Khanna, Foundry Technology, 15th Edition, Dhanpat Rai Publication, 2011.
3. P. C. Sharma, Production Technology: Vol. 1: Manufacturing Processes, 1st Edition, 2006.
4. P. C. Sharma, Production Technology: Vol. 2: Machine Tools, 2nd Edition, 2006.

References:

1. E. Paul DeGarmo, J.T. Black, Materials and Processes in Manufacturing, 8th Edition, PHI Publication, 1997.
2. George E. Dieter, Mechanical Metallurgy, 3rd Edition, Tata McGraw Hill Publication, 2013.
3. Steve F. Krar, Mario Rapisarda, Machine Tools and Manufacturing Technology, 2nd Edition, Delmar publisher, 2010.
4. W. A. J. Chapman, Workshop Technology, 5th Edition, CBS Publishing and Distributors, N. Delhi, 2007.

Online Learning Resources

1. https://nptel.ac.in/courses/112105126
2. https://www.coursera.org/courses?query manufacturing
3. https://www.edx.org/learn/manufacturing
4. https://iitb.vlabs.co.in/

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1	Manufacturing Processes (Foundry & Casting) Virtual Simulation	https://mp-dei.vlabs.ac.in

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List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Determination of the mass moment of inertia (MI) of a connecting rod using the compound pendulum method.	2
2	Determination of the mass moment of inertia (MI) of a given component using the bifilar suspension method.	2
3	Determination of the mass moment of inertia (MI) of a given component using the trifilar suspension method.	2
4	Determination of gyroscopic couple and verification of gyroscopic effect on a spinning disc	2
5	Static and dynamic Balancing of rotating masses in the same and different planes.	3
6	Graphical analysis of primary and secondary unbalanced forces in a reciprocating engine.	3
7	Verification of a dynamically equivalent system for a connecting rod (analytical/numerical).	2
8	Determination of natural frequency of spring–mass system and verification with simulation (Python/MATLAB).	4
9	Determination of damping factor using logarithmic decrement and time-response plotting (Python/MATLAB).	4
10	Forced vibration response of spring–mass–damper system and resonance characteristics.	4
	Total Practical Hours	**30**

Text Books

1. Ratan S.S., Theory of Machines, 3rd ed., Tata McGraw-Hill, New Delhi, 13th reprint, 2012.
2. Ballany P.L., Theory of Machines, 25th ed., Khanna Publication, New Delhi, 2012.
3. Singh V.P., Theory of Machines, 3rd ed., Dhanpat Rai and Sons, 2012.
4. Martin G., Kinematics & Dynamics of Machines, 2nd ed., Waveland Press Inc., 2002.
5. Singh V.P., Mechanical Vibrations, 6th ed., Dhanpat Rai and Sons, 2017.
6. Grover G.K., Mechanical Vibrations, 8th ed., Nem Chand & Bros., Roorkee, India, 2014.

References:

1. Bevan Thomas, Theory of Machines, 3rd ed. CBS Publishers, New Delhi, reprint 2005.
2. Shigley, Theory of Machines and Mechanism, 3rd ed., Oxford International, 2009.
3. Sadhu Singh, Theory of Mechanism and Machines, 1st ed., Pearson, 2012.
4. Jagdish Lal, Theory of Machines and Mechanism, 1st ed., Metropolitan Book Company, 2011.
5. Ghosh and Mallik, Mechanism and Machines, 3rd ed., East West Press, 1998.
6. Sarkar, Theory of Machines, 1st ed., Tata McGraw-Hill, 2002.
7. Singiresu S. Rao, Mechanical Vibrations, 6th ed., Pearson Education, 2004.

Online Learning Resources

1. NPTEL Course on Dynamics of Machines, by Prof. Amitabha Ghosh, IIT Kanpur
   https://nptel.ac.in/courses/112104114
2. NPTEL Course on Introduction to Mechanical Vibration, by Prof. S. Graham Kelly / IIT Roorkee (NPTEL)
   https://nptel.ac.in/courses/112107212
3. NPTEL Course on Elements of Mechanical Vibration, by Prof. Sondipon Adhikari, IIT Kharagpur
   https://nptel.ac.in/courses/112105212
4. NPTEL Course on Kinematics of Machines, by Prof. Amitabha Ghosh, IIT Kanpur
   https://nptel.ac.in/courses/112104121
5. NPTEL Course on Kinematics of Mechanisms and Machines, by Prof. J.S. Rao, IIT Kharagpur
   https://nptel.ac.in/courses/112105268
6. NPTEL Course on Rotor Dynamics, by Prof. S.K. Dwivedy, IIT Guwahati
   https://nptel.ac.in/courses/112103025
7. Online Course on Machine Dynamics and Vibrations, by Prof. Ahmed Shabana, University of Illinois (Coursera)
   https://www.coursera.org/learn/machine-dynamics
8. Online Course on Mechanical Vibrations, by Prof. David W. Brown, Massachusetts Institute of Technology (MIT OpenCourseWare)
   https://ocw.mit.edu/courses/2-003sc-engineering-dynamics-fall-2011/

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9. Online Course on Dynamics and Control, by Prof. Fred Borrelli, University of California, Berkeley (edX) https://www.edx.org/course/dynamics-and-control	
Experiments that may be performed through virtual labs:	

S.No	Experiment Name	Experiments Links
1.	SVirtual Lab on Machine Dynamics & Mechanical Vibrations, NITK Surathkal (Virtual Labs, IIT Delhi Initiative) https://mdmv-nitk.vlabs.ac.in	All Experiments
2.	Virtual Lab on Dynamics of Machine, NITK Surathkal (Virtual Labs) https://dom-nitk.vlabs.ac.in	All Experiments
3.	Virtual Lab on Vibration and Acoustics, COEP Technological University Pune (Virtual Labs) https://vlab.co.in	All Experiments
4.	Virtual Lab on Kinematics and Dynamics of Mechanisms, IIT Kharagpur (Virtual Labs) https://vlab.co.in	All Experiments

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Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - IV						**Category**	**MM**	
Minor Stream	**Industrial Engineering (IE)**								
Course Code, Course Title	**3MEIE217, Industrial Engineering**						**Type**	**LIT2**	
Prerequisites	-								
Teaching Scheme (per week)	**Lecture**	**Tutorial**		**Practical**		**Self-Study**		**Credits**	
	3	-		2		3		4	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**		**CIA**	**ESE**	
		40	20	40			50	-	

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Describe the fundamental concepts of industrial engineering, productivity, plant layout, lean manufacturing tools, work & method study, planning & scheduling, inventory control and network techniques through relevant terminology, standard definitions and basic mathematical relationships.
CO2	Apply appropriate method study, work measurement, capacity planning and inventory control techniques for given industrial tasks & production systems by choosing appropriate methods and strategies.
CO3	Compute the productivity, the normal and standard time, allowances, and the optimum sequence and schedule for given production scenario, various industrial activities and jobs using equations of work measurement and scheduling.
CO4	Construct the appropriate charts, diagrams and project network diagrams for industrial tasks and operations based on task data and project activity information by applying suitable recording and network techniques.

Syllabus:

Module	Contents	Lecture Hours
I	**Industrial Engineering, Productivity & Plant Layout:** Introduction, Role & Functions of industrial engineer, tools and techniques of industrial engineering, Concept of organization, its elements & organizational structure. Introduction to Value Engineering and Value Analysis. Productivity- concept, objective, factors affecting productivity, tools & techniques to improve productivity (Numerical treatment on productivity measures). Need and factors influencing plant location. Objectives, principles, types of plant layouts.	08
II	**Lean manufacturing:** JIT, SMED, 5S, Kaizen, Six Sigma, Kanban, Management Information System, Total productive maintenance, Poka-Yoke, case studies for each Lean tool	07
III	**Method Study:** Introduction , objectives & scope of Work study, Objectives of method study, steps involved in method study, various recording techniques, therblings, micro-motion study, MEMO motion study, principles of motion economy. (Exercises on recording techniques), Application of Artificial Intelligence in Work Study and Motion Analysis.	08
IV	**Work Measurement:** Definitions, objectives, various techniques of work measurement, steps in work measurement; Time Study: Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, performance rating, rating methods and allowances; Work sampling; Introduction to PMTS and MTM, Introduction to MOST.(Numerical treatment on performance rating, normal and standard time calculations), Application of Artificial Intelligence in Work Measurement.	07
V	**Capacity and aggregate planning and scheduling of operations:** Introduction, measures of capacity, capacity strategies, overcapacity & under capacity factors. Aggregate planning, Aggregate planning strategies. Sequencing problems, n jobs 1 Machine, n jobs 2 Machines, n jobs 3 Machines. (Numerical treatment), Application of Artificial Intelligence in capacity and aggregate planning and scheduling of operations.	08

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VI	**Inventory Control and Network Techniques:** Introduction Inventory control, objectives, benefits, Inventory valuation by LIFO and FIFO, ABC analysis, network techniques, critical path method, forward & backward scheduling. (Numerical treatment on critical path method), Application of Artificial Intelligence in inventory control.	**07**
	Total Lecture Hours	**45**

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Measurement and analysis of productivity.	4
2	Exercise on plant layout preparation.	1
3	Application of lean manufacturing tools.	3
4	Application of recording techniques for industrial activities.	4
5	Standard time estimation by using appropriate industrial engineering methods.	4
6	Determination of optimal sequence and minimum elapsed time using n-jobs 2/3 machine technique.	4
7	Development of CPM & PEART Network for any project involving minimum seven activities.	4
8	Exercise on assembly line balancing.	3
9	Rapid Upper Limb Assessment (RULA)	3
10	Rapid Entire Body Assessment (REBA)	3
	Total Practical Hours	**30**

Text Books

1. O. P. Khanna, Industrial Engineering and Management, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.
2. Dinesh Seth & Subhash Rastogi, Global Management Solutions Demystified, 2nd Edition, Cengage Learning Publications, 2009.
3. Martand Telsang, Industrial Engineering and Production Management, Revised Edition, S. Chand & Company Ltd., New Delhi, 2006.
4. M. I. Khan, Industrial Engineering, 2nd Edition, New Age International Publishers, 2004.

References:

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing Company, New Delhi, Second Indian Adaptation, 2008.
2. H. B. Maynard, Industrial Engineering Handbook, 4th Edition, Tata McGraw Hill Publication, 2009.
3. Barnes, R. M., Motion and Time Study: Design and Measurement of Work, 7th Edition, Wiley, 2009
4. R. G. Askin, & J. B. Goldberg, Design and Analysis of Lean Production Systems, 1st Edition, Wiley, 2001.

Online Learning Resources

1. NPTEL Course on Industrial Engineering, by Prof. D.K.Dwivedi, IIT Roorkee https://nptel.ac.in/courses/112107292
2. NPTEL Course on Industrial Engineering and Operations Research, by Prof. Uday Shanker Dixit, IIT Guwahati https://nptel.ac.in/courses/112103774
3. https://engineering.purdue.edu/online/courses/design-control-production-manufacturing-systems?utm
4. https://www.coursera.org/courses?query=operations+management&utm

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	Ergonomics lab (Hand movement, Posture & Entire body Assessment)	https://www.iitg.ac.in/cseweb/vlab/ergonomics/

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Annasaheb Dange College of Engineering and Technology
Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Mechanical Engineering
Established: 1999

Course Information:							
Class, Semester	SY. B. Tech, Semester - IV					**Category**	**MM**
Minor Stream	**Manufacturing System (MS)**						
Course Code, Course Title	**3MEMS218, Engineering Materials**					**Type**	**LIT2**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	3	-	2	3	4		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Classify engineering materials based on their properties, processing methods, and applications.
CO2	Explain material processing techniques and manufacturing methods used for engineering applications.
CO3	Select suitable engineering materials for robotics, aerospace, electronics, and energy applications based on functional requirements.
CO4	Analyze material behavior and performance using destructive and non-destructive testing techniques

Syllabus:

Module	Contents	Lecture Hours
I	Classification: Metals, Polymers, Ceramics, Composites, **Metallic Materials:** Types, Properties and Applications, Ferrous alloys- Carbon steels, Cast iron, Alloy steels, Stainless steels- types, Introduction to heat treatment and its influence on material properties; **Non-ferrous alloys**- Copper and aluminum based alloys, High thermal conductivity materials, light weight materials **Applications** in: Food Industry, Robotics frames, Aerospace lightweight structures, Electronics cooling (heat sinks, AI server cooling, mobile thermal management)	8
II	**Material Testing:** Destructive Testing methods: Hardness, Tensile, Compressive, Impact, Fatigue, Non- Destructive Testing: Visual inspection, Dye Penetrant, Magnetic, Ultrasonic, Radiography Selection of testing methods for real applications (electronics, aerospace, robotics)	7
III	**Sintered Materials-** Manufacturing of metal powder, Powder metallurgy process, Sintering process, Mechanical properties of sintered materials, Heat treatment of sintered material **Surface coating materials-** Metal spraying, Surface coating techniques- Electroplating, Vapor deposition coating, Powder coating **Engineering ceramics -** Physical and mechanical properties of engineering ceramics, Electronic ceramics, applications	8
IV	**Polymers and fiber reinforced plastics-** Type of plastics and their properties and applications. Polymers as bearing material, 3D printing polymers (PLA, ABS), Polymers and fiber reinforced plastics(FRP), manufacturing of FRP, Properties and applications of FRP, Lightweight materials for drones & robotics **Rubbers**-Types, properties and applications **Metallic foams**-properties and applications Applications in sensors, power electronics, electric vehicles, and embedded systems	7
V	**Advanced materials I –** Electro-rheological fluids, Magneto-rheological fluids and their properties; Smart materials: Types, Piezoelectric, Magnetostrictive, Shape memory alloys; EMI shielding materials- Types, properties; Electronic Packing materials, properties, applications; Functional insulation materials: electrical, thermal, acoustic - properties, applications Thermal management materials: TIMs, PCM, heat dissipation materials for electronics and EVs	8

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VI	**Advanced materials II-** **Semiconductor materials-** Concept of conductors, semiconductors, and insulators, Doping and Types of Semiconductors, Common Semiconductor Materials- Silicon, Gallium Arsenide, Applications **Battery materials-** Role of batteries in modern systems, concept of Chemical energy to Electrical energy, Working Principle, Anode Materials, Cathode Materials, Electrolytes, Performance Parameters, Applications. **Magnetic materials and properties-** Alnico alloys, Ferrite and rare earth alloys, Neodymium iron boron as magnetic material. Process of magnet manufacturing	7
	Total Lecture Hours	**45**

List of Experiments with CO Mapping

S.No	Title of the Experiment	CO Mapped
1	Microstructure study of common metallic materials (Cu, Al, Ti, Brass, etc.)	1
2	Selection of material for applications such as : Food equipment, Drone frame, Heat sink, Battery enclosure, Mobile phone casing, etc.	3
3	Thermal conductivity of metal rod	3
4	Hardness test of engineering materials by Brinell and Rockwell tester	4
5	Tensile test for measurement of mechanical properties	4
6	Compression test for measurement of mechanical properties	4
7	Determine impact strength of engineering materials using impact test	4
8	Surface damage analysis using dye-penetration test	4
9	Crack detection in metal components using ultrasonic testing	4
10	Study of polymer and composite materials	2, 3
	Total Practical Hours	**30**

Text Books

1. V. D. Kodgire, Material Science and Metallurgy for Engineers, 12th Edition, Everest Publishers, Pune, 2009.
2. S. H. Avner, Introduction to Physical Metallurgy, 2nd Edition, McGraw Hill Book Company Inc., 1988.
3. R. A. Higgins, Engineering Metallurgy Part-I, 6th Edition, ELBS with Edward Arnold, 1994.
4. V. Raghavan, Material Science and Engineering, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.

References:

1. W. Callister, Materials Science & Engineering, 2nd Edition, John Wiley & Sons, Reprint 2017.
2. T. V. Rajan and C. P. Sharma, Heat Treatments: Principles and Practices, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1994.
3. R. Balasubramaniam, Callister's Materials Science and Engineering, 3rd Edition, Wiley India Pvt. Ltd., 2008.
4. K. Bhargava, Mechanical Behaviour and Testing of Materials, 2nd Edition, PHI Publications, 2011.

Online Learning Resources

1. NPTEL Course on *Materials Science and Engineering*, by Prof. Vivek Pancholi, IIT Roorkee https://onlinecourses.nptel.ac.in/noc24_mm12/preview
2. Materials Project - AI-driven material properties database, https://next-gen.materialsproject.org/

Experiments that may be performed through virtual labs:

S. No	Experiment Name	Experiments Links
1.	Microstructure of Engineering Materials	https://spm-iitk.vlabs.ac.in/exp/common-metallic-materials/
2.	Thermal Conductivity Of Metal Rod	https://ht-nitk.vlabs.ac.in/exp/thermal-conductivity-metal-rod/index.html

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - IV						**Category**	**PC**	
Course Code, Course Title	**3MEPC219, Machine Design-1**						**Type**	**T1**	
Prerequisites	3MEES111,3MEPC206								
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**				
	2	-	-	2	2				
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**		
		40	20	40		-	-		

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Describe the concept of design against static & fluctuating load, and material selection for various machine elements by knowing their actual use in real practice.
CO2	Derive the expressions for various machine elements by acquiring knowledge of the design process.
CO3	Compute the dimensions of various machine elements by applying standard design processes.
CO4	Design the various machine elements subjected to static or fluctuating load using design methodologies and catalogues.

Syllabus:

Module	Contents	Lecture Hours
I	**Fundamentals of Machine Design:** Concept of Machine design, basic procedure of design of machine elements, Types of loads, Factor of safety- its selection & significance, Review & Selection of various engineering material properties, Factors governing the selection of engineering materials.	4
II	**Mechanics of Machine element & Design for static load:** Load & stress, Fundamental concept of Shear stress-shear strain, stresses due to bending and torsional moment, principal stresses, Eccentric axial loading, Modes of failure, Design of simple machine elements under static loading- Knuckle joint, Levers. Numerical on each machine element.	5
III	**Design of Threaded and Welded joints:** **a) Threaded joints:** Types of threads, Terminology of threads, Types of threaded joints, Design of bolted joint loaded eccentrically for condition such as 1) Joints in shear 2) Joints subjected to load perpendicular to the axis of bolt. Numerical on each case. **b) Welded joints** – Terms used in weld joints, Types of welded joints and weld material, Strength of transverse and parallel fillet welds, Design of welded joint loaded eccentrically for condition such as 1) Joint loaded in plane of weld 2)Joint subjected to bending moment. Numerical on each case.	6
IV	**Design of Spring:** Functions of spring, Types of springs, its material and applications, Terminology used for helical springs, styles of end, Design of helical compression spring subjected to static loading. Numerical on helical springs.	4
V	**Design of Power screw:** Forms of threads, Terminology of screw threads, Torque requirement, Self- locking and overhauling properties, Efficiency of square threaded, Self-locking screw, Collar friction torque, Design of power screw & nuts, Numerical on power screw applications.	5
VI	**Design for fluctuating load with AI Applications:** Stress concentration - causes & remedies, fluctuating stresses, S-N diagram under fatigue load, Endurance limit, Notch sensitivity, Endurance strength- modifying factors, Design for finite and infinite life under reversed stresses, Soderberg and Goodman diagrams, Modified Goodman diagram, Fatigue design for components under combined stresses such as springs, Beams subjected to point loads etc. Introduction to Artificial Intelligence (AI) and Machine Learning concepts in mechanical design, AI-assisted failure prediction concept of machine elements under cyclic loading	6
	Total Lecture Hours	30

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Text Books
1. V. B. Bhandari, Design of Machine Elements, 3rd Edition, Tata McGraw-Hill Publication, 2012.
2. J. F. Shigley, Design of Machine Element, 8th Edition, Tata McGraw-Hill Publication, 2010.
3. R. K. Jain, Machine Design, 7th Edition, Khanna Publication, 2004.
4. J. F. Shigley and C. R. Mischke, Mechanical Engineering Design, 8th Edition, Tata McGraw-Hill Publication, 2010.
5. M. F. Spotts, Design of Machine Elements, 8th Edition, Pearson Education Inc., 2004.
6. P. Kannaiah, Design of Machine Elements, 2nd Edition, Scitech Publication, 2008.
7. Mohammed Hamed Ahmed Soliman , AI for Predictive Maintenance in Industry 4.0, August 2025
References:
1. R. L. Norton, Machine Design: An Integrated Approach, 2nd Edition, Pearson Education Publication, 2007.
2. J. Marshek, Fundamentals of Machine Component Design, 3rd Edition, Willey Eastern Ltd., 2011.
3. H. Burr and Cheatam, Mechanical Analysis & Design, 2nd Edition, Prentice Hall Publication, 1997.
4. Hall, Holowenko and Laughlin, Machine Design, 1st Edition, Tata McGraw-Hill Publication, 2008.
5. J. Shigley and C. Mischke, Standard Handbook of Machine Design, 3rd Edition, Tata McGraw-Hill Publication, 2004.
6. PSG, Design Data Book, PSG Publication.
7. V. B. Bhandari, Design Data Book, 1st Edition, Tata McGraw-Hill Publication, 2014.
Online Learning Resources
1. NPTEL, Machine Design I, National Programme on Technology Enhanced Learning (NPTEL), IITs & IISc, Academic Year 2026–27, Available at: https://nptel.ac.in
2. ANSYS Learning Hub, Introductory Modules on Stress Analysis and Fatigue, Available at: https://www.ansys.com
3. MATLAB Online Documentation, Design Optimization and Fatigue Analysis Tools, Available at: https://www.mathworks.com
4. Autodesk, Generative Design and Machine Design Tutorials, Available at: https://www.autodesk.com

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Annasaheb Dange College of Engineering and Technology
Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - IV						**Category**	**PE**	
Course Code, Course Title	**3MEPE220, PE- I Engineering Tribology**						**Type**	**T1**	
Prerequisites	3MEES111, 3MEPC206								
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**				
	2	-	-	2	2				
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**		
		40	20	40		--	--		

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the fundamental concepts of friction, wear, lubrication, and surface interactions in tribological systems.
CO2	Apply principles of lubrication to select suitable lubricants and lubrication systems for engineering applications.
CO3	Analyze friction and wear mechanisms and determine factors affecting performance of hydrodynamic and hydrostatic bearings using appropriate testing methods.
CO4	Interpret AI-based approaches for condition monitoring, fault diagnosis, and predictive maintenance in tribological systems.

Syllabus:

Module	Contents	Lecture Hours
I	**Fundamentals of Tribology and Surface Interactions** Introduction to tribology, importance in engineering systems, historical development. Surface topography and characterization (roughness parameters, measurement techniques), surface interactions, contact mechanics (Hertzian contact), real vs apparent area of contact, adhesion theory, energy dissipation. Types of friction (static, kinetic, rolling), laws of friction, friction measurement techniques. Introduction to wear and classification.	5
II	**Friction and Wear Mechanisms** Theories of friction (adhesion, ploughing, deformation). Detailed study of wear mechanisms: adhesive wear, abrasive wear, corrosive wear, erosive wear, surface fatigue wear. Factors affecting wear (load, speed, temperature, material properties, environment). Wear models and equations. Wear testing methods (pin-on-disc, abrasion test, erosion test). Surface modification techniques (coating, heat treatment, surface hardening).	5
III	**Lubrication Principles and Lubricant Technology** Fundamentals of lubrication, regimes of lubrication (hydrodynamic, boundary, mixed, electrohydrodynamic). Properties of lubricants (viscosity, viscosity index, flash/fire point, pour point). Types of lubricants (liquid, solid, semi-solid, nano-lubricants, bio-lubricants). Additives and their functions (anti-wear, anti-oxidant, extreme pressure). Lubrication systems (manual, automatic, centralized). Lubricant selection and maintenance practices.	5
IV	**Hydrodynamic and Hydrostatic Bearings** Theory of hydrodynamic lubrication, derivation and assumptions of Reynolds equation (conceptual understanding). Journal bearing design, pressure distribution, load carrying capacity, frictional losses. Hydrostatic lubrication principles and applications. Comparison of hydrodynamic and hydrostatic bearings. Performance parameters: Sommerfeld number, stability, temperature effects, cavitation. Introduction to rolling element bearings.	5
V	**Smart Tribology** Introduction to smart tribology and Industry 4.0 concepts. Sensors for condition monitoring (temperature, vibration, acoustic emission). Data acquisition systems and signal processing. Machine learning techniques for wear prediction and fault diagnosis. Predictive maintenance strategies. Digital twin concept in tribological systems. Case studies using AI in lubrication monitoring and bearing failure prediction.	5

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VI	**Advanced Applications and Emerging Trends** Tribology in automotive systems (engine, brakes, gears). Tribology in manufacturing (cutting, forming, tool wear). Space tribology and extreme environments. Nano-tribology and MEMS applications. Green tribology and sustainability. Surface texturing and coatings (DLC, ceramic coatings). Industrial case studies.	**5**
	Total Lecture Hours	**30**

Text Books

1. Gwidon Stachowiak, Andrew W. Batchelor, Engineering Tribology, 5th Edition, Butterworth-Heinemann, 2025.
2. Ian Hutchings, Philip Shipway, Tribology: Friction and Wear of Engineering Materials, 2nd Edition, Elsevier, 2017.
3. Kenneth C. Ludema, Layo Ajayi, Friction, Wear, Lubrication: A Textbook in Tribology, 2nd Edition, CRC Press, 2018.
4. Arun Kumar, A Textbook of Tribology, 1st Edition, S.K. Kataria & Sons, 2014.

References:

1. Bharat Bhushan, Handbook of Micro/Nano Tribology, 2nd Edition, CRC Press, 2020.
2. J. Paulo Davim (Ed.), Tribology for Engineers: A Practical Guide, 1st Edition, Woodhead Publishing, 2011.
3. Duncan Dowson, History of Tribology, 2nd Edition, Wiley, 1998.
4. Michael J. Neale (Ed.), The Tribology Handbook, 2nd Edition, Butterworth-Heinemann, 1995.

Online Learning Resources

1. https://onlinecourses.nptel.ac.in/noc24_me75/preview - AI in Tribology
2. https://virtual-labs.github.io/exp-wear-testing-iitd/ -Virtual Lab
3. https://ocw.mit.edu/courses/2-800-tribology-fall-2004/
4. https://www.comsol.com/model/elastohydrodynamic-lubrication-in-a-cylindrical-journal-bearing-132311 Model

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	S. Y. B. Tech, Semester - IV					**Category**	**PE**
Course Code, Course Title	**3MEPE221, PE- I Vehicle Engineering**					**Type**	**T1**
Prerequisites	3MEPC112, 3MEPC205						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**		**Credits**	
	2	-	-	2		2	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		--	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Describe the major components and systems of an automobile, including emerging technologies and modern industrial practices, and examine their influence on society, environmental sustainability, and transportation efficiency.
CO2	Analyze automotive configurations—including drive systems, body styles, and materials—to determine the ideal setup for diverse operational requirements
CO3	Investigate the fundamental principles of automotive electrical circuits via empirical observation and system testing
CO4	Demonstrate automotive fault detection and evaluate the performance of braking and steering systems using structured logic, hazard mitigation, and safety metrics.

Syllabus:

Module	Contents	Lecture Hours
I	**Introduction**: - Automobile history and development, vehicle life development cycle overview, classification of vehicles, vehicle layouts (engine location and drive arrangement), chassis types, types of frames, sub-frames, frameless vehicles, constructional details, details of chassis materials, types of vehicle bodies, body parts and their advanced materials, vehicle specifications, and safety regulations.	6
II	**Performance of Automobiles**: Resistance to vehicle motion (air resistance, rolling resistance, and gradient resistance), traction and tractive effort, distribution of weight, acceleration, grad ability and drawbar pull, selection of gear ratio, rear axle ratio (numerical).	4
III	**Transmission System Clutch** – Function and requirements, necessity of gearbox, classification, construction and working of single-plate clutch and fluid flywheel, construction of manual gearboxes (synchromesh), epicyclic gear train, automatic transmission (torque converter and electronic transmission control), overdrive, propeller shaft, differential, final drive, and axles.	5
IV	**Control systems** **Steering System**: Steering system layout, automotive steering mechanisms, types of steering gearboxes, condition for true rolling, steering geometry (camber, caster, kingpin inclination, included angle, toe-in and toe-out), wheel alignment, slip angle, understeer and oversteer, and types and working of power steering. **Braking System**: Function of automotive braking system, types of braking mechanisms (internal expanding and disc brakes), mechanical, hydraulic and air brake systems, servo and power brakes, anti-lock and anti-skid braking systems, and calculation of braking force required, stopping distance, and dynamic weight transfer (numerical).	6
V	**Suspension System** **Suspension System:** - Functions of suspension system, sprung and unsprung mass, types of suspension linkages, types of springs (leaf, coil, air springs), telescopic shock absorber, hydro-gas suspension, rubber suspension, interconnected suspension, self-leveling (active) suspension, advances in suspension systems including air suspension.	6

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	Wheels and Tyre:- (wheel construction, alloy wheels, types, tyre construction, tread design, specifications, factors affecting tyre performance, tyre wear and its causes, wheel balancing), panel board instruments, electronically controlled management systems (ECM), and automobile wiring.	
VI	**Introduction to electric vehicle** Introduction to electric vehicle, hybrid vehicle. Transmission in electric vehicle: Battery management system, electric motors and converters. Sensors used in automobile ,42 volt battery technology AI Based mechanical vehicle, electric vehicle, & hybrid vehicle. Vehicle Technologies automation, control, and decision-making in vehicles.	**3**
	Total Lecture Hours	**30**

Text Books

1. G. B. S. Narang , *Automobile Engineering* , 9th Edition, Khanna Publication ,2010.
2. N. K. Giri , *Automobile Mechanics* , 2nd Edition, Khanna Publication ,2011.
3. P. S. Kohali, *Automobile Electrical Equipment*, 14th Edition, Technical education series,2016.
4. Dr.Kirpal Singh, *Automobile Engineering(Vol-I)*, 12th Edition, Standard Publisher Distributer,2009.

References:

1. P.Ketts , Motor Vehicle , 8th Edition, Springer ,2011.
2. Ramalingam, Automobile Engineering, 1st Edition, SCITECH publication ,2009.
3. Ramalingam Fundamentals of Automobile Engineering, 6th Edition, SCITECH publication ,2011.
4. J D Harderman Automotive Engines Theory & Servicing 1st Edition, Mitchell Pierson Education 2006.

Online Learning Resources

1. NPTEL Course on *Advanced Automobile Engineering*, by Prof. H.K. Dass, IIT Delhi https://nptel.ac.in/courses/ 107106088
2. Introduction to automotive (ntop) https://www.ntop.com/industries/automotive.
3. Introduction to ARAI https://www.araiindia.com/

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Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - IV					**Category**	**PE**
Course Code, Course Title	**3MEPE222, PE- I Sustainable and Renewable Energy Technology**					**Type**	**T1**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	2	-	-	2	2		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain renewable energy resources and their significance in addressing energy and environmental challenges.
CO2	Describe the construction, operation, and applications of solar energy conversion systems.
CO3	Analyze the operating characteristics of renewable energy systems including wind, biomass, hydro, ocean, and geothermal technologies
CO4	Apply hybrid renewable energy and energy storage concepts for sustainable energy solutions.

Syllabus:

Module	Contents	Lecture Hours
I	**Introduction to Renewable Energy :** Conventional vs renewable energy, Energy Scenario and Fossil Fuel Crisis, Environmental impacts of fossil fuels, Classification of renewable energy resources, Energy Policy, Regulations and Schemes	4
II	**Solar Energy :** Introduction to thermal systems and applications, Solar thermal collectors, Flat plate collectors, Evacuated tube collectors, Compound parabolic collectors, Solar air heaters, Solar dryers ,Solar cookers, Solar stills, Solar ponds, Concentrating collectors, Photovoltaic Effect and Solar Cell Physics, Types of Solar Cells PV System Components	6
III	**Wind Energy System:** Wind characteristics and resource assessment, Wind turbine classification, Power extraction and efficiency, Wind farms, site selection, offshore wind farms, Solar Wind Hybrid energy systems.	5
IV	**Biomass & Biogas Energy :** Biomass resources and availability, Biomass conversion methods, Biogas plant construction and operation, Biofuels	4
V	**Hydro, Ocean & Geothermal Energy:** Hydroelectric Power Fundamentals, Micro and mini hydro systems, Tidal and wave energy, Ocean Thermal Energy Conversion (OTEC), Geothermal energy systems.	6
VI	**Energy Storage & Hybrid Systems :** Need for energy storage, Battery Energy Storage Systems, Thermal energy storage, Hydrogen energy systems, Hybrid renewable energy systems, Solar – Fuel cell hybrid systems	5
	Total Lecture Hours	**30**

Text Books

1. B. H. Khan, Non-Conventional Energy Resources, 3rd Edition, McGraw Hill Education (India), 2017
2. G. D. Rai, Non-Conventional Energy Sources, 6th Edition, Khanna Publishers, New Delhi, 2017
3. S. P. Sukhatme and J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, 3rd Edition, Tata McGraw Hill, 2018.
4. Ashok V. Desai, Non-Conventional Energy, 2nd Edition, Wiley Eastern Ltd., 2009
5. D. P. Kothari, K. C. Singal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, 2nd Edition, PHI Learning Pvt. Ltd., 2011

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References:
1. John Twidell and Tony Weir, Renewable Energy Resources, 3rd Edition, Routledge / Taylor & Francis, 2015.
2. Godfrey Boyle, Renewable Energy: Power for a Sustainable Future, 3rd Edition, Oxford University Press, 2012
3. Bent Sørensen, Renewable Energy: Physics, Engineering, Environmental Impacts and Economics, 5th Edition, Academic Press, 2017
Online Learning Resources
1. NPTEL Course on RENEWABLE ENERGY ENGINEERING: SOLAR, WIND AND BIOMASS ENERGY SYSTEMS, by Prof. R. Anandalakshmi and Prof. Vaibhav Vasant Goud, IIT Guwahati https://nptel.ac.in/courses/111105035
2. NPTEL Course on SUSTAINABLE ENERGY TECHNOLOGY, by Prof. SAYAK BANERJEE, IIT Hyderabad https://nptel.ac.in/courses/112106318

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Department of Mechanical Engineering

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Course Information:								
Class, Semester	SY. B. Tech, Semester - IV						**Category**	**PE**
Course Code, Course Title	**3MEPE223, PE-I Non-conventional Machining Processes**						**Type**	**T1**
Prerequisites	3MEPC112							
Teaching Scheme (per week)	**Lecture**	**Tutorial**		**Practical**		**Self-Study**	**Credits**	
	2	-		-		2	2	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**		**CIA**	**ESE**
		40	20	40			-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Compare the working principles, process characteristics, advantages, limitations, and applications of various non-traditional machining
CO2	Explain the operational principles, material removal mechanisms, and effect of process parameters on the performance of mechanical, thermal, electrochemical, and chemical machining processes.
CO3	Analyze the effect of process parameters / factors on material removal rate, surface finish, tool wear, and accuracy for a given non-traditional machining process.
CO4	Select an appropriate non-traditional process or a combination of processes for a specific application based on material, geometry, accuracy, and resource availability.

Syllabus:

Module	Contents	Lecture Hours
I	**Overview of Non-Traditional Machining Processes** Need for non-traditional machining processes. Processes selection & classification on – comparative study of different processes. **Mechanical Energy Based Process** **Ultrasonic Machining (USM):** Equipment and material removal process, Effect of process parameters on performance of the process. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM. Abrasive Jet Machining (AJM): Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, standoff distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish.	6
II	**Electro Thermal Metal Removal Process** Electric discharge machining: Principle of operation – mechanism of metal removal, basic EDM circuitry, material removal rate in EDM, effect of various parameters on performance of the process, Advantages, Limitations and Applications.Integration of EDM with additive manufacturing (Hybrid EDM) for complex geometry fabrication.**AI-assisted EDM optimization** Introduction to Digital Twin concept for EDM process monitoring; Integration of EDM with Additive Manufacturing (Hybrid EDM) for complex geometry fabrication	5
III	**Electro Chemical Processes** **Electro chemical machining (ECM)** ECM process-principle of ECM, Chemistry of the ECM, parameters of the processes, determination of the metal removal rate, -Advantages, disadvantages & applications. Electro Chemical Grinding, Chemical Machining: Introduction-fundamental principle types of chemical machining, Mask ants, Etchants- Advantages, disadvantages & applications.	5
IV	**Thermal Metal Removing Processes** **Plasma Arc Machining (PAM) and Laser Beam Machining (LBM)** Introduction, Generation of Plasma and equipment, Mechanism of metals removal, parameters-process characteristics - type of torches, applications. **Electron Beam Machining (EBM):** Introduction-Equipment for production of Electron beam - Theory of electron beam machining Thermal & non thermal type's characteristics, applications.	5

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	Real-time adaptive laser parameter control using ML; computer vision for seam tracking and defect detection in laser cutting; brief introduction to AI-assisted process planning	
V	**High Energy Beam Machining** **Electron Beam Machining (EBM) & Ion Beam machining: (IBM)** Introduction-principle of EBM Equipment and Machining Procedure-Process characteristics-advantages and limitations applications. Ion Beam Machining Process: Introduction Working principle of operation, parameters, advantages and applications, Emerging dual-beam systems (FIB-SEM) enhanced with AI for real-time 3D nanoscale characterization and machining, Application of IBM in space technology for surface texturing of satellite components and ion propulsion systems,	**5**
VI	**High Velocity forming process & Hybrid Non-Traditional machining processes** Introduction, development of specific process selection comparison of conventional and high velocity forming methods - Types of high velocity forming methods- explosion forming process-electro hydraulics forming, magnetic pulse forms.	**4**
	Total Lecture Hours	**30**

Text Books

1. Jagadeesha T, Non-Traditional Machining Processes, IK International Publishing House.
2. V.K. Jain, Advanced Machining Processes, Allied Publishers Pvt. Ltd.
3. P.C Pandey and H.S. Shan, Modern Machining Process, Tata McGraw Hill - ISBN:0070965536
4. P.K. Mishra, Non-Conventional Machining, Narosa Publishing House.

References:

1. J.A. McGeough, *Advanced Methods of machining Processes*, Springer International Edition.
2. F.M Wilson, *High Velocity Forming of Metals*, ASTME Prentice Hall.
3. Adithan, *Modern Manufacturing Method*, New Age International (p) Limited - ISBN: 8122408176.
4. Bijoy Bhattacharyya, *Modern Machining Technology*, Elsevier.

Online Learning Resources

1. Advanced Machining Processes https://onlinecourses.nptel.ac.in/noc26_me45/preview
2. Advanced Machining Processes https://onlinecourses.nptel.ac.in/noc20_me76/preview
3. Non-Traditional Abrasive Machining Processes Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining https://onlinecourses.nptel.ac.in/noc21_me05/preview

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(An Empowered Autonomous Institute)
Department of Mechanical Engineering

Established: 1999

Course Information:

Class, Semester	SY. B. Tech, Semester - IV					**Category**	**PE**
Course Code, Course Title	**3MEPE224, PE- I Iotics**					**Type**	**T1**
Prerequisites	3MEES111, 3MEPC206						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	2	-	-	2	2		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		--	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the fundamental concepts of friction, wear, lubrication, and surface interactions in tribological systems.
CO2	Apply principles of lubrication to select suitable lubricants and lubrication systems for engineering applications.
CO3	Analyze friction and wear mechanisms and determine factors affecting performance of hydrodynamic and hydrostatic bearings using appropriate testing methods.
CO4	Interpret AI-based approaches for condition monitoring, fault diagnosis, and predictive maintenance in tribological systems.

Syllabus:

Module	Contents	Lecture Hours
I	**Fundamentals of IoT and Industrial Applications** Definition and concept of IoT, evolution of IoT and Industrial IoT (IIoT), IoT architecture including 3-layer and 5-layer models, components of IoT such as sensors, actuators, controllers, and communication systems, comparison of IoT with embedded systems, and applications in mechanical engineering including smart manufacturing, predictive maintenance, and smart energy systems.	5
II	**Sensors, Actuators, and Data Acquisition** Types of sensors including temperature, pressure, proximity, flow, and vibration, working principles of sensors used in mechanical systems, actuators such as DC motors, servo motors, stepper motors, solenoids, and relays, basics of signal conditioning and interfacing, data acquisition systems, and sensor calibration with error and uncertainty.	5
III	**Microcontrollers and Embedded IoT Platforms** Introduction to microcontrollers such as Arduino, PIC, and STM32, architecture and working of microcontrollers, basics of Arduino Uno and Raspberry Pi, programming fundamentals using Embedded C and Python, interfacing of sensors and actuators with microcontrollers, and real-time data handling.	5
IV	**IoT Communication and Networking** Basics of communication systems in IoT, wired and wireless communication, serial communication protocols such as UART, I2C, and SPI, IoT communication protocols including MQTT, HTTP, and CoAP, wireless technologies such as Wi-Fi, Bluetooth, and Zigbee, and introduction to IoT network architecture and cloud connectivity.	5
V	**IoT Data Management and Cloud Integration** Data collection, storage, and visualization, introduction to cloud platforms such as Thing-Speak and AWS IoT, data analytics and visualization tools, edge computing versus cloud computing, security issues in IoT systems, and case studies in mechanical engineering including machine monitoring and energy optimization.	5

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VI	**IoT Applications in Mechanical Engineering** Smart manufacturing and Industry 4.0 concepts, predictive maintenance of machines, condition monitoring using vibration and temperature analysis, smart HVAC systems, IoT applications in Mechanical engineering,	5
	Total Lecture Hours	**30**

Text Books

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, 1st Edition, Universities Press, 2015.
2. Raj Kamal, Internet of Things: Architecture and Design Principles, 2nd Edition, McGraw Hill, 2017.
3. Cuno Pfister, Getting Started with the Internet of Things, 1st Edition, O'Reilly Media, 2011.
4. Srinivasa K. G., Internet of Things, 1st Edition, Cengage Learning India, 2017.

References:

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things (A Hands-on Approach), 2nd Edition, VPT, 2019.
2. Samuel Greengard, The Internet of Things, 1st Edition, MIT Press, 2015.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley, 2012.
4. Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6, 1st Edition, Wiley, 2013.

Online Learning Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview – Internet of Things (NPTEL)
2. https://nptel.ac.in/courses/106105166 – IoT by IIT Kharagpur
3. https://ocw.mit.edu/courses/6-08-introduction-to-embedded-systems-fall-2010/ Virtual Lab
4. https://thingspeak.com/ – IoT Analytics Platform (MathWorks)

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Department of Mechanical Engineering
Established: 1999

Course Information:

Class, Semester	SY. B.Tech, Semester - IV					**Category**	**VS**
Course Code, Course Title	**3MEVS226, CAD Laboratory**					**Type**	**L1**
Prerequisites	3MEES103						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	-	-	2	-	1		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	50

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Prepare accurate 2D sketches and engineering drawings using CAD software by applying appropriate geometric constraints, drafting standards, and CAD data management practices
CO2	Develop parametric solid and surface models using feature-based modeling techniques, design intent, parametric relations, and engineering constraints.
CO3	Modify CAD models through editing operations, design configurations, and parametric modeling techniques to meet engineering requirements.
CO4	Build assembly models using top-down or bottom-up approaches by applying assembly constraints, interference and clearance checks, stack-up analysis, and generate production drawings incorporating GD&T and standard annotations.

Syllabus:

Module	Contents	Lecture Hours
I	**Introduction to CAD/CAM/CAE and Digital Engineering** Introduction to CAD, CAM, CAE and integration with PLM, modeling, simulation, analysis and optimization. Different CAD software, file format IGES, STEP, applications. Introduction to Graphical User Interface (GUI) of 3D modeling software, 2D sketching.	-
II	**Advanced Parametric Solid Modeling**Parametric solid modeling – fundamentals, transform the parametric 2-D sketch into a 3D solid, introduction to different commands in 3-D solid modeling, feature operations. Introduction to design tables/configurations	-
III	**Assembly Modeling & Mechanism Design** Introduction to Assembly modeling, defining relationship between various parts of machine, top down approach, bottom up approach, creation of constraints, generation of exploded view. BOM generation, Interference and clearance checking, stack-up analysis, reverse engineering.	-
IV	**2–D Drafting & GD&T (Manufacturing Focus)**Introduction to Drafting, Production drawing – Generation of 2-D sketches from solid model and assembly model, Geometric Dimensioning and Tolerance, straightness, perpendicularity, flatness, angularity, roundness, concentricity, cylindricity, run out, profile, true position, parallelism, orientation.)	-
V	**Surface Modeling** Difference: solid vs surface modeling, Introduction to surface modeling, difference between part modeling and surface modeling, various commands in surface modeling, creation of different surfaces. Introduction to reverse engineering (basic concept).	-

List of Experiments with CO Mapping

S. No	Title / Topic of the Experiment	CO Mapped
1	Introduction to CAD/CAM/CAE, GUI of CAD software (CATIA/ SolidWorks) and integration with PLM.	1
2	2D Sketching with geometric constraints and dimensioning	1
3	Basic Parametric Solid Modeling, commands and design tables/configurations	2, 3
4	Development of Solid Model: Exercise 1	2, 3
5	Development of Solid Model: Exercise 2	2, 3
6	Development of Solid Model: Exercise 3	2, 3

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7	Development of Solid Model: Exercise 4	2, 3
8	Drafting from 3D Models with GD&T and standard annotations	4
9	Development of Assembly Modeling : Exercise 1	4
10	Development of Assembly Modeling : Exercise 2	4
11	Introduction to Surface Modeling and commands	2

Text Books

1. Ibrahim Zeid, R. Sivasubramanian, CAD/CAM, 1st Edition, Tata McGraw Hill Pvt. Ltd, 2008.
2. P. N. Rao, CAD/CAM (Principles & Applications), 5th Edition, Tata McGraw Hill Pvt. Ltd., 2012.
3. Kuldeep Sareen and Chandandeep Grewal, CAD/CAM, 1st Edition, S. Chand, 2009.
4. Shyam Tickoo and Deepak Maini, CATIA V6R16/17, DreamTech Press, 2009

Reference Books

1. M. P. Groover and E. W. Zimmer, CAD/CAM, 1st Edition, Prentice Hall of India Pvt. Ltd., 2007.
2. Radhakrishnan and Subramanyam, CAD/CAM/CIM, 2nd & 3rd Editions, New Age International Publishers, 2004, 2008.
3. V. Ramamurti, Computer Aided Mechanical Design & Analysis, 4th Edition, Tata McGraw Hill Pvt. Ltd., 2000.
4. C. S. Krishnamoorthy, S. Rajeev, and A. Rajaraman, Computer Aided Design, 2nd Edition, Narosa Publishing House, 2005
5. N. K. Chougule, CAD/CAM/CAE, 1st Edition, Scitech Publications, 2009
6. S. S. Khandare, Computer Aided Design, 3rd Edition, Charotar Publishing House, 2011.

Online Learning Resources

1. CATIA User Portal / 3DEXPERIENCE Edu – Student tutorials, structured learning paths, and practice exercises
2. Dassault Systèmes Learning Library – CATIA Part Design, Assembly Design, Drafting, and Surface Design
3. NPTEL CAD/CAM courses covering CATIA-based modeling concepts
4. SWAYAM courses on CAD, Product Design, and Manufacturing (CATIA compatible concepts)
5. Shyam Tickoo CATIA Tutorials

Experiments that may be performed through virtual labs: Nil

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Established: 1999

Course Information:

Class, Semester	S. Y. B. Tech. Semester - IV					**Category**	**HS**
Course Code, Course Title	3MEHS227, Foreign Language - German					**Type**	**T2**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	2	-	2	2	2		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	50	-		-	-

Course Outcomes (Cos):
Upon successful completion of this course, the student will be able to:

CO1	Explain basic German vocabulary, grammar, pronunciation, and common expressions used in everyday communication.
CO2	Apply basic German language skills to communicate in familiar situations through listening, speaking, reading, and writing activities.
CO3	Apply appropriate German vocabulary, sentence structures, and grammar to engage in simple conversations and respond to routine personal and social situations.
CO4	Prepare simple written texts such as emails, messages, and short paragraphs in German using appropriate vocabulary and grammatical structures.

Syllabus:

Module	Contents	Lecture Hours
	PRE TERM SECTION	
1	**Introduction to German Language** • Introduction to German language and culture • German alphabets • Pronunciation and phonetics • Greetings and farewells • Classroom expressions • Basic vocabulary	10
2	**Self-Introduction and Basic Communication** • Personal pronouns • Verbs Haben and Sein • Verb conjugation • Introducing oneself and others • Numbers (0–1000) • Days of the week • Basic sentence structure • W-Fragen (Question Words)	10
3	**Countries, Languages and Daily Communication** • Countries and nationalities • Languages • Asking and answering simple questions • Yes/No questions • Articles (Definite and Indefinite) • Simple conversations	10
	IN TERM SECTION	
4	**Friends, Family and Hobbies** • Talking about friends and colleagues • Family members • Hobbies and interests • Daily routine	10

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	• Possessive articles • Describing people	
5	**Time, Dates and Appointments** • Days, months and seasons • Telling time • Dates and birthdays • Making appointments • Invitations • Apologizing • Modal verbs	10
6	**Work and Workplace Communication** • Occupations and professions • Workplace vocabulary • Talking about studies and work • Telephone conversations • Job advertisements • Expressing opinions about jobs	10
7	**City, Transport and Directions** • Places in a city • Means of transport • Asking for and giving directions • Enquiring information • Imperative forms • Negation • Definite and indefinite articles	10
	Self-Study Section	
8	**Food, Shopping and Restaurants** • Food and beverages • Shopping conversations • Ordering food • Paying bills • Akkusativ case • Verbs with Akkusativ • Restaurant communication	10
9	**Home, Communication and Writing Skills** • Describing home and surroundings • Understanding advertisements • Likes and dislikes • Letters and emails • Understanding texts • Dativ case • Dativ prepositions • Wechselpräpositionen	10
10	**Social Life, Past Events and Fashion** • Planning activities with friends • Event information and radio announcements • Separable verbs • Personal pronouns • Präteritum of Haben and Sein • Perfekt tense and Partizip II • Conjunctions (und, oder, aber) • Clothes and fashion • Demonstrative and interrogative articles • Verbs with Dativ	10
	Total Lecture Hours	**100**

Text Books:

1. Netzwerk neu A1 Kursbuch Goyal publishers & Distributors Pvt. Ltd. First Indian reprint 2020 Reprinted 2023
2. Netzwerk neu A1 Übungsbuch Goyal publishers & Distributors Pvt. Ltd. First Indian reprint 2020 Reprinted 2023

References:

1. Fit fürs Goethe -Zertifikat A1 Start Deutsch 1 Hübner

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Course Information:

Class, Semester	S. Y. B. Tech. Semester - IV					**Category**	**HS**
Course Code, Course Title	3MEHS228, Foreign Language - Japanese					**Type**	**T2**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Tutorial**		
	2	-	-	2	-		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**Theory**	**MSE**	**TA**	**Theory**
		-	50	-	-	-	-

Course Outcomes (Cos):
Upon successful completion of this course, the student will be able to:

CO1	Explain basic German vocabulary, grammar, pronunciation, and common expressions used in everyday communication.
CO2	Apply basic German language skills to communicate in familiar situations through listening, speaking, reading, and writing activities.
CO3	Apply appropriate German vocabulary, sentence structures, and grammar to engage in simple conversations and respond to routine personal and social situations.
CO4	Prepare simple written texts such as emails, messages, and short paragraphs in German using appropriate vocabulary and grammatical structures.

Syllabus:

Module	Contents	Lecture Hours
	MODULE 1 - PRE-TERM	
I	**Introduction to Japanese Language and Culture** • Overview of Japanese language and culture • Japanese writing systems: Hiragana, Katakana, Kanji • Basic pronunciation and phonetics • Greetings according to time of day • Classroom and workplace expressions • Asking for repetition and clarification • Basic etiquette and manners	10
II	**Self-Introduction and Personal Information** • Introducing oneself and others • Name, nationality, occupation, and residence • Family members • Languages spoken • Basic sentence patterns • Introduction to Hiragana writing practice	10
III	**Hiragana and Katakana Mastery** • Complete Hiragana characters • Complete Katakana characters • Reading and writing practice • Simple words and phrases • Listening and pronunciation exercises • Everyday vocabulary development	10
	MODULE 2 - IN-TERM	
IV	**Food and Dining** • Food and beverage vocabulary • Expressing likes and dislikes • Reading simple menus • Ordering food and drinks • Restaurant conversations • Japanese dining etiquette	10

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V	**Home, Family and Surroundings** • Describing houses and rooms • Household objects and furniture • Family relationships • Location expressions • Counting objects and people • Describing surroundings	10
VI	**Daily Life and Time Expressions** • Telling time • Days, dates, and months • Daily routines • Operating hours and schedules • Borrowing and lending items • Making simple appointments	10
VII	**Hobbies, Interests and Social Interaction** • Hobbies and leisure activities • Sports, movies, music, manga, and anime • Inviting friends • Accepting and declining invitations • Expressing preferences and interests • Social conversations	10
	MODULE 3 - SELF STUDY	
VIII	**Transportation and Navigation** • Public transportation vocabulary • Trains, buses, stations, and landmarks • Asking for directions • Giving simple directions • Understanding signs and notices • Travel-related conversations	10
IX	**Shopping and Everyday Transactions** • Shopping vocabulary • Asking for products and prices • Quantities and measurements • Locating items in stores • Purchasing goods • Customer-service interactions	10
X	**Holidays, Experiences and Future Plans** • Talking about past weekend activities • Introduction to simple past tense • Expressing wishes and desires • Travel plans and future intentions • Introduction to frequently used Kanji • Course review and consolidation • Speaking role-plays and presentations • Reading and writing assessment	10
	Total Lecture Hours	**100**

Text Books

1. Irodori: Japanese for life in Japan (A1), The Japan Foundation, 2020

Reference Books

1. Marugoto Starter (A1) Katsudoo + Rikai (2 Books set) https://amzn.in/d/07fApBbW
2. Genki: An Integrated Course in Elementary Japanese Vol. 1 [3rd Edition] https://amzn.in/d/0gXGM2Ef
3. Minna no Nihongo 1-1&1-2 Main Textbook elementary +Translation & Grammatical with downloadable CDs. https://amzn.in/d/0dyQ9ips

NPTEL and Online Resources

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Department of Mechanical Engineering

Established:

Course Information:

Class, Semester	S. Y. B. Tech. Semester –IV					**Category**	**HS**
Course Code, Course Title	**3MEHS229, Psychology**					**Type**	**T2**
Prerequisites	----						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	1	-	-	1	1		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	50	-		-	-

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Explain the fundamental concepts of decision making, emotional intelligence, emotional regulation, and procrastination in everyday personal, academic, and professional contexts.
CO2	Differentiate between effective and ineffective thinking patterns, emotional responses, decision-making approaches, and behavioural strategies using psychological principles.
CO3	Apply appropriate psychological principles and decision-making strategies to improve self-management, interpersonal effectiveness, and productivity in real-life situations.
CO4	Evaluate the influence of cognitive biases, emotions, attention, and behavioural habits on decision making and personal effectiveness, and select appropriate corrective strategies.

Syllabus:

Module	Contents	Lecture Hours
I	**Decision Making** • Decision Making in Everyday Life • Why Smart People Make Poor Decisions • How Our Brain Makes Decisions (System 1 & System 2) • Cognitive Biases in Real Life • Decision-Making Frameworks • Thinking Tools	5
II	**Understanding Emotional Intelligence** • Understanding emotions and importance • EI vs IQ and 5 Domains of EI • Emotional Intelligence and Personality	3
III	**Emotional Regulation & Interpersonal Skills** • Impulse control (self-regulation) • Handling criticism (self-management) • Empathy and altruism (social awareness) • Assertiveness (relationship management)	3
III	**Procrastination** • Introduction and definition of procrastination • Why do we procrastinate • Time management myths • Techniques to beat procrastination	4
	Total Lecture Hours	**15**

Reference Books

1. "Thinking, Fast and Slow", Daniel Kahneman, Penguin Books, 2011
2. Emotional Intelligence: Why It Can Matter More Than IQ", Daniel Goleman, Bantam Books, 1995
3. "Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones", James Clear, Avery, 2018
4. "Deep Work: Rules for Focused Success in a Distracted World", Cal Newport, Grand Central Publishing, 2016
5. "The Power of Habit: Why We Do What We Do in Life and Business", Charles Duhigg, Random House, 2012

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6. "Nudge: Improving Decisions About Health, Wealth, and Happiness", Richard H. Thaler & Cass R. Sunstein, Penguin Books, 2008
7. "The 7 Habits of Highly Effective People", Stephen R. Covey, Free Press, 1989

NPTEL and Onljne Resources

Youtube Channel:

1) https://www.youtube.com/watch?v=O2y1QGClzMw
2) https://www.youtube.com/watch?v=33d61cpRfog
3) https://www.youtube.com/watch?v=b6FpfGiENPo
4) https://www.youtube.com/watch?v=YLhGgef7SvA
5) https://www.youtube.com/watch?v=TOFjyi0tg5w

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Established:

Course Information:

Class, Semester	S. Y. B. Tech. Semester - IV					**Category**	RM
Course Code, Course Title	**3MERM230, Research Methodology**					**Type**	L2
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	-	-	2	-	1		
Examination Scheme (Marks)	**Theory**				**Practical**		
	MSE	**TA**	**ESE**		**CIA**	**ESE**	
	-	-	-		**50**	-	

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Utilize fundamental concepts of research, research problems, literature sources, and research methodologies for engineering applications under given research scenarios.
CO2	Apply appropriate research design, sampling techniques, and data collection methods to conduct systematic research studies under given problem statements.
CO3	Analyze research data using qualitative, quantitative, statistical, and hypothesis testing techniques under given research scenarios.
CO4	Develop a technical research article with ethical publication practices, appropriate referencing standards, and quality research guidelines.

Syllabus:

Module	Contents	Lecture Hours
I	**Research Fundamentals** Meaning and objectives of research, Significance of research, Types of research, Research process, Criteria of Good Research, Importance of Research in Engineering	4
II	**Research Problem & Literature Review** Meaning of Research Problem, Identification & Formulation of research Problem, Techniques for defining Research Problem, Literature Sources: Journals, Conferences, Patents, Use of Digital Libraries, Literature Review techniques and gap identification.	5
III	**Research Design & Methodology** Need & Features of Good Research Design, Types of Research Design: Exploratory, Descriptive, Experimental, Sampling Techniques. Data Collection: Types of Data: Primary, Secondary, Methods of Data Collection: Survey, Questionnaire, Interview, Observation, Experimentation	6
IV	**Data Analysis & Testing of Hypothesis** Types of data: Qualitative and Quantitative, Basic statistical tools: Mean, Median, Standard Deviation, Data representation: Tables, Graphs, Charts, Introduction to analysis tools, Interpretation of results, Hypothesis, Basic concepts concerning testing of hypothesis, Procedure for hypothesis testing, Flow diagram of hypothesis testing, Test of hypothesis, Hypothesis testing of Means, Hypothesis testing for differences between Means.	5
V	**Report Writing** Introduction Technical Report Writing and tools (Latex), Significance of report writing, Steps in writing report, Types of reports, Layout and structure of reports, Documentation and Referencing Styles, Presentation Tools & Techniques: Zotero & Mendeley.	4
VI	**Research Journals and Publication Ethics** Research Journals, Types of Journals, Research Publication Process, Journal Indexing: Meaning and Importance of Journal Indexing, Benefits of Indexed Journals, Major Indexing Databases, (Scopus, Web of Science, Google Scholar, SCI, ESCI, and PubMed), Journal Metrics and Quality Indicators: Impact Factor, h-index, i10-index,CiteScore, SNIP and SJR, Types of Publications, Ethics in Research Publication: Plagiarism and Similarity Index (Turnitin Software), Copyright and Authorship, Duplicate Publication, Clone, Predatory, and Fake Journals, Researcher Profiles and Identifier (ORCID, Researcher ID)	6
	Total Lecture Hours	**30**

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Text Books
1. Research Methodology–Methods and Techniques by C. R. Kothari, Second Edition, New Age International Publishers
2. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24
Reference Books
1. Research Methodology Concept and cases By Deepak Chawala and Neena Sondhi
2. Research Methodology: Step by step guide for beginners, Ranjeet Kumar, 5th Edition, SAGE Publications
3. How to Write and Publish a Scientific Paper, Robert A. Day, Barbara Gastel, 8th Edition: 8th Edition, Cambridge University Press
NPTEL and Online Resources
1. https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed28
2. https://onlinecourses.swayam2.ac.in/e-learning/course/nou26_ge46
ISE Activities 1. Conduct a literature review in the selected domain, identify the research gap, and submit a Literature Review Report. 2. Prepare and submit a Technical Article on the chosen topic based on the literature review.

Annasaheb Dange College of Engg. & Tech. ASHTA 416 301

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Annasaheb Dange College of Engineering and Technology
Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Mechanical Engineering
Established: 1999

Course Information:

Class, Semester	S.Y.B. Tech, Semester - IV					**Category**	**HS**
Course Code, Course Title	**3MEHS231, Environmental Studies**					**Type**	**T2**
Prerequisites	------						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**		
	2	--	-	-	2		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	50	-		-	-

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Explain environmental systems, population dynamics, natural resources, and sustainability concepts.
CO2	Explain the Sustainable Development Goals (SDGs) and their significance in engineering for sustainable development.
CO3	Apply pollution concepts to identify sources, impacts, and suitable control measures for air, water, soil, and noise pollution.
CO4	Apply principles of climate change mitigation and adaptation, renewable energy, waste management, and environmental governance to recommend sustainable engineering practices.

Syllabus:

Module	Contents	Lecture Hours
I	**Environmental Systems, Population, and Resource Use:** Components of environment and earth systems, Population growth, urbanization, and industrial development, Natural resources: water, energy, land, minerals, Resource depletion, carrying capacity, **and en**vironmental stress, Human–environment interactions and sustainability challenges	5
II	**Sustainable Development Goals (SDGs) and Engineering Responsibility:** Evolution of sustainable development concept, Overview of 17 Sustainable Development Goals and key targets, Interlinkages among SDGs (water–energy–food–climate nexus), SDGs relevant to engineering disciplines, Role of engineers in achieving SDGs	5
III	**Pollution Science and Environmental Quality:** Air pollution: sources, types, impacts, and control overview, Water pollution: indicators, standards, reuse and recycling, Soil pollution: contamination sources and remediation concepts, Noise pollution: sources, measurement, impacts, and mitigation.	5
IV	**Climate Change – Science, Mitigation, and Adaptation:** Greenhouse effect and climate change science, Evidence of climate change and observed impacts, Mitigation strategies: technology, energy transition, efficiency, Adaptation strategies: climate-resilient infrastructure and planning, Role of engineers in climate action.	5
V	**Renewable Energy and Sustainable Technologies:** Overview of renewable energy technologies, Solar energy (PV and thermal systems), Wind energy systems, Hydropower, geothermal, ocean energy, Bioenergy and waste-to-energy, Comparative assessment of renewable technologies.	5
VI	**Waste Management, and Environmental Governance:** Solid waste management and E-waste management, Life Cycle Assessment (LCA): concept and applications, Environmental policies and legislation (India and global overview), Environmental Impact Assessment (EIA), Ethics and professional responsibility of engineers	5
	Total Lecture Hours	**30**

Text Books:

1. Singh, J. S., Singh, S. P., Gupta, S. R., and Singh, R. Ecology, Environmental Science and Conservation. 2nd Edition. S. Chand Publishing, 2025.
2. Bharucha, E. Environmental Studies for Undergraduate Courses. 4th Edition. Universities Press (India) Pvt. Ltd. 2025.
3. Cunningham, W.P., & Cunningham, M.A., Environmental Science: A Global Concern, 15th Edition, McGraw-Hill Education, New Delhi, 2020.

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4. Rathoure, V.C., Fundamentals of Environmental Studies, 2nd Edition, Tata McGraw-Hill Education, New Delhi, 2019
5. Singh, J.S., & Singh, S.P., Environmental Science: An Integrated Approach, 5th Edition, Jones & Bartlett Learning, 2019
6. Kaushik, A., & Kaushik, C.P., Perspectives in Environmental Studies, 5th Edition, New Age International Publishers, New Delhi, 2018.
References:
1. Trivedi, R.K., & Goel, P.K., An Introduction to Environmental Biology, 1st Edition, University Book House, Jaipur, 2018.
2. Odum, E.P., Fundamentals of Ecology, 5th Edition, Cengage Learning, 2017.
3. Dash, M.C., Fundamentals of Ecology, 4th Edition, McGraw-Hill Education, New Delhi, 2016.
Online Learning Resources
https://www.youtube.com/watch?v=MtpxOdtS9KU&list=PL3qvHcrYGy1u2egw2tipHWODV6elVC2Gg
https://niti.gov.in/divisions/division/sustainable-development-goal
https://sdgs.un.org/goals
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_de04

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Department of Mechanical Engineering
Established:

Course Information:

Class, Semester	S. Y. B. Tech. Semester - IV	**Category**	**EL**
Course Code, Course Title	**3MEHS232, Innovation and Product Development**	**Type**	**L2**
Prerequisites	--		

Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**
	-	-	2	-	1

Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Identify innovative product ideas by observing real-world problems and user needs using creativity and design thinking tools.
CO2	Apply design thinking techniques to generate and refine innovative solutions for identified engineering or societal problems based on user requirements.
CO3	Construct functional prototypes and estimate preliminary production costs using appropriate materials, manufacturing methods, and engineering tools.
CO4	Analyze prototype performance and production feasibility by interpreting testing results, cost data, and scalability requirements.
CO5	Evaluate intellectual property opportunities, commercialization potential, and production planning based on technical feasibility, market requirements, and economic considerations.
CO6	Develop a comprehensive entrepreneurial proposal integrating intellectual property protection, commercialization strategy, and production planning for an innovative product.

Syllabus:
The Innovation Prototype course is designed to provide students with experiential learning in innovation, prototyping, product development, and commercialization. The course focuses on identifying real-world problems and transforming innovative ideas into functional prototypes/models/products through systematic design and development processes.
Students will learn techniques for validating innovative concepts, assessing feasibility and utility, selecting suitable materials, along with design thing approach and developing prototypes/models/products through iterative improvement and performance testing. The course also emphasizes expert reviews, prototype assessment, cost estimation, pricing strategies, and preliminary production planning for scalability.
Further, students will gain exposure to Intellectual Property Rights (IPR), commercialization processes, and startup development, enabling them to prepare draft proposals for patenting, commercialization, or entrepreneurial ventures based on their innovative solutions.

INNOVATION PROTOTYPE ACTIVITY PLAN

Sr. No	Innovation Prototype Course Activities	Planned Week
01	Introduction to Innovation and Prototyping	Week 1
02	Revising Design Thinking Approach	Week 2
03	Identifying Innovative Problems (Students & Faculty)	Week 3
04	Validating Innovation: Assessing Utility of a Proposed Concept	Week 4
05	**Review No. 1 – by Guides** - Innovativeness Assessment - (Final Idea Presentation)	Week 5
06	Planning and Designing the Prototype	Week 6
07	Choosing and Testing Materials for the Prototype	Week 7
08	Building the working Prototype / Model/ Product	Week 8
09	Improving working Prototype / Model/ Product	Week 9
10	Testing the Prototype / Model/ Product Performance	Week 10
11	**Review No. 2 – by Expert Panel** - Prototype/Model/Product Assessment along with poster	Week 11
12	Estimating Costs & Formulating a Pricing Strategy for Product	Week 12
13	Creating a Preliminary Production Plan for Scaling the Prototype	Week 13
14	Formulating IPR or Commercialization or Start up	Week 14
15	**Review No. 3** – Submission of Draft Copy for IPR or Commercialization or Start up	Week 15

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Course Information:

Class, Semester	S. Y. B. Tech. Semester – IV					**Category**	**MA**
Course Code, Course Title	**3MEMA233, Aptitude and Reasoning -II**					**Type**	**T2**
Prerequisites							
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**		**Self-Study**	**Credits**	
	2	-	-		2	-	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**Theory**	**MSE**
		-	50	-		-	-

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

CO1	Apply quantitative aptitude concepts such as Partnership, Average, and Syllogism to solve numerical and logical problems effectively.
CO2	Analyze and solve reasoning-based problems involving Seating Arrangements, Puzzles, and Direction Sense using systematic problem-solving approaches.
CO3	Demonstrate professional communication and employability skills through presentation skills, grooming, body language, group discussions, and interview techniques for effective participation in hiring processes.
CO4	Develop career readiness skills by preparing professional resumes, optimizing LinkedIn profiles, and applying networking strategies such as cold calling for internship and job opportunities.

Syllabus:

Module	Contents	Lecture Hours
I	Partnership Average	5
II	Seating Arrangements Puzzles	5
III	Syllogism Direction	5
IV	Presentation Skills Grooming & Body Language	5
V	Resume Writing LinkedIn Cold Calling	5
VI	Group Discussion Interview	5
	Total Lecture Hours	**30**

Text Books

1. R.S. Agarwal S Chand Quantitative Aptitude, 2019
2. R.S. Agarwal S Chand Verbal & Non-verbal Reasoning, 2010
3. P.C. Wren S Chand Wren & Martin (Verbal, Grammar), 2017

Reference Books

1. Face Wiley, APTIPEDIA (Quantitative, Logical, Verbal Aptitude) 2017
2. P.A. Anand Maestro Wiley (Quantitative Aptitude) 2015
3. Meenakshi Upadhyay Arun Sharma (Verbal Ability) McGraw Hill 2020

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