K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 Batch

Department of Mechanical Engineering

B.Tech. in Mechanical Engineering with Multidisciplinary Minor

K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 Batch

Department of Mechanical Engineering

Class: S. Y. B. Tech **Semester:** III

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Theory (Marks %) Min. for passing	Practical (Marks %) Max.	Practical (Marks %) Min. for passing
ME2094	Mathematics for Mechanical Engineers	2	-	-	2	ISE	20	40	---	---
						UT1	15			
						UT2	15			
						ESE	50	40		
ME2114	Manufacturing Processes and Machine Tool	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
ME2134	Engineering Thermodynamics	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
ME2154	Engineering Mechanics	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
ME237	Fluid Mechanics	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
-	Multidisciplinary Minor- I	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
ME239	Fluid Mechanics Lab	-	-	2	1	ISE	---	---	50	50
						ESE	---	---	50	50
ME2314	Engineering Mechanics Lab	-	-	2	1	ISE	---	---	100	50
ME2334	Machine Drawing Lab	-	-	2	1	ISE	---	---	50	50
						ESE	---	---	50	50
ME2354	Workshop Practice-I	-	-	2	1	ISE	---	---	50	50
-	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	---	---	100	50
-	**TOTAL**	16	-	10	21	-				
	TOTAL CONTACT HOURS	26								

ISE - In Semester Evaluation, UT1 - Unit Test-1, UT2 -Unit Test-2, ESE - End Semester Exam.

Total Contact Hours/week : 26

Total Credits : 21

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Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	**SH2634**
2.		Interpersonal Skills	**SH2614**
3.		Innovation Tools and Methods for Entrepreneurs	**SH2694**
4.		Personal Effectiveness and Body Language	**SH2594**
5.		German Language-III	**SH2734**
6.		Japanese Language-III	**SH2714**

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Professional Skills Development Programme. A course in each semester will be allocated without any repetition.
2. Foreign Language course selected in F. Y. B. Tech Sem-I will remain the same with next levels in Sem-III & IV. (No new entries in S. Y. B. Tech Sem-III)

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Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 Batch

Department of Mechanical Engineering

Class: S. Y. B. Tech **Semester:** IV

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max	Min.for passing
ME2124	Mechanics of Solids	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME2144	Material Science and Metallurgy	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME236	Kinematics of Machines	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			--	---
						UT2	15			---	---
						ESE	50	40		---	---
ME238	Computer Programming-C++	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Multidisciplinary Minor-II	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			--	---
						UT2	15			---	---
						ESE	50	40		---	---
SH2174	Environmental Science	1	-	2	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
ME240	Computer Programming-C++ Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---		50	50
ME2224	CAD Modelling Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---			50	50
ME2244	Material Science and Metallurgy Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---			50	50
ME2344	Workshop Practice-II	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---		50	50
-	Professional Skills Development and Foreign Languages-II	-	-	2	1	ISE	---	---	--	100	50
ME242	Mini Project	-	-	2	1	ISE	---	---	---	100	50
ME244	MOOCS-I**	-	-	-	1	---	---	---	---	100	50
-	**TOTAL**	15	-	14	23	-					
	TOTAL CONTACT HOURS	29									

ISE - In Semester Evaluation, UT1 - Unit Test I, UT2 - Unit Test II, ESE - End Semester Exam.

Total Contact Hours/week : 29

Total Credits : 23

Note: Students are required to undergo industrial / field training of minimum two weeks in the vacation of Semester-IV and its evaluation will be carried out in the Semester-V.

Note:** MOOC course certification marks will be caried out for the credits

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Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	**SH2634**
2.		Interpersonal Skills	**SH2614**
3.		Innovation Tools and Methods for Entrepreneurs	**SH2694**
4.		Personal Effectiveness and Body Language	**SH2594**
5.		German Language-IV	**SH2644**
6.		Japanese Language-IV	**SH2624**

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Professional Skills Development Programme. A course in each semester will be allocated without any repetition.
2. Foreign Language course selected in F. Y. B. Tech Sem-I will remain the same with next levels in Sem-III & IV. (No new entries in S. Y. B. Tech Sem-III)

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To be implemented for 2024-28 Batch
Department of Mechanical Engineering

Class: T. Y. B. Tech **Semester:** V

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for Passing		Max	Min. for passing
ME3114	Heat and Mass Transfer	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME385	Dynamics of Machines	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME387	Design of Machine Elements	2***	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Program Elective-I	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Open Elective-I	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Multidisciplinary Minor- III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Multidisciplinary Minor- IV (Online)	2	-	-	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
ME3214	Heat and Mass Transfer Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
ME3234	Kinematics and Dynamics of Machines Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
ME3254	Software Training Lab-I	-	-	2	1	ISE	---	---	---	100	50
ME3835	Summer Internship	-	-	-	1	ISE	---	---	---	100	50
SH3035	Scholastic Aptitude-I	2*	-	-	Audit	ISE	100	50 (P/NP)	---	---	---
ME399	MOOCS-II**	-	-	-	1	ISE	---	---	---	100	50
-	**TOTAL**	**19**	**-**	**6**	**23**	-					
	TOTAL CONTACT HOURS	**25**									

ISE - In Semester Evaluation, UT1 - Unit Test I, UT2 - Unit Test II, ESE - End Semester Exam, P-Pass and NP-Not Pass.

Total Contact Hours/week : 25
Total Credits : 23

Note:

***Students should complete 5 days (30 Hours) of Scholastic Aptitude training program organized by the institute.**
MDM-IV will be conducted through online mode using recorded videos and online study material.
* *MOOC course certification marks will be caried out for the credits.
***For Design of Machine Elements (ME387) one extra lecture will be allotted in time table.

Program Elective-I

Sr. No	Course Code	Domain	Course
1.	**ME389**	Design	Design Thinking
2.	**ME333**		Engineering Optimization
3.	**ME391**		Engineering Failure Analysis
4.	**ME393**	Thermal	Fuel Cell Technology
5.	**ME343**		Alternative sources of energy
6.	**ME345**		Hybrid and Electric Vehicles
7.	**ME3514**	Manufacturing	World Class Manufacturing
8.	**ME395**		Control Engineering
9.	**ME3534**		Non-Traditional Machining Process
10.	**ME359**		Operations Research
11.	**ME3594**		Production and Operation Management
12.	**ME397**	Mechatronics	Sensor Technology and Applications

Open Elective - I

Sr. No	Course Code	Course Name	Offered By Department
1	OE3044	Renewable Energy Sources	Robotics & Automation
2	OE3064	Environmental Impact Assessment	Civil Engineering
3	OE3104	Network Administration	Computer Science and Engineering
4	OE3381	Disaster Management	Civil Engineering
5	OE341	Energy Audit and Management	Electrical Engineering
6	OE343	Data Science	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
7	OE365	Distributed Systems	Computer Science and Information Technology
8	OE347	New Product Design & Development	Mechanical Engineering
9	OE349	Non-Conventional Energy Sources	Mechanical Engineering
10	OE351	Hydrogen & Fuel Cell Technology	Mechanical Engineering
11	OE353	Factory Automation	Mechatronics Engineering Dept.
12	OE355	Cyber Physical System	Mechatronics Engineering Dept.
13	OE357	Internet of things	Electronics & Telecommunication Engineering
14	OE359	Drone technology	Electronics & Telecommunication

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			Engineering
15	OE361	Object Oriented Modeling and Design	Computer Science and Information Technology
16	OE363	Robotics Engineering & Applications	Robotics & Automation

Software Training Lab-I (ME3254)

Sr. No.	Software courses
1.	NX CAM
2.	NX CAD
3.	Software Development using Python
4.	Software Development using C++

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Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 Batch

Department of Mechanical Engineering

Class: T. Y. B. Tech **Semester:** VI

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks %)			Practical (Marks %)	
		L	T	P	Credits	Scheme	Max	Min. for passing		Max	Min. for passing
ME3104	Finite Element Method	2	-	-	2	ISE	20	40	40	---	---
						UT1	15				
						UT2	15				
						ESE	50	40			
ME378	Applied Thermodynamics	3	-	-	3	ISE	20	40	40	---	---
						UT1	15				
						UT2	15				
						ESE	50	40			
ME380	Fluid Turbo Machinery	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME316	Research Methodology	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME382	Mechatronics and Automation	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Program Elective-II	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Open Elective-II	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Multidisciplinary Minor-V	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME3644	Software Training Lab-II	-	-	2	1	ISE	--	--	--	50	50
ME3664	Fluid Turbomachinery Lab	-	-	2	1	ISE	--	--	--	50	50
						ESE	--	--	--	50	50
ME 378	Applied Thermodynamics Lab	-	-	2	1	ISE	--	--	--	50	50
						ESE	--	--	--	50	50
ME3764	Capstone project Phase I	-	-	2	1	ISE	---	---	---	100	50
SH3065	Scholastic Aptitude-II	2*	-	-	Audit	ISE	100	50 (P/NP)	---	---	---
-	**TOTAL**	**20**	**-**	**8**	**24**	-					
	TOTAL CONTACT HOURS	**28**									

ISE - In Semester Evaluation, UT1 - Unit Test I, UT2 - Unit Test II, ESE - End Semester Exam P-Pass and NP-Not Pass.

Total Contact Hours/week : 28

Total Credits : 24

Note*: Students should complete 5 days (30 Hours) of Scholastic Aptitude training program organized by the institute.

Program Elective-II

Sr.No.	Course Code	Discipline	Course
1.	ME384	Design	Product Design & Development tools
2.	ME3264		Machine Tool Design
3.	ME328		Smart Material and Systems
4.	ME3304		Engineering Acoustics
5.	ME3364	Thermal	Energy Conservation & Management
6.	ME3384		Gas Turbine & Jet Propulsion
7.	ME340		Computational Fluid Dynamics (CFD)
8.	ME3424		Alternative Fuels
9.	ME3484	Manufacturing	Computer Integrated Manufacturing
10.	ME3504		Total Productive Maintenance
11.	ME3524		Tool Engineering
12.	ME3544		Industrial Organization and Management
13.	ME382		Process Equipments and Engineering
14.	ME386	Mechatronics	Automation in Manufacturing

Open Elective-II

Sr. No.	Course Code	Course Name	Offered By Department
1	OE3024	Reliability Engineering	Robotics & Automation
2	OE3084	Materials Management	Civil Engineering
3	OE3182	Industrial Drives	Electrical Engineering
4	OE3284	Supply Chain Management	Mechanical Engineering
5	OE3324	Entrepreneurship Development	Mechanical Engineering
6	OE3401	Cyber Security	Computer Science and Information Technology
7	OE342	Data Mining	CSE(AI&ML)
8	OE344	Supply Chain Analytics	Mechatronics Engineering Dept.
9	OE346	Mobile Robotics	Mechatronics Engineering Dept.
10	OE348	Information Technology Foundation Program	Computer Science and Engineering
11	OE350	Operations Research	Civil Engineering
12	OE352	Image Processing	Electronics & Telecommunication Engineering
13	OE354	Fuzzy logic and Neural Network	Electronics & Telecommunication

			Engineering
14	OE356	Project Management	Mechanical Engineering
15	OE358	Plumbing (Water and Sanitation)	Civil Engineering
16	OE362	Flexible Manufacturing System	Robotics & Automation
17	OE364	AI for Manufacturing	Computer Science and Information Technology
18	OE366	AI for Cybersecurity	Computer Science and Engineering
19	OE368	AI for Agriculture	CSE(AI&ML)
20	OE370	AI for Sustainability	Electronics & Telecommunication Engineering
21	OE3242	Marketing for Engineers	MBA

Software Training Lab-II (ME3644)

Sr. No.	Software courses
1.	ABAQUES
2.	HYPERMESH
3.	ANSYS
4.	Computational Fluid Dynamics (CFD)

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Department of Mechanical Engineering

Class: Final Year B. Tech **Semester: VII**

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max.	Min. for passing		Practical (Marks %) Max.	Min. for passing
ME4894	Mechanical System Design	3	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
										---	---
						ESE	50	40		---	---
ME4034	Metrology and Quality control	2	-	-	2	ISE	20	40	40	---	---
						MSE	30			---	---
										---	---
						ESE	50	40		---	---
ME4054	Industrial Engineering	3	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
										---	---
						ESE	50	40		---	---
-	Program Elective-III	3	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
										---	---
						ESE	50	40		---	---
-	Program Elective-IV	3	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
										---	---
						ESE	50	40		---	---
ME4074	Mechanical System Design Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
ME4094	Industrial Engineering and Quality control Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
ME4114	Metrology and Measurement Lab	-	-	2	1	ISE	---	---	---	100	50
ME4134	Workshop Practice III (IR4)	-	-	2	1	ISE	---	---	---	100	50
-	Program Elective-IV Lab	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
ME4874	Capstone Project Phase II	-	-	6	3	ISE	--	---		50	50
						ESE	--	---		50	50
-	TOTAL	14	-	16	22	-					
	TOTAL CONTACT HOURS	30									

ISE - In Semester Evaluation, MSE- Mid Semester Exam, ESE - End Semester Exam.

Total Contact Hours/week : 30
Total Credits : 22

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Program Elective-III

Sr.No.	Course Code	Discipline	Course
1.	**ME4154**	Design	Condition Monitoring
2.	**ME423**		Computer Aided Design and Analysis
3.	**ME4194**		Autotronics & Vehicle Intelligence
4.	**ME489**		Mechanics of Composite Material
5.	**ME491**		Fracture Mechanics
6.	**ME4234**	Thermal	Cryogenics
7.	**ME425**		Design of Heat Exchanger
8.	**ME427**		Battery Thermal Management system
9.	**ME429**	Manufacturing	Foundry Technology
10.	**ME431**		Enterprise Resource Planning (ERP) and Product Life Cycle Management (PLM)
11.	**ME433**		Sustainable Manufacturing
12.	**ME435**		Digital Manufacturing
13.	**ME493**	Mechatronics	Robotics for Industrial Applications

Program Elective-IV

Sr.No.	Course Code	Discipline	Course
1.	**ME4394**	Design	Mechanical Vibration
2.	**ME4414**		Experimental Stress Analysis
3.	**ME4434**		Engineering Tribology
4.	**ME495**		Industry Textile and Applications: Noise & Vibration reduction
5.	**ME4494**	Thermal	I C Engines
6.	**ME4514**		Refrigeration and Air conditioning
7.	**ME4534**		Automotive Engineering
8.	**ME4554**	Manufacturing	Industrial Hydraulics and Pneumatics
9.	**ME459**		Additive Manufacturing
10.	**ME461**		Mechatronics and IoT
11.	**ME497**	Mechatronics	Mechatronics system Design

Program Elective-IV Lab

Sr. No	Course Code	Discipline	Course
1.	**ME4634**	Design	Mechanical Vibration Lab.
2.	**ME4654**		Experimental Stress Analysis Lab.
3.	**ME467**		Engineering Tribology Lab.
4.	**ME499**		Industry Textile and Applications: Noise & Vibration reduction Lab
5.	**ME4734**	Thermal	I C Engines Lab
6.	**ME4754**		Refrigeration and Air conditioning Lab
7.	**ME4774**		Automotive Engineering Lab
8.	**ME479**	Manufacturing	Industrial Hydraulics and Pneumatics Lab
9.	**ME483**		Additive Manufacturing Lab
10.	**ME485**		Mechatronics and IoT Lab
11.	**ME487**	Mechatronics	Mechatronics system Design Lab

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Department of Mechanical Engineering

Choice based Internship Model
Model I: Industry Internship (II)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks %)			Practical (Marks %)	
		L	T	P	Credits	Scheme	Max.	Min. for passing		Max.	Min. for passing
OE4382	Financial Management (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4362	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
IP4024	Industry Internship & Project	-	-	-	12	ISE	---	---		50	50
						ESE	---	---		50	50
-	TOTAL	4	-	-	16	---	---	---		---	---

ISE - In Semester Evaluation, ESE - End Semester Exam.

Total Contact Hours/week : --
Total Credits : 16

Note:

1] Weekly Contact hours are not mentioned as student is expected to be in industry regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.

2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

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Department of Mechanical Engineering
Model II: Research Internship (RI)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max.	Min. for passing		Practical (Marks %) Max.	Min. for passing
OE4382	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4362	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
RE4044	Research Internship	-	-	-	12	ISE	---	---		50	50
						ESE	---	---		50	50
-	**TOTAL**	4	-	-	16	---	---	---		---	---

ISE - In Semester Evaluation, UT1 - Unit Test I, UT2 - Unit Test II, ESE - End Semester Exam.

Total Contact Hours/week : -
Total Credits : 16

Note:

1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.

2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.

3] Students who opt for research internship need to undergo a minimum of one month of research internship in outside research organizations or laboratories.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

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Department of Mechanical Engineering
Model III: Entrepreneurial Internship (EI)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme			Credits	Evaluation Scheme					
		L	T	P		Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max	Min. for passing
ED4104	Project Management (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
ED4044	Commercial Aspects of the Project (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
ED4064	Entrepreneurship Development Program (EDP)	-	-	-	1	ISE	-	-	-	100	50
ED4084	Entrepreneurial Internship	-	-	-	11	ISE	-	-	-	50	50
						ESE				50	50
-	TOTAL	4	-	-	16	-	-	-	-	-	-

ISE - In Semester Evaluation, UT1 - Unit Test I, UT2 - Unit Test II, ESE - End Semester Exam.
Total Contact Hours/week : -
Total Credits : 16

Note:
1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.
2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
3] Students who opt for an Entrepreneurial Internship need to undergo a one month internship at an outside reputed organization or a firm.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.
4] A one week Entrepreneurship Development Program (EDP) will be conducted after completion of 7th semester and before start of 8th semester.

Multidisciplinary Minor

Note:

- Student should choose any one specialization given by the department and complete all the five courses under the specialization
- Following are the baskets of multidisciplinary minor courses

• Multidisciplinary Minor Baskets					
MDM Basket Name	**Sr. No.**	**Course Code**	**Course Name**	**Semester**	**Offered by Department**
Construction Engineering	1	CEMD201	Building Construction and Planning	III	Civil Engineering
	2	CEMD202	Building Estimation and Valuation	IV	
	3	CEMD301	Infrastructure Engineering	V	
	4	CEMD303	Smart Cities and Sustainable Development	V	
	5	CEMD302	Environmental Engineering	VI	
Software Programming	1	CSMD201	Introduction to Data Structures	III	Computer Science & Engineering
	2	CSMD202	Problem solving using JAVA	IV	
	3	CSMD301	Fundamentals of Database Systems	V	
	4	CSMD303	Object-oriented Programming in Python	V	
	5	CSMD302	Artificial Intelligence	VI	
Electrical Power System	1	EEMD201	Electrical Power Generation	III	Electrical Engineering
	2	EEMD202	Power System	IV	
	3	EEMD301	Electrical Machines	V	

	4	EEMD303	Electrical Technology	V	
	5	EEMD302	Smart Grid	VI	
Electronics System Design	1	ECMD201	Electronics Devices and Applications	III	Electronics &Telecommunication Engineering
	2	ECMD202	Electronics Communication Systems	IV	
	3	ECMD301	Advanced Communication Systems	V	
	4	ECMD303	Electronic Product Design	V	
	5	ECMD302	Industrial Electronics	VI	
Software Development	1	CIMD201	Data Structures	III	Computer Science & Information Technology
	2	CIMD202	Computer Algorithms	IV	
	3	CIMD301	Introduction to DBMS	V	
	4	CIMD303	OOP using Java	V	
	5	CIMD302	Software Engineering	VI	
Product Design and Development	1	MEMD203	Design Thinking	III	Mechanical Engineering
	2	MEMD204	Behavioral Engineering and Design	IV	
	3	MEMD305	Product Design Tools and Techniques	V	
	4	MEMD307	Design and Prototyping	V	
	5	MEMD304	Marketing and Business Fundamentals for New Products	VI	
Mechatronics Engineering	1	MCMD201	Fundamentals of Mechatronics	III	Mechatronics Engineering
	2	MCMD202	Industrial Fluid Power	IV	

	3	MCMD301	Sensor and Instrumentation	V	
	4	MCMD303	Industrial Automation	V	
	5	MCMD302	Industrial Robotics	VI	
Artificial Intelligence	1	AIMD201	Object Oriented Programming	III	Computer Science & Engineering (AI-ML)
	2	AIMD202	Data Structures and Algorithms	IV	
	3	AIMD301	Machine Learning	V	
	4	AIMD303	Business Intelligence	V	
	5	AIMD302	Principles of AI	VI	
Robtocis & Automaiton	1	RAMD201	Fundamentals of Robotics & Automation	III	Robtocis & Automaiton
	2	RAMD202	Sensors and Actuators	IV	
	3	RAMD301	Kinematic & Dynamics for Robots	V	
	4	RAMD303	Robot Programming	V	
	5	RAMD302	Industrial Automation and Control	VI	

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B.Tech. in Mechanical Engineering with Double Minor (Multidisciplinary and Specialization Minor)

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B.Tech. in Mechanical Engineering with Double Minor degree

1. It is required to complete SIX courses (each of 3 credits) from ONLINE platform to earn total of 18 credits under Double Minor (DM) certification.
2. Student must complete and earn the credits for all the six courses starting from Second Year First semester (3rd semester) to Final Year Second Semester (8th semester).
3. Basket of the DM courses and respective semester is mentioned in the following table.

Sr. No.	Semester	Course	Code
1	III	DM – I	MEDM3XXX
2	IV	DM – II	MEDM4XXX
3	V	DM – III	MEDM5XXX
4	VI	DM – IV	MEDM6XXX
5	VII	DM – V	MEDM7XXX
6	VIII	DM – VI	MEDM8XXX

4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
   a. If timeline of NPTEL course is not in line with timeline of academic calendar.
   b. The suitable succeeding course in line with previous course is not available on NPTEL.
   c. If any other unavoidable circumstances occurs.
6. Platform and course selection must be as per recommendation of BOS of the department.
7. Student will get the credits of respective DM course in following conditions,
   a. In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
   b. In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.
8. While selecting online course, following points must be taken care of,
   a. Selected course must be of basic or fundamental level.
   b. Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective) or in Multidisciplinary Minor (MDM)
   c. Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for UDEMY, COURSERA courses.

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B.Tech. in Mechanical Engineering with Honor and Multidisciplinary Minor

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Department of Mechanical Engineering

B.Tech. in Mechanical Engineering with Honor and Multidisciplinary Minor degree

1. It is required to complete SIX courses (each of 3 credits) from ONLINE platform to earn total of 18 credits under Honor certification.
2. Student must complete and earn the credits for all the six courses starting from Second Year First semester (3rd semester) to Final Year Second Semester (8th semester).
3. Basket of the Honor courses and respective semester is mentioned in the following table.

Sr. No.	Semester	Course	Code
1	III	Honor - I	MEH3XXX
2	IV	Honor - II	MEH4XXX
3	V	Honor - III	MEH5XXX
4	VI	Honor - IV	MEH6XXX
5	VII	Honor - V	MEH7XXX
6	VIII	Honor - VI	MEH8XXX

4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
   a. If timeline of NPTEL course is not in line with timeline of academic calendar.
   b. The suitable succeeding course in line with previous course is not available on NPTEL.
   c. If any other unavoidable circumstances occurs.
6. Platform and course selection must be as per recommendation of BOS.
7. Student will get the credits of respective Honor course in following conditions,
   a. In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
   b. In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.
8. While selecting online course, following points must be taken care of,
   a. Selected course must be of advanced level and not basic or fundamental level.
   b. Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective)
   c. Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for COURSERA, UDEMY courses.

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B.Tech. in Mechanical Engineering-Honors with Research and Multidisciplinary Minor

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Honors with Research and Multidisciplinary Minor

The student will work on Research Project or Dissertation for 18 Credits in the Fourth Year in respective discipline. The distribution of 18 Credits for Research project in Sem-VII and Sem-VIII is given below. To get B.Tech. in Mechanical Engineering-Honors with Research and Multidisciplinary Minor degree Student need to earn total 206 Credits which consist 170 credits of regular Multidisciplinary Minor courses, 18 Credits of Honor courses and 18 credits of Research courses

Class: Final Year B. Tech **Semester:** VII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
REH401	Intellectual Property Rights (IPR)	-	-	-	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
REH403	Research project (Synopsis) phase - I	-	-	-	2	ISE	---	---		50	50
						ESE	---	---		50	50
REH405	Research Specific core course - I (Online NPTEL course)	-	-	-	3	ISE	50	40	40	---	---
						ESE	50	40		---	---
-	**TOTAL**	-	-	-	7	-	-	-		-	-

ISE - In Semester Evaluation, ESE - End Semester Exam.

Note: For Evaluation of Online NPTEL course ISE Marks will be marks obtained by students in the assignments given by NPTEL, students who will secure NPTEL certification will be only eligible for ESE of the same course which will be conducted at institute

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Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
REH402	Research project phase - II	-	-	-	11	ISE	---	---	---	50	50
						ESE	---	---		50	
-	**TOTAL**	-	-	-	11		-	-		-	-

ISE = In Semester Evaluation, ESE = End Semester Exam.

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Class: **S. Y. B. Tech**	Semester: **III**
Course Code: **ME2094**	Course Name: **Mathematics for Mechanical Engineers**

L	T	P	Credits
2	--	--	2

Course Description: Mathematics for Mechanical Engineering is offered at the third semester of the second year of engineering degree course. This course intends to build the competency in the students to apply the concepts learned in respective modules to various Engineering Problems. It contains six units that accomplish the fundamentals of mathematics required for Engineers.

Course Learning Outcomes:
After successful completion of the course the student should be able to:
1. Solve the differential equation using the appropriate concept.
2. Determine the Laplace & inverse Laplace transform of various functions.
3. Solve Problems on different probability distributions.
4. Develop Fourier series of periodic functions.

Prerequisite:
1. Linear algebra, Interpolation, and Ordinary Differential Equation
2. Calculus

Course Content

Unit No	Description	Hrs.
1.	**Linear Differential Equations with constant coefficients** Definition, complete solution of Linear Differential Equation with constant coefficients (All Types to find Particular Integral & General type)	04
2.	**Linear Differential Equations with variable coefficients** Solution of Linear Differential Equation with Variable coefficients (Cauchy Linear differential equation, Legendre's Linear differential equation)	04
3.	**Laplace Transform** Definition of Laplace transform, Laplace transform of standard functions, properties of Laplace transform.	04
4.	**Inverse Laplace Transform** Definition of inverse Laplace transform, Properties of inverse Laplace transform, convolution theorem, Application to solve ordinary differential equation with one dependent variable.	04
5.	**Probability** Introduction, Binomial probability distribution, Poisson probability	04

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	distribution, and Normal probability distributions.	
6.	**Fourier Series** Definition, Eulers Formulae, Expansions of Functions, Change of Interval, Even and Odd Function.	**04**

References:

Text Books:

- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
- Ronald E. Walpole, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineering and Scientists, Pearson Prentice Hall.

Reference Books:

- Erwin Kreyszig, Advanced Engineering Mathematics, Wiley.
- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi.
- N. P. Bali, Ashok Saxena and N. Ch. S. N. Iyengar, A Text Book of Engineering Mathematics, Laxmi Publications.
- Peter V. O'Neil, Advanced Engineering Mathematics, Cole Publishing House.

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Class: **S. Y. B. Tech**	Semester: **III**
Course Code: **ME2114**	Course Name: **Manufacturing Processes and Machine Tools**

L	T	P	Credits
3	--	--	3

Course Description:
Manufacturing is value adding activity in which materials converted into products thereby adding value of the original material. Proper selection of materials and processes are vital for minimizing the waste & maximizing the efficiency.
The subject Machine tools & processes focused on the study of introduction to metal cutting & machine tools. Also, it covers working principles, operations performed, accessories & attachments used on center lathe, capstan lathe, turret lathe, drilling, boring, shaping, planning, milling, broaching, and grinding machines.
This course intends to build the competency in the students to identify & select a proper manufacturing process for manufacturing different components used in engineering industry.
This course intends to build the competency in the students to identify & select a proper machine tools, proper cutting tools, select cutting process, types of operations, and use of accessories & attachments on the machine tools, also selection of plastic & ceramic processes etc.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Select suitable Engineering forming process for production of component of required specification.
2. Select casting as manufacturing process suitable for the component design and production volume.
3. Select suitable furnaces in casting process as per requirement.
4. Select appropriate joining process for given application.
5. Illustrate and identify main parts of machine tools for metal cutting operations.
6. Describe the Construction of different components of precision machines.

Course Content

Unit No	Description	Hrs
1.	**Forming Process** a) Introduction, types and importance of Rolling, Forging, Extrusion, Wire, rod and pipe drawing, Sheet Metal Working. b) Introduction to plastics, blow molding, injection molding, extrusion, calendaring and thermo forming.	07
2.	**Casting Process: Pattern and Mold Making** a) Importance of casting as manufacturing Process, advantages and disadvantages of casting processes. General introduction to patterns, core boxes and gating systems. Types of patterns and cores and core boxes, materials used and selection criteria for pattern making, pattern allowances. Components of gating system and its importance,	07

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	solidification control devices: chills, ceramics bricks, directional solidification. b) Types of moulding and core making sands and their properties, green sand Moulding, shell Moulding, CO2 Moulding, Investment casting. Moulding machines and core making machines, Introduction to permanent mould casting Process-Gravity and pressure die-casting, Centrifugal casting, Continuous casting. Pollution Control in foundries.	
3.	**Melting and Pouring** Types of fuel fired melting Furnaces-Cupola furnace, oil/gas fired furnaces, crucible furnaces, Electrical furnaces, Metal pouring equipment, Cleaning-fettling and inspection of casting, Defects in casting.	**05**
4.	**Joining Processes** Welding processes: Arc, TIG, MIG, submerged arc welding and Resistance welding, Brazing and Soldering, Welding of dissimilar metals.	**04**
5.	**Machine Tools for Metal Cutting** Introduction of Lathe, Capstan, turret lathe, Boring Machines, Drilling, shaping machine, planning machine and milling machine.	**08**
6.	**Construction of Precision Machine** Antifriction slide construction, LM guide ways, ball screw, construction of Spindle and Tool holder, Requirement of lubrication system, Automatic tool changer.	**05**

References:

Text Books:

- P. N. Rao, Manufacturing Technology- Foundry, Forming and Welding, Vol. I", Tata-McGraw-Hill, New Delhi.
- P. L. Jain, Principles of Foundry Technology, Tata McGraw-Hill, New Delhi.
- P. C. Sharma, A Textbook of Production Technology (Manufacturing Processes), S. Chand and Company Pvt. Ltd, New Delhi.
- O. P. Khanna, Foundry technology, Dhanpat Rai Publications Pvt. Ltd, New Delhi.
- O. P. Khanna, Welding Technology. Dhanapat Rai Publications.
- S.K. Hajra Choudhury and A.K. Hajra Choudhury, Elements of Workshop Technology vol. II", Media Promoters and Publishers Pvt. Ltd, New Delhi.

Reference Books:

- Hein and Rosenthal, Principles of metal casting, Tata McGraw-Hill Book, Company. New Delhi.
- ASTM Volumes on Welding, casting, forming and material selection.
- ASM Handbook, Volume-15, 1988, Casting.
- W.A. J. Chapman, "Workshop Technology", CBS Publishing and Distributors, New Delhi.

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Class: S. Y. B. Tech	Semester: **III**
Course Code: ME2134	Course Name: **Engineering Thermodynamics**

L	T	P	Credits
3	--	--	3

Course Description:
The aim of this course is to provide students the basic concepts of thermodynamic systems and their applications. It also covers the basic properties of gases, liquids and vapors (specific heat capacities), energy, entropy, enthalpy, exergy, energy, laws of thermodynamics, vapor power cycles; ideal gas mixtures; and efficiencies of energy conversion systems, such as boilers, turbines, condensers, pump and the use of steam tables to gather energy properties of the steam at different conditions. The effective moving the heat energy generated in the various processes in the steam power plant is computed.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply thermodynamics principles to mechanical engineering applications.
2. Describe entropy, change in entropy and increase of entropy principle.
3. Differentiate between available and unavailable energy with examples.
4. Recognize the properties of pure substances and use thermodynamic property tables charts.
5. Apply mathematical fundamental to study the properties of steam gas and gas mixtures.
6. Explain the air and vapor power cycles and calculate cycle performance.

Prerequisite:
Students should know Concept of energy, work, heat and conversion between them.

Course Content

Unit No	Description	Hrs.
1.	**Basic Concepts** Thermodynamics system, Microscopic & macroscopic point of view, thermodynamic system and control volume, thermodynamic properties, processes and cycles, Thermodynamic equilibrium, Quasi-Static process, Zeroth law of thermodynamics **First law of Thermodynamics** First law for a closed system undergoing a cycle and change of state, energy, PMM1, first law of thermodynamics for steady flow process, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump. (Numerical Treatment)	06
2.	**Second law of thermodynamics** Limitations of first law of thermodynamics, Kelvin Planck and Clausius statements and their equivalence, PMM2, causes of irreversibility, Carnot theorem, corollary of Carnot theorem, thermodynamic temperature scale.	06

	Entropy Clausius theorem, property of entropy, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, entropy change for non-flow and flow processes, third law of thermodynamics (Numerical Treatment)	
3.	**Availability** Energy of a heat input in a cycle, exergy destruction in heat transfer process, exergy of finite heat capacity body, exergy of closed and steady flow system, irreversibility second law efficiency (Numerical Treatment).	**06**
4.	**Properties of gases and gas mixtures** Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart, Gibbs Dalton law, internal energy; enthalpy and specific heat of a gas mixtures, Simple Calculations (Numerical Treatment).	**06**
5.	**Properties of Pure Substances** Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of 1st and 2nd law for pure substances (Numerical Treatment).	**06**
6.	**Air and Vapor Power Cycles** Air standard cycles, Carnot, Otto and Diesel, Carnot cycle using steam, limitations of Carnot cycle, Rankine cycle, representation on T-s and h-s planes, thermal efficiency, specific steam consumption. Work ratio, effect of steam supply pressure and temperature, condenser pressure on the performance. (Numerical Treatment).	**06**

References:

Text Books:

- P.K. Nag, Engineering Thermodynamics, Tata McGraw Hill, New Delhi.
- Ballaney P.L., Thermal Engineering, Khanna Publishers, New Delhi.
- Kumar and Vasandani, Thermal Engineering, Metropolitan Book Co, Delhi.
- R. Yadav, Steam & Gas Turbines, CPH Allahabad.
- B. K. Sarkar, Thermal Engineering, Tata McGraw Hill.
- R. K. Rajput, Thermal Engineering, Laxmi Publications, New Delhi.
- Mahesh M Rathore, Thermal Engineering, McGraw Hill Education, New Delhi.

Reference Books:

- J P Holman, Thermodynamics, McGraw Hill, London.
- Wylen Van, G. J. & Sonntag R. E., Fundamentals of Classical Thermodynamics, John Wiley & Son.
- Yunus A. Cengel, Thermodynamics an Engineering Approach, Tata McGraw Hill.
- S. C. Jain, Steam Tables, Birla Publications Pvt. Ltd. Delhi.

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Class: **S. Y. B. Tech**	Semester: **III**
Course Code: ME2154	Course Name: **Engineering Mechanics**

L	T	P	Credits
2	**--**	**--**	**2**

Course Description:
Engineering Mechanics focuses on the analysis of static bodies. The course helps the students to understand facts, concepts, principles and techniques of scientific investigation in the field of engineering. It develops thinking, analytical ability and imaginative skill of student. It develops thinking, analytical ability and imaginative skill of student. It is an introductory course which supports study of many other advanced courses like analysis and design of various structures and

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Calculate resultant force of coplanar force system.
2. Analyze engineering problems applying conditions of equilibrium.
3. Determine centroid & moment of inertia of the geometrical plane lamina.

Prerequisite: Engineering Mathematics, Engineering Physics.

Course Content

Unit No.	Description	Hrs
1.	**Fundamentals of Mechanics and force systems** Force and classification of force systems. Resultant of parallel, concurrent and non-concurrent coplanar forces.	04
2.	**Equilibrium of force system** Free body diagram, conditions of equilibrium, types of loads, types of beams, types of supports and reactions. Analysis of simple and compound beams using conditions of equilibrium.	04
3.	**Friction** Introduction to Laws of friction, Surface friction for bodies on horizontal and inclined planes.	04
4.	**Analysis of trusses** Analysis of simple truss, Method of joints, Method of sections.	04
5.	**Centroid** Centroid of plane and composite figures.	04
6.	**Moment of Inertia** Moment of Inertia of plane and composite figures.	04

References:

Text Books:

- Bhavikatti S. S., Rajashekarappa, Engineering Mechanics, New age international publication (India) Pvt. Ltd. New Delhi.
- Ramamrutham S., Engineering Mechanics, Dhanpat Rai Publishing Company Ltd., New Delhi.

Reference Books:

- S. Junnarkar, Elements of Applied Mechanics, Charotar Publishing House (India) Pvt. Ltd., Anand (Gujarat).
- Ferdinand. Beer and E. Russell Johnson, Vector Mechanics for Engineers (Statics and Dynamics), McGraw Hill Publication, New York.
- Ferdinand L. Singer, Engineering Mechanics (Statics and Dynamics) Publications (India) Pvt. Ltd. Noida.
- Timoshenko and Young, Engineering Mechanics (Statics and Dynamics), McGraw Hill.

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Class: **S. Y. B. Tech.**	Semester: **III**
Course Code: **ME237**	Course Name: **Fluid Mechanics**

L	T	P	Credits
3	-	--	3

Course Description:
This undergraduate course covers the core principles of fluid mechanics essential for engineering applications. Topics include fluid properties, pressure measurement, fluid kinematics, Bernoulli's and momentum equations, laminar and turbulent flow, pipe flow, boundary layer behavior, forces on submerged and immersed bodies, compressible flow, and dimensional analysis. The course emphasizes conceptual understanding, practical relevance, and problem-solving skills.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Describe the fundamental properties of fluids, types of fluids, and the principles of pressure and pressure measurement.
2. Apply the continuity equation, Bernoulli's equation, and momentum equations to analyze and solve problems in fluid flow systems.
3. Classify types of fluid flows and explain the behavior of laminar flow through pipes and between parallel plates.
4. Estimate energy losses in pipe systems and assess flow behavior in siphons, branched pipes, and networks.
5. Analyze boundary layer characteristics and apply dimensional analysis and similitude principles using Buckingham's π theorem for model testing.
6. Analyze the forces on immersed and apply compressible flow concepts to engineering problems.

Prerequisite: Nil

Course Content

Unit No	Description	Hrs
1.	**Properties of Fluids** Definition, Laws, Types of Fluid, Viscosity, Compressibility, Surface Tension, Capillarity, Vapor Pressure and cavitation, Pascal's Law, Types of pressure, Pressure Measurements, Numerical Treatment	06
2.	**Kinematics of Fluid Flow** Introduction, Types of Flow, Continuity Equation in Cartesian Co-Ordinates System, Acceleration of Fluid, Numerical Treatment	06
3.	**Dynamics of Fluid Flow** Introduction, Euler's Equation of Motion, Bernoulli's Equation, Venturimeter, Orifice Meter, Notches. Momentum Equation, Application of Momentum Equation, Numerical Treatment.	06

4.	**Laminar flow and Flow through pipes** Laminar Flow-Introduction, Laminar Flow Through Circular Pipe. Laminar Flow through Parallel Plates. Numerical Treatment. Flow Through Pipe- Introduction, Losses of Energy, Darcy's Equation, Chezy's Equation, Minor Losses, Siphon Pipe, Branched Pipes.	**06**
5.	**Boundary layer and Dimensional analysis** Boundary Layer Theory- Thickness, Characteristics, Separation. Dimensional Analysis- Homogenous Equation, Buckingham's π Theorem. Dimensionless Parameters, Similitude, Model Testing.	**06**
6.	**Forces on immersed bodies and compressibility** Forces on immersed Bodies- Types of drag and lift on Aerofoil, parachute and kite, Numerical Treatment. Compressible Flow- Introduction, Mach number and Mach cone. Stagnation Temperature, Stagnation Pressure.	**06**

References:

Text Books:

- R.K. Bansal, Fluid Mechanics, Laxmi Publications.
- R.K. Rajput, A Textbook of Fluid Mechanics and Hydraulic Machines, S. Chand & Company.
- D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, S.K. Kataria & Sons.
- S. Balani and R.K. Basal, Hydraulics and Fluid Mechanics, Khanna Publishers.
- H. Lamb, An Introduction to Fluid Dynamics, Cambridge University Press.

Reference Books:

- S.K. Som and G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill.
- Frank M. White, Fluid Mechanics, McGraw-Hill.

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Multidisciplinary Minor- I

Class: **S. Y. B. Tech.**	Semester: **III**
Course Code: **CEMD201**	Course Name: **Building Construction and Planning**

L	T	P	Credits
3	-	-	3

Course Description:
The content of the course 'Building Construction and Planning' provides an overview of properties and applications of various building materials. The course offers an insight into the functional design of building components. It enables the students in planning of the buildings. It also deals with various services and finishes employed in buildings.

Course Outcomes:
After successful completion of the course, student will be able to,

1. Suggest appropriate materials for building construction applications.
2. Prepare a functional design of components of the building.
3. Design and draw residential building using principles of planning and bye-laws.
4. Prepare plumbing and electrification plan for the building.
5. Explain properties of building finishing materials and application procedure.

Prerequisite: Basic knowledge of mathematics.

Course Content

Unit No.	Details of Content	Hrs.
1.	**Construction Materials** Properties and applications of Various materials viz. Stone, Aggregate, Brick, Steel, Aluminium, Timber, Glass, Flooring materials, Roofing materials, Cladding materials, Plumbing materials. Mortar, Plain Cement Concrete, Reinforced Cement Concrete and pre-stressed concrete.	05
2.	**Components of Building I** Types of structures: Load Bearing Structure and Framed Structure, Preparation of sectional view drawing of load bearing and framed structure showing different building components, Concept of Soil Bearing Capacity, Substructure of a building, Components of Substructure of a building, Types of foundation and their suitability, Types of Masonry: Types of brick and stone masonry, bonds in brickwork and stone masonry.	05
3.	**Components of Building II** Building components in superstructure: Column, Beam, Wall, Sill, Lintel, Chajja, Slab, Ventilator, Roofing, Parapet wall, Ramp, ladder, lift and escalator. Doors, Windows and Staircase: Technical terms, classification,	06

	functional design and drawing.	
4.	**Planning of Buildings and Bye-laws** Types of buildings, Site Selection criteria, Concept of Planning, Principles of planning. Bye-laws: Definition, Necessity, Procedure for obtaining Development permission/Building permission /Commencement permission, General land development requirements, General building requirements: Setback, Marginal distance, height and FSI as per Unified Development Control and Promotion Regulations for Maharashtra State. Introduction and necessity of building drawings, concept of scale, Types of building drawings-layout plan, site plan, measured, submission, working and perspective drawing. Preparation of building plans using principles of planning and bye-laws.	**07**
5.	**Building Services** Concept of Plumbing & Drainage plan, Plumbing systems, Types of traps, Fittings, Septic Tank, Soak pit, Rainwater harvesting, and Plumbing layout for buildings, Preparation of Plumbing and Electrification layouts for building.	**07**
6.	**Building Finishes** Plastering and pointing. Paints-Characteristics of ideal paints, constituents, classification, suitability, applying procedure and applications, defects. Varnishes- Characteristics of good varnish, ingredients, types, suitability, applying procedure and applications. Distemper- ingredients, applying procedure and applications. White washing and color washing.	**06**

References:

References Books:

- V. B. Sikka, A Course in Civil Engineering Drawing, S. K. Kataria and Sons.
- W.B Macay, Building Construction, Pearson Education.
- S.Mantri, The A to Z of Practical Building Construction and its Management, Satya Prakashan.
- C.M. Kale, M.G. Shah, S.Y. Patki, Building Drawing And Planning With An Integrated Approach To Build Environment, Tata McGraw-Hill Education Pvt. Ltd.

Text Books:

- S. P. Arora, S. P. Bindra, A Text Book of Building Construction, Dhanpat Rai Publications
- B. C. Punmia, A Text Book of Building Construction, Laxmi Publications.

Government Rules & Regulations:

- Unified Development Control and Promotion Regulations for Maharashtra State (UDCPR 2020), Urban Development Department, Government of Maharashtra.

Class: **S. Y. B. Tech.**	Semester - **III**
Course Code: **CSMD201**	Course Name: **Introduction to Data Structures**

L	T	P	Credits
3	-	-	3

Course Description:
The Data Structures and Algorithms course is a comprehensive study of fundamental concepts and techniques essential for efficient problem-solving in computer science. Students will explore various data structures, including arrays, linked lists, stacks, queues, trees, graphs, and hash tables, and learn how to analyze their time and space complexity. The course extensively explores the design and analysis of algorithms, encompassing various topics such as sorting, searching, and graph traversal. Emphasis is placed on understanding algorithmic paradigms and their applications. Through programming assignments and theoretical exercises, students will gain practical experience in implementing algorithms and solving real-world problems. This course serves as a foundation for algorithmic thinking and prepares students for advanced computer science topics.

Course Learning Outcomes:

After successful completion of the course, strudels will be able to:

1. Compare between linear and nonlinear data structures.
2. Describe the characteristics of various data structure such as stacks, queues, trees, graphs and Hash tables.
3. Analyze various searching and sorting algorithms and apply it to solve particular problem.
4. Determine a suitable data structure and algorithm to solve a real-world problem.

Prerequisite: Basic knowledge of C programming, Knowledge of basic mathematical concepts.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Introduction to Data Structures** Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types, Complexity Analysis.	**05**
2.	**Linear Data Structures** **Stack:** Definition, Representation and Applications of Stack. **Queue:** Definitions, Representation and Applications of Linear Queue, Circular Queue, and Priority Queue.	**06**
3.	**Linked Lists** Definition, Representation, Operations and Applications of singly linked list, doubly linked list, circular linked list, Application of linked list-Stack & queue, Introduction to Sparse matrix, representation of sparse matrix using linked list.	**08**

4.	**Searching, Sorting and Hashing Techniques** Linear search, Binary search, Bubble sort, insertion sort, Merge sort, Quick sort, Selection sort, Radix sort, Heap sort, Complexity of algorithms **Hashing**: Definition, Hash functions, Overflow, Collision, Open Hashing, closed hashing, Rehashing Techniques.	**08**
5.	**Trees** Basic Technology, Binary Tree, Traversal methods, Binary search tree, AVL Tree, B tree, B+ tree, Heaps - operations and their applications.	**05**
6.	**Graphs** Basic concepts of graph theory, Storage representation, Operations on graphs, Traversing a graph, shortest path algorithm.	**04**

References:

Text Books:

- Amol M. Jagtap & Ajit S. Mali, Data Structures using C, A Practical Approach for Beginners, CRC press.
- Seymour Lipschutz, Data structures -Schaum's Outlines, Publisher: McGraw-Hill.
- Ashok N. Kamthane, Introduction to Data Structures in C, Publisher: Pearson Education.

Reference Books:

- Alfred V. Aho, John E. Hopcroft & J. D. Ullman, Data Structures and Algorithms, Addison-Wesley Series.
- ISRD Group, Data Structure using C, Tata McGraw-Hill (TMH), ACE Series.

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Class: **S. Y. B. Tech.**	Semester- III
Course Code: **EEMD201**	Course Name: **Electrical Power Generation**

L	T	P	Credits
03	--	--	03

Course Description:
The overarching aim of the course is to allow students to develop an understanding of the fundamental principles and performance of devices / components that are associated with Generation of Electrical Energy. Electricity is a secondary energy source. It is produced through conversion of primary energy sources as coal, hydro, natural gas, nuclear, solar, and wind into electrical energy. Electricity is also a critical energy carrier, facilitating both transfer of energy and conversion to other forms, such as mechanical, chemical, etc. This course is designed with multi-disciplinary approach to embark importance of electrical energy among the students from different programs.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. List the main components of different power plants.
2. Describe the operation of various power plants used for electrical power generation.
3. Explain working principles of various power plants.
4. Compare different power plants based on advantages, limitations and future prospects.
5. Draw layout of electrical power plants.
6. Explore alternate electrical energy resources for future needs and challenges.

Prerequisite: Basic Electrical Engineering, Basic Mechanical Engineering, Basic Civil Engineering, Engineering Physics and Chemistry.

Course Content

Unit No	Description	Hrs
1.	**Solar Power Generation** Solar radiation, solar energy collectors, solar power plant, solar power tower, conversion of solar heat to electricity, PV cells, PV power generation, solar energy storage, solar-hydrogen energy cycle, future prospects of solar energy in India.	06
2.	**Wind Power Generation** Wind speed and power relation, power extracted from wind, components of Wind power system, maximum power operation, operation and layout of standalone and grid connected Wind Turbine Generators (WTG).	06

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3.	**Thermal Power Plant** Main equipment, coal handling plant, pulverizing plant, draft system, boiler, super-heater, re-heater, steam turbine, ash handling plant, condenser and cooling tower, feed water heater, economizer, air preheater, auxiliary supply, layout of thermal power plant. heat balance and efficiency, supercritical technology.	**06**
4.	**Hydro Power Plant** Main components, storage reservoirs, dam, surge tank, penstock, spillway, tailrace, turbines, layout of hydro-power plant, site selection, run-off and its measurement, hydrograph, flow duration curve, mass curve, Hydro potential in India, problems in hydro-power plant development.	**06**
5.	**Nuclear Power Plant** Fundamentals of nuclear power, layout of nuclear power plant, selection of site, radioactivity & nuclear reactions, nuclear fission chain reaction in reactors, reactor classification, control of reactors, disposal of nuclear waste and effluent, biological effects of radiation, shielding, development of nuclear power plant in India.	**06**
6.	**Alternate Energy Sources** Fuel Cell: Principle, types of fuel cell, fuel for fuel cells, limitations and future prospects. Biomass Energy: Availability of biomass, fluidized bed combustion, biomass power plant. Tidal Energy: Tidal phenomenon, tidal barrage, tidal power schemes Geothermal Energy: General, heat extraction, vapor-turbine cycle, difficulties and disadvantages	**06**

References:

Text Books:

- Rao, S. and Parulekar, B.B., Energy Technology: Non-Conventional, Renewable and Conventional, Khanna Publishers,
- Viorel Badescu, George Cristian Lazaroiu, Linda Barelli, Power Engineering Advances and Challenges, Part A: Thermal, Hydro and Nuclear Power, CRC Press.
- B. R. Gupta, Generation of Electrical Energy, S. Chand Publication.
- Rai, G.D., Non-Conventional Energy Sources, Khanna Publishers.

Reference Books:

- Twidell, J. and Tony W., Renewable Energy Resources, Taylor & Francis.
- Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction, Academic Press, Elsevier.
- Yasuo Koizumi, Tomio Okawa and Shoji Mori, Fundamentals of Thermal and Nuclear Power Generation, Elsevier, Publisher.

Class: **S. Y. B. Tech.**	Semester: **III**
Course Code: **ECMD201**	Course Name: **Electronics Devices and Applications**

L	T	P	Credits
3	-	--	3

Course Description:
This course introduces analog and digital electronics devices along with their circuits and applications. It deals with fundamentals of analog electronic devices such as R-L-C components, Diodes and its applications, BJT and FET. It focuses on working principles of operational amplifiers, electrical parameters of Op-Amp and its applications. This course also consists of number system, their conversions, logic gates, combinational and sequential logic circuits.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe the fundamental concepts of electronics and working principles of different devices.
2. Analyze different analog and digital electronics circuits.
3. Design digital electronics circuits with truth table and logic diagram.

Prerequisite: Fundamental concepts of Mathematics and Physics.

Course Content

Unit No.	Description	Hrs
1.	**Introduction to Electronic components** Resistor, Inductor, Capacitor, Transformer, Diodes: P-N Junction Diode, Zener diode, LED, Photo diode. Applications of diodes: Rectifiers, Clippers and Clampers.	06
2.	**Bipolar Junction Transistor & Field Effect Transistor** Introduction to transistors, BJT characteristics, Common Emitter configuration of BJT. Application of BJT: Transistor as a switch, Transistor as an amplifier. Introduction & types of FET.	06
3.	**Operational Amplifiers** Block Diagram of Op-Amp, Characteristics of Op-Amp, Virtual ground concept, Inverting and Non-inverting amplifier. Linear Applications of Op-Amp: Adder, Subtractor. Non-linear Applications of Op-Amp: Schmitt Trigger, Comparator.	06
4.	**Fundamentals of Digital System** Number systems: Decimal, Binary, Octal, Hexadecimal, Binary coded decimal (BCD), Number system conversions, Binary Arithmetic, 1's and 2's complements, Logic gates.	06

5.	**Combinational Logic Circuits** Standard representation for logic functions, K-map, Minimization of logic functions using K-map, Half Adder, Full Adder, Half Subtractor, Full Subtractor, 1-Bit Comparator, Multiplexer, Demultiplexer, Encoder, Decoder.	**06**
6.	**Sequential Logic Circuits** S-R flip-flop, D flip-flop, J-K flip-flop, T flip-flop. Applications of flip-flops: Shift registers, Counters: Ripple/asynchronous counters, Synchronous counters, Counters design using flip flops, Ring counter & Twisted ring/ Johnson counter.	**06**

References:

Text Books:

- Boylestad, Robert & Louis, Nashelsky, Electronics Devices and Circuit Theory, Pearson.
- Ramakant Gayakwad, Op-Amps and Linear Integrated Circuits, PHI.
- A. Anand Kumar, Fundamentals of Digital Circuits, PHI.

Reference Books:

- Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata McGraw Hill.
- R. P. Jain, Modern Digital Electronics, Tata McGraw Hill.

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Class: **S. Y. B. Tech.**	Semester: III
Course Code: **CIMD201**	Course Name: **Data Structures**

L	T	P	Credits
3	-	–	3

Course Description:
This course considers common data structures that are used in various computational problems. Students will explore various data structures, including arrays, linked lists, stacks, queues, trees, and graphs. This course serves as a foundation for algorithmic thinking and prepares students for advanced computer science topics. The course covers various applications of data structures. The course also focuses on typical use cases for these data structures.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Explain basic terminologies of data structures.
2. Write algorithms for operations performed on data structures.
3. Demonstrate the working of various data structures like stack, queue, linked list, tree, graph, etc.
4. Compare static and dynamic representations of data structures.
5. Choose appropriate data structure while developing solution to the problem.

Prerequisite: Basics of C language.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Data Structures** Introduction to data structures, basic terminologies in data structure, Need and Applications, classification of data structures, Operations on data structures, Abstract Data Types.	06
2.	**Array Data Structures** Introduction of Array, Representation of Array, Memory allocation of Array, types of arrays, operation in array, Applications of Array, Advantages and Disadvantages of Array	04
3.	**Stack and Queue** Stack: Definition, Representation, Operations and Applications of Stack. Queue: Definition, Representation, Operations and Applications of Linear Queue, Circular queue, Deque, Priority Queue.	07
4.	**Linked Lists** Definition, Terminologies, Representation, Operations, singly linked list, Doubly linked list, Circular linked list, Stack using linked list, Queue using linked list.	07

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5.	**Trees Terminology in data Structure** Tree definition, Terminologies and Applications, Binary trees and types. Binary tree traversals, Binary search trees, AVL tree, B tree.	**06**
6.	**Graphs Terminology in data Structure** Graph Definition, Terminologies and Applications, Types of graphs, Representation of graph using adjacency matrix and adjacency list, Graph traversal Techniques: Depth first and Breath first search.	**06**

References:

Text Books:

- G. S. Baluja, Data Structure Through C: A Practical Approach, Dhanpat Rai Publications.
- S. Tanenbaum, Y. Langsam, M. J. Augenstein, Data Structure using C, PHI.

Reference Books:

- Alfred V. Aho, John E. Hopcroft, J. D. Ullman, Data structures and Algorithms, Addision Welsely Series.
- Ashok N. Kamthane, Introduction to Data Structures in C, Pearson Education.
- Yashwant P. Kanetkar, Data Structures through C, BPB Publications.

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Class: **S. Y. B. Tech**	Semester: III
Course Code: **MEMD203**	Course Name: **Design Thinking**

L	T	P	Credits
3	--	--	3

Course Description:
Maximizing the success of new products and services can drive growth and shareholder value, lead to significant competitive advantage and leapfrog a company ahead of its competitors. However, innovation is risky and most new products fail in the marketplace. Often, failure is due to an ineffective process. Thus, expertise in the design and marketing of new products is a critical skill for all managers, inside and outside of the marketing department. In this course, we first focus on the tools and techniques associated with analyzing market opportunities and then focus on designing new products and services. This course will introduce the new product development process and cover the two main areas of focus:

- Discovery - opportunity identification.
- Design - concept and product design, development and evaluation.

Course Learning Outcomes:
After successful completion of the course, student will be able to:

1. Identify the new product opportunities and sources of new product ideas.
2. Elaborate the product life cycle and product design process.
3. Integrate the customer and end-consumer needs into design process.
4. Assimilate the various product characteristics to design a novel product.
5. Participate effectively in group work sessions and teams to become acquainted with the importance of teamwork and collaboration that is critical to new product success.

Prerequisite:
Course is open to all Students. The course demands application of creativity, sensitivity towards solving problems and liking for doing something new and creative.

Course Content

Unit No.	Description	Hrs
1.	**Discovery- Opportunity Identification for New products** Product life cycle, need for new products, strategic planning and new product opportunity, sources of new product ideas, S curves and technology forecasting. Product idea generation, Product Design Process steps.	06
2.	**Creativity and Innovation** Definition, relevance of Creativity and Innovation in new product design, Improving creativity and innovation, hindrances to creative thinking, importance and formation of teams.	06

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	Improving creativity and innovation, hindrances to creative thinking, importance and formation of teams.	
3.	**Identifying Customer Needs** Understanding customer needs, Voice of the customer, gathering customer needs, organizing and prioritizing needs, Product mission statement, establishing product function.	**06**
4.	**Establishing Product Specification** Product Teardown and Experimentation, Benchmarking, Quality Function Deployment (QFD)	**06**
5.	**Product Portfolios and Portfolio Architecture** Product Architecture-types, establishing architecture, Modular design-basic clustering method, advanced functional methods	**06**
6.	**Product Concept Generation, Selection and Testing** Concept generation process and methods, Concept selection mechanism and techniques, Concept Testing-Purpose, process and methods.	**06**

References:

Reference Books:

- Ulrich, Eppinger, Anita Goel, Product Design and Development, McGraw Hill Publishing.
- Otto & wood, Product Design, Pearson Education, reprint.
- Charles Flurscheim, Industrial Design in Engineering, the Design Council, London.
- Devdas Shetty, Design for product success, Society for Manufacturing Engineering.

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Class: **S. Y. B. Tech.**	Semester: **III**
Course Code: **MCMD201**	Course Name: **Fundamentals of Mechatronics**

L	T	P	Credits
3	-	--	3

Course Description:
This course aims at providing fundamental understanding about the basic elements of a mechatronics system, interfacing, and its practical applications.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Identify various elements of mechatronics systems.
2. Select appropriate sensor for different applications.
3. Select appropriate Actuator and drives for different mechatronics application.
4. Identify suitable controller/algorithms for specific mechatronic application.
5. Analyze different circuits used for signal conditioning.
6. Develop mechatronic system for various applications.

Prerequisite: The students should have knowledge of basic electronics.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction** Introduction to Mechatronics, Key elements of Mechatronics, Block diagram of mechatronics system, Control systems and Modes of control, Difference between traditional and concurrent design process.	02
2.	**Sensors and transducers** **Transducers-** classification, Development in Transducer technology **Sensors -** Introduction, Need of Sensors, Classification, Working and Application of- Potentiometer Sensors, Strain Gauge Elements. Capacitive Elements, Eddy Current, Proximity Sensors, Inductive, Proximity Sensors, Light Sensors, Pressure Sensors, Pneumatic Sensors, Pyro electrical Sensors, Piezoelectric Sensors, Shaft Encoders. Selection of Sensors.	08
3.	**Drives and Actuators** Introduction and Classification of Actuators. Need and Scope. Hydraulic Actuation systems – Linear, Single and Double Acting system, Pneumatic Actuation systems- Gear Motors and Vane Motors. Electrical Actuation Systems – solenoid type Devices, Stepper Motors, and Servo Motor. Selection of Actuators.	06
4.	**Controllers** PLC- Introduction, definitions, PLC block diagram, Difference between Relay panel and PLC, Selection of PLC, Programming formats, Ladder logic programming. Microcontroller and Microprocessor- Introduction, Comparison of Microcontroller and Microprocessor, Architecture – Pin configuration of 8051 Microcontroller,	08

	Assembly programming.	
5.	**Signal Conditioning** Operational amplifier circuits, filtering circuits, Analog, and Digital signal conversion.	**06**
6.	**Advanced applications in mechatronics** Mechatronics in automated manufacturing, Artificial intelligence in mechatronics, Fuzzy logic in mechatronics, Case studies of mechatronics systems.	**06**

References:

Textbooks:

- Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.).
- Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education.
- A Textbook of Mechatronics, R.K. Rajput, S. Chand & Company Private Limited.
- Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.

Reference Books:

- Introduction to Mechatronics & Measurement System, David G. Alciatore, Michael B. Histand, McGraw Hill Education.

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Class: **S. Y. B. Tech**	Semester- **III**
Course Code: **AIMD201**	Course Name: **Object Oriented Programming**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces object-oriented programming using the Java programming language. Students will learn how to program in Java and use some of its most important APIs. Special importance will be assigned to the object-oriented nature of Java and its use of polymorphism. Hands-on labs and exercises will enable students toward becoming highly skilled Java Application developers.

Course Learning Outcomes:
The course should enable the students to:
1. Understand the basic object-oriented programming concepts and apply them in problem solving.
2. Illustrate inheritance concepts for reusing the program.
3. Implement program using loops, decision statements and functions in Python.
4. Plot data using appropriate Python visualization libraries.

Prerequisite: Basic Programming Skills.

Course Content

Unit No	Description	Hrs
1.	**Oops Concepts and Java Programming** OOP concepts: Procedural and object-oriented programming paradigm, Classes and objects, data abstraction, encapsulation, constructors, inheritance, polymorphism and overloading, Java programming: History of java, comments data types, variables, constants, scope and life time of variables, operators, control flow statements, arrays, console input and output, garbage collection, exploring string class.	06
2.	**Multiple Inheritance, Interfaces and Packages** Inheritance: Inheritance hierarchies, super and subclasses, preventing inheritance, Polymorphism: dynamic binding, method overriding, Interface: Interfaces VS Abstract classes, implement interfaces, accessing implementations through interface references, Packages: Defining, creating and accessing a package, importing packages.	06
3.	**Introduction to Python fundamentals** Python introduction, Python syntax, Python comments, Python variables, Python data types, Python numbers, Python casting, Python strings, Python Booleans, Python operators.	06

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4.	**Lists, Tuples, Sets, Dictionaries** Access, change, add and remove list elements, loop lists, list comprehension, list methods, access, update, unpack tuples, loop tuples, tuple methods, Access, add, remove set items, set methods, access, add, change, remove dictionary items, nested dictionaries, dictionary methods.	**06**
5.	**Python conditional statements** If-else, while, for, lambda, arrays, Python Iterators, Python scope. **Python classes and objects** Classes, objects, parameterized and non-parameterized in it constructor, object methods, self-parameter, association, aggregation and inheritance using python.	**06**
6.	**Python for Machine Learning:** Numpy, Pandas, Matplotlib and Seaborn	**06**

References:

Text Books:

- Herbert Schildt and Dale Skrien, Java Fundamentals – A comprehensive Introduction, McGraw Hill.
- Herbert Schildt, Java the complete reference, McGraw Hill, Osborne.
- Charles Dierbach, Introduction to Computer Science Using Python, Wiley India.
- Reema Thareja, Python Programming using problem solving approach, Oxford University press.

Reference Books:

- P. Radhakrishna, Object Oriented programming through Java, CRC Press.
- Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", Shroff Publishers.

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S. Y. B. Tech. Syllabus
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Department of Mechanical Engineering

Class: **S.Y. B. Tech.**	Semester - **III**
Course Code: **RAMD201**	Course Name: **Fundamentals of Robotics & Automation**

L	T	P	Credits
3	-	--	3

Course Description:
This course provides an in-depth understanding of the fundamental concepts and applications of robotics and automation. It provides an introduction to robotics, it's history and development, various types of end effectors, grippers, kinematic and dynamics of robotics, robot drive systems, sensors and actuators and fundamentals of robot programming and applications. This course also introduces the need for automation, its types and various applications of automation technology in industries.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Differentiate various robotic configurations and performance metrics.
2. Compare various end effectors, sensors, and drive systems in robotic applications.
3. Illustrate kinematic and dynamic principles applied to robotic systems.
4. Outline robot programming solutions for diverse applications.
5. Distinguish various types and aspects of automation.
6. Relate the knowledge of Programmable Logic Controllers (PLCs) to industrial automation tasks.

Prerequisite: Engineering Science Courses, Engineering Mathematics, Basic Mechanics, Programming Fundamentals.

Course Content

Unit No.	Description	Hrs
1.	**Introduction to Robots** Definition - Historical background - Various generations of robots – Robot Anatomy - Robot configuration: Polar, Cylindrical, Cartesian coordinate, Joint-arm configuration - Degree of freedom - Work volume and Dead zone - Dynamic performance: Speed of response and Stability - Precision of movement: Spatial Resolution, Accuracy, Repeatability and Compliance.	06
2.	**Robot End Effectors, Sensors and Drive Systems** **End Effectors**: Characteristic features - Types: Mechanical grippers, Magnetic grippers, Vacuum cups, Adhesive gripper, Hooks and Scoops - Tools as end effectors - Robot / End-effectors interface - Consideration in Gripper selection and Design **Sensors**: Transducers and Sensors - Sensors in Robotics: Tactile, Proximity and Range Sensors, Miscellaneous sensors and sensor-based systems - Robot Vision System. **Robot Drive System**: Hydraulic, Electric and Pneumatic.	06

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3.	**Robot Kinematics & Dynamics** Representation of objects in 3-D space-position and orientation, representation of orientation using roll, pitch and yaw angles, representation of orientation using Euler angles. Denavit - Hartenberg notations- link and joint parameters-rules for coordinate assignments, forward and inverse kinematics, Introduction to inverse and forward dynamics, determination of inertia tensor, Lagrange-Euler formation for joint torque	**06**
4.	**Robot Programming and Its Applications** Lead-through Programming, Walk-through Programming, Use of Teach pendants - Capabilities and limitations. Textural Programming: requirements of robot programming language, problems pertaining to robot programming languages, Common languages/Software used- - Robot program as a path in space Applications: Factors influencing the selection of Robots - Robots for Materials handling, Assembly, Agriculture and Chemical Plants - Advanced applications. Intelligent Robots - Introduction to Mobile Robots, Legged Robots and Remote-Controlled Robots, Automated Guided Robots, Micro Robots - Control and Safety Issues.	**06**
5.	**Introduction to Automation** Mechanization and Automation - History of Automation - Reasons for automation - Merits and limitations - Automation systems - Types of Automation: Fixed, Flexible and Programmable Automation - Intelligent Industrial Automation - Automation and Robotics.	**06**
6.	**Introduction to Programmable Logic Controller (PLCs)** Principles of operation of Programmable Logic Controller (PLC), PLC verses computer, PLC hardware components, Scan time of a cycle, Industrial PLC, Application of PLCs.	**06**

References:

Text Books:

- Mittal R K & Nagrath, Robotics and Control, McGraw Hill Publication TMH.
- S. K. Saha, Introduction to Robotics, TMH.
- Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, "Industrial Robotics, Technology, Programming & Applications", Tata McGraw Hill Education Pvt. Ltd. New Delhi.

Reference Books:

- John J Craig, Introduction to Robotics, Pearson Edu.
- Fu K.S, Robotics, McGraw Hill.
- Niku SB, "Introduction to Robotics – Analysis, Control, Applications", John Wiley & Sons Ltd.

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NPTEL Course on Robotics:

- https://onlinecourses.nptel.ac.in/noc19_me74/preview.
- https://onlinecourses.nptel.ac.in/noc20_de11/preview.

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Class: **S. Y. B. Tech**	Semester: **III**
Course Code: **ME239**	Course Name: **Fluid Mechanics Lab**

L	T	P	Credits
-	-	2	1

Course Description:
This course covers verification of theoretical concepts, calculation of coefficient of discharge of various flow apparatus and determination of losses through pipes. Student will also conduct trials on pumps, compressors and turbine and will evaluate their performance.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Verify and apply Bernoulli's Theorem.
2. Determine coefficient of discharge of fluid flow apparatus.
3. Calculate various losses through pipes.
4. Analyze flow behavior in series and parallel pipe networks.
5. Identify and classify flow regimes using Reynolds apparatus.
6. Visualize and interpret fluid flow patterns using Hele-Shaw apparatus.
7. Correlate theoretical concepts with practical applications through an industrial visit.

Course Content

Expt. No.	Description	Hrs.
1.	Verification of Bernoulli's equation.	02
2.	Calibration of Venturimeter.	02
3.	Calibration of Orifice meter.	02
4.	Determination of various hydraulic coefficients for orifice under steady and unsteady flow condition.	02
5.	Calibration of V-notch.	02
6.	Calibration of Rectangular notch.	02
7.	Determination of major losses in pipe fittings.	02
8.	Determination of minor losses in pipe fittings.	02
9.	Determination of loss of head and discharge in parallel and series pipes.	02
10.	To study types of flow by using Reynolds apparatus.	02
11.	Demonstration of flow visualization by using Hele-Shaw apparatus.	02
12.	Industrial Visit.	02

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References:

Text Books:

- R.K. Bansal, Fluid Mechanics, Laxmi Publications.
- R.K. Rajput, A Textbook of Fluid Mechanics and Hydraulic Machines, S. Chand & Company.
- D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, S.K. Kataria & Sons.
- S. Balani and R.K. Basal, Hydraulics and Fluid Mechanics, Khanna Publishers.
- H. Lamb, An Introduction to Fluid Dynamics, Cambridge University Press.

Reference Books:

- S.K. Som and G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill.
- Frank M. White, Fluid Mechanics, McGraw-Hill.

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Class: **S. Y. B. Tech**	Semester: **III**
Course Code: **ME2314**	Course Name: **Engineering Mechanics Lab.**

L	T	P	Credits
--	--	**2**	**1**

Course Description:
Engineering Mechanics Laboratory deals with performing experiments, interpreting results, and correlate theoretical and experimental results. This lab focuses on verification of Laws of forces, principle of moment, Lami's theorem, compare coefficient of friction and will be assessed through rubrics designed. It develops thinking, analytical ability and imaginative skill of student. It is an introductory course which supports study of many other advanced courses like analysis and design of various structures and machine components.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Verify law of polygon of forces, law of triangle of forces and principle of moment.
2. Verify Lami's theorem.
3. Compare coefficient of friction of various surfaces in contact.
4. Correlate theoretical and practical results of support reactions and Centroid of plane lamina.
5. Analyze a simple truss.

Prerequisite: Engineering Mathematics, Engineering Physics.

Course Content		
Expt. No.	**Description**	**Hrs.**
	I-Experiments	
1.	Law of polygon of forces.	**02**
2.	principle of moment using Bell Crank Lever.	**02**
3.	Support reactions of simple beam.	**02**
4.	Support reactions of compound beam.	**02**
5.	Lami's Theorem.	**02**
6.	Equilibrium of connected bodies.	**02**
7.	Compare value of coefficient of Friction for various contact surfaces.	**02**
8.	Analysis of simple truss.	**02**

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9.	Analysis of simple truss by graphical method	**02**
10.	Centroid of plane & composite figures	**02**
	II- Assignments: One Assignment per unit of course Engineering Mechanics	

References:

Text Books:

- Bhavikatti S. S., Rajashekarappa, Engineering Mechanics, New age International Publication (India) Pvt. Ltd. New Delhi.
- Ramamrutham S., Engineering Mechanics, Dhanpat Rai Publishing Company Ltd., New Delhi.

Reference Books:

- S. Junnarkar, Elements of Applied Mechanic, Charotar Publishing House (India) Pvt. Ltd., Anand (Gujarat).
- Ferdinand. Beer and E. Russell Johnson, Vector Mechanics for Engineers (Statics and Dynamics), McGraw Hill Publication, New York.
- Ferdinand L. Singer, Engineering Mechanics (Statics and Dynamics) Publications (India) Pvt. Ltd. Noida.
- Timoshenko and Young, Engineering Mechanics (Statics and Dynamics), McGraw Hill Publication, New York.

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Class: **S.Y. B. Tech**	Semester: **III**
Course Code:**ME2334**	Course Name: **Machine Drawing Lab**

L	T	P	Credits
--	--	2	1

Course Description:
Drawing is commonly used mode of communication in engineering industry. The potentialities of drawing as an engineer's language may be made use of as a tool for imparting knowledge and providing information on various aspects of engineering. Appropriate exposure to drawing helps the students to translate different ideas into practical applications. Acquisition of drafting skills as per standard conventions is used to make the drawing of a given object or component so that others can understand and interpret the drawing as intended by the draftsman. Industries follow drafting standards as approved by International Organization for Standards (ISO). When these are followed, drawings prepared by anyone would convey the same information to all concerned, irrespective of the firm or even the country.
This course is designed to impart the skill to interpret, to prepare machine drawings using the standard conventions and also to build on visualization power to imagine, analyze and communicate. Mechanical engineering students have to be familiar with industrial drafting practices and thorough understanding of machine drawings, so as to fit very well in industries

Course Learning Outcomes:
1. Prepare free hand sketches of engineering and working drawings with dimensions following proper BIS conventions.
2. Develop details and assembly drawings using part drawings of machine components with dimensions using CAD.
3. Apply limits and tolerances to part and assemblies and choose appropriate fits.
4. Interpret the symbols of welded, machining and surface roughness on the component drawings.
5. Apply the geometrical dimensioning and tolerances to the mechanical components.
6. Prepare details and assembly production drawings using actual measurements of part drawings of machine components with dimensions using CAD.

Prerequisite:
1. Engineering Graphics.
2. Knowledge about functioning of various mechanical components.

Course Content

Unit No	Description	Hrs.
1.	**BIS conventions and Free Hand Sketches** BIS conventions and Free hand Sketches of screwed fasteners, Keys, cotters and pin joints, shaft couplings, pipe joints, pulleys, riveted joints, welded	02

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	joints, bearings, chain and gears.	
1.	**Details and Assembly Drawing** Detailed drawings of following machine parts are given to students to assemble and draw the sectional or plain elevations / plans / and side views with Dimensioning and Tolerancing. Sleeve & Cotter joint, Spigot & Cotter joint, knuckle joint, Stuffing Box, Screw Jack, Foot step bearing, Universal Coupling, Plummer Block, Swivel Bearing, Simple Eccentric, Machine Vice, protected type flanged coupling, Connecting Rod, Tail Stock	**03**
2.	**Limits, Fits, Tolerances and Machining Symbols** Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Manual, Actual profile, reference profile, Datum Profile, Peak to valley height, Mean roughness index, surface roughness number, Machining Symbols, Indication of surface roughness.	**02**
3.	**Geometric Dimensioning and Tolerances** Introduction, Features and Rules of GD&T, Datum's Control, Adding GD&T to a Design, Form Tolerances, Orientation Tolerances, Profile Tolerances, Location Tolerances, Runout Tolerances.	**02**
4.	**Production Drawings** Preparation of production drawings and reading of part and assembly drawings.	**03**

References:

Text Books:

- K. L. Narayana, Machine Drawing, New Age International Publisher.
- P. S. Gill A Textbook of Machine Drawing, S.K. Kataria & Sons.
- N. D. Bhat, V M Panchal, Machine Drawing, Charotar Publication House.
- Junnarkar N. D. Machine Drawing, Pearson Education.

Reference Books:

- K. C. John, Textbook of Machine Drawing, PHI.
- R. K. Dhawan, A Textbook of Machine Drawing, S. Chand.

Class: **S. Y. B. Tech**	Semester: **III**
Course Code:**ME2354**	Course Name: **Workshop Practice -I**

L	T	P	Credits
--	--	2	1

Course Description:
This course is designed to make aware the students about different machining processes and understand the effect of sped, feed depth of cut. Also, they will learn Welding processes and the parameters associated with welding process.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Demonstrate effect of variables such as Voltage, current on welding process.
2. Produce given joint by MIG welding process.
3. Produce welding run on S.S. by TIG welding.
4. Produce welding run on Aluminum by TIG welding.
5. Produce given job with proper taper and V threading within dimensional tolerances ± 0.2 mm on diameter and ± 0.5 mm on length. (Job – A).

Course Content

Unit No	Description	Hrs.
1.	**Lathe Operations** Job Involving Tool Grinding, Facing, Step Turning, Taper Turning, Knurling, 'V' Threading Operations, Analyzing Machining response during these operations e.g., Surface roughness and Tool wear.	06
2.	**Advance Welding Shop** Job on TIG Welding, Job on MIG Welding, Demonstration of Stainless Steel & Aluminum Welding, Job on Plasma Arc Cutting, Job on Submerged Arc Welding, Comparison of strength of various weld joints.	06

References:

Text Books:

- Hajra Choudhary, Element of Workshop Technology vol. II, Media Promoters and Publications.
- Hajra Choudhary, Element of Workshop Technology vol. I, Media Promoters and Publications.

Reference Books:

- Raghuvansrii, Workshop Technology, vol. II, Dhanpat Rai.
- W A. J. Chapman, Workshop Technology, Part II, Oxford and IBH Publishing Co.

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Choice Based Professional Skills Development and Foreign Languages Programme
for
Second Year B. Tech.
(Sem. III and IV)

Professional Skills Development and Foreign Languages Courses

1. Professional Leadership Skills (SH2634)
2. Interpersonal Skills (SH2614)
3. Innovation Tools and Methods for Entrepreneurs (SH2694)
4. Personal Effectiveness and Body Language (SH2594)
5. German Language - Level III (SH2734)
6. German Language - Level IV (SH2644)
7. Japanese Language - Level III (SH2714)
8. Japanese Language - Level IV (SH2624)

An Important Notes:
A student has to complete any two courses out of six choices offered under Choice Based Professional Skills Development Programme. A course in each semester will be allocated without any repetition.

Foreign language course selected in F.Y. Sem-I will remain the same with next levels in Sem-III and IV. (No new entries in S.Y.B.Tech Sem.-III)

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Class: **S. Y. B. Tech**	Semester: **III/IV**
Course Code: **SH2634**	Course Name: **Professional Leadership Skills**

L	T	P	Credits
-	-	2	1

Course Description: This course is one of various courses offered under Choice Based Professional Skills Development programme. This course guides those special students who want to be entrepreneurs and professional leaders. This course covers various aspects of Leadership which includes Team formation, conflict management, motivation and presentation skills.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Explain the traits of a leadership through real life examples.
2. Exhibit the ability to work effectively in team.
3. Prepare a presentation as per the audience and context requirements.

Prerequisite: A Student, who is going to enroll for this course should have -
1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Ability to communicate moderately in English.

Minimum 12 sessions will be conducted from the following list.

Course Content		
Experiment No	**Description**	**Hrs**
1.	**SMART Goal Setting, SWOT/C Analysis and Action Plan:** Discussion on Dos and Don'ts, Advantages, and Generation of the Document by Students and its Assessment.	02
2.	**Assertiveness and Positive Thinking:** Types of Behaviour, Benefits of Being Assertive and Positive Thinking, Developing Positive Attitude, Case Studies and Presentations.	02
3.	**Self Management:** Need of Self Management, Developing Self Acceptance, Steps of Self Management, Individual Classroom Activity and its Assessment.	02
4.	**Leadership Styles and Change Management:** Introduction to Different Types of Leaderships, Effective Organizational Change Management, Individual Classroom Activity and its Assessment.	02
5.	**Team Formation and Leading a Team-I:** Why Teams? Roles and Responsibilities in Teams, Strategies for Team Development, Barriers to Teams, Steps of Team Development.	02

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6.	**Team Formation and Leading a Team – II:** Case Studies of Teams and Student Presentations.	**02**
7.	**Business Meetings and Decision Making – I:** Preparing for the Meeting, Role of Chairperson and Participants in Meetings.	**02**
8.	**Business Meetings and Decision Making – II:** Mock Meetings, Decision Making Case Studies and Feedback.	**02**
9.	**Conflict Management:** Types of Personalities, Possible Reasons of Conflicts at Work Place, Conflict Resolution Strategies, Conflict Management Case Studies and Feedback.	**02**
10.	**Time Management:** Time Management Techniques, Introduction to Time Management Tools, Benefits of Time Management, Case Studies and Presentations.	**02**
11.	**Presentation Skills – I:** Preparation, Types of Presentations - Informative, Instructional, Arousing, Persuasive, Decision-making, Presentation Tools.	**02**
12.	**Presentation Skills – II:** Body Language, Managing Questions and Student Presentations Student Presentations and Feedback, Student Presentations and Feedback.	**02**
13.	**Creative and Critical Thinking:** Approaches to Creative Thinking, Strategies for Creative Thinking, Characteristics and Strategies of Critical Thinking.	**02**
14.	**Motivating People:** Types of Motivation, Components of Motivation, Steps in Keeping Motivation Level High	**02**

References:

- Krishna Mohan and Meera Banerji; *Developing Communication Skills*, Macmillan India Ltd., New Delhi
- Masters, L. Ann et al. *Personal Development for Life and Work*, New Delhi: Cengage Learning.
- Jeff Butterfield, *Soft Skills for Everyone*, Cengage Learning India Private Limited.
- John Seely, *Oxford Guide to Effective Writing and Speaking*; Oxford University Press.
- UNLESH the power within... Soft Skills – Infosys Training Manual *Module 1 to 5* (Infosys Campus Connect Programme)

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session student will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech.**	Semester: **III/IV**
Course Code: **SH2614**	Course Name: **Interpersonal Skills**

L	T	P	Credits
-	-	2	1

Course Description: This course offers the tips and techniques to lead a life full of success, prosperity and happiness by changing the current mind set to that of positive and harmonious thinking. It further teaches upon important aspects such as priorities in life, how to manage stress, teamwork , laws of nature , human body as a divine computer , power of mind etc.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Exhibit interpersonal communication skills.
2. Demonstrate decision-making skills.
3. Apply conflict resolution styles appropriate in different situations.
4. Demonstrate skills to manage balance in work and life.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:
1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Communicate moderately using English language.

Course Content

Experiment No	Description	Hrs
1.	**Importance of Universal Laws of Nature in Human Life.-** Overview, scientific, universal, secular, usefulness in every walk and phase of life, overview of Universal Laws of Nature, determining factor in human life, important laws of nature and its influence on life of individual, family, society and world at large. wisdom, living life in tune with laws of nature	02
2.	**'You are the Architect of your Destiny' -** This unit will make you aware that none else but you alone are responsible and accountable for what you achieve in your life, freedom of decisions, choices to make up your future, guiding powers to make the choices in your life, achieving life full of health, wealth, success, peace and happiness for yourself and all.	02
3.	**Setting and Achieving Goals** – Defining your own goals in life, Concept of power of mind , concepts of interaction of conscious and	02

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	subconscious levels of mind, tips and techniques to harness the amazing power of subconscious mind to achieve goals, Visualization and auto-suggestion techniques, real life examples.	
4.	**Work-life Balance** – What is means by work-life balance, priorities in life, time management, its importance, practical tips that enable to achieve work-life balance	**02**
5.	**Art of Harmonious Thinking.** – Importance , concept of harmonious thinking, Wishful Thinking, Positive Thinking, difference between Harmonious Thinking and Positive Thinking, powerful techniques to inculcate the habit of Harmonious Thinking, concept of Spiritual Thinking , Divine Universal Prayer – the life changer, Bless All technique, benefits of chanting the prayer	**02**
6.	**Spirituality in Day-to-day Life** – Concept of Love Work, 7 dimensions of Love Work, benefits us as individual, family, society and entire human race, important to be a good human being, usefulness to become successful, tools to apply the different 'Lifeskills ' in day-to-day life, simple but powerful and useful techniques such as attitude of gratitude , attitude of win-all	**02**
7.	**Human Values** – Ethics and Human values, difference in ethics and values, Qualities of human values	**02**
8.	**Communication Skills** – Ability to commendably read, write, speak and listen by conforming knowledge and presenting in a structured, cohesive fashion, Understanding and demonstrating workplace communication in the context of organization's business, understanding one's core skills for job	**02**
9.	**Interpersonal Skills** – Presenting interpersonal skills by amiable and respecting individuals, effective listening to stakeholders, bonding and developing rapport, Team success	**02**
10.	**Decision Making** – Importance of correct decision making, Analytical thinking / mind, Information processing ability, Making sound judgment and confident decision	**02**
11.	**Cross cultured sensitizations & Adaptability** – Adapting multinational & multicultural environment, embracing diversity, culturally sensitive and bonding to colleagues and stakeholders, sense of belongings and promotion of unity at work place	**02**
12.	Evaluation of Students for their Understanding of Various Concepts Discussed.	**02**

References:

- Spiritual Wisdom in Day-to-day life – Blogs by Mr. Pralhad Wamanrao Pai
- Towards the goal of beautiful life – Book by Satguru Shri Wamanrao G. Pai
- Power of your subconscious mind – Dr. Murphy
- Seven people of highly effective people – Stephen Covey
- How to win friends and influence people – Dale Carnegie
- S. Hariharan, et al; *Soft Skills*, MJP Publishers, Chennai (2010)
- Gopalaswamy Ramesh et al. *The ACE of Soft Skills: Attitude, Communication and Etiquette for Success*, New Delhi: Pearson Education, 2012. Print.
- Masters, L. Ann et al. *Personal Development for Life and Work*, New Delhi: Cengage Learning, 2012. Print.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech.**	Semester: **III/IV**
Course Code: **SH2694**	Course Name: **Innovation Tools and Methods for Entrepreneurs**

L	T	P	Credits
-	-	2	1

Course Description: This course helps students to identify different tools for developing the solution that student has already learned to ideate in the previous course "Creativity and Design Thinking". Further, students get information about various tools to carry out competitor analysis and user journey map. It would help him to come up with detailed specifications and USP of the product based on the competitor survey.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Explain structured approach to define the problem with every possible detail, identify conflicts and solve them.
2. Apply User Journey Map to the selected problem to show user interaction at various stages.
3. Analyze the solutions provided by competitors for effectiveness and gaps if any.

Prerequisite: A Student who is going to enroll for this course should have following abilities:
1. Creativity and Innovativeness
2. Problem identification
3. Apply design thinking approach to develop working prototype
4. Structured approach to problem solving

Minimum 12 sessions will be conducted from the following list.

Course Content		
Experiment No	**Description**	**Hrs**
1.	**Systematic Innovation:** Define the problem in depth with all details, Trend prediction, Modeling the problem to identify tradeoffs and contradictions.	**02**
2.	**TRIZ:** Theory of Inventive problem solving (TRIZ), HIT Matrix, Scamper, Algorithms of brain storming and innovation, Functional Analysis.	**02**
3.	**Frugal and Disruptive Innovation:** Biomimicry and frugal innovation for prototyping, Disruptive innovation.	**02**
4.	**User Journey Map:** Map showing user interaction at every stage of product/service. Step-by step process of UJM creation.	**02**
5.	**Competitor analysis:** Analysis of competitor and users for similar products, effectiveness of existing solutions and identifications of	**02**

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	gaps.	
6.	**Product/Software Design Specifications:** Detailed specifications for better product design, detailed UI for software for clarity on user interaction, specify USPs of the product in comparison to the competitors.	**02**
7.	**Business Canvas:** Definition of a Business Model The 9 Building Blocks: 1. Customer 2. Value Propositions 3. Channels, distribution, 4. Customer relationships 5. Revenue 6. Key Resources 7. Key Activities 8. Key Partnerships 9. Cost Structure	**02**
8.	**Design Thinking (Part I):** Customer Insights, Ideation, Visual Thinking.	**02**
9.	Design Thinking (Part II): Prototyping. Storytelling. Scenarios	**02**
10.	**Institutional arrangement for Entrepreneurship Development:** Institutional arrangement for Entrepreneurship Development – DIC, ITCOT, SIDCO, NSIC, SISI, TIIC, SIDBI, Commercial Banks	**02**
11.	**Project Report:** a) Economic Aspects b) Technical Aspects c) Financial Aspects d) Production Aspects **e)** Managerial Aspects	**02**
12.	**Investor Pitch Tool:** a) Introduction b) Helpful Tips about preparation, pitchin and content sharing c) Does and Don'ts d) Introduction e) Problem f) Solution/Product/Service g) Traction h) Market Opportunities/ Size i) Competition j) Go To Market Strategies k) Financials l) Team	**02**
13.	**Revision -I**	**02**
14.	**Revision-II**	**02**

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References -

- J. Knapp. Design Sprint, Simon & Schuster Publisher.
- D. Silverstein. The Innovator's Toolkit, Wiley Publishing House.
- M. A. Orloff. ABC-TRIZ: Introduction to creative design thinking with modern TRIZ modeling, Springer Publication.
- M. Laverty. Entrepreneurship, OpenStax Publication.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech.**	Semester: **III/IV**
Course Code: **SH2594**	Course Name: **Personal Effectiveness and Body Language**

L	T	P	Credits
-	-	2	1

Course Description: This course is one of various courses offered under Choice Based Professional Skills Development programme. The course with its interactive and need based sessions helps students in knowing and managing self, set and pursue meaningful goals, and develop positive personal qualities for sustainability in today's global world.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Develop skills to build self-esteem and positive attitude.
2. Develop interpersonal skills characterized by effective communication and conflict resolution.
3. Demonstrate responsiveness towards time, stress, and health issues.
4. Interpret the non-verbal behavior of a person.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:
1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Communicate moderately using English language.

Minimum 12 sessions will be conducted from the following list.

Course Content		
Experiment No	**Description**	**Hrs**
1.	**Self-awareness and Self Esteem** Meaning, Factors influencing self-esteem- environmental and social factors Developing self-esteem- strategies for building self-esteem.	**02**
2.	**Goal Setting** Long term and short-term goals, Steps in goal setting (SMART)- - identify strategies - consider possible blocks and ways to deal with them - outline the steps - set deadlines.	**02**
3.	**Self-Analysis** SWOT Analysis, who am I, Attributes, Importance of Self Confidence.	**02**
4.	**Personality Typing** Extraversion, Introversion, Sensing, Intuition, Thinking, Feeling, Judging Perceiving.	**02**
5.	**Life Skills for Personal Effectiveness**	**02**

	Values: Punctuality, Honesty, Loyalty, Dependability, Reliability- Application of Life Skills in day - to- day life - Life Skills for Adolescents and Youth.	
6.	**Time Management** Strategies for effective time management (Principles, Planning, Identify & Control time stealers, Prioritize, Problems and Solutions, learn to say NO.	**02**
7.	**Stress Management** Sources of stress, types, signs and symptoms of stress - positive aspects of stress - negative aspects of stress.	**02**
8.	**Stress Management Techniques** Coping mechanisms, Deep Breathing Exercise, Meditation and Visual Imagery techniques, Muscle Relaxation, Peer Sharing, Emotional Intelligence.	**02**
9.	**Decision-making** Definition, Informed Decision Making, Consequences of Decision Making and Models of Decision Making.	**02**
10.	**Creative Thinking** Out-of-the box thinking, Stages of Creative Thinking, Factors hindering creative thinking, Characteristics of Creative thinkers.	**02**
11.	**Interpersonal skills** Meaning, need to develop interpersonal skills, components of interpersonal skills, techniques to improve skills, benefits with real life examples/case studies.	**02**
12.	**Art of Communication** Verbal & Non-Verbal Communication, 7'Cs of Effective Communication, Importance of Effective Communication.	**02**
13.	**Body Language – I** Non-verbal codes: Kinesics, Proxemics.	**02**
14.	**Body Language – II** Vocalics, Haptics, Appearance.	**02**

References:

- S. Hariharan, Soft Skills, MJP Publishers, Chennai.
- Gopalaswamy Ramesh, The ACE of Soft Skills: Attitude, Communication. and Etiquette for Success, New Delhi: Pearson Education.
- Jeff Butterfield, Soft Skills for Everyone, cengage Learning India Private Limited.
- UNLESH the power within... Soft Skills – Infosys Training Manual Module 1 to 5 (Infosys Campus Connect Programme).
- Masters, L. Ann, Personal Development for Life and Work, New Delhi: Cengage Learning.
- Covey, Stephen R., Seven Habits of Highly Effective People: Powerful Lessons in Personal Change.

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- Barun K. Mitra, *Personality Development & Soft Skills*, Oxford Publishers, Third impression.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)

Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech**	Semester: III
Course Code: **SH 2734**	Course Name: **German Language - Level III**

L	T	P	Credits
-	-	2	1

Course Description: This course meets the requirements of student's overall personality development. The course helps the student in learning German as a foreign language. Vocabulary building activities, grammar, reading skills and basic conversational skills are addressed in this course.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Interpret the language if the next person is speaking slowly and clearly.
2. Make use of the language in routine life with the routing topics like family, shopping, work etc.
3. Demonstrate the language by self-introduction in German with simple sentences.

Prerequisite: A Student, who is going to enroll for this course, should have following German language abilities:
1. Adequate knowledge of basic grammar of German language.
2. Intermediate level vocabulary of German language.
3. Communicate moderately using German language.

Course Content		
Experiment No	**Description**	**Hrs**
1.	Professions and their workplace Getting acquainted with different professions, usual tasks in particular profession, likes, dislikes etc.	**02**
2.	Job advertisements reading and understanding. To express oneself about his preferences for part time jobs. his likes and dislikes	**02**
3.	Short texts about finding jobs (for understanding the short paragraphs) & telephonic conversation Grammar- conjunctions and, or, but (und ,oder ,aber)	**02**
4.	Grammar-Present Perfect Tense Exercises based on present perfect tense	**02**
5.	Present perfect tense with helping verb haben and sein. Difference between these two verbs and related exercises	**02**
6.	Vocabulary of clothes and conversation while buying the clothes	**02**

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7.	Grammar- 'W' questions related to clothes(welche und diese) Exercises related to welche und diese in nominative and accusativ	**02**
8.	Grammar- present perfect tense of separable and non-separable verbs	**02**
9.	Dativ verbs Exercises related to dativ verbs	**02**
10.	Dialog between shopkeeper and customer Personal Pronomen in Dativ	**02**
11.	Orientation in the shopping mall. Understanding the floors and information on notice boards.	**02**
12.	Revision of the grammar and doubts clearing	**02**
13.	Test and presentations assigned to students during semester	**02**

References:

- Studio D – A 1, Cornelsen Verlag, Goyal Publishing House, New Delhi.
- Tangram Aktuell – A 1, Goyal Publishing House, New Delhi.
- Language A 1, Goyal Publishing House, New Delhi.
- Network A 1, Goyal Publishing House, New Delhi.

The extra notes will be provided to the students to complete the required syllabus.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session student will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech**	Semester: IV
Course Code: **SH 2644**	Course Name: **German Language - Level IV**

L	T	P	Credits
-	-	2	1

Course Description: This course exposes a learner to LSRW skills of German language. The course takes a student's German language skills to advanced level with situational conversations. The course helps learners in creating cross-cultural sensitization and adaptability skills. Here, a student prepares himself for German language examination.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Interpret the language if the next person is speaking slowly and clearly.
2. Make use of the language in routine life with the routing topics like family, shopping, work etc.
3. Demonstrate the language by self-introduction in German with simple sentences.

Prerequisite: A Student, who is going to enroll for this course, should have following German language abilities:
1. Adequate knowledge of basic grammar of German language.
2. Intermediate level vocabulary of German language.
3. Communicate moderately using German language.

Course Content

Experiment No	Description	Hrs
1.	Body parts and Krankheiten(diseases) and home remedies	02
2.	Grammar- Imperative for du ,ihr, Sie	02
3.	Health tips and conversation at clinic Modal verbs - dürfen & sollen	02
4.	Professions related to health	02
5.	Vocabulary of vacation and activities in vacation	02
6.	Writing a postcard Grammar- Pronoun - man	02
7.	Topic- Weather Reading texts related to vacation and formation of "W" questions	02
8.	Grammar revision for the entire book	02
9.	Explaining the pattern of the exam and explanation of each skill's	02

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	exam requirement	
10.	Practice for Skill "Writing" and "Speaking"	**02**
11.	Practice for skill "Reading" and "Listening"	**02**
12.	Solving exam set 1 Speaking practice	**02**
13.	Solving exam set 2 speaking practice	**02**

References:

- Studio D – A 1, Cornelsen Verlag, Goyal Publishing House, New Delhi.
- Tangram aktuell A 1, Goyal Publishing House, New Delhi.
- Lagune A 1, Goyal Publishing House, New Delhi.
- Netzwerk A 1, Goyal Publishing House, New Delhi.

The extra notes will be provided to the students to complete the required syllabus.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session student will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech**	Semester: **III**
Course Code: **SH2714**	Course Name: **Japanese Language - Level III**

L	T	P	Credits
-	-	2	1

Course Description: This course is designed to introduce students to the everyday language of Japan. Lessons are organized around natural conversational topics, leading students from fundamental aspects of grammar to readings in simple texts.

Course Outcomes:
After successful completion of the course, students will be able to,
1) Make use of basic conversations in various situations.
2) Identify the sentence patterns.
3) Explain insights about the communication required for living in Japan.
4) Interpret Japanese work ethics required in their professional career.

Prerequisite: A Student, who is going to enroll for this course, should have following Japanese language abilities:
1) Knowledge of basic grammar of Japanese Language.
2) Communicate moderately using Japanese Language.

All the 15 lab sessions will be conducted to meet the needs of following content delivery.

Course Content		
Experiment No	**Description**	**Hrs**
1	Polite way of request for something, using て forms of the verbs.	02
2	Expressions used for offering to do something.	02
3	To ask for permission to do something.	02
4	Pattern used to express prohibition.	02
5	Use of て forms of the verbs to express sequence in action.	02
6	How to join two or more than two sentences together.	02
7	How to express something done after something.	02
8	Introduction of interrogative pronouns used to specify one item out of list of 2 or more than 2 things.	02
9	Rules for adjective – adjective combinations in one sentence.	02
10	How to make ない forms of the verbs.	02

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11	Use of ない forms of the verbs to ask or to tell someone not to do something.	**02**
12	Must do pattern using なければ　なりません。	**02**
13	How to make dictionary forms of the verbs.	**02**
14	Uses Potential form できる	**02**
15	How to express the hobby.	**02**

***Note**: Words written phonetically using the Latin alphabet (*romaji*) will be only used in the very initial stage to aid learning pronunciations.

References:

- Minna No Nihongo I (3A Corporation, Japan), Publications: Goyal publishers.
- Nihongo shouhou, Publication: JALTAP

Other reference material, practice papers & CDs for listening practice.
The extra notes will be provided to the students as per the requirement of the syllabus.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **SH2624**	Course Name: **Japanese Language - Level IV**

L	T	P	Credits
-	-	2	1

Course Description: This course is designed to introduce students to the everyday language of Japan. Lessons are organized around natural conversational topics, leading students from fundamental to advanced aspects of grammar to readings in simple texts.

Course Outcomes:
After successful completion of the course, students will be able to,
1) To be able to make basic conversations in various situations.
2) To recognize the sentence patterns.
3) To improve Japanese Language proficiency.
4) To give students insights about the communication required for living in Japan.
5) To expose students to the Japanese work ethics required in their professional careers.

Prerequisite: A Student, who is going to enroll for this course, should have following Japanese language abilities:
1) Knowledge of basic grammar of Japanese Language.
2) Communicate moderately using Japanese Language.

All the 15 lab sessions will be conducted to meet the needs of following content delivery.

Course Content		
Experiment No	**Description**	**Hrs**
1	How to make た forms of the verbs.	02
2	To express "have the experience of " using た forms of the verbs.	02
3	To express two or more than two actions in one list using た forms of the verbs.	02
4	Polite forms & plain forms (Style of speech)	02
5	Conversation in plain forms & polite forms.	02
6	To express ideas or judgements.	02
7	Report speech.	02
8	To express recommendation, suggestion.	02
9	How to seek agreement or confirmation from the listener.	02
10	Noun modification.	02

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11	Describing an appointment, errand.	**02**
12	Rules while using とき	**02**
13	Verbs used for giving & receiving of things (polite & plain forms)	**02**
14	Conditional forms of verbs, adjectives & nouns.	**02**
15	Subject of subordinate clause.	**02**

***Note**: Words written phonetically using the Latin alphabet (*romaji*) will be only used in the very initial stage to aid learning pronunciations.

References:

- Minna No Nihongo I (3A Corporation, Japan), Publications: Goyal publishers.
- Nihongo shouhou, Publication: JALTAP
- Other reference material, practice papers & CDs for listening practice. The extra notes will be provided to the students as per the requirement of the syllabus.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ME2124**	Course Name: **Mechanics of Solids**

L	T	P	Credits
3	--	--	3

Course Description:
Mechanics of Solids is more concerned with the internal forces and associated changes in the geometry of the components involved. Of particular importance are the properties of the materials used, the strength of which will determine whether the components fail by breaking in service, and the stiffness of which will determine whether the amount of deformation they suffer is acceptable. Therefore, the course the Mechanics of Solids is central to the whole activity of engineering design. Usually, the objectives in analysis here will be the determination of the stresses, strains, and deflections produced by loads. Theoretical analysis and experimental results have equal roles in this field.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Determine types of stresses and strains induced in any machine component.
2. Draw Shear force and bending moment diagram for different types of beams.
3. Develop bending stress distribution and shear stress distribution for various cross sections of beam.
4. Estimate the slope and deflection of beams by analytical and graphical method.
5. Find the principal stress and strain for plain stress system.
6. Analyze axially loaded column for different end conditions.

Prerequisite:
Knowledge of Applied Mechanics and Engineering Mathematics.

Course Content

Unit No	Description	Hrs
1.	**Simple stresses and strains** Concept of stress and strain (linear, lateral, shear and volumetric), Elastic constants and their relationship, Stresses, strains and deformation in determinate, homogeneous and composite bars under concentrated loads, thermal stresses. **Torsion of shaft** Derivation of torsion formulae, stresses and deformation in determinate shafts of hollow, solid.	06
2.	**Shear force and bending moment diagrams** Concept and definition of shear force and Bending Moment in beams due to concentrated load, UDL, uniformly varying loads and couples in determinate beams. Relation between SF, BM and intensity of loading, construction of SF and BM diagrams for beams.	06

3.	**Flexural Stresses** **Bending Stress:** Theory of simple bending, concept and assumptions, Derivation of Flexure formula. Bending stress distribution diagram for various cross sections of a beam. **Shear stress**: Shear stresses concept, derivation of shear stress distribution formulae. Shear stress distribution diagram for various cross sections of a beam. viz. Rectangular, Circular, and I section.	**06**
4.	**Slope and Deflection of Beams** Concept and definition, relation between B.M., slope and deflection by double integration method and Moment area method, Macaulay's method for Simply Supported and cantilever beams.	**06**
5.	**Principal stresses** Normal and shear stresses on any oblique planes and concept of principal stress and Principal planes by analytical and graphical methods (Mohr's circle of stress 2-D).	**06**
6.	**Axially Loaded columns** Concept of critical load and buckling, derivation of Euler's formulae for buckling load with hinged ends, concept of equivalent length for various end conditions. Limitation of Euler's formulae, Rankine's formulae.	**06**

References:

Text Books:

- Ramamurthum, Strength of Materials, Dhanpat Rai and Sons, New Delhi.
- R.K. Rajput, Strength of Material, Laxmi Publication, New Delhi.

Reference Books:

- G.H. Rider, Strength of Material, Mac Millan India Ltd.
- Ferdinand P Beer and E.R. Johnston JR. John Dewolf, Mechanicas of Materials, McGraw Hill Book company.
- Gere &Timoshenko, Mechanics of Material, CSB Publisher.
- Timoshenko and Young, Elements of Strength of Materials, East-West Press. Pvt. Limited, New Delhi.
- Hibbler, Mechanics of Materials, Pearson Education Publication.
- Den Hartong, Strength of Materials, McGraw Hill, New York.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ME2144**	Course Name: **Material Science & Metallurgy**

L	T	P	Credits
3	–	–	3

Course Description:
Material Science & Metallurgy is offered as the course at the Fourth semester of Mechanical Engineering undergraduate programme. It focuses on fundamentals in Material Science as preparation of equilibrium diagrams from cooling curves, determination of mechanical properties from crystal structures, macrostructures and microstructures. It covers the important part of material testing i.e. Destructive and Non-destructive testing which is important in evaluation of mechanical properties and determination of flaws in materials. In this course students are introduced to important equilibrium diagrams of Ferrous and Nonferrous families, different alloys on the diagrams with their properties and applications. The course also covers fundamentals of heat treatment processes of steel and the improvement in mechanical properties by various heat treatment processes. The whole notion of this course is selection of materials for various engineering applications.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain different alloys, their properties and applications by referring equilibrium diagrams.
2. Determine mechanical properties by destructive testing methods.
3. Detect flaws in components by non-destructive testing methods.
4. Select suitable heat treatment to achieve desired changes in mechanical properties of steels.
5. Select suitable material for given engineering applications.
6. Explain manufacturing of a component by using powder metallurgy.

Prerequisite:
1. Atomic structures in metals.
2. Types of bonds in metals.

Course Content

Unit No	Description	Hrs.
1.	**Metals and Alloy Systems** Crystal structure in metals (BCC, FCC, HCP), Imperfection in crystals, nucleation, solidification and growth, cooling curves, Solid solutions and intermediate phases, Construction of equilibrium diagrams from cooling curves, components of different solubility in liquid and solid state, Lever arm	06

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	principles, dendritic structure and coring.	
2.	**Phase diagrams for Ferrous alloys** Fe-Fe3C Diagram, Plain carbon steels, Steel specifications, Alloy steels- Free cutting steels, HSLA, Maraging steels, creep resisting steels, Different types of Stainless steels, tooling materials such as hot work, cold work tool steels, high speed steel, cast iron.	**06**
3.	**Principles of Metallurgical Testing** **Destructive Testing methods:** Tensile, Compressive, Impact, Fatigue, Creep, Hardness. **Non- Destructive Testing:** Dye Penetrant, magnetic, ultrasonic, Radiography, Eddy Current testing.	**06**
4.	**Non-ferrous alloys, Non-metallic and Advanced materials** Alloys of Copper, Aluminium, Magnesium, Titanium, Other alloys of lead, tin, zinc, nickel, manganese, white metals and bearing alloys, Polymers, ceramics, Composites, smart materials, Nano materials, Bio materials.	**06**
5.	**Heat Treatment Processes** Transformation products in steel upon cooling and heating, TTT Diagram and CCT Diagram, Effect of alloying dements on TTT diagram and its significance, Annealing, Normalizing, Hardening and tempering, Mechanism of quenching Surface hardening, Flame hardening and other heat treatment processes, Heat treatment defects and remedies.	**06**
6.	**Powder Metallurgy & Material Selection** Introduction to Powder Metallurgy and its applications. Relationship between material selection, material properties and material processing, Criteria for selection of engineering materials, Selection of materials for strength, toughness, fatigue and creep, Case studies in material selection.	**06**

References:

Text Books:

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

Reference Books:

- William D. Callister, Materials Science and Engineering an Introduction, John Wiley & Sons.
- Vijendra Singh, Engg. Physical Metallurgy, Standard Publishers Delhi.
- Prabhudev, Heat treatment of Steels, HMT Handbook.
- S. H. Avner, Physical Metallurgy, Tata McGraw-Hill publication.
- F.A.A. Cranes & J.A. Charles, Selection and Uses of Engineering Materials, Butterworth & Com.Ltd., London.

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Class: **S. Y. B. Tech.**	Semester: IV
Course Code: **ME 4894**	Course Name: **Kinematics of Machines**

L	T	P	Credits
3	--	--	3

Course Description:

Basically, Kinematics of machines course deals with study of machines & mechanisms with and without consideration of forces causing the motions in these (kinetics & kinematics). The subject under consideration, i.e. Kinematics of Machines is concerned with kinematics part i.e. study of machines & mechanisms without considering the forces causing motions in these. The major focus is on determination of displacement, velocity & acceleration of different links of the mechanisms using different methods like Graphical method, analytical methods etc. This is required further for kinetic analysis of the mechanisms. Apart from above, generation of cam profile, study of synthesis & governors, toothed wheels and gear train are the major contents of the syllabus.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Select suitable mechanisms for given application.
2. Analyze the mechanism for velocity and acceleration.
3. Design the CAM for given condition.
4. Apply appropriate power transmission method for mechanical system.
5. Analyze kinematically flywheel, governor and gear system.
6. Synthesize given mechanical system.

Prerequisite:

The prerequisite for study of this course is that students should have complete course of Applied Mechanics. In addition, the students should have adequate knowledge about graphical skills and analytical skills.

Course Content

Unit No	Description	Hrs.
1.	**Unit No. 1 Fundamentals of kinematics and Mechanisms** Kinematic links, pairs, and chains. Constrained motions, Machine, Mechanism & Structure, Kutzbach criteria, Grublers criteria, Inversion : definition , types Inversions of four bar chain, Slider crank chain, double slider crank chain and its inversions.	**08**
2.	**Unit No. 2 Analysis of Mechanism** Relative velocity method, Relative Acceleration Method , Coriolis component of acceleration. Velocity analysis by Instantaneous centre method, Velocity and acceleration analysis by Klein's Construction Method.	**04**

3.	**Unit No. 3 Cams** Types of cams and followers, Analysis of standard motions to the follower, Determination of cam profiles for given follower motion, Analysis of cams with specified contours cams and circular arc cam, Tangent cam, jumping of follower.	**06**
4.	**Unit No. 4 Mechanical Power Transmission** Belts: Types of belts & rope drives, calculation of length & power transmitted, Belt tension ratio, sleep & creep of belt. Chain drive: Classification, length, angular speed ratio, classification of chains. Toothed Gears: Geometry of motion, Gear geometry, Types of profiles Involute & Cycloidal, theory of spur, Helical and Spiral gears, Interference in involute tooth gears and methods for its prevention, path of contact, arc of contact, contact ratio. Gear trains.	**06**
5.	**Unit No. 5 Gear Trains, Flywheel and Governor** **Gear Trains:** Types, Tabular method for finding speeds of elements in epicyclic gear train, Differential gear box. **Flywheel:** Introduction, Turning moment diagram for different engines, fluctuation of energy, determination of maximum fluctuation of energy, coefficient of fluctuation of energy, coefficient of fluctuation of speed, Energy stored in flywheel, Dimensions of the flywheel rim. **Governor:** Types, Porter and Hartnell governor, Controlling force and stability of Governor, hunting, sensitivity, isochronisms, Governor effect and power insensitiveness of Governor	**06**
6.	**Unit No. 6 Synthesis of Mechanisms** Steps in synthesis process: Type, number and dimensional synthesis. Tasks of Kinematic synthesis: Path, function and motion generation (Body guidance). Precision Positions, Chebychev spacing, Mechanical and structural errors. Graphical synthesis: Two and three position synthesis using relative pole method and inversion method for single slider crank and four bar mechanism. Freudenstein's equation for four bar Mechanism, Three position function generation using the equation	**06**

References:

Text Books:

- Charles E. Wilson and J. Peter Sadler, Kinematics and Dynamics of Machinery, Pearson Education Inc.
- Ratan S.S, Theory of Machines, Tata McGraw Hill New Delhi.
- P. L. Ballany, Theory of Machines & Mechanism, Khanna Publication, New Delhi.
- V.P. Singh, Theory of Machines, Dhanpat Rai and Sons.
- Phakatkar,Theory of Machines I and II, Nirali Publication, Pune.
- Dr. R.K.Bansal, Theory of machines, Laxmi Publication.

Reference Books:

- Thomas Bevan, Theory of Machines, CBS Publishers, New Delhi.

- Shigley, Theory of Machines and Mechanism, McGraw Hill, New York.
- J.S. Rao and R.V. Dukipatti, Theory of Machines and Mechanism, New Age Int. Publications Ltd. New Delhi.
- Shah and Jadhawani, Theory of Machines, DhanpatRai& Sons.
- Abdullah Shariff, Theory of Machines, McGraw Hill, New Delhi.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ME238**	Course Name: **Computer Programming C++**

L	T	P	Credits
2	--	--	2

Course Description:
Object-Oriented Programming (OOP) is a well-established and widely adopted programming paradigm known for its effectiveness in managing software complexity and promoting code reusability and modularity.
This course introduces students to the core principles of OOP, such as classes, objects, inheritance, polymorphism, and encapsulation. Emphasis is placed on developing secure and efficient programs applicable to mechanical engineering contexts, including handling file-based data storage and generating basic geometric visualizations.

Prerequisite: Knowledge of C Programming.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply object-oriented programming principles to design modular and reusable code using classes, objects, data abstraction, and encapsulation.
2. Develop efficient C++ programs by implementing function overloading, operator overloading, constructors, destructors, and friend functions.
3. Implement various forms of inheritance and resolve ambiguity in multiple inheritance situations.
4. Implement various file handling techniques by creating, opening, closing files and performing read, write and append operations.
5. Write C++ programme to draw simple geometric shapes.

Prerequisite: Knowledge of C Programming.

Course Content

Unit No	Description	Hrs
1.	**OOPs Concept** Procedure Oriented Programming and its drawbacks, Structure. Object Oriented Programming Concept and its benefit, class, object, data member, member function, visibility mode. Arrays of objects, arrays in objects.	06
2.	**Functions in C++** Inline function, friend function, function overloading, operator overloading, constructor, destructor.	06
3.	**Inheritance** Inheritance definition. Public/Private/Protected derivation. Types of inheritance: single, multilevel, multiple, hierarchical, hybrid, virtual base class.	06

4.	**Working with files & C++ Graphics** Creating/opening, closing a file for writing, reading & appending operations. C++ Graphics: Generating 2D graphics shapes using C++ program. Use of graphics functions such as: initgraph(), closegraph(), line(), circle(), rectangle(), setcolor(), etc.	**06**

References:

Text Books:

- Balguruswami, Object Oriented Programming, Tata McGraw Hill Publications.
- Yashwant Kanitkar, Let us C++, BPB Publication

Reference Books:

- Herbert Schildt, The Complete Reference C++, McGraw Hill Publication.
- Robert Lafore, Object Oriented Programming in Turbo C++, Galgotia Publications Pvt Ltd, New Delhi.
- Bjarne Stroustrup, An Overview of C++ Programming Language, Addison Wesley Longman, Inc.
- Henricson and Erik Nyquist, Programming in C++: Rules and Recommendations, ftp-able postscript file, Ellemtel Telecomunication Systems Laboratories.

Multidisciplinary Minor- II

Class: **S. Y. B. Tech.**	Semester: **IV**
Course Code: **CEMD202**	Course Name: **Building Estimation and Valuation**

L	T	P	Credits
3	--	--	3

Course Description:
Building Estimation and Valuation course intends to develop the proficiency and confidence of the students so that they can prepare estimate of different civil engineering structures. The students will be able to analyze the rate of different building items. Thus, by studying this course, students will be more comfortable to prepare different bills on construction site.

Course Outcomes:
After successful completion of the course, student will be able to,

1. Explain the types and basic requirements of the estimate.
2. Explain measurement sheet, abstract sheet, and detailed specifications of different construction items.
3. Prepare detailed estimate of load bearing structure and framed structure.
4. Prepare rate analysis and bar bending schedule of different construction items.
5. Explain the tenders and contracts.
6. Describe basic terms of valuation.

Prerequisite: Unit conversions and the fundamental information of different construction materials with their rates.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction SSR** General introduction to Quantity surveying, Purpose of estimates, Types of Estimates- Approximate and Detailed, Various items to be included in estimates of building, road and culvert with their modes of measurement, I.S. 1200, Prime cost, Provisional sums , Provisional quantities, Administrative approval and technical sanction to estimates. Introduction to S.S.R., General notes and guide lines.	06
2.	**Specifications** Specification- purpose and types, General specifications for different class of buildings, Detailed specifications of building items like PCC, RCC, brick and stone masonry, plastering, flooring. Measurement sheet, Abstract sheet, Long wall-short wall and center line method for finding quantities and problems.	06
3.	**Detailed estimate of building, road and culvert** Detailed estimate of load bearing structures and RCC structures.	06

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4.	**Rate Analysis and Schedule of Reinforcement** Importance of rate analysis, Factors affecting the cost of materials, labour, Task work, Transports, Overhead charges, market rates of various materials, labours. Rate analysis preparation of PCC, RCC, brick and stone masonry, plastering, pointing, flooring. Preparation of bar bending schedule for isolated footings, pile footings, beams, columns, slabs, staircase, lintel, chajja.	**06**
5.	**Introduction of Tender and Contracts** Tender- Notice, Documents, Procedure and Types, Contract- Types, Conditions, Earnest money, Security deposit, Validity period, Defect liability period, Liquidated and liquidated damage, Arbitration, Escalation of cost, Daily reports maintained on site.	**06**
6.	**Valuation** Definition, Necessity, Cost, Price, Value, Types of values, Depreciation and obsolescence, Sinking fund, Methods of calculating depreciation, Annuity, Year purchase, Land valuation, Methods of land and building valuation, Methods of valuation, Freehold and leasehold property, types of lease, Mortgage, Mortgage deed and Precautions, Problems based on valuation.	**06**

References:

References Books:

- B. N. Dutta, "Estimating and Costing in Civil Engineering", USB Publishers, Distributors Pvt. Ltd. Delhi-110 002.
- M. Chakroborty, "Estimating, Costing, Specification and Valuation in Civil Engineering", USB Publishers, Bhabananda Road, Kolkata-700026.
- B. S. Patil, "Civil Engineering Contracts and Estimates", Universities Press Private Ltd. Hyderguda, Hyderabad. 500029, (A.P), India.
- S.C. Rangwala, "Elements of Estimating and Costing", Charotar Publishing House - opposite Amul dairy, court Road Anand. 388001.India

I. S. Code:

- Updated I. S. 1200
- Updated S. S. R.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **CSMD202**	Course Name: **Problem Solving using JAVA**

L	T	P	Credits
2	-	2	3

Course Description:
This course introduces object-oriented programming using the Java programming language. Students will learn how to program in Java and use some of its most important APIs. Special importance will be assigned to the object-oriented nature of Java and its use of polymorphism. Hands-on labs and exercises will enable students toward becoming highly skilled Java Application developers.

Course Learning Outcomes:
After successful completion of the course, strudels will be able to:
1. Understand the basic object-oriented programming concepts and apply them in problem solving.
2. Apply concept of inheritance for code reusability.
3. Develop Programs using multithreading.
4. Develop data-centric applications using JDBC.
5. Design the basics of java console and GUI based programming.

Prerequisites:
Concepts of C programming language.

Course Content

Unit No.	Description	Hrs.
1.	**OOPS Concepts and Java Programming** OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, polymorphism, Java programming: History of java, comments data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control structure, simple java standalone programs, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection.	05
2.	**Interfaces and Packages** Interface: Interfaces VS Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface; Packages: Defining, creating and accessing a package, understanding CLASSPATH, importing packages.	04

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3.	**Exception Handling and Multithreading** Exception Handling: Benefits of exception handling, the classification of exceptions, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions, exception specification, built in exceptions, creating own exception sub classes. Multithreading: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.	**04**
4.	**Files Handling** Files: streams, byte streams, character stream, text input/output, binary input/output, random access file operations, file management using file class.	**03**
5.	**Connecting to Database** Introduction of different types of drivers for database connectivity, querying a database and processing the results, updating data with JDBC.	**04**
6.	**GUI Programming** GUI Programming with Java: The AWT class hierarchy, introduction to swing, swings Vs AWT, hierarchy for swing components. Containers: JFrame, JApplet, JDialog, Jpanel, overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications. Layout management: Layout manager types, border, grid and flow.	**04**

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

Course Content		
Exp. No.	**Description**	**Hrs.**
1.	Implement Arrays, Control and Looping Statements.	**02**
2.	Implement Access Control and Inheritance.	**02**
3.	Implement Polymorphism, Abstraction and Inner class.	**02**
4.	Implement Static and this keyword.	**02**
5.	Implement Creating package for Custom Exception Interfaces and Vectors.	**02**
6.	Implement Class, Object, String classes.	**02**
7.	Implement Multithreading in Java.	**02**
8.	Implement File System interaction.	**02**
9.	Implement GUI Design using AWT.	**02**
10.	Implement GUI Design using Swing.	**02**

References:

Text Books:

- Herbert Schildt and Dale Skrien, Java Fundamentals – A comprehensive Introduction", McGraw Hill.
- Herbert Schildt, "Java the complete reference", McGraw Hill, Osborne.
- T. Budd, "Understanding Object- Oriented Programming with Java", Pearson Education.

Reference Books:

- P. J. Dietel and H. M. Dietel, Java How to program, Prentice Hall.
- P. RadhaKrishna, "Object Oriented programming through Java", CRC Press.
- S. Malhotra and S. Choudhary, "Programming in Java", Oxford University Press.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **EEMD202**	Course Name: **Power System**

L	T	P	Credits
3	--	--	3

Course Description:
The power system comprises of generation, transmission and distribution of electric power This course covers economics of power generation using different types of generating sources. Different types of loads in power system, Moreover, this course covers importance of power factor in power system and different types of tariffs. Overview of transmission and distribution systems.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Write the basic working principles of different generating sources.
2. Analyze different types of loads.
3. Explain importance of power factor and tariffs in power system.
4. Identify various components in power transmission and distribution system.
5. Select substation equipments as per requirement.

Prerequisite: Basic Electrical Engineering, Basic Mathematics and Physics.

Course Content

Unit No	Description	Hrs
1.	**Power Generation** Structure of power system, generating stations – operation and working of conventional and nonconventional energy sources. Comparison between Them.	06
2.	**Variable load on power stations** Load curves and types of loads – base and peak loads, cost of electrical energy, depreciation and its methods.	06
3.	**Power factor and Electric Tariff** Power triangle, power factor and causes of low power factor and methods of power factor improvement. Tariff and its characteristics.	06
4.	**Electrical and Mechanical Design of Transmission lines** Construction of transmission lines and its components, line resistance, inductance and capacitance. Sag and its calculation, String efficiency.	06
5.	**Supply systems** AC and DC transmission systems and comparison. Overhead and underground system, Construction of cables and types.	06
6.	**Substation** Classification of substations, outdoor and indoor substations. Symbols for equipments in substations and their functions.	06

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References:

Text Books:

- V.K Mehta, Principles of Power Systems, S. Chand.
- Ashfak Husain, Electrical Power System, CBS Publication.

Reference Books:

- S.Sivanagaraju and S. Satyanarayana Electric Power Transmission and Distribution, Pearson.
- W.D. Stevenson (Jr.), Elements of Power System Analysis, McGraw Hill International.

Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ECMD202**	Course Name: **Electronics Communication Systems**

L	T	P	Credits
3	-	-	3

Course Description:
Analog and Digital Communication are the fundamental and core subjects in Electronics and Telecommunication Engineering. The course provides knowledge of basic principles of communication, modulation and demodulation techniques, transmission and reception methods in analog as well as digital communication.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Describe different communication systems.
2. Explain applications of analog and digital modulation techniques.
3. Analyze different modulation and demodulation techniques.
4. Explain the use of satellite communication.

Prerequisite:
Fundamental concepts of engineering and Mathematics.

Course Content

Unit No	Description	Hrs
1.	**Amplitude Modulation & Demodulation** Electromagnetic spectrum, Introduction to communication system, Need for modulation. Amplitude Modulation, Definition, Time domain and frequency domain description, power relations in AM waves. Generation of AM waves, Detection of AM Waves.	06
2.	**Frequency Modulation & Demodulation:** Introduction of FM, Description of systems, Mathematical representation of FM, Frequency Spectrum of FM wave, Phase modulation, Intersystem comparisons, Pre-emphasis and de-emphasis, Generation of Frequency Modulation and Demodulation methods, Angle Modulation.	06
3.	**Radio Receivers:** Function of AM receiver, receiver parameters: Sensitivity, Selectivity, Dynamic Range, Tracking, Fidelity, Receiver Types- Tuned Radio Frequency (TRF) receiver, AM Receiver- RF section, Mixer, IF Frequencies and Amplifiers, FM Receivers- Common circuits, Comparison with AM receivers, Amplitude Limiting.	06
4.	**Digital Modulation Techniques:** And Data Formats Data Formats, ASK, FSK, PSK, coherent and non-coherent reception, BPSK, DPSK, QPSK, 16-QAM, MSK, Waveforms and Comparison of digital modulation	06

5.	**Satellite Communication:** Basic concepts of Satellite Communications, Satellite subsystems, Satellite Link design, Orbital Mechanics,	**06**
6.	**Satellite Application:** DBS, VSAT, GPS, Case Studies – Mars Mission, Chandrayan.	**06**

References:

Text Books:

- K.Sam Shanmugan, Digital & Analog Communication Systems, Wiley India.
- RP Singh, S D Sapre, Communication System-Analog & Digital, Tata Mc-Graw Hill.
- Kennedy, Davis, Electronics Communication Systems, Tata McGraw Hill.

Reference Books:

- Bernard Sklar, Digital Communication-Fundamentals and Applications, Pearson Education.
- Tomasi, Electronic Communication Systems Pearson Education.
- Taub, Schilling, Principles of communication systems, Tata McGraw Hill.
- Louis E Frenzel, Communication Electronics Principles & Applications, Tata McGraw Hill.

Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **CIMD202**	Course Name: **Computer Algorithms**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces students to the design of computer algorithms, as well as analysis of sophisticated algorithms. It contains design and analysis of algorithms to solve wide variety of problems including searching, sorting and graph algorithms. It covers various techniques that can be used to solve new problems you face, like divide and conquer, greedy algorithms, dynamic programming etc.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Analyze asymptotically the performance of algorithms.
2. Compare and analyze searching and sorting algorithms.
3. Apply different algorithm design techniques to solve problems like job sequencing, knapsack, TSP, finding shortest path etc.
4. Apply backtracking method to solve problems like N-queens, graph coloring, sum of subsets etc.
5. Describe computational complexity theory to classify computational problems according to their inherent difficulty.

Prerequisite: Basic knowledge of Mathematics.

Course Content

Unit No	Description	Hrs
1.	**Introduction** Introduction, Characteristics of algorithm, Pseudocode conventions, Recursive algorithms, Performance analysis – time and Space complexity, asymptotic notations.	05
2.	**Searching and Sorting Methods** Linear Search, Binary Search, Bubble sort, Quick Sort, Merge Sort, Selection Sort, Insertion sort, Radix Sort, Bucket Sort. Divide and Conquer- General method, Finding the maximum and minimum, Strassen's matrix multiplication.	07
3.	**Greedy Method** General method, Knapsack problem, Job sequencing with deadlines, Minimum-cost spanning trees – Prim's And Kruskal's algorithms, Optimal storage on tapes, Single source shortest paths.	05
4.	**Dynamic Programming** General method, Multistage graphs, All pair shortest paths, 0/1 Knapsack	07

	problem, Reliability design, Traveling sales person problem.	
5.	**Backtracking** General method, n-Queens problem, Subset sum problem, Graph coloring problem, Travelling sales person problem.	**06**
6.	**Introduction to Complexity Theory** The P and NP Classes, Polynomial, time reductions, NP- Hard and NP-Complete classes. NP-Hard graph problems- Clique decision problem, Vertex cover problem, Travelling sales person decision problem, Randomized algorithms.	**06**

References:

Text Books:

- Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, "Fundamentals of Computer Algorithms", Universities Press.
- Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms" The MIT Press.

Reference Books:

- Sara Baase & Allen VanGelder "Computer Algorithms: Introduction to Design & Analysis", Addision Wesley.
- Alfred V. Aho, "The design and analysis of computer algorithms", Addison-Wesley Pub.

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Class: **S. Y. B. Tech**	Semester: IV
Course Code: **MEMD204**	Course Name: **Behavioral Engineering and Design**

L	T	P	Credits
3	--	--	3

Course Description:
This course delves into the principles and practices of behavioral engineering and design as applied to the creation of new products, encompassing physical consumer goods as well as software and mobile applications. Through theoretical exploration and hands-on projects, students will learn how to design products that effectively influence user behavior and enhance user experience.

Course Learning Outcomes:
After successful completion of the course, student will be able to:

1. Explain key concepts and theories related to influencing user behavior in product design.
2. Utilize psychological principles to develop product designs that effectively address user needs and preferences.
3. Create products that demonstrate high levels of user engagement, measured through metrics such as adoption rates, user interaction patterns, user satisfaction and usability.
4. Incorporate aesthetic appeal into product designs, assessed through objective criteria such as visual appeal ratings.
5. Incorporate ergonomic considerations into product designs assessed through objective criteria such as user comfort.

Prerequisite: Course on Design Thinking.

Course Content		
Unit No.	**Description**	**Hrs**
1.	**Behavioral Engineering and Design for Product Innovation:** Overview of behavioral engineering and its relevance in product design, Key concepts and theoretical frameworks, Understanding the role of psychology in product development, Ethical considerations in designing products for behavior change	06
2.	**Human Behavior and Product Design:** Psychological principles influencing user behavior, Factors affecting consumer decision-making, User experience (UX) design principles for physical and digital products, Designing for emotional engagement and user satisfaction	06

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3.	**Applying Behavioral Insights in New Product Development:** Integrating behavioral research into the product design process, Behavioral design techniques for enhancing product adoption and usage, Case studies of successful products leveraging behavioral engineering principles, Hands-on exercises in applying behavioral insights to product ideation and prototyping	06
4.	**Persuasive Design for Consumer Products:** Principles of persuasive design in consumer product development, creating compelling product experiences through persuasive techniques, Designing for habit formation and behavior change, Ethical considerations in persuasive product design.	06
5.	**Aesthetics:** Principles of aesthetic design and its impact on user perception, Integrating aesthetics with functional design requirements	06
6.	**Ergonomics in Product Design:** Understanding anthropometrics and ergonomics in product design, Case studies of products exemplifying successful integration of aesthetics and ergonomics	06

References:

Reference Books:

- Nir Eyal, "Hooked: How to Build Habit-Forming Products", Penguin Books Limited.
- Don Norman, "The Design of Everyday Things", Basic Books Publication.
- Stephen Anderson, "Seductive Interaction Design: Creating Playful, Fun, and Effective User Experiences", New Riders Publication.
- William Lidwell, Kritina Holden, and Jill Butler, "Universal Principles of Design", Rockport Publishers.
- Mark S. Sanders and Ernest J. McCormick, "Human Factors in Engineering and Design", McGraw-Hill Publication.

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Class: **S. Y. B. Tech.**	Semester: IV
Course Code: **MCMD202**	Course Name: **Industrial Fluid Power**

L	T	P	Credits
3	-	--	3

Course Description:
Fluid power has the highest power density of all conventional power-transmission technologies. Learn the benefits and limitations of fluid power, how to analyse fluid power components and circuits, and how to design and simulate fluid power circuits using Automation Studio for applications.
In this course, you will be introduced to the fundamental principles and analytical modelling of fluid power components, circuits, and systems. You will learn the benefits and limitations of fluid power compared with other power transmission technologies; the operation, use, and symbols of common hydraulic & pneumatic components; how to formulate and analyse models of hydraulic & pneumatic components and circuits; and how to design and predict the performance of fluid power circuits.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain the structure and function of common hydraulic and pneumatic components such as cylinders, valves, pumps, and motors etc.
2. Model and analyze common hydraulic and pneumatic components such as cylinders, valves, pumps, and motors.
3. Create & simulate basic hydraulic and pneumatic circuit diagrams for different applications.
4. Design, develop & analyze simple hydraulic and pneumatic systems for given task.

Prerequisite: Fundamental concepts of fluid mechanics, basic electrical engineering, and engineering mechanics.

Course Content

Unit No.	Description	Hrs.
1.	**Fluid Power Systems and Fundamentals** Introduction to fluid power, Advantages of fluid power, Application of fluid power system, Types of fluid power systems, Properties of hydraulic fluids, General types of fluids, Fluid power symbols. (ISO/JIC), Use of Automation studio to draw circuits.	06
2.	**Hydraulic System and Components (Pumps and Actuators)** Pumping theory, Pump classification, Gear pump, Vane Pump, construction and working of pumps, pump performance, piston pump, Variable displacement pumps, Linear hydraulic actuators, Types of hydraulic cylinders, Single acting, Double acting cylinders, Special cylinders like tandem, Rod less, Telescopic - Construction and application, Cushioning	06

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	mechanism, Mounting of actuators, Rotary actuators - Gear, Vane and Piston motors.	
3.	**Hydraulic Valves, Accumulators and Circuits** Directional control valve .4/2, 4/3, 5/3-way valves, Shuttle valve check valve, Pressure control valve, Flow control valve (Fixed and adjustable), Electrical control solenoid valves, Types of accumulators, Accumulators circuits, Intensifier Circuit and Application, Speed control circuits, synchronizing circuit and industrial application circuits copying circuit and press circuit, regenerative circuit.	**06**
4.	**Pneumatic Systems, Components and Circuits** Properties of air Compressors, Filter, Regulator, and Lubricator Unit, Air control valves, Quick exhaust valves and pneumatic actuators, Pneumo-hydraulic circuit, Time delay circuits, Sequential circuit design for simple applications using cascade method.	**06**
5.	**Fluid Logic Control System** Hydro Mechanical servo systems, Electro-hydraulic and Electro- pneumatic systems and proportional valves, Introduction to fluidic devices, simple circuits, PLC applications in fluid power control, Failure and troubleshooting in fluid power systems, Pneumatic positioning and servo systems, air hydro boosters.	**06**
6.	**Hydraulic/Pneumatic Circuit Design** Steps in hydraulic circuit design, and simulation using Automation Studio. 2. Steps in pneumatic circuit design, and simulation using Automation Studio.	**06**

References:

Text books:

- Fluid Power, Anthony Esposito, Prentice Hall Publications.
- Industrial Hydraulics and Pneumatics, Stewart.
- Industrial Hydraulics and Pneumatics, H.P. Garg.
- Oil Hydraulic Systems: Principles and Maintenance by S. R. Mujumdar.

Reference Books:

- Industrial Hydraulics, Vickers Handbook.
- Hydraulics-Basic level TP501 handbook by FESTO.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **AIMD202**	Course Name: **Data Structures & Algorithms**

L	T	P	Credits
3	--	--	3

Course Description:
The Data Structures and Algorithms course is a comprehensive study of fundamental concepts and techniques essential for efficient problem-solving in computer science. Students will explore various data structures, including arrays, linked lists, stacks, queues, trees, graphs, and hash tables, and learn how to analyze their time and space complexity. The course extensively explores the design and analysis of algorithms, encompassing various topics such as sorting, searching, and graph traversal. Emphasis is placed on understanding algorithmic paradigms and their applications. Through programming assignments and theoretical exercises, students will gain practical experience in implementing algorithms and solving real-world problems. This course serves as a foundation for algorithmic thinking and prepares students for advanced computer science topics.

Course Learning Outcomes:
The course should enable the students to:
1. Compare between linear and nonlinear data structures.
2. Describe the characteristics of various data structure such as stacks, queues, trees, graphs and Hash tables.
3. Analyze various searching and sorting algorithms and apply it to solve particular problem.
4. Determine a suitable data structure and algorithm to solve a real-world problem.

Prerequisite:
Basic knowledge of C programming, Knowledge of basic mathematical concepts

Course Content

Unit No	Description	Hrs
1.	**Introduction to Data Structures** Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types, Complexity Analysis	05
2.	**Linear Data Structures** **Stack:** Definition, Representation and Applications of Stack. **Queue:** Definitions, Representation and Applications of Linear Queue, Circular Queue, and Priority Queue.	06
3.	**Linked Lists** Definition, Representation, Operations and Applications of singly linked list, doubly linked list, circular linked list, Application of linked list-Stack & queue, Introduction to Sparse matrix, representation of sparse matrix using linked list.	07

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4.	**Searching, Sorting and Hashing Techniques** Linear search, Binary search, Bubble sort, insertion sort, Merge sort, Quick sort, Selection sort, Radix sort, Heap sort, Complexity of algorithms **Hashing**: Definition, Hash functions, Overflow, Collision, Open Hashing, closed hashing, Rehashing Techniques.	**07**
5.	**Trees** Basic Technology, Binary Tree, Traversal methods, Binary search tree, AVL Tree, B tree, B+ tree, Heaps - operations and their applications.	**06**
6.	**Graphs** Basic concepts of graph theory, Storage representation, Operations on graphs, Traversing a graph, Shortest path algorithm.	**05**

References:

Text Books:

- Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines.

Reference Books:

- Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (Addision- Wesely Series).
- Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education).

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S. Y. B. Tech. Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechanical Engineering

Class: **S. Y. B. Tech.**	Semester: **IV**
Course Code: **RAMD202**	Course: **Sensors & Actuators**

L	T	P	Credits
3	-	-	3

Course Description:
The goal of this course is to give senior and graduate students in engineering a hands-on introduction to the fundamental technology and practical applications of sensors. Various sensors, including capacitive, inductive, ultrasonic, accelerometers, image sensors and others will be covered in the course. Instrumentation techniques incorporating computer control, sampling, and data collection and analysis are reviewed in the context of real-world scenarios. There will be weekly laboratory assignments where students will have hands on experience with various sensors. The course is based around a custom board equipped with various sensors, such as a high speed camera, touch sensor, humidity sensor, temperature sensor, pressure sensor, accelerometer and position sensor. Additional peripheral sensors using the PMOD interface standard can also be attached to the sensor board. The board interfaces with these sensors via an FPGA device and it can also communicate with a PC via USB 3.0 interface. Students will use Verilog language to program the FPGA and communicate with various sensors and PC.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Explain the functioning of various sensors and transducers.
2. Calibrate the transducers such as accelerometers, microphones and strain gauges.
3. Explain the characteristics of various sensors and transducers.
4. Describe the process and need for calibration.
5. Choose the sensor for measurement of few parameters.
6. Use the appropriate sensor and calibrate.

Prerequisite: A basic course on Automotive engineering and Electrical machines is recommended as pre-requisites for this course.

Course Content:

Unit No.	Description	Hrs.
1.	**Sensors** Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.	06

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2.	**Inductive & Capacitive Transducer** Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer. Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning-Applications: - capacitor microphone, capacitive pressure sensor, proximity sensor.	**06**
3.	**Intelligent Sensors** General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.	**06**
4.	**Micro Sensors and Micro Actuators** Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.	**06**
5.	**Sensor Materials and Processing Techniques** Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.	**06**
6.	**Actuators** Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors-Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.	**06**

References:

Text Book:

- DVS Murthy, Transducers and Instrumentation, PHI
- D Patranabis, Sensors and Transducers, PHI.
- S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, /Instrument Society of America.
- Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill.
- Patranabis. D, "Sensors and Transducers", Wheeler publisher.
- Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Microbotics", First edition, Springer –Verlag New York, Inc.

- Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Springer

Reference Books:

- Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI.
- A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques, PHI.
- Hermann K.P. Neubert, "Instrument Transducers", Oxford University Press.

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S. Y. B. Tech. Syllabus
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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **SH2174**	Course Name: **Environmental Science**

L	T	P	Credits
1	--	2	2

Course Description:

The syllabus of Environmental Science provides an integrated, quantitative and interdisciplinary approach to the study of environmental systems. The students of Engineering undergoing this course would develop a better understanding of human relationships, perceptions and policies towards the environment and focus on design and technology for improving environmental quality. Project has been incorporated to enhance high potential in the student and built research and positive attitude towards environment related issues, which will help them in their social and technical life ahead. The project is designed to make them apply practical knowledge with relevant tools and techniques to solve real life problems related to the environment and industry. This course will help students in developing eco-friendly approach to achieve sustainable development.

Course Outcomes:

After successful completion of the course, students will be able to,

1. Apply interdisciplinary knowledge from various fields of science and engineering to address environmental issues.
2. Evaluate environmental impacts of human activities on the environment.
3. Use scientific approach to identify and solve environment related problems.
4. Design sustainable solutions to address environmental challenges.
5. Participate in group work to become acquainted with the importance of teamwork, collaboration.
6. Develop presentation and report writing skills.

Course Content

Unit No	Description	Hrs
1.	**Natural Resources and Ecosystem** Renewable and Non-renewable resources, Forest resources, water resources, Mineral resources, food resources, Energy resources, alternative energy resources Land resources, Structure and Functions of ecosystem, biotic and abiotic components, food chains, food web Biodiversity, types of biodiversity, conservation of biodiversity.	04
2.	**Environmental Pollution and Health** Environmental Pollution, types of pollution, Air pollution, Water Pollution, Noise Pollution, Soil Pollution, Marine Pollution, Radioactive Pollution, Thermal Pollution (Causes, sources and effects, abatement methods), Pollution Case studies-Bhopal Gas Tragedy, Chernobyl Accident: A nuclear Disaster, Ganga Water Pollution. Solid Waste management (Causes, sources, effects & control measures), Hazardous waste management, Plastic waste management, E-waste management.	04

	Disaster management and risk analysis.	
3.	**Climate change and Sustainable development** From unsustainable to sustainable development, Urban problems related to energy, Water conservation: Rainwater harvesting, Watershed management, Climate change, Global Warming, Ozone layer depletion, Acid Rain, Consumerism & waste Products, Concepts of Eco-labeled products, Eco-mark, Awareness of Environmental Legislation.	**04**

Guidelines for Project:

1. The distribution of project group will be done by project coordinator and respective head of the department to the faculty.
2. Project will be the team work consisting min 3 to max 5 students.
3. Project topic should be application oriented and with consideration to Environmental science problems in their respective stream. Selection and finalization will be through project guide.
4. Prepare project report as per guidelines.
5. Project group must provide complete solution to the selected problem with conceptual clarity.
6. The project will be evaluated by respective branch HOD and project guide and senior faculty.
7. The project should be presented before the committee, which shall evaluate for 50 marks.

References:

Text Books:

- D.K.Asthana, Meera Asthana, A Textbook of Environmental Studies, S.Chand Publication.
- S. Deswal & A. Deswal, Basic course in environmental Studies, Dhanpat Rai & Co ltd., Delhi.

Reference Books:

- Eldon D Enger, Bradley F. Smith, Environmental science – a study of inter-relationships Wm C Brown Publishers.
- Francois Ramade Ecology of Natural resources, John wiley & Sons
- Robert Leo Smith, Ecology and field biology, Harper Collins Publishers
- Gilbert M. Masters, Introduction to Environmental Engineering & Science, Prentice Hall International Inc.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ME240**	Course Name: **Computer Programming C++ Lab**

L	T	P	Credits
-	-	2	1

Course Description:
Object-Oriented Programming (OOP) is a well-established and widely adopted programming paradigm known for its effectiveness in managing software complexity and promoting code reusability and modularity.
This course introduces students to the core principles of OOP, such as classes, objects, inheritance, polymorphism, and encapsulation. Emphasis is placed on developing secure and efficient programs applicable to mechanical engineering contexts, including handling file-based data storage and generating basic geometric visualizations.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply object-oriented programming principles to design modular and reusable code using classes, objects, data abstraction, and encapsulation.
2. Develop efficient C++ programs by implementing function overloading, operator overloading, constructors, destructors, and friend functions.
3. Implement various forms of inheritance and resolve ambiguity in multiple inheritance situations.
4. Implement various file handling techniques by creating, opening, closing files and performing read, write and append operations.
5. Write C++ programme to draw simple geometric shapes.

Prerequisite: Knowledge of C Programming.

Course Content

Experiment No	Description	Hrs
1.	Programs on Functions in C++.	02
2.	Programs on Classes & Objects-1.	02
3.	Programs on Classes & Objects-2.	02
4.	Programs on arrays of objects and arrays in objects.	02
5.	Programs on inline function & friend function.	02
6.	Programs on function overloading & operator overloading.	02
7.	Programs on constructor and destructor.	02
8.	Programs on Inheritance (single, multilevel, multiple).	02

9.	Programs on Inheritance (hierarchical, hybrid, virtual base class).	**02**
10.	Programs on file operations.	**02**
11.	Programs on graphics and line simulation-1.	**02**
12.	Programs on graphics and line simulation-2.	**02**

References:

Text Books:

- Balguruswami, Object Oriented Programming, Tata McGraw Hill Publications.
- Yashwant Kanitkar, Let us C++, BPB Publication.

Reference Books:

- Herbert Schildt, The Complete Reference C++, McGraw Hill Publication.
- Robert Lafore, Object Oriented Programming in Turbo C++, Galgotia Publications Pvt Ltd, New Delhi.
- Bjarne Stroustrup, An Overview of C++ Programming Language, Addison Wesley Longman, Inc.
- Henricson and Erik Nyquist, Programming in C++: Rules and Recommendations, ftp-able postscript file, Ellemtel Telecomunication Systems Laboratories.

Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ME2224**	Course Name: **CAD Modelling Lab**

L	T	P	Credits
-	-	2	1

Course Description:
This course equips students with the knowledge and skills to create detailed 2D and 3D models, perform assemblies, generate bill of material (BOM), and produce technical drafts for mechanical components. Students will learn to use SolidWorks CAD software, focusing on essential commands for sketching, modeling, and assembly processes. The curriculum includes setting drawing units, applying geometric and dimensional constraints, and integrating components into functional assemblies. Additionally, students will develop proficiency in creating and analyzing BOM and generating comprehensive 2D drafts in various projection views.

Course Outcomes:
At the end of the course the students will be able to,
1. Construct accurate sketches of machine parts using CAD software.
2. Develop 3D models of machine parts by applying essential modeling commands.
3. Assemble multiple machine components into functional assemblies using advanced CAD tools.
4. Evaluate detailed drawing views, including various projections and annotations, for technical accuracy and completeness.

Course Content

Expt. No	Description	Hrs
1.	Introduction and Overview of SolidWorks, CAD/CAM/CAE Product Cycle, Environment of SolidWorks, Introduction to Menu Bars, Features, and Modules.	02
2.	Overview of SolidWorks User Interface: Command Manager, Feature Tree, and Property Manager. Understanding File Management and Templates.	02
3.	Constraints: Geometric and Dimensional Constraints, Sketch Tools, Sketch Solving Status, Sketch Relations, Standard Options, and Reference Geometry.	02
4.	3D Features: Extruded Boss/Base, Extruded Cut, Revolve, Sweep, Loft, Rib, Hole Wizard, and Slot Creation.	02
5.	Advanced Features: Fillet, Chamfer, Draft, Shell, Thread/Tap, Patterning (Linear, Circular, and Mirror), and Scaling Transformations.	02
6.	Creating and Managing Reference Geometry: Planes, Axes, Coordinate Systems, and Measurements.	02
7.	Assemblies: Inserting Components, Mating Features, Exploded Views, Smart Mates, Manipulating Parts, and Interference Detection.	02
8.	Advanced Assembly Operations: Coincidence, Contact, Offset, Angle Mates, Fixing Components, Quick Constraints, and Checking Interference/Clash.	02
9.	Drafting and Detailing: Front View, Auxiliary View, Section Views, Broken Views, Clipping Views, and Balloon Generation. Adding Dimensions,	02

	Tolerances, and Annotations. Generating Bill of Materials (BOM).	
10.	Case Study: Application of all modules for the assembly and drafting of a screw jack or other mechanical components.	**02**

References:

Text Books:

- Sham T. Solid Works for Designers. Softcover, CADCIM Technologies.
- Planchard, D., & Planchard, M. Engineering Design with SolidWorks. SDC Publications.
- Shih, R. SolidWorks: A Step-by-Step Project-Based Approach. SDC Publications.
- Zeid, I. Mastering SolidWorks. McGraw-Hill Education.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ME2244**	Course Name: **Material Science & Metallurgy Lab**

L	T	P	Credits
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Course Description:
This lab covers the important part of material testing i.e. Destructive and Non-destructive testing which is important in evaluation of mechanical properties and determination of flaws in materials. This lab also covers preparation of specimen for micro structural examinations, correlation of structures with mechanical properties. Students will be familiarized with selection of suitable heat treatment process for modification of mechanical properties.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Explain different alloys, their properties and applications by referring equilibrium diagrams.
2. Determine mechanical properties by destructive testing methods.
3. Detect flaws in components by non-destructive testing methods.
4. Select Suitable heat treatment to achieve desired changes in mechanical properties of steels.
5. Select suitable material for given engineering application.
6. Explain manufacturing of a component by using powder metallurgy.

Course Content

Expt. No.	Description	Hrs.
1.	Tensile test on Mild steel.	02
2.	Rockwell and Brinell hardness test on various metals.	02
3.	Micro-Vickers Hardness of delicate samples.	02
4.	Impact test on various metals.	02
5.	Demonstration of Non-destructive testing methods.	02
6.	Examination of microstructures of steel.	02
7.	Examination of microstructures of Cast Iron.	02
8.	Heat treatments of steel.	02
9.	Compositional analysis by using Optical emission spectrometer.	02

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10.	Jominy end quench test for Hardenability.	**02**

References:

Text Books:

- V.D. Kodgire, Material science and metallurgy, Everest Publishers Pune.
- William D. Callister, Materials Science and Engineering an Introduction, John Wiley & Sons.

References Books:

- Vijendra Singh, Physical Metallurgy, Standard Publishers Delhi.
- Prabhudev, Heat treatment of Steels, HMT Handbook.
- S. H. Avner, Physical Metallurgy, Tata McGraw-Hill publication.

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Class: **S. Y. B. Tech**	Semester: **IV**
Course Code: **ME2344**	Course Name **Workshop Practice -II**

L	T	P	Credits
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Course Description:
This course is designed to make aware the students about different machining processes and fabricate the different parts of the job and to assemble them together. Also, they will learn advanced machining processes viz; shaping machine, cylindrical and surface grinding and milling machine.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Demonstrate effect of variables such as speed, feed and depth of cut on machining process.
2. Produce given job with proper taper fitting and within dimensional tolerances ± 0.2 mm on diameter and ± 0.5 mm on length. (Job – b).
3. Produce given job with proper V threading fitting and within dimensional tolerances ± 0.2 mm on diameter and ± 0.5 mm on length. (Job – c).
4. Produce given job of sq. threading of given specifications. (Job – D).

	Course Content	
Expt. No.	**Description**	**Hrs.**
1.	**Lathe Operations** Fabricate parts (B, C and D) and assemble them together with part "A" with close dimensional tolerance. Job involving Boring machining process, internal taper operation, internal and external threading operations, 'V' and square threading, cylindrical grinding process, Surface grinding process, milling operations, drilling operations, Turret lathe operations. Analyzing Machining response during these operations e.g., Surface roughness and Tool wear	**12**

References:

Reference Books:

- Hajra Choudhary, Element of Workshop Technology vol. II, Media promoters and Publications.
- Hajra Choudhary, Element of Workshop Technology vol. I, Media promoters and Publications.
- Raghuvansrii, Workshop Technology, vol. II, Dhanpat Rai.
- W A. J. Chapman, Workshop Technology, Part II, Oxford and IBH publishing Co.

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Class: **S. Y. B. Tech Mech**	Semester: **VI**
Course Code: **ME242**	Course Name: **Mini Project**

L	**T**	**P**	**Credits**
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Course Description:
During the semester, students will complete a mini project that involves the full development cycle of a system or application. The project will consist of four main phases: problem analysis, solution design, building and testing (which may involve software, hardware, or both), and finally, demonstration and reporting. Students are expected to deliver a functional design that meets the specifications of the assigned project and to clearly demonstrate their learning through both implementation and documentation. Every mini project should be aligned with atleast any one of the Sustainable Development Goals (SDG) and should be clearly mentioned in the synopsis and final report as well as during all assessments.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Select title of mini-project and formulate its objectives correctly mentioning SDGs addressed.
2. Develop, simulate and implement the system by complying with desired technical specifications.
3. Analyze and synthesize obtained results in theoretical and practical context.
4. Present findings in logical order.
5. Write a report to document the findings.

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Class: **S. Y. B. Tech Mech**	Semester: **VI**
Course Code: **ME244**	Course Name: **Massive Open Online Course-I (MOOCS-I)**

L	T	P	Credits
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Course Description:
Online courses offered through platforms like NPTEL, SWAYAM, and NASSCOM provide opportunities to deepen the understanding of advanced mechanical engineering concepts and technologies to Mechanical Engineering students. These courses focus on critical domains such as Design, manufacturing, thermal engineering, CAD/CAM/CAE, robotics & automation, materials engineering, and emerging fields like renewable energy and Industry 4.0. They blend theoretical foundations with practical applications, enabling students to strengthen problem-solving skills, engage with modern engineering tools, and prepare for industry-oriented challenges, enabling lifelong learning. The objective of this course is to emphasize the development of skills and attitudes that enable continuous learning & adaptation to new situations.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Explain advanced principles, methods, and technologies in various areas of mechanical engineering.
2. Analyze mechanical engineering problems using mathematical, computational, and engineering fundamentals.
3. Design solutions for mechanical systems using modern engineering tools, software, and simulation platforms.
4. Apply programming, simulation, and analysis techniques (such as FEA, CFD, CAD/CAM) to develop and test mechanical systems and processes.
5. Demonstrate the ability to engage in independent and self-directed learning.

Note:

1. Student will get the credits of respective course in following conditions,
   a. In case of course selected from NPTEL/SWAYAM/NASSCOM platforms, students have to complete the timely assignments, pass the exam and secure the certificate.

2. While selecting online course, following points must be taken care of,
   a. Selected course must be approved by Departmental Programme Committee (DPC).
   b. Duration of each online course must be of at least FOUR weeks for NPTEL/SWAYAM & minimum 12 to 20 hours for NASSCOM.

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References:

- NPTEL (National Programme on Technology Enhanced Learning) https://nptel.ac.in
- SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) https://swayam.gov.in
- MOOCs on NASSCOM www.nasscom.in