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 2023-27 and 2024-28 NEP 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 2023-27 and 2024-28 NEP 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	40	---	---
						UT1	15				
						UT2	15				
						ESE	50	40			
ME2114	Manufacturing Processes and Machine Tool	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME2134	Engineering Thermodynamics	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME2154	Engineering Mechanics	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Multidisciplinary Minor- I	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME2174	Computer Programming C++	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---		50	50
ME-2314	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	---	---		100	50
ME2374	Technical Aptitude-I	-	-	2	1	ESE	---	---		100	50
-	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	---	---		100	50
-	TOTAL	13	-	12	19	-					
	TOTAL CONTACT HOURS	25									

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

Total Contact Hours/week : 25

Total Credits : 19

Technical Aptitude Courses : Mathematics for Mechanical Engineers, Manufacturing Processes and Machine Tools, Engineering Thermodynamics, Engineering Mechanics.

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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 2023-27 and 2024-28 NEP 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
ME210	Fluid Mechanics and Turbomachinery	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
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		---	---
-	Multidisciplinary Minor-II	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			--	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Modern Indian Language	2	-	-	2	ISE	100	50	---	---	-
SH2174	Environmental Science	1	-	2	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
ME2204	Fluid Mechanics and Turbomachinery 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	---	---		100	50
ME2364	Technical Aptitude-II	-	-	2	1	ESE	---	---		100	50
-	Professional Skills Development and Foreign Languages-II	-	-	2	1	ISE	---	---	--	100	50
-	TOTAL	15	-	14	22	-					
	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 : 22

Technical Aptitude Courses : Fluid Mechanics and Turbomachinery, Mechanics of Solids, Material Science and Metallurgy.

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.

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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)

Sr. No.	Modern Indian Language: Subject Name	Course Code
1	मराठी भाषिक कौशल्यविकास	SH202
2	हिंदी कथा साहित्य एवं प्रयोजमूलक हिंदी	SH204

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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		---	---
ME313	Kinematics and Dynamics of Machines	3	-	-	3	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	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
SH3034	Scholastic Aptitude-I	2*	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						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	---	---	---	100	50
ME3254	Software Training Lab-I	-	-	2	1	ISE	---	---	---	100	50
ME3814	Technical Aptitude-III	-	-	2	1	ESE	---	---	---	100	50
ME3834	Summer Internship	-	-	-	2	ISE	---	---	---	100	50
-	TOTAL	18+1*	-	8	24	-					
	TOTAL CONTACT HOURS	27									

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

Total Contact Hours/week : 27

Total Credits : 24

Technical Aptitude Courses : Heat and Mass Transfer, Kinematics and Dynamics of Machines

Note*: One extra lecture to be allotted to Scholastic Aptitude-I in the time Table.

Program Elective-I

Sr. No	Course Code	Domain	Course
1.	ME3314	Design	Mechanics of Composite Material
2.	ME333		Engineering Optimization
3.	ME3354		Fracture Mechanics
4.	ME336		Python Programing
5.	ME3414	Thermal	Cogeneration and waste heat management
6.	ME343		Alternative sources of energy
7.	ME345		Hybrid and Electric Vehicles
8.	ME3514	Manufacturing	World Class Manufacturing
9.	ME3534		Non Traditional Machining
10.	ME355		Operation Research
11.	ME357		Quality Management System
12.	ME3594		Production and Operation Management
13.	ME361		Sensors and Actuators in Robotic Technology

Open Elective – I

Sr. No	Course Code	Course Name	Offered By Department
1	OE345	Soft Computing	Computer Science & Information Technology
2	OE343	Data Science	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
3	OE347	New Product Design & Development	Mechanical Engineering
4	OE349	Non-Conventional Energy Sources	Mechanical Engineering
5	OE351	Hydrogen & Fuel Cell Technology	Mechanical Engineering
6	OE3044	Renewable Energy Sources	Automobile Engineering
7	OE353	Factory Automation	Mechatronics Engineering
8	OE355	Cyber Physical Systems	Mechatronics Engineering
9	OE3104	Network Administration	Computer Science & Engineering
10	OE3064	Environmental Impact Assessment	Civil Engineering
11	OE3084	Materials Management	Civil Engineering
12	OE341	Energy Auditing and Management	Electrical Engineering
13	OE357	Internet of Things	Electronics & Telecommunication Engineering
14	OE359	Drone Technology	Electronics & Telecommunication Engineering

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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			
ME3124	Applied Thermal Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME3144	Design of Machine Elements	3	-	-	3	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		---	---
-	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		---	---
SH3064	Scholastic Aptitude-II	2*	-	-	2	ISE	20	40	40	---	----
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME3644	Software Training Lab-II	-	-	2	1	ISE	--	--	--	100	50
ME3664	Applied Thermal Engineering Lab	-	-	2	1	ISE	---	---	---	100	50
ME3744	Technical Aptitude-IV	-	-	2	1	ESE	---	---	---	100	50
ME3764	Capstone project Phase I	-	-	2	1	ISE	---	---	---	100	50
-	TOTAL	21+ 1*	-	8	25	-					
	TOTAL CONTACT HOURS	30									

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

Total Contact Hours/week : 30
Total Credits : 25
Technical Aptitude Courses: Applied Thermal Engineering, Design of Machine Elements
Note*: One extra lecture to be allotted to Scholastic Aptitude-II in the time Table.

Program Elective-II

Sr.No.	Course Code	Discipline	Course
1.	**ME322**	Design	Industrial Robotics
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.	**ME356**		Supply Chain Management
14.	**ME358**		Robot Dynamics and Applications

Open Elective -II

Sr. No.	Course Code	Course Name	Offered By Department
1	OE3401	Cyber security	Computer Science & Information Technology
2	OE342	Data Mining	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
3	OE3024	Reliability Engineering	Automobile Engineering
4	OE344	Supply Chain Analytics	Mechatronics Engineering
5	OE346	Mobile Robotics	Mechatronics Engineering
6	OE348	Information Technology Foundation Program	Computer Science & Engineering
7	OE3381	Disaster Management	Civil Engineering
8	OE350	Operations Research	Civil Engineering
9	OE3182	Industrial Drives	Electrical Engineering
10	OE352	Image Processing	Electronics & Telecommunication Engineering
11	OE354	Fuzzy logic and Neural Network	Electronics & Telecommunication Engineering
12	OE3284	Supply Chain Management	Mechanical Engineering
13	OE3324	Entrepreneurship Development	Mechanical Engineering
14	OE356	Project Management	Mechanical Engineering

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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 %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
ME4014	Mechanical System Design	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME4034	Metrology and Control Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
ME4054	Industrial Engineering	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Program Elective-III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
-	Program Elective-IV	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						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, UT1 - Unit Test I, UT2 - Unit Test II, ESE - End Semester Exam.

Total Contact Hours/week : 30

Total Credits : 22

Program Elective-III

Sr.No.	Course Code	Discipline	Course
1.	**ME4154**	Design	Condition Monitoring
2.	**ME417**		Computer Aided Design and Analysis
3.	**ME4194**		Autotronics & Vehicle Intelligence
4.	**ME421**		Engineering Failure Analysis
5.	**ME4234**	Thermal	Cryogenics
6.	**ME425**		Design of Heat Exchanger
7.	**ME427**		Battery Thermal Management system
8.	**ME429**	Manufacturing	Foundry Technology
9.	**ME431**		Enterprise Resource Planning (ERP) and Product Life Cycle Management (PLM)
10.	**ME433**		Sustainable Manufacturing
11.	**ME435**		Digital Manufacturing

Program Elective-IV

Sr.No.	Course Code	Discipline	Course
1.	**ME4394**	Design	Mechanical Vibration
2.	**ME4414**		Experimental Stress Analysis
3.	**ME4434**		Engineering Tribology
4.	**ME447**	Thermal	Heating Ventilation and Air Conditioning (HVAC)
5.	**ME4494**		I C Engines
6.	**ME4514**		Refrigeration and Air conditioning
7.	**ME4534**		Automotive Engineering
8.	**ME4554**	Manufacturing	Industrial Hydraulics and Pneumatics
9.	**ME4574**		Mechatronics system Design
10.	**ME459**		Additive Manufacturing
11.	**ME461**		Mechatronics and IoT

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.	ME471	Thermal	Heating Ventilation and Air Conditioning (HVAC) Lab.
5.	**ME4734**		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.	**ME4814**		Mechatronics system Design Lab
10.	**ME483**		Additive Manufacturing Lab
11.	**ME485**		Mechatronics and IoT Lab

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

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	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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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 %)			Practical (Marks %)	
							Max.	Min. for passing		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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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**
Automobile Engineering	1	ATMD201	Automobile Systems	III	Automotive Technology
	2	ATMD202	I. C. Engines	IV	
	3	ATMD301	Automotive Safety & Ergonomics	V	
	4	ATMD303	Automotive Engineering Lab.	V	
	5	ATMD302	Electric Vehicles	VI	
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	Public Health 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	V	

			Python		
	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 Lab	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	System Analysis using MATLAB	V	
	4	ECMD303	PCB Design and Fabrication	V	
	5	ECMD302	Electronics for Industrial Applications	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	
Elements of Mechanical Engineering	1	MEMD201	Materials and Applications	III	Mechanical Engineering
	2	MEMD202	Design and Drawing of Machine Components	IV	
	3	MEMD301	Manufacturing and Assembly Process	V	
	4	MEMD303	Refrigeration and Air Conditioning	V	
	5	MEMD302	Power Plant	VI	

			Engineering		
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	

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

B.Tech. in Mechanical Engineering with Double Minor degree

- To get B.Tech. in Mechanical Engineering with Double Minor degree student need to earn extra 18 credits by completing 6 minor courses (One minor course / semester)
- Minor courses can be completed through online platforms
- Student can choose any one specialization given by the department and complete all the six courses under the specialization to earn total 188 Credits which consist 170 credits of regular Multidisciplinary Minor courses and 18 Credits of Double Minor courses.
- Following are the baskets of Minor courses

Double Minor Baskets					
Double Minor Basket Name	**Sr. No.**	**Course Code**	**Course Name**	**Semester**	**Offered by Department**
Electric Vehicle	1	ATDM201	Powertrain for EV	III	Automotive Technology
	2	ATDM202	Battery Management Systems for Electric Vehicles	IV	
	3	ATDM301	Hybrid Vehicles	V	
	4	ATDM302	Fuel Cell Technology	VI	
	5	ATDM401	Charging Infrastructure	VII	
	6	ATDM402	Autonomous Vehicle	VIII	
Infrastructure Engineering	1	CEDM201	Geoinformatics	III	Civil Engineering
	2	CEDM202	Smart Cities and Sustainable Development	IV	
	3	CEDM301	Life Cycle Assessment	V	
	4	CEDM302	Sensor Technologies in Civil Engineering	VI	
	5	CEDM401	AI applications in civil engineering	VII	
	6	CEDM402	Construction Materials	VIII	
Data Science	1	CSDM201	Principles of Data Science	III	Computer Science & Engineering
	2	CSDM202	Data Wrangling with Python	IV	

	3	CSDM301	Data management and representation	V	
	4	CSDM302	Exploratory Data Analysis	VI	
	5	CSDM401	Business Analytics	VII	
	6	CSDM402	NPTEL/SWAYAM	VIII	
Electric Vehicle & Renewable Energy Systems	1	EEDM201	Technologies for Clean And Renewable Energy Production	III	Electrical Engineering
	2	EEDM202	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems	IV	
	3	EEDM301	Solar Photovoltaics Fundamentals, Technology and Applications	V	
	4	EEDM302	Introduction to Hybrid and Electric Vehicles	VI	
	5	EEDM401	Fundamentals of Electric vehicles: Technology and Economics	VII	
	6	EEDM402	Electric vehicles and Renewable energy	VIII	
Internet of Things	1	ECDM201	Sensors and Actuators	III	Electronics &Telecommunication
	2	ECDM202	Wireless Sensor Networks	IV	
	3	ECDM301	IoT protocols and Security	V	
	4	ECDM302	Embedded System Design for IoT	VI	
	5	ECDM401	Android Application Design	VII	
	6	ECDM402	Cloud Integration using AWS	VIII	
Artificial Intelligence and Data Science	1	CIDM201	Artificial Intelligence	III	Computer Science &Information Technology
	2	CIDM202	Data Science with R programming	IV	
	3	CIDM301	Machine Learning	V	

	4	CIDM302	Business Intelligence	VI	
	5	CIDM401	Deep learning	VII	
	6	CIDM402	Data Ethics and Privacy	VIII	
AI Based Condition Monitoring	1	MEDM201	Fundamentals of Structural Dynamics	III	Mechanical Engineering
	2	MEDM202	Principles of Vibration control	IV	
	3	MEDM301	Machinery Fault Diagnosis	V	
	4	MEDM302	Instrumentation and Data Recording	VI	
	5	MEDM304	Double Minor IV Lab	VI	
	6	MEDM401	AI Tools and Signal Processing	VII	
	7	MEDM402	AI Based Condition Monitoring	VIII	
Autotronics	1	MCDM201	Fundamentals of Automotive Systems	III	Mechatronics Engineering
	2	MCDM202	Automotive Electrical and Electronics	IV	
	3	MCDM301	Automotive Communication System	V	
	4	MCDM302	Automotive Driver Assistant System	VI	
	5	MCDM401	Engine Control System	VII	
	6	MCDM402	Automotive Diagnostics	VIII	
Artificial Internet of Things - AIOT	1	AIDM201	Introduction to Internet of Things	III	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
	2	AIDM202	IoT Protocols	IV	
	3	AIDM301	IoT System Design	V	
	4	AIDM302	Industry 4.0 and IIoT	VI	
	5	AIDM401	Internet of Things Technology and Applications	VII	
	6	AIDM402	NPTEL/SWAYAM	VIII	

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

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

- To get B.Tech. in Mechanical Engineering with Honor and Multidisciplinary Minor degree student need to earn extra 18 credits by completing 6 Honor courses (One course / semester)
- Honor course can be completed through online platforms
- Student can choose any one specialization given by the department and complete all the six courses under the specialization to earn total 188 Credits which consist 170 credits of regular Multidisciplinary Minor courses and 18 Credits of Honor courses.
- Following are the baskets of Honor courses

Specialization: Design Engineering			
Sr. No.	**Course Code**	**Course Name**	**Offered in Semester**
1	**MEHO201**	Advanced Solid Mechanics	III
2	**MEHO202**	Synthesis of Mechanism	IV
3	**MEHO301**	Engineering Failure Analysis	V
4	**MEHO302**	Product Design and Development	VI
5	**MEHO401**	Non-Linear Finite Element Analysis	VII
6	**MEHO403**	Students can choose any one course from NPTEL, UDEMY, CORSERA.	VIII

Specialization: Thermal Engineering			
Sr. No.	**Course Code**	**Course Name**	**Offered in Semester**
1	**MEHO203**	Advanced Thermodynamics	III
2	**MEHO204**	Advanced Mechanics of Fluids	IV
3	**MEHO303**	Fluid Power System	V
4	**MEHO304**	Numerical Techniques for Fluid Flow	VI
5	**MEHO405**	Micro Fluidics and its Application	VII
6	**MEHO407**	Students can choose any one course from NPTEL, UDEMY, CORSERA.	VIII

Specialization: Manufacturing Engineering			
Sr. No.	**Course Code**	**Course Name**	**Offered in Semester**
1	**MEHO205**	Material Characterization	III
2	**MEHO206**	Metal Casting Technology	IV
3	**MEHO305**	Micro & Nano Machining	V
4	**MEHO306**	Manufacturing Automation	VI
5	**MEHO409**	Product Design for Manufacturing	VII
6	**MEHO411**	Students can choose any one course from NPTEL, UDEMY, CORSERA.	VIII

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

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 %) Max.	Theory (Marks %) Min. for passing		Practical (Marks %) Max.	Practical (Marks %) 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

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.

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
S. Y. B. Tech. Syllabus
To be implemented for 2023-27 and 2024-28 NEP Batch
Department of Mechanical Engineering

Class:-**S.Y. B. Tech Mech**	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

	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.
- S. C. Gupta, Fundamentals of statistics, Himalaya Publishing House.

Class:- **S.Y. B. Tech Mech.**	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	07

	allowances. Components of gating system and its importance, 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 Vol. I [ISBN-13:9788123904016]2001, Vol. II [9788123904115] 2007 and Vol.III [9788123904122] 1995.

Class:- **S Y B Tech Mech.**	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, anergy, 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	06

	theorem, corollary of Carnot theorem, thermodynamic temperature scale. **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, 6th edition, 2002.
- Yunus A. Cengel, Thermodynamics an Engineering Approach, Tata McGraw Hill.

Data Book:

- S. C. Jain, Steam Tables, Birla Publications Pvt. Ltd. Delhi, 16th edition, 2007.

Class: **S.Y. B. Tech Mech.**	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 machine components.

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 Publication, New York.

Class: **S. Y. B. Tech.**	Semester: **III**
Course Code: **ATMD201**	Course: **Automobile Systems**

L	T	P	Credits
3	-	-	3

Course Description:
Automobile systems is a one of the core courses of Automotive Engineering and lays foundation for the advanced courses like vehicle dynamics and automotive design. The course introduces the major automotive chassis systems like steering, brakes and suspensions. It also covers the drivetrain elements like clutches, gearbox and differential. The course emphasizes on fundamental principles of operation, functional system equations, various system configurations and advancements. Successful completion of this course is very much essential for further learning and industry career.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain constructional details and operation of the automotive systems.
2. Interpret the influence of various technical parameters on the behavior of the automotive systems.
3. Configure the systems and its elements for integrating into drivetrain/chassis systems appropriate for given automotive application.
4. Present in detail the technological advancements of the automotive systems.

Prerequisite: Basics of Mechanical Engineering.

Course Content:

Unit No.	Description	Hrs.
1.	**Automotive clutches:** Requirements, mathematical model, types, clutch assembly, diaphragm clutch, centrifugal clutch, fluid flywheel, torque converter	06
2.	**Gearbox:** Need of gearbox, manual gearbox, automatic transmissions, AMT, DCT, CVT	06
3.	**Propeller shaft, differential and axles:** Propeller shaft/drive shafts, Universal joints, differential, differential lock, final drive, axle arrangements, 4WD arrangement	06
4.	**Steering system:** Steering geometry, Ackermann steering, steering ratio, layouts, power steering, active steering, steer-by-wire system, 4W steering	06
5.	**Suspension system:** Principles, elements, quarter car model, dampers, roll centers, adaptive suspensions	06
6.	**Braking system;** Principles, drum and disc brake arrangements, hydraulic brake system, air and vacuum brakes, ABS and ESP	06

References-

Text Books:

- Newton, Steed & Garret, Motor Vehicles, Butterworth Heinemann
- Henz Heisler, Advanced Vehicle Technology, SAE International

Reference Books:

- Henz Heisler, Vehicle and Engine Technology, SAE International
- J. Reimpell, H. Stoll, J. W. Betzler, The Automotive Chassis, Butterworth Heinemann
- Giles J. G., Steering, Suspension & Tyres, Illiffe Book Ltd. London
- William Crouse, Donald Anglin, Automotive Mechanics, McGraw-Hill
- Gillespie T. D., Fundamentals of Vehicle Dynamics, SAE International
- N. K. Giri, Automotive Mechanics, Khanna Publishers

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, functional design and drawing.	06
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 colour 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 BuiltEnvironment", Tata McGraw-Hill Education Pvt. Ltd.

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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:

- "Data Structures using C, A Practical Approach for Beginners" by Amol M. Jagtap & Ajit S. Mali
- Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines.
- Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education).

Reference Books:

- Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (Addision- Wesely Series)
- Data Structure using C -- ISRD Group (TMH) ACE series.

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
3	**Thermal Power Plant:**	06

	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.	
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
- 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.

Class:- **S.Y. B. Tech**	Semester-**III**		**L**	**T**	**P**	**Credits**
Course Code : **CIMD201**	Course Name : **Data Structures**		**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. Describe the basic terminologies of data structures.
2. Examine the linear data structure array with its types.
3. Demonstrate the working of stack, queue performed on data structures.
4. Illustrate the working of linked list.
5. Discuss Tree terminologies and their Applications.
6. Elaborate Graph terminologies with their types.

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 array, 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	07

	linked list.	
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.

Class:- **S.Y. B. Tech**	Semester-**III**
Course Code:**MEMD201**	Course Name: **Materials and Applications**

L	T	P	Credits
3	--	--	3

Course Description:
Materials and Applications is an advanced interdisciplinary course that delves into the fascinating world of materials science and engineering, with a special focus on topics such as Smart Materials, Magnetic materials, and Electronic materials. This course is designed to provide students with a comprehensive understanding of different ferrous, nonferrous and advanced materials, their properties and applications. The course also covers applications of the components made by Powder Metallurgy. 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. Describe crystal structures and crystal imperfections.
2. Illustrate plotting of Equilibrium diagrams from Cooling Curves and its fundamentals.
3. Explain different Ferrous, Nonferrous alloys, their properties and applications by referring equilibrium diagrams.
4. Explain properties and applications of Smart Materials, Magnetic Materials and Electronic materials.
5. Explain properties and applications of Powder Metallurgy
6. Select suitable material for given engineering application.

Prerequisite:
The students should have knowledge of basic principles of physics, chemistry and mathematics in XII standard.

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 principles, dendritic structure and coring.	06
2.	**Ferrous Alloys:** Fe-Fe_3C 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.	**Non Ferrous Alloys:** Alloys of Copper, Aluminium, Magnesium, Titanium, Other alloys of lead, tin, zinc, nickel, manganese, white metals and bearing alloys.	**06**
4.	**Smart Materials:** Piezoelectric materials, Shape memory alloys and shape memory polymers, Magneto-strictive materials, pH-sensitive polymers, Halochromic materials, Chromogenic-systems, Ferro fluid, Rheological fluid, Processing and applications of different smart materials viz; aerospace, robotics, electronics, and medical devices.	**06**
5	**Magnetic Materials and Electronic materials:** Classification of Magnetic Materials, Magnetic Dipoles and Magnetic Moments, Magnetization, permeability and the magnetic field, Diamagnetic, paramagnetic, Ferromagnetic, Ferrimagnetic and Super magnetic Materials, Semiconductors and their applications.	**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.
- Ajit Behera, Advanced Materials, Springer.
- S. H. Avner, Physical Metallurgy, Tata McGraw-Hill publication.

Reference Books:

- William D. Callister, Materials Science and Engineering: An Introduction, John Wiley & Sons.
- WD. Callister, Materials Science and Engineering. Wiley India Pvt. Ltd.
- F.A.A. Cranes & J.A. Charles, Selection and Uses of Engineering Materials, Butterworth & Com. Ltd., London.
- James A. Jacobs & Thomas F. Kilduff, Engineering Material Technology Prentice Hall
- Smallman, A.H.W, R Physical Metallurgy and Advanced Materials Butterworth-Heinemann, Elsevier.
- Mark J. Hampden-Smith Wiley-VCH, Chemistry of Advanced Materials: An Overview, Wiley.

Class: **Second Year 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 Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify various elements of mechatronics systems.
2. Select appropriate sensor/Actuator/controller/control algorithm for different applications.
3. Develop PLC/ microcontroller-based 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	08

	Microcontroller, 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.

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

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 init 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
- ReemaThareja, "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

Class:-**S.Y. B. Tech Mech.**	Semester-**III**
Course Code:**ME2174**	Course Name:**Computer Programming C++ Lab**

L	T	P	Credits
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Course Description:
Object Oriented Programming (OOP) has become the preferred programming approach by the software industries, as it offers a powerful way to cope with the complexity of real-world problems.This course gives basic concepts of OOPs to the students, which makes them capable to develop secured program for designing mechanical components.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Build Object Oriented Programs.
2. Elaborate the concepts of "inline function", "friend function", "function overloading" and "operator overloading".
3. Extend the program by using inheritance.
4. Use memory management technique "constructors" & "destructors".

Prerequisite: Knowledge of C Programming.

Course Content

Experiment No.	Description	Hrs
1.	Introduction to C++ and OOPs concept	02
2.	Programs on Functions in C^{++}	02
3.	Programs on Classes & Objects	02
4.	Programs on arrays of objects	02
5.	Programs on inline function & friend function	02
6.	Programs on function overloading	02
7.	Programs on Operator overloading	02
8.	Programs on constructor and destructor	02
9.	Programs on Inheritance (single, multilevel, multiple)	02
10.	Programs on Inheritance (hierarchical, hybrid, virtual base class)	02

References –

Text Books:

- E. 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.

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

L	T	P	Credits
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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
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.

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

L	T	P	Credits
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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

	joints, bearings, chain and gears.	
2.	**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
3.	**Limits, Fits, Tolerances and Machining Symbols:** Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Manual, Actual profile, reference profile, Datum Profile, Peak to valley height, Mean roughness index, surface roughness number, Machining Symbols, Indication of surface roughness.	02
4.	**Geometric Dimensioning and Tolerances:** Introduction, Features and Rules of GD&T, Datum's Control, Adding GD&T to a Design, Form Tolerances, Orientation Tolerances, Profile Tolerances, Location Tolerances, Runout Tolerances.	02
5.	**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 Mech**	Semester-**III**
Course Code:**ME2354**	Course Name: **Workshop Practice -I**

L	T	P	Credits
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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. Describe the principles and techniques of tool grinding and sharpening and apply them to improve tool performance.
2. Perform different operations to produce "A" part of job on lathe machine such as turning, facing, step turning, knurling, threading operations on MS workpiece, ensuring flatness, smooth surface finish with accuracy and precision.
3. Operate TIG, MIG and submerged arc welding setup with proficiency.
4. Analyze the factors affecting machining responses such as surface roughness and tool wear.

Course Content

Description	Practicals
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
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.

Class:- **S.Y. B. Tech Mech**	Semester-**III**
Course Code:**ME2374**	Course Name :**Technical Aptitude -I**

L	T	P	Credits
--	--	2	1

Course Description: Technical aptitude I course is designed as per syllabus of GATE examination. Courses added in this specifically focusing applicable for GATE exam. The questions solved in this course are a part of GATE examination. Students need to solve and practice these questions as they will get basic knowledge of subjects related to GATE and Technical Examinations which will be further helpful for placement preparations and interviews.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply the fundamental knowledge to solve the mechanical engineering problems.
2. Develop the ability of problem solving.

Course Content:
Multiple Choice Questions (MCQ) examination will conducted at the end of the semester on following courses.

- Mathematics for Mechanical Engineers
- Manufacturing Processes and Machine Tool
- Engineering Thermodynamics
- Engineering Mechanics

The students have to do preparation on all the courses listed above. This test will increase the student's learning and understanding of above courses for Semester-I of S.Y.B.Tech

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)*

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
6.	**Team Formation and Leading a Team – II:** Case Studies of Teams	02

	and Student Presentations	
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 students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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 ,	**02**

	Concept of power of mind , concepts of interaction of conscious and 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.

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

	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:** A. Definition of a Business Model B. 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): A. Prototyping. B. Storytelling. C. 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

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.

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*
- 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.

Rajarambapu Institute of Technology Rajaramnagar Mech. Engg. Dept. 415 414

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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

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 students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

Rajarambapu Institute of Technology Mech Engg Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Sangli 415 414 K.E.S.

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

	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 students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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

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.

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

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.

Class:- **S.Y. B. Tech Mech.**	Semester-**IV**
Course Code:**ME210**	Course Name: **Fluid Mechanics and Turbomachinery**

L	T	P	Credits
3	--	--	3

Course Description:
Fluid Mechanics and Machines is a fundamental engineering course that explores the behavior and properties of fluids and their applications in various engineering systems. The course provides a comprehensive understanding of fluid mechanics principles, fluid dynamics, and the operation of fluid machines. It equips students with essential knowledge and problem-solving skills to analyze and design fluid-based systems commonly found in engineering fields.

Course Learning Outcomes:
1. Define, calculate, and measure properties of fluid
2. Apply Continuity equation, Bernoulli's equation, Equation of motion and Momentum equation for different flow system
3. Estimate forces acting on fluid & different energy losses in fluid flow.
4. Estimate forces acting on bodies submerged in fluid.
5. Explain construction, working of turbo machines and select appropriate hydraulic machine for specific applications
6. Perform basic hydraulic/thermal design and interpret performance characteristic curves.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Properties of Fluids & Kinematics:** Properties of Fluid, hydrostatic force, Kinematics of Fluid- Introduction, Types of Flow, & Flow Lines. Streamline, Path line, Streak line, Continuity Equation in Cartesian Co-Ordinates System, Velocity & Acceleration of fluid particles.	**06**
2.	**Dynamics of Fluid Flow:** Dynamics of Fluid flow- Introduction, Equation of Motion, Bernoulli's equation, discharge measurement, Momentum Equation- Introduction & Derivation, Application of Momentum Equation.	**06**
3.	**Flow through pipes:** Flow through pipes-Laminar Flow-Introduction, Laminar Flow Through Circular Pipe & parallel plates. Flow Through Pipe- Introduction, Losses of Energy, Applications of Darcy's and Chezy's Equation, Minor Losses, Flow Through Series Pipes, Parallels Pipes, Siphon Pipe.	**06**
4.	**Forces on submerged bodies:** Boundary Layer Theory- Thickness, Separation, Control. Forces on	**06**

	Immersed Bodies- Drag & Lift forces. Dimensional analysis & model Testing-Buckingham's theorem, dimensionless numbers, model laws, model testing	
5.	**Hydraulic Turbines:** Hydraulic Turbines- Classification, construction, working, velocity triangles, Hydraulic design, work done, various efficiencies of impulse & reaction turbines, governing of turbine, selection of turbine, characteristic curves. Different Hydraulic Pumps- classification, various heads, construction & working, selection of pump. Centrifugal pump-velocity triangles, hydraulic design, power required to drive pump, various efficiencies. Characteristic curves	**06**
6.	**Introduction to compressors:** Construction, working, selection and basic design terminology of Reciprocating compressor, Centrifugal compressor and blowers, Introduction to basic gas turbine cycles.	**06**

References –

Text Books:

- R.K. Bansal, Fluid Mechanics
- R. K. Rajput, Fluid Mechanics and Fluid Machinery,

Reference Books:

- S.K. Som, G Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid Machines. Modi and Seth, Fluid mechanics and hydraulic machines
- Dr. D.S. Kumar, Fluid Mechanics and Fluid Power engineering

Class:- **S.Y. B. Tech Mech.**	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 beam.
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

Class:-**S.Y. B. Tech Mech.**	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

	principles, dendritic structure and coring.	
2.	**Phase diagrams for Ferrous alloys:** Fe-Fe_3C 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.

- Myer Kutz , Handbook of Materials Selection -, John Wiley & Sons, New York.
- G.T. Murray, M. Dekker ,Handbook of Materials Selection for Engineering Applications.

Class: **S. Y. B. Tech.**	Semester: **IV**
Course Code: **ATMD202**	Course: **I. C. Engines**

L	T	P	Credits
3	-	-	3

Course Description:
This course describes the fundamentals of internal combustion engines used in automotive and allied application. The effect of operation and design of internal combustion engines on their performance, efficiency, fuel requirements, and environmental impact is studied. Topics include thermodynamics of engine processes, engine fluid flow; fuel systems in SI and CI engines, combustion, heat transfer and friction phenomena and engine performance such as power, efficiency are studied under this course. Students examine the design features and operating characteristics of different types of internal combustion engines wise spark-ignition, compression ignition engines.

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

1. Perform a primary thermodynamic analysis of Otto and diesel cycle engines.
2. Select appropriate engine for specific application.
3. Select proper fuel system for IC engine.
4. Conduct performance test of IC engine and portray operating characteristics of engine.
5. Identify abnormal combustion in engine and remedy over it.
6. Select proper lubrication, intake, exhaust, cooling system for engine.

Prerequisite: Applied Thermodynamics, Fluid Mechanics and Machinery, Theory of Machines, Heat Transfer.

Course Content:

Unit No.	Description	Hrs.
1.	**I. C. Engine types and applications:** Engine nomenclature and classification, Valve and Port timing diagram, Engine selection, Engine Cycles, fuel-air cycle, Actual cycle,	06
2.	**Engine Performance:** Performance parameters and its measurement, Heat balance, IS codes of engine testing, Heat rejection and cooling, Air cooling, liquid cooling, Numerical on Performance.	06
3.	**Fuel Supply System S.I. Engine:** Carburetion, Gasoline injection, Electronic fuel injection system, Engine ECU- Operation and programming, Numerical on simple carburetor and gasoline injection system.	06
4.	**Fuel supply system for C I Engine:** Requirements & types of Fuel injection pumps, injectors, Governor, Common rail and Electronic injection system, Engine ECU- Operation and programming, Numerical on Fuel injection pumps, injectors and CRDI.	06

5.	**Combustion:** Combustion in S. I. Engine, Stages, Abnormal combustion, Control of abnormal combustion, Combustion chambers, Stages of combustion in CI engine, Abnormal combustion, Control over abnormal combustion, Combustion chambers for CI engines	06
6.	**Induction and Exhaust System:** Air intake system, filters & manifolds, Mufflers and resonators, Supercharging, Turbocharging, Scavenging of two stroke and four stroke engines, Engine Friction and Lubrication, Pumping and blow by losses, Lubricating systems	06

References-

Text Books:

- John b Heywood, Internal Combustion Engine, Tata McGraw Hill Publication.
- V. Ganeshan, I C Engine, Tata McGraw Hill Publication.

Reference Books:

- E. F. Obert, I.C. Engine & Air Pollution, Harper & Row Publishers.
- SAE, Automotive Handbook, Bosch.

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
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.

Class: - **S.Y. B. Tech CSE**	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

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 driver's 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.

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**

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. Analysing asymptotically the performance of algorithms.
2. Compare and analyse 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 problem, Reliability design, Traveling sales person problem.	07
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.

Class:- **S.Y. B. Tech.**	Semester-**IV**
Course Code :**MEMD202**	Course Name : **Design and Drawing of Machine Components**

L	T	P	Credits
3	--	--	3

Course Description:
Design and Drawing of Machine Component is offered as the multidisciplinary minor course at the fourth semester of Engineering undergraduate program and consists of six chapters. The first chapter focuses on Free hand sketches and representation of assembly drawing, the second chapter deals with limits, fits, tolerances and production drawing. The third chapter deals with Basic design procedure, requirement of machine element and material selection. Design of machine elements against static loading like knuckle joint, Design of shaft, keys is dealt with in the fourth chapter. The next chapters' deal with Design of Spur Gear and Selection of bearing. Last chapter emphasizes on design of component subjected to fluctuating load.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Produce the production drawing of simple mechanical assemblies.
2. Design the machine components subjected to static loading.
3. Design of spur gear and selection of roller bearing.
4. Design a components against fluctuating load.

Prerequisite:
The students should have knowledge of basic principles of science. They should have knowledge of fundamentals of Engineering Graphics.

Course Content

Unit No	Description	Hrs
1.	**Assemblies of basic mechanical components:** Importance of sketching, Introduction to basic mechanical components Nuts, bolts, couplings, pulleys, belt, shaft, gear, spring etc. Free hand sketches of types of nuts, bolts, couplings and pulleys. Details and assembly drawing of Screw jack, Tools post of center lathe.	06
2.	**Production drawing:** Limits, Fits and Tolerances ISO system of tolerance, Tolerance charts, Hole - base and shaft -base system of tolerance, Types of fits, symbols and applications. Geometric Tolerances: Introduction, Nomenclature, Rules,	06

	Symbols. Surface Roughness & Production Drawing.	
3.	**Design procedure of machine components:** Introduction: Engineering Design and classification, Basic design procedure, requirement of machine element, standards and codes, State of stresses, Theories of elastic failure, Classification of engineering materials, selection of materials.	06
4.	**Design against static loading:** Design of knuckle joint, Design of solid & hollow shafts, transmission shafts, Design of keys.	06
5.	**Gear and bearing:** Types of gears, Terminology of gear, force analysis, Spur gear design based on beam strength and wear strength criteria. Types of bearings, Terminology of bearing, Selection of roller bearing from manufacturer's catalogue.	06
6.	**Design for Fluctuating Load:** Stress concentration-causes & remedies, fluctuating stresses, fatigue failure, S-N curve, Endurance limit, Notch sensitivity, Endurance strength, modifying factors, reversed stresses. Design for finite & infinite life, Soderberg & Goodman diagram, Modified Goodman diagram, Fatigue design of components under combined stresses such as shaft.	06

References –

Text Books:

- P. S. Gill, Machine Drawing, S. K. Kataria & Sons.
- V. B. Bhandari, Design of Machine Elements, New Edition Tata Mc-graw hill.

Reference Books:

- Machine Design Integrated approach by Robert L. Norton.
- PSG Design data Book
- Machine Design by Pandya Shah.
- Design of Machine Element by M. F. Spotts.
- Mechanical Analysis & Design by H. Burr & Cheata

Class: **Second Year B. Tech.**	Semester: **IV**
Course Code: **MCMD 202**	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. Describe 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** 1. Introduction to fluid power, Advantages of fluid power. 2. Application of fluid power system. 3. Types of fluid power systems, Properties of hydraulic fluids, General types of fluids. 4. Fluid power symbols. (ISO/JIC) 5. Use of Automation studio to draw circuits.	06
2.	**HYDRAULIC SYSTEM AND COMPONENTS (PUMPS and ACTUATORS)** 1. Pumping theory, Pump classification. 2. Gear pump, Vane Pump, construction and working of pumps, pump performance, piston pump 3.	06

	Variable displacement pumps. 4. Linear hydraulic actuators, Types of hydraulic cylinders, Single acting, Double acting cylinders. 5. Special cylinders like tandem, Rod less, Telescopic - Construction and application. 6.Cushioning mechanism, Mounting of actuators 7. Rotary actuators - Gear, Vane and Piston motors.	
3.	**HYDRAULIC VALVES, ACCUMULATORS AND CIRCUITS** 1. Directional control valve .4/2, 4/3, 5/3-way valves. 2. Shuttle valve check valve 3. Pressure control valve,4. Flow control valve (Fixed and adjustable) 5. Electrical control solenoid valves 6. Types of accumulators, Accumulators circuits 7. Intensifier Circuit and Application, 8. Speed control circuits, synchronizing circuit and industrial application circuits copying circuit and press circuit, regenerative circuit.	**06**
4.	**PNEUMATIC SYSTEMS, COMPONENTS AND CIRCUITS** 1.Properties of air Compressors. 2.Filter, Regulator, and Lubricator Unit 3. Air control valves, Quick exhaust valves and pneumatic actuators 4. Pneumo-hydraulic circuit 5. Time delay circuits 6. Sequential circuit design for simple applications using cascade method.	**06**
5.	**FLUID LOGIC CONTROL SYSTEM** 1. Hydro Mechanical servo systems. 2 Electro-hydraulic and Electro-pneumatic systems and proportional valves 3. Electro-hydraulic and Electro-pneumatic systems and proportional valves 4. Introduction to fluidic devices, simple circuits 5. PLC applications in fluid power control 6. Failure and troubleshooting in fluid power systems 8. Pneumatic positioning and servo systems, air hydro boosters.	**06**
6.	**HYDRAULIC/PNEUMATIC CIRCUIT DESIGN** 1. Steps in hydraulic circuit design, and simulation using Automation Studio. 2. Steps in pneumatic circuit design, and simulation using Automation Studio.	**06**

References -

Textbooks:

- 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.

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

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).

Class: **S.Y. B. Tech. Mech.**	Semester-**IV**
Course Code: **SH202**	Course Name: मराठी भाषिक कौशल्यविकास

L	T	P	Credits
2	--	--	2

अभ्यासक्रम वर्णन: सर्वांगीण व्यक्तिमत्व विकासामध्ये विद्यार्थ्यास भाषा, साहित्य आणि कला परिणामकारकतेने समजावून घेणे आजची गरज बनली आहे. जीवनाच्या परिपूर्ण आकलनामध्ये आणि प्रगल्भतेसाठी विद्यार्थ्यांमध्ये भाषिक तसेच साहित्यिक क्षमता अडीच लागणे आवश्यक झाले आहे. या अभ्यासक्रमाद्वारे विद्यार्थी भाषा आणि व्यक्तिमत्व विकास यातील सहसंबंध समजून घेईल. विविध भाषिक कौशल्य आणि भाषा उपायोजनाची विविध अविष्कार रूपे यांची ओळख या अभ्यासक्रमाद्वारे विद्यार्थ्यास होईल. तसेच विद्यार्थी कथा आणि एकांकिका या मराठी साहित्य प्रकारातील लिखाणांचे विश्लेषण करू शकेल.

अभ्यासक्रम शिकण्याचे परिणाम:
हा अभ्यासक्रम यशस्वीपणे पूर्ण केल्यानंतर विद्यार्थी खालील क्षमता प्राप्त करेल:

१. भाषा आणि व्यक्तिमत्व विकास यांमधील सहसंबंध स्पष्ट करू शकेल
२. भाषिक कौशल्यविकास करू शकेल
३. कथा या मराठी साहित्य प्रकाराचे विश्लेषण करू शकेल
४. एकांकिका या मराठी साहित्य प्रकाराच्या विश्लेषणाची क्षमता प्राप्त करेल

पूर्वतयारी: विद्यार्थ्याने मराठी भाषिक मूलभूत कौशल्य – ऐकणे, बोलणे, वाचन, आणि लेखन आत्मसात केलेली असावीत. तसेच, भाषिक कौशल्य विकासाची स्वयंप्रेरणा विद्यार्थ्यांमध्ये असावी.

अभ्यासक्रम वर्णन		
घटक	**तपशील**	**तास**
१.	भाषा आणि व्यक्तिमत्व विकास: सहसंबंध भाषिक कौशल्यविकास - नैसर्गिक: आकलनासह श्रवण	०४
२.	भाषिक कौशल्यविकास – अर्जित : संभाषण, वाचन, लेखन, इ-संवाद कौशल्य प्रगत: सारांशलेखन, सारग्रहण	०४
३.	भाषा उपयोजनाची विविध आविष्कार रूपे संवादलेखन, कल्पनाविस्तार, घोषवाक्य लेखन, भाषांतर	०४
४.	कथा : स्वरूप, घटक, आणि प्रकार (रचनाप्रकार आणि प्रवाह) एकांकिका : स्वरूप, घटक, संहितामूल्य व प्रयोगमूल्य	०४
५.	समकालीन मराठी कथा: १. लाल चिखल - भास्कर चंदनशिव २. कष्टाची भाकरी - सचिन पाटील	०४

६.	मराठी एकांकिका: विठ्ठल तो आला आला - पु. ल. देशपांडे	०४

संदर्भ ग्रंथ -

- मराठी साहित्य : प्रेरणा आणि स्वरूप, संपादक डॉ. गो. मा. पवार, डॉ. म. द. हातकणंगलेकर, पॉप्युलर प्रकाशन, १९८६.
- साहित्यमूल्य आणि अभिरुची, डॉ. गो. मा. पवार, साकेत प्रकाशन,
- कथा : संकल्पना आणि समीक्षा, सुधा जोशी, मौज प्रकाशन, २०००.
- व्यावहारिक मराठी, पुणे विद्यापीठ प्रकाशन, पुणे.
- व्यावहारिक आणि उपयोजित मराठी, डॉ. मनोहर रोकडे, स्नेहवर्धन प्रकाशन,
- मराठी भाषेची संवाद कौशल्ये (पुस्तक क्र. १ ते ८) य. न. म. मुक्त विद्यापीठ, नाशिक.
- मराठी कथा : विसावे शतक, संपादक के. ज. पुरोहित, सुधा जोशी, मॅजेस्टिक प्रकाशन.
- समकालीन मराठी कथा , (संपादक) डॉ. शिरीष लांडगे, डॉ. दिलीप पवार, डॉ. संदीप सांगळे. अक्षरबंध प्रकाशन, पुणे, २०१९.
- मराठी भाषा उपयोजन आणि सर्जन, प्रा. सुहासकुमार बोबडे
- मराठी एकांकिका (विठ्ठल तो आला आला – पु. ल. देशपांडे, हंडाभर चांदण्या– दत्ता पाटील) सांपादक प्रा. डॉ. शिरीष लांडगे, प्रा. डॉ. बाळकृष्ण लळीत, प्रा. डॉ. भास्कर ढोक, पद्मगंधा प्रकाशन, पुणे, २०१९.
- मराठी एकांकिका तंत्र व विकास, श्री. रं. भिडे, सुपर्ण प्रकाशन, पुणे.
- एकांकिका विचार आणि सर्वोत्तम एकांकिका, जयंत पवार व इतर, नेहरू सेंटर प्रकाशन, मुंबई १९९३.

Class: **S.Y. B. Tech. Mech.**	Semester-IV
Course Code: **SH204**	Course Name: हिंदी कथा साहित्य एवं प्रयोजमूलक हिंदी

L	T	P	Credits
2	--	--	2

पाठ्यक्रम परिचय

हिन्दी भारतीय आर्य भाषा परिवार की भाषा है। संस्कृत भाषा से लेकर पालि प्राकृत, अपभ्रंश आदि सोपानों से गुजरती हुई आज संपूर्ण भारत की संपर्क भाषा बन गई है। **हिन्दी भाषा** का विकास अंताक्षेत्रीय भाषा, राष्ट्रभाषा, राजभाषा और अंतर्राष्ट्रीय भाषा के रूप में हो रहा है। हमारे जन-जीवन, सामाजिक, सांस्कृतिक संप्रेषण ज्ञान-विज्ञान और सृजनात्मक साहित्य की **भाषा** के रूप में विकसित हिन्दी भाषा हमारी ही नहीं अपितु पूरे विश्व की शिक्षा व्यवस्थाओ में महत्वपूर्ण स्थान प्राप्त कर चुकी हैं।इसी का परिणाम है कि हिन्दी भाषा अपने देश में मातृभाषा प्रथम भाषा, दूसरी भाषा आदि रूपों में पढ़ी और पढाई जा रही है तथा यह भारत से बाहर अनेक देशों में भी अध्ययन और अध्यापन हो रहा है।स्वतंत्रता प्राप्ति के बाद सन् 1952 में **हिन्दी भाषा** को भारत की राजभाषा होने का गौरव प्राप्त हुआ | उत्तर प्रदेश, हिमाचल प्रदेश, हरियाणा, राजस्थान, मध्यप्रदेश, बिहार, उत्तरांचल, झारखंडता इत्तीसगढ़ राज्यों और दिल्ली एवं अंडमान सत्य राज्य-क्षेत्रों में शासन और शिक्षा की भाषा हिन्दी ही है।हम इस पाठ्यक्रम में हिंदी भाषा के इतिहास के साथ आधुनिक काव्य कहानी तथा व्यवहारिक हिंदी से परिचित कराएंगे

पाठ्यक्रम सीखने के प्रतिफल (Course Learning Outcomes:)

पाठ्यक्रम के सफल पूर्वक अध्ययन समाप्ति के बाद.....

1. विद्यार्थियों में मानवीय संवेदनाओं के विकास के साथ नवीन सामाजिक सांस्कृतिक बोधऔर जीवन मूल्यों का विकास होगा।
2. विद्यार्थियों में साहित्य के माध्यम से कलात्मक गुणों की अभिवृद्धि होगी कला की साहित्यिक विधाओं के प्रति अभिरुचि जागृत होगी तथा रचनात्मक कौशल्य को बढ़ावा मिलेगा।
3. विद्यार्थियों में नए वैश्विक मूल्यों के प्रति सजगता को बढ़ावा मिलेगा एवं मूल्यवादी दृष्टि के प्रति दायित्व बोध उत्पन्न होगा।छात्र व्यवहार में हिंदी भाषा का उचित प्रयोग कर सकेंगे।
4. छात्र व्यवहार में हिंदी भाषा का उचित प्रयोग कर सकेंगे।

Prerequisite: मूलभूत हिंदी भाषा बोलना समझना और लिखना

पाठ्यक्रम विवरण

इकाई नंबर		घंटे
1.	**आधुनिक काव्य साहित्य** 1. वह तोड़ती पत्थर: सूर्यकांत त्रिपाठी 'निराला'	04

	2. कोशिश करने वालों की हार नहीं होती: मोहनलाल द्विवेदी 3. एक और युद्ध: ओमप्रकाश वाल्मीकि	
2.	**कहानी साहित्य:** 1. भगत की गत: हरिशंकर परसाई 2. कफन: प्रेमचंद 3. पंचलाइट: कनिस्वरनाथ रेणु	04
3.	**प्रयोजन मूलक हिंदी** 1. प्रयोजन मुलक हिंदी अर्थ परिभाषा स्वरूप 2. पारिभाषिक शब्दावली के रूप में 50 प्रति शब्दों की सूची संलग्न 3. अनुवाद: अर्थ स्वरूप परिभाषा महत्व	04
4.	**कार्यालयीन एवं व्यवसायिक पत्रलेखन:** 1.कार्यालयीन पत्र कार्यालय आदेश, कार्यालय ज्ञापन, कार्यालय परिपत्र, व्यवसायिक पत्र: 2.आवेदन (रिक्त पद, अवकाश) पूछताछ, क्रयादेश 3.शिकायती पत्र (सार्वजनिक)	04
5.	**जनसंचार माध्यम और हिंदी** 1.दूरदर्शन स्वरूप विकास उपयोगिता भाषा 2.इंटरनेट का स्वरूप विकास अनुप्रयोग 3.यूट्यूब स्वरूप विकास महत्व 4.वीडियो कॉन्फ्रेंस स्वरूप प्रक्रिया एवं उपयोग	04
6.	**हिंदी लेखन** 1.फीचर लेखन 2.पटकथा लेखन 3.रेडियो वार्ता लेखन	04

संदर्भ ग्रंथ:

- अनुवाद के रूपरेखा डॉ सुरेश कुमार
- अनुवाद के भाषिक पक्ष: विभा गुप्ता
- भाषा प्रौद्योगिकी एवं भाषा प्रबंधन: सूर्य प्रकाश दीक्षित
- प्रयोजनमूलक हिंदी प्रयुक्ति और अनुवाद: डॉ. माधव सोनतक्के
- भारतीय काव्यशास्त्र: डॉ. योगेंद्र प्रताप सिंह
- आधुनिक हिंदी साहित्य में व्यंग्य: वीरेंद्र मेहंदीरता
- कार्यालय दीपिका हरिबाबू कंसल
- आधुनिक पत्रकारिता डॉ अर्जुन तिवारी

Class: **S.Y. B. Tech Mech.**	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	04

	waste management, Plastic waste management, E-waste management. 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.

Class:-**S.Y. B. Tech Mech.**	Semester-**IV**
Course Code :**ME2204**	Course Name :**Fluid Mechanics and Turbomachinery Lab**

L	T	P	Credits
--	--	2	1

Course Description:
This course covers verification of theoretical concepts, measurement of pressure and discharge 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. Select proper measuring device and Measure pressure and discharge in fluid system.
2. Calculate various losses through pipes.
3. Evaluate various efficiencies of pumps, compressors and turbines.
4. Draw performance characteristic curves for pumps, compressors and turbines.

Prerequisite:
Basic Mechanics, Physics, mathematics, Fluid Mechanics and Fluid machines.

Course Content - Any 10 experiments.		
Expt. No.	**Description**	**Hrs.**
1.	Verification of Bernoulli's equation	02
2.	Determination of coefficient of discharge of Venturimeter and Orificemeter.	02
3.	Determination of coefficient of discharge of V notch and rectangular notch.	02
4.	Determination of major and minor losses in pipe fittings	02
5.	Performance investigation of Pelton turbine. (Operating Characteristics curves)	02
6.	Performance investigation of Francis/Kaplan turbine. (Main Characteristics curves)	02
7.	Performance investigation of centrifugal pump.	02
8.	Performance investigation of gear and vane pump	02
9.	Performance investigation of reciprocating air compressor	02
10.	Performance investigation of Blower	02

11.	Basic IHP circuit design and demo on trainer.	02
12.	Industrial Visit -Report. (Hydroelectric power plant/Pump house)	02

References -

Text Books:

- R.K. Bansal, Fluid Mechanics.

Reference Books:

- S.K. Som, Introduction to Fluid Mechanics and Fluid Machines,Biswas

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

L	T	P	Credits
-	-	2	1

Course Description:
This course enables students to create 2D, 3D model, Assembly, bill of material and drafting of any mechanical component. Students learn CATIA CAD modelling software in which they are taught different commands for sketching, modelling and assembly. Also they taught to select drawing units, apply constraints. After assembly, students can create bill of material and evaluate 2D drafting in different views.

Course Outcomes:
At the end of the course the students will be able to: -
1. List the different CAD software used for mechanical engineering
2. Model machine parts using CAD software
3. Assemble machine Parts by using CAD tool
4. Generate detailed drawing views
5. Create surface features using surfacing tools

Course Content

Expt. No	Description	Hrs
1.	Introduction and Overview of CATIA, CAD/CAM/CAE Product Cycle, Environment of CATIA , Introduction to Menu Bars, Modules	02
2.	Introduction and Overview of CATIA, CAD/CAM/CAE Product Cycle, Environment of CATIA , Introduction to Menu Bars, Modules	02
3.	Constraint- Geometrical constraint. Tools- Sketch solving status. Sketch tool, Views, Standard options etc	02
4.	3D Reference Elements (Point, Line, Plane), Pad, Pocket, Shaft, Groove, Hole, Rib, Slot, Stiffener, Loft, Remove Loft	02
5.	Fillet, Chamfer, Draft, Shell, Thickness, Thread/ Tap, filleted pocket, Transformation feature- Patterning, Scaling, Mirror	02
6.	Insert, Measure, and creation of axis system	02
7.	Insert Component, Product, Part, Existing component, Replace component, recording, Generate numbering. Manipulation, Snap, Smart move, Explode, Stop manipulate on clash etc.	02
8.	Coincidence, Contact creation, Offset, Angle, Fix, Fix together, Quick constraint, Change Constraint, Reuse pattern etc. Checking Interference- Clash, Sectioning etc. Assembly Features etc.	02
9.	Front View, Auxiliary View, Projection Views, Unfolded view, Section Views, Detail View, BrokenView, Clipping view, View creation wizard etc. Dimension generation, Balloon generation etcPositioning Views, Modifying Views etc Dimension properties, Addition of tolerance etcFrame cretion, frame	02

	modification, Addition of Bill of material etc	
10.	Case study will be based on all above module e.g. assembly and drafting of screw jack	**02**

References:

Text Books:

- CATIA V5 for Designers by Prof. Sham Tickoo Purdue Univ. and CADCIM Technologies.
- SolidWorks 2023 Learn by Doing: Part, Assembly, Drawings, Sheet Metal, Surface Design, Mold Tools, Weldments, DimXpert, and Rendering" by Tutorial Books.
- CATIA V5 Workbook Release V5-6R2013 by Richard Cozzens.
- CATIA V5 Basics - Part I: Getting Started and Sketcher Workbench by Tutorial Books

Class: - **S.Y. B. Tech. Mech.**	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. Evaluate mechanical properties of materials using Destructive tests
2. To measure micro-hardness of various delicate samples.
3. To explain non-destructive testing methods.
4. Correlate mechanical properties with microstructures of steel and cast iron.
5. To estimate composition of various ferrous and non-ferrous metals.
6. Heat treat given specimen to modify the properties.

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
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.

Class: **S.Y. B. Tech. Mech.**	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 proficiency in using various lathe operations to fabricate composite parts (by performing boring, taper turning, threading etc.) and to assemble them with close dimensional tolerance, ensuring proper alignment and fit.
2. Perform cylindrical grinding and surface grinding process to achieve better surface quality.
3. Analyze material removal and profile generation during milling operations and enhance surface finish and material removal efficiency.
4. Analyze Surface contouring during shaping operations, demonstrating the ability to create complex shapes and profiles.
5. Perform operations on Turret lathe and drilling machine for engineering applications.

Course Content	
Description	**Practicals**
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: -

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

Class:- **S.Y. B. Tech Mech.**	Semester-**IV**
Course Code:**ME2364**	Course Name:**Technical Aptitude -II**

L	T	P	Credits
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Course Description: Technical aptitude I course is designed as per syllabus of GATE examination. Courses added in this specifically focusing applicable for GATE exam. The questions solved in this course are a part of GATE examination. Students need to solve and practice these questions as they will get basic knowledge of important subjects related to GATE and Technical Examinations which will be further helpful for placement preparations and interviews.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply the fundamental knowledge to solve mechanical engineering problems.
2. Develop the ability of problem solving.

Course Content:
Multiple Choice Questions (MCQ) examination will conduct at the end of the semester on following courses.

1. Fluid Mechanics and Turbomachinery,
2. Mechanics of Solids,
3. Material Science and Metallurgy.

The students have to do preparation on all the courses listed above. This test will increase the student's learning and understanding of above courses for Semester-II of S.Y.B. Tech