24-28

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented 2024-28 NEP Batch
Department of Mechatronics Engineering

B. Tech. in Mechatronics Engineering with Multidisciplinary Minor

Rajarambapu Institute of Technology • Rajaramnagar • Mechatronics Dept. 415 414

K.E.S. Rajarambapu Institute of Technology * Rajaramnagar Autonomous 415414

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics Engineering

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)	
							Max	Min. for passing	Max.	Min. for passing
MC2011	Engineering Mathematics for Mechatronics Engineering	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	---
						ESE	50	40	----	----
MC2031	Analog and Digital Electronics	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
MC2051	Industrial Fluid Power	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
MC2071	Engineering Mechanics	2	-	-	2	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
	Multi-Disciplinary Minor-I	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
MC2511	Analog and Digital Electronics Lab	-	-	2	1	ISE	----	----	50	50
						ESE	----	----	50	50
MC2531	Industrial Fluid Power Lab	-	-	2	1	ISE	----	----	50	50
						ESE	----	----	50	50
MC2551	Workshop Practice –I (Electrical Machines Lab)	-	-	2	1	ISE	----	----	100	50
MC2571	Machine Drawing and CAD Modelling Lab	-	-	2	1	ISE	---	----	50	50
						ESE	----	----	50	50
MC2591	Engineering Mechanics Lab			2	1	ISE	---	----	100	50
MC2593	Python Programming Lab	-	-	2	1	ISE	---	----	50	50
						ESE	----	----	50	50
	Professional Skills Development and Foreign Languages-I	-	-	2	1	ISE	----	---	100	50
	TOTAL	**14**	**-**	**14**	**21**					
	TOTAL CONTACT HOURS	**28**								

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam.

Total Contact Hours/week : 28

Total Credits : 21

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

Professional Skills Development and Foreign Languages-

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-Level III	SH2734
6.		Japanese Language-Level III	SH2714

Note:

1. A student must 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).

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics 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
MC2021	Strength of Materials	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC2041	Microcontrollers and Embedded Systems	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC2061	Kinematics & Dynamics of Machines	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			--	---
						UT2	15			---	---
						ESE	50	40		---	---
MC2081	Manufacturing Technologies	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			--	---
						UT2	15			---	---
						ESE	50	40		---	---
MC210	Robot Operating System	2	-	-	2	ISE	20	40		---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multi-Disciplinary Minor-II	3	-	-	3						
SH2174	Environmental Science	1	-	2	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
MC2501	Microcontrollers and Embedded Systems Lab	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
MC2541	Workshop Practice – II	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
MC258	Robot Operating System Lab	-	-	2	1	ISE	---	----		100	50
	Professional Skills Development and Foreign Language	-	-	2	1	ISE	--	---		100	50
	TOTAL	**18**	**-**	**10**	**23**						
	TOTAL CONTACT HOURS	**28**									

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam.

Total Contact Hours/week : 28

Total Credits : 23

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

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

Professional Skills Development and Foreign Languages-

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 –Level IV	**SH2644**
6.		Japanese Language – Level IV	**SH2624**

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics 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
MC3011	Industrial Automation	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC3031	Sensors and Instrumentation	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC3151	Control Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective Course-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		---	---
	Multi-Disciplinary Minor-III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multi-Disciplinary Minor-IV	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC3511	Industrial Automation Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
MC3531	Sensors and Instrumentation Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
MC3551	Control Engineering Lab	-	-	2	1	ISE	---	---	---	100	50
SH3035	Scholastic Aptitude-I	1	-	2	Audit	ISE	100	50 (P/NP)	--	--	
MC3591	Summer Internship	-	-	-	2	ISE	---	---	---	100	50
	TOTAL	**20**	**-**	**8**	**24**						
	TOTAL CONTACT HOURS	**28**									

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam.

Total Contact Hours/week : 28

Total Credits : 24

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

Program Elective-I

Sr. No	Course Code	Course Name	Domain
1.	MC3071	Data Base Management System	Intelligent Systems
2.	MC3091	Condition Monitoring	Design & Manufacturing
3.	MC3111	Battery And Fuel Cell Technology	Advanced Mobility System
4.	MC3131	Industrial Organization and Management	Design & Manufacturing

Open Elective –I

Sr. No.	Course Code	Open Elective Course Name	Offered by the department
1	OE3044	Renewable Energy Sources	Robotics & Automation
2	OE3064	Environmental Impact Assessment	Civil Engineering
3	OE3104	Network Administration	Computer Science and Engineering
4	OE3381	Disaster Management	Civil Engineering
5	OE341	Energy Audit and Management	Electrical Engineering
6	OE343	Data Science	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
7	OE365	Distributed Systems	Computer Science and Information Technology
8	OE347	New Product Design & Development	Mechanical Engineering
9	OE349	Non-Conventional Energy Sources	Mechanical Engineering
10	OE351	Hydrogen & Fuel Cell Technology	Mechanical Engineering
11	OE353	Factory Automation	Mechatronics Engineering Dept.
12	OE355	Cyber Physical System	Mechatronics Engineering Dept.
13	OE357	Internet of Things	Electronics & Telecommunication Engineering
14	OE359	Drone technology	Electronics & Telecommunication Engineering
15	OE361	Object-Oriented Modeling and Design	Computer Science and Information Technology
16	OE363	Robotics Engineering & Applications	Robotics & Automation

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics 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
MC3021	Machine Design	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
MC3041	Power Electronics and Drives	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
MC3061	Research Methodology	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Program Elective-II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Open Elective-II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Multi-Disciplinary Minor-V	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
MC3241	Image Processing	2	-	-	2	ISE	20	40	---	----
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
MC3601	Image Processing Lab	-	-	2	1	ISE	--	--	50	50
						ESE	--	--	50	50
MC3501	Workshop Practice – III	-	-	2	1	ISE	---	----	50	50
						ESE	--	--	50	50
MC3521	Power Electronics and Drive Lab	-	-	2	1	ISE	---	---	50	50
						ESE	---	---	50	50
MC362	DCS Lab	-	-	2	1	ISE	---	---	50	50
						ESE	---	---	50	50
SH3065	Scholastic Aptitude-II	1	-	2	Audit	ISE	100	50 (P/NP)	--	--
MC3581	Capstone project -Phase I	-	-	2	1	ISE	----	----	100	50
	TOTAL	**20**	**-**	**12**	**24**					
	TOTAL CONTACT HOURS	**32**								

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam.

Total Contact Hours/week : 32

Total Credits : 24

Rajarambapu Institute of Technology • Mechatronics Dept. 415 414 • Rajaramnagar

K.E. Rajarambapu Institute of Technology * Rajaramnagar Autonomous 415414

Program Elective - II

Sr. No.	Course Code	Course	Domain
1.	MC3081	Finite Element Methods	Design & Manufacturing
3.	MC3121	Additive Manufacturing	Design & Manufacturing
4.	MC324	Digital Twin	Intelligent Systems
5.	MC3161	Industry 4.0 Technologies and IIOT	Design & Manufacturing & Intelligent Systems
6.	MC3181	Wireless Sensor Network	Automation
7.	MC3201	Microelectromechanical Systems	Automation
8.	MC326	Fuzzy Logic & Neural Networks	Intelligent Systems

Open Elective –II

Open Elective II			
Sr. No.	**Course Code**	**Open Elective Subject Name**	**Offered by the department**
1	OE3024	Reliability Engineering	Robotics & Automation
2	OE3084	Materials Management	Civil Engineering
3	OE3182	Industrial Drives	Electrical Engineering
4	OE3284	Supply Chain Management	Mechanical Engineering
5	OE3324	Entrepreneurship Development	Mechanical Engineering
6	OE3401	Cyber Security	Computer Science and Information Technology
7	OE342	Data Mining	CSE(AI&ML)
8	OE344	Supply Chain Analytics	Mechatronics Engineering Dept.
9	OE346	Mobile Robotics	Mechatronics Engineering Dept.
10	OE348	Information Technology Foundation Program	Computer Science and Engineering
11	OE350	Operations Research	Civil Engineering
12	OE352	Image Processing	Electronics & Telecommunication Engineering
13	OE354	Fuzzy logic and Neural Network	Electronics & Telecommunication Engineering
14	OE356	Project Management	Mechanical Engineering
15	OE358	Plumbing (Water and Sanitation)	Civil Engineering
16	OE362	Flexible Manufacturing System	Robotics & Automation
17	OE364	AI for Manufacturing	Computer Science and Information Technology
18	OE366	AI for Cybersecurity	Computer Science and Engineering
19	OE368	AI for Agriculture	CSE(AI&ML)
20	OE370	AI for Sustainability	Electronics & Telecommunication Engineering
21	OE3242	Marketing for Engineers	MBA

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics 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
MC4011	Design of Mechatronics System	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC4031	Machine Learning	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC4051	Industrial Robotics	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective Course-III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective Course-IV	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
MC4511	Industrial Robotics Lab	-	-	2	1	ISE	--	---	100	50	50
						ESE	--	---	100	50	50
MC4531	Circuit Simulation and PCB Design Lab	-	-	2	1	ISE	--	---	100	50	50
						ESE	--	---	100	50	50
	Program Elective-IV Lab	-	-	2	1	ISE	--	---	100	50	50
						ESE	--	---	100	50	50
MC4711	Capstone Project Phase II	-	-	6	3	ISE	--	---		50	50
						ESE	--	---		50	50
	TOTAL	**14**	**-**	**12**	**20**						
	TOTAL CONTACT HOURS	**26**									

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam.

Total Contact Hours/week : 26

Total Credits : 20

Rajarambapu Institute of Technology • Mechatronics Dept. 415 414 • Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

Program Elective-III

Sr. No.	Course Code	Course Name	Domain
1.	MC4071	Building Automation	Automation
2.	MC4091	Basics of Cloud Computing	Intelligent Systems
3.	MC4111	Machine Tool Design	Design & Manufacturing
4.	MC4151	Hybrid and Electric Vehicle	Advanced Mobility System
5.	MC4171	Industrial Engineering	Design & Manufacturing
6.	MC4191	Emerging Smart Materials for Mechatronics Applications	Design & Manufacturing

Program Elective-IV

Sr.No.	Course Code	Course	Domain
1.	MC4231	Computer Network and Cyber Security	Intelligent System
2.	MC433	Unmanned Arial vehicles	Advanced Mobility System
3.	MC4271	VLSI Design	Automation

Program Elective-IV Lab

Sr. No.	Course Code	Course	Domain
1.	MC4551	Computer Network and Cyber Security Lab	Intelligent System
2.	MC4571	VLSI Design Lab	Intelligent System
3.	MC467	Unmanned Arial Vehicles Lab	Advanced Mobility System

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

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 %)			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		---	---
IP4024	Industry Internship & Project	-	-	-	12	ISE	---	----		50	50
						ESE	---	---		50	50
	TOTAL	-	-	-	**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, students need to report to Institute mentors as and when required.
2] For online courses, lecture videos of each unit will be made available through college platforms to the students. For each unit there will be separate assignments. Students need to submit all assignments within a specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exams will be held at college campus.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics Engineering

Model II: Research Internship (RI)

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			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	-	-	-	**16**						

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam.

Total Contact Hours/week : -
Total Credits : 16

Note:

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

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

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

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

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics Engineering

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

Course Code	Course	Teaching Scheme			Credits	Evaluation Scheme					
						Scheme	Theory (Marks %)			Practical (Marks %)	
		L	T	P			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	
		-	-	-	**16**						

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam.

Total Contact Hours/week : 04

Total Credits : 16

Note:

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

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

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

3] A one-week Entrepreneurship Development Program (EDP) will be conducted after completion of the 7th semester and before start of 8th semester.

4] Students who opt for an entrepreneurial internship need to undergo a one-month internship at an outside reputed organization or firm.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Multidisciplinary Minor

- Student should choose any one specialization given by the department and complete all the five courses under the specialization to earn 170 Credits.
- Following are the baskets of multidisciplinary minor courses

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

	4	EEMD303	Electrical Technology 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	Advanced Communication Systems	V	
	4	ECMD303	Electronic Product Design	V	
	5	ECMD302	Industrial Electronics	VI	
Software Development	1	CIMD201	Data Structures	III	Computer Science & Information Technology
	2	CIMD202	Computer Algorithms	IV	
	3	CIMD301	Introduction to DBMS	V	
	4	CIMD303	OOP using Java	V	
	5	CIMD302	Software Engineering	VI	
Product Design and Development	1	MEMD203	Design Thinking	III	Mechanical Engineering
	2	MEMD204	Behavioral Engineering and Design	IV	
	3	MEMD305	Product Design Tools and Techniques	V	
	4	MEMD307	Design and Prototyping	V	
	5	MEMD304	Marketing and Business Fundamentals for New Products	VI	

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

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	
Robotics & Automation	1	RAMD201	Fundamentals of Robotics & Automation	III	Robotics & Automation
	2	RAMD202	Sensors and Actuators	IV	
	3	RAMD301	Kinematics & Dynamics for Robots	V	
	4	RAMD303	Robot Programming.	V	
	5	RAMD302	Industrial Automation & Control	VI	

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

B.Tech. in Mechatronics Engineering with Double Minor degree

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

Sr. No.	Semester	Course	Code
1	III	DM – I	MCDM3XXX
2	IV	DM – II	MCDM4XXX
3	V	DM – III	MCDM5XXX
4	VI	DM – IV	MCDM 6XXX
5	VII	DM – V	MCDM 7XXX
6	VIII	DM – VI	MCDM 8XXX

4.To select course platform, first preference must be given to NPTEL.
5.Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,

a. If timeline of NPTEL course is not in line with timeline of academic calendar.
b. The suitable succeeding course in line with previous course is not available on NPTEL.
c. If any other unavoidable circumstances occur.

6.Platform and course selection must be as per the recommendation of BOS of the department.
7.Student will get the credits of respective DM course in following conditions,

d. In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
e. In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.

8.While selecting online course, following points must be taken care of,

f. Selected course must be of basic or fundamental level.
g. Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective) or in Multidisciplinary Minor (MDM)
h. Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for UDEMY, COURSERA courses.

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

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

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

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

Sr. No.	Semester	Course	Code
1	III	Honor - I	MCH3XXX
2	IV	Honor - II	MCH4XXX
3	V	Honor - III	MCH5XXX
4	VI	Honor - IV	MCH6XXX
5	VII	Honor - V	MCH7XXX
6	VIII	Honor - VI	MCH8XXX

4.To select course platform, first preference must be given to NPTEL.

5.Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,

a. If timeline of NPTEL course is not in line with timeline of academic calendar.
b. The suitable succeeding course in line with previous course is not available on NPTEL.
c. If any other unavoidable circumstances occurs.

6.Platform and course selection must be as per recommendation of BOS.

7.Student will get the credits of respective Honor course in following conditions,

d. In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
e. In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.

8.While selecting online course, following points must be taken care of,

f. Selected course must be of advanced level and not basic or fundamental level.
g. Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective)

Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for COURSERA, UDEMY courses.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics Engineering

B. Tech. in Mechatronics 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 Mechatronics Engineering Honors with Research and Multidisciplinary Minor degree Student need to earn total 188 Credits which consist 170 credits of regular Multidisciplinary Minor courses and 18 credits of Research courses.

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

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

ISE = In Semester Evaluation, ESE = End Semester Evaluation

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

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Mechatronics Engineering

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 Evaluation

Rajarambapu Institute of Technology • Rajaramnagar • Mechatronics Dept. 415 414

K.E. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

24-28

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

Class: **S. Y. B. Tech**	Semester – **III**	**L**	**T**	**P**	**Credits**
Course Code: **MC2011**	Course Name: **Engineering Mathematics for Mechatronics Engineering**	**3**	**--**	**--**	**3**

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

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Illustrate curve fitting concepts in Mechatronics related problems.
2. Compute problems on probability distribution by using different formulae.
3. Evaluate differential equation using appropriate concept.
4. Analyze the problem and apply the concept of partial differential equations.
5. Evaluate Laplace & inverse Laplace transform of function and solve ordinary differential equations and linear time invariant systems.
6. Develop Fourier series of periodic functions.

Prerequisite: Engineering Mathematics-I and Engineering Mathematics-II

Course Content

Unit No	Description	Hrs
1.	**Statistics:** Coefficient of correlation by Karl Pearson's method, lines of regression, fitting of curve (Straight line and Parabola) by least square method.	06
2.	**Probability:** Probability of Random Variable, Discrete and Continuous Probability Distributions, Binomial, Poisson and Normal Distributions,	06
3.	**Linear Differential Equations:** Definition, complete solution of Linear Differential Equation with constant coefficients. (All Types to find Particular Integral & General type) Solution of Linear Differential Equation with Variable coefficients. (Cauchy Linear differential equation, Legendre's Linear differential equation)	06

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E. Society's Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

4.	**Partial Differential Equations** Solution to linear homogeneous & nonhomogeneous partial differential equation of higher order, Method of separation of variable, application to one dimensional heat equation, Two-dimensional heat equation, Laplace equation.	**06**
5.	**Laplace Transforms** Definition of Laplace transform, Laplace transform of standard functions, properties of Laplace transform, Definition of inverse Laplace transform, Properties of inverse Laplace transform, convolution theorem, Application to solve ordinary differential equation with one dependent variable.	**06**
6.	**Fourier Series** Definition, Dirichlets condition, Fourier expansion of given function, Fourier half range sine series, and Fourier half range cosine series, Application of Fourier Series (Periodically Forced Oscillation).	**06**

Reference Books:

Textbook:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 41th edition

Reference Books:

1. Erwin Kreyszig, Advanced engineering mathematics, 9th edition, Wiley, 2011.
2. Raman B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi.
3. N. P. Bali, Ashok Saxena and N. Ch. S. N. Iyengar, A Textbook of Engineering Mathematics, Laxmi Publications, New Delhi, 6th edition, 2004.
4. Peter V. O'Neil, Advanced Engineering Mathematics, Cole publishing house, 4th edition, 2002.
5. P. N. Wartikar and J. N. Wartikar, A Textbook of Applied Mathematics, Vol. I, Vol. II, VidyarthiGrihaPrakashan, Pune. 9th Revised edition, October 1984, Reprints: September 2005.

Class: **S.Y. B. Tech.**	Semester: **III**
Course Code: **MC2031**	Course Name: **Analog and Digital Electronics**

L	T	P	Credits
3	-	--	3

Course Description:
The course introduces characteristics and applications of analog and digital circuits. It will give a basis for understanding and constructing simple systems of analog and digital electronic circuit elements. The students will understand basic analog and digital electronics, including semiconductor properties, construction, operational amplifiers, combinational and sequential logic.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain working principles of electronic devices
2. Illustrate applications of analog and digital electronic circuits.
3. Analyze various analog and digital circuits.
4. Design applications using electronic devices and circuits.

Prerequisite: Fundamental concepts of Mathematics, Physics and Boolean Algebra.

Course Content

Unit No.	Description	Hrs.
1.	**PN Junction Diode & Bipolar Junction Transistors:** PN Junction Diode and its characteristics, Diode applications: Voltage Multiplier, Clipper and Clamper Circuits, Rectifiers: Half-wave, Full-wave, NPN Bipolar Junction Transistor, V-I Characteristics, Transistor as a Switch.	06
2.	**FET (Field Effect Transistor):** JFET, VI Characteristics of JFET, MOSFET, VI Characteristics of MOSFET, applications.	06
3.	**OP AMP Circuits and Its Applications:** Basics of OPAMP, characteristics of OPAMP, OPAMP as Inverting amplifier, non-inverting amplifier, summing amplifier, Difference amplifier, Integrator, Differentiator, Comparator, Zero Crossing Detector.	06
4.	**Boolean Algebra and Logic Gates:**	06

	Logic Gates, Basic Theorems, Properties of Boolean Algebra, minimization using rules of Boolean Algebra, realization of Boolean equations using gates, SOP and POS forms, Canonical and standard form, Min and Max terms, Minimization of logical functions using K-map.	
5.	**Combinational and Sequential Logic:** Adders, Subtractors, Multiplexers, Demultiplexers, Magnitude Comparator, Flip-flops (SR, JK, T, D), Synchronous and Asynchronous Counters, Shift Registers.	**06**
6.	**Applications:** Voltage Regulator, DC Power Supply, Schmitt Trigger, Instrumentation Amplifier, BCD to 7 segment display, Traffic Light Controller, Priority Encoder.	**06**

References -

Textbooks:

1. R. L Boylestad, L. Nashlesky, "Electronic Devices and Circuits Theory", Pearson Education.
2. Donald Neaman, "Electronic Circuit Analysis and Design", Tata McGraw Hill,
3. R.P Jain, "Modern digital electronics", Tata McGraw Hill Publication,

Reference Books:

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson.
2. Anand Kumar, "Fundamentals of digital circuits", PHI Publication.
3. Wakerly, "Digital Design Principles and Practices", Pearson Education.
4. M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons Inc.

NPTEL/SWAYAM Course:

1. Digital Circuits, By Prof. Santanu Chattopadhyay, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc23_ee115/
2. Analog Electronic Circuit, By Prof. Shouribrata Chatterjee, IIT Delhi. https://onlinecourses.nptel.ac.in/noc23_ee106/
3. Semiconductor Devices and Circuits, By Prof. Sanjiv Sambandan, IISc Bangalore. https://onlinecourses.nptel.ac.in/noc23_ee91/
4. Analog Electronic Circuits, By Prof. Pradip Mandal, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc20_ee45/preview

Class: **S.Y. B. Tech.**	Semester: **III**
Course Code: **MC2051**	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** Introduction to fluid power, Advantages of fluid power, Application of fluid power system, Types of fluid power systems, Properties of hydraulic fluids,	**06**

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

References -

Textbooks:

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

Reference Books:

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

Class: **S.Y. B. Tech.**	Semester: **III**
Course Code: **MC2071**	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 skills of students. It develops thinking, analytical ability and imaginative skills of students. It is an introductory course which supports the 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 co-planar 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.
01	**Fundamentals of Mechanics and Force Systems**: Force and classification of force systems. Resultant of parallel, concurrent, and non-concurrent coplanar forces.	**04**
02	**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**
03	**Friction:** Introduction to Laws of friction, Surface friction for bodies on horizontal and inclined planes.	**04**
04	**Analysis of trusses:** Analysis of simple truss, Method of joints, Method of sections.	**04**
05	**Centroid:** Centroid of plane and composite figures.	**04**
06	**Moment of Inertia**: Moment of Inertia of plane and composite figures.	**04**

References:

Textbooks:

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

Reference Books:

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

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	06

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

References-

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.

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

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

References -

Text Books:

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

Reference Books:

- Twidell, J. and Tony W., Renewable Energy Resources, Taylor & Francis.

- Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction, Academic Press, Elsevier.
- Yasuo Koizumi, Tomio Okawa and Shoji Mori, Fundamentals of Thermal and Nuclear Power Generation, Elsevier, Publisher.

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

L	T	P	Credits
3	--	--	3

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

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

Prerequisite: Fundamental concepts of Mathematics and Physics.

Course Content

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

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

References –

Text Books:

- Boylestad, Robert & Louis, Nashelsky, "Electronics Devices and Circuit Theory", Pearson.
- Ramakant Gayakwad, Op-Amps and Linear Integrated Circuits, PHI
- 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**
Course Code: **CIMD201**	Course Name: **Data Structures**

L	T	P	Credits
3	--	--	3

Course Description:

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

Course Learning Outcomes:

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

1. 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 linked list.	**07**
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: **MEMD203**	Course Name: **Design Thinking**

L	T	P	Credits
3	--	--	3

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

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

Course Learning Outcomes:
This course is designed to familiarize students with the principles and practices in the development, design, Development and introduction of new products and services. After successful completion of the course, student will be able to:

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

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

Course Content

Unit No.	Description	Hrs
1.	**Discovery- Opportunity Identification for New products:** Product life cycle, need for new products, strategic planning and new product opportunity, sources of new product ideas, S curves and technology forecasting. Product idea generation, Product Design Process steps.	06

Rajarambapu Institute of Technology • Rajaramnagar • Mechatronics Dept. 415 414

K.E. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

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

References: -

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

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

L	T	P	Credits
3	-	--	3

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

Course 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 Microcontroller, Assembly programming	**08**
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:

1. Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.).
2. Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education.
3. A Textbook of Mechatronics, R.K. Rajput, S. Chand & Company Private Limited
4. 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. Identify and integrate basic object-oriented programming concepts and apply them in problem-solving
2. Construct and test inheritance concepts for reusing the program.
3. Develop and test a program using loops, decision statements, and functions in Python.
4. Evaluate the given 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.**	Semester - **III**
Course Code: **RAMD201**	Course Name: **Fundamentals of Robotics & Automation**

L	T	P	Credits
3	-	--	3

Course Description:

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

Course Outcomes:

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

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

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

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

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

References-
Text Books:

- Mittal R K & Nagrath, "Robotics and Control", 2nd Edition, McGraw Hill Publication TMH.
- S. K. Saha, "Introduction to Robotics".
- Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, "Industrial Robotics, Technology, Programming & Applications", Tata McGraw Hill Education Pvt. Ltd. New Delhi.

Reference Books:

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

NPTEL Course on Robotics:

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

Class: - **S.Y. B.Tech.**	**Semester-III**
Course Code: **MC2511**	Course Name: **Analog and Digital Electronics Lab**

L	T	P	Credits
-	-	2	1

Course Description:
Analog and Digital Electronics Lab course focuses on working principles of electronic devices, Operational amplifiers, Logic gates. This course also develops an ability to analyse and design various applications of electronic devices.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Analyze electronic circuits as per requirements.
2. Conduct an experiment to observe response.
3. Calculate different parameters from experimental results and plot the response.
4. Interpret results of experiment and compare with measured values.
5. Improve the ability to communicate effectively through written lab journals.

Prerequisite: Basic knowledge of active and passive components, Multimeter, Breadboard, CRO.

Course Content		
Expt. No.	**Title of the Experiment**	**Hrs.**
1.	Study characteristics of PN junction diode.	02
2.	Analyze types of clipper circuits.	02
3.	Analyze types of clamper circuits.	02
4.	Design of half wave rectifier	02
5.	Design of full wave rectifier.	02
6.	Design inverting and non-inverting amplifier using OP-AMP.	02
7.	Verify the truth tables of all basic gates.	02
8.	Design and verify half-adder & half-subtractor using logic gates.	02

9.	Verify the truth table of SR, JK, T and D flip-flops using NAND & NOR gate.	02
10.	Verify the truth table of synchronous and asynchronous counter.	02
11.	Verify the truth table of serial-in parallel-out shift register.	02

References –

Textbooks:

1. R. L. Boylestad, L. Nashlesky, "Electronic Devices and Circuits Theory", Pearson Education.
2. Donald Neaman, "Electronic Circuit Analysis and Design", Tata McGraw Hill, (3rd Edition).
3. R.P. Jain, "Modern digital electronics", Tata McGraw Hill Publication, (3rd Edition).

Reference Books:

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson.
2. Anand Kumar, "Fundamentals of digital circuits", PHI Publication.

Class: - **S.Y. B.Tech.**	**Semester-III**
Course Code: **MC2531**	Course Name: **Industrial Fluid Power Lab**

L	T	P	Credits
-	-	2	1

Course Description: Hydraulic and pneumatic operated machines and equipment are widely used in various industries due to their versatility and adaptability to automation. Mechanical engineering technologists are required to maintain such systems in different segments of industries. This competency needs the knowledge of construction and working of different components of hydraulic and pneumatic systems. This course will give the students the basic skills and knowledge to use and maintain different types of hydraulic systems and pneumatic systems.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Demonstrate & identify various components of Hydraulics & Pneumatic System along with standard symbols.
2. Design & analyze basic hydraulic and pneumatic circuits using training kits.
3. Design & analyze electrohydraulic and electropneumatic circuits using training kits.
4. Use Automation Studio software to design & simulate the fluid power circuits.

Prerequisite: Basic knowledge of fundamentals of fluid power and electrical systems.

Course Content		
Expt. No.	**Title of the Experiment**	**Hrs.**
1.	Identify the components and Draw ISO symbols used in hydraulic and pneumatic system.	**02**
2.	Construct and actuate hydraulic circuit for SAC, DAC and Hydro motor for the given purpose.	**02**
3.	Construct and actuate Meter-in, Meter-out Hydraulic circuit for the given purpose.	**02**
4.	Construct and actuate hydraulic circuit for the given sequencing of operations.	**02**
5.	Construct and actuate Pneumatic circuit for SAC, DAC and Air motor for the given purpose.	**02**

6.	Construct and actuate speed control Pneumatic circuits for the given purpose.	**02**
7.	Construct and actuate indirect (pilot) control Pneumatic circuit for the given purpose.	**02**
8.	Construct and actuate Pneumatic circuit for the given sequencing of operations.	**02**
9.	Construct and actuate Pneumatic circuit for the given Logic functions (AND/OR/TIME DELAY).	**02**
10.	Construct and actuate Electro-Pneumatic circuit/PLC controlled circuit for given application.	**02**

References –

Textbooks:

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

Reference Books:

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

Class: - **S.Y. B. Tech.**	Semester-**III**	**L**	**T**	**P**	**Credits**
Course Code: **MC2551**	Course Name: **Workshop Practice –I** (Electrical Machines Lab)	-	-	2	1

Course Description:
The course aimed at acquiring an understanding of basic principles, operation, and concepts of electrical machines. The performance, control, testing and maintenance of AC and DC machines are covered in the course. Hands-on experiments will ensure student learning and boost their confidence while handling any electrical machines.

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

1. Perform experiments on AC and DC machines.
2. Demonstrate testing and control of various electrical machines.
3. Plot the characteristics of various electrical machines.
4. Analyse the performance parameters of electrical machines.
5. Compare the performances of the electrical machines.

Prerequisite: Students should have knowledge of Engineering Physics and Basic Electrical Engineering.

Course Content		
Experiment No	**Description**	**Hrs.**
1.	Demonstration of D.C Machine parts (Assembly and Dismantling)	**02**
2.	Plotting open circuit characteristics of DC Generator	**02**
3.	Speed Control of DC shunt motor by flux control and armature voltage control.	**02**
4.	Plotting Load Characteristics of D.C. Motor	**02**
5.	Demonstration of single-phase transformer	**02**
6.	Perform Polarity & Voltage ratio Test on Single Phase Transformer	**02**
7.	Perform Open circuit and Short. circuit Test on single Phase Transformer	**02**
8.	Demonstration of 3-Phase Induction of motor.	**02**
9.	Speed and direction control of 3-phase induction motor.	**02**

10.	Perform Load test on three phase induction motors	**02**

References -

Textbooks:

1. Ashfaq Husain, Electric Machines, Dhanpat Rai Publication Delhi, Third Edition, 2016.
2. "Principle of Electric Machine" By V K Mehta, 2002, S Chand Publication.

Reference Books:

1. Bimbhra. P.S, Electrical Machinery, Khanna Publishers, IL Kosow, "Electrical Machines & Transformers", Prentice Hall of India. 2nd edition 2003
2 B. L. Theraja, Textbook of Electrical Technology Vol.-I, S. Chand and Co. Ltd. Publication, Third Edition, 2005.

Class: - **S.Y. B. Tech.**	Semester-**IV**	**L**	**T**	**P**	**Credits**
Course Code: **MC2571**	Course Name: **Machine Drawing and CAD Modeling Lab**	**-**	**-**	**2**	**1**

Course Description:

This course enables students to create 2D, 3D models, 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 a bill of material and evaluate 2D drafting in different views.

Course Learning Outcomes:

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

1. List and draw different standard parts like fasteners and keys.
2. Inspect Limit, fits and tolerances from sketches of machine parts.
3. Model machine parts using CAD software.
4. Assemble machine Parts by using CAD tool.
5. Generate detailed drawing views.
6. Create surface features using surface tools.

Prerequisite: Basic study of engineering drawing, machine drawing is required.

Course Content		
Experiment No	**Description**	**Hrs**
1.	Introduction to Thread Forms, fasteners, keys, joints, and couplings (2D Drawing of any two parts)	**02**
2.	**Limits, Fits and Tolerances**: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings.	**02**
3.	**Free Hand Sketching:** Sketching of different shapes, Machine Components.	**02**
4.	**Introduction to CAD and CATIA** Introduction and Overview of CATIA, CAD/CAM/CAE Product Cycle, Environment of CATIA, Introduction to Menu Bars, Modules	**02**
5.	**SKETCHER MODE** Profile, Predefined profile, Circle, Spline, Conic, Line, Axis, Point, Corner, Chamfer, Transformation.	**02**
6.	Constraint- Geometrical constraint. Tools- Sketch solving status. Sketch tool, Views, Standard options etc.	**02**

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

7.	**PART DESIGN-I** 3D Reference Elements (Point, Line, Plane), Pad, Pocket, Shaft, Groove, Hole, Rib, Slot, Stiffener, Loft, Remove Loft	**02**
8.	**PART DESIGN-II** Fillet, Chamfer, Draft, Shell, Thickness, Thread/ Tap, filleted pocket, Transformation feature- Patterning, Scaling, Mirror	**02**
9.	**ASSEMBLY DESIGN-I** Insert Component, Product, Part, Existing component, replace component, recording, Generate numbering. Manipulation, Snap, Smart move, Explode, stop manipulation on clashes etc.	**02**
10.	**Generative Drafting** Front View, Auxiliary View, Projection Views, unfolded view, Section Views, Detail View, Broken View, Clipping view, View creation wizard etc. Dimension generation, Balloon generation etc. Positioning Views, Modifying Views etc., Dimension properties, Addition of tolerance etc., Frame creation, frame modification, Addition of Bill of material etc.	**02**

References -

1. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishes
2. Various books by Sham Tickoo, book title, publication

Class: **S.Y. B. Tech.**	Semester: **III**
Course Code: **MC2591**	Course Name: **Engineering Mechanics Lab**

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

Course Description:
The 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 students. 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. Explain the law of polygon of forces, law of triangle of forces and principle of moment.
2. Discuss Lami's theorem.
3. Compare the 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

Expt. No.	Name of Experiment	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:

Textbooks:

1. Bhavikatti S. S., Rajashekarappa, "Engineering Mechanics", New Age international publication (India) Pvt. Ltd. New Delhi,
2. Ramamrutham S., "Engineering Mechanics", Dhanpat Rai Publishing Company Ltd., New Delhi.

Reference Books:

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

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Second Year B. Tech Syllabus

To be implemented for 2024-28 NEP Batch

Department of Mechatronics Engineering

Class: - **S.Y. B. Tech.**	Semester-**III**
Course Code: **MC2593**	Course Name: **Python Programming Lab.**

L	T	P	Credits
--	-	2	1

Course Description:

This course is designed to provide students with a comprehensive understanding of the Python programming language, which is widely recognized for its versatility and ease of use. The course discusses the fundamental principles of Object-Oriented Programming, as well as in-depth data and information processing techniques. Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications.

Course Learning Outcomes:

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

1. To understand the basic concepts of scripting and the contributions of scripting language.
2. Ability to explore python data structures like Lists, Tuples, Sets and dictionaries.
3. Ability to create practical and contemporary applications using Functions, Modules and Regular Expressions.

Prerequisite: Knowledge on Problem Solving Through Computer Programming.

Course Content		
Expt. No.	**Description**	**Hrs.**
1	Introduction to python programming: Versions, Installation, working etc.	02
2	Demonstrate fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)	02
3	Demonstrate various methods of String, List and tuple.	02
4	Demonstrate various methods of sets and dictionary.	02
5	Demonstrate the Conditional statements in Python with suitable examples. (If statement, if else statement, if – elif – else statement)	02
6	Demonstrate the Iterative statements in Python with suitable examples. (While loop, for loop)	02
7	Demonstrate the Break, Pass and Continue statements in Python with suitable examples.	02
8	Demonstrate various functions in the python. (In Built, User Define)	02
9	Demonstrate the File Handling: Data streams, Access modes, Read/Write/Seek	02
10	OOP: Classes, Objects	02

References –

Textbooks-

1. Exploring Python, Timothy Budd, Mc Graw Hill Publication, ISBN:9780073523378.
2. Beginning Python, Peter C. Norton, Alex Samuel, Dave Aitel, Eric Foster-Johnson, Leonard Richardson, Jason Diamond, Aleatha Parker, Michael Roberts, ISBN: 978- 0-7645-9654-4.

Reference Books

1. Python: Create - Modify - Reuse, James O. Knowlton, Wrox Publication, ISBN: 978- 0-
2. 470- 25932-0.
3. Professional Python Frameworks: Web 2.0 Programming, Dana Moore, Raymond Budd,William Wright, Wrox Publication, ISBN: 978-0-470-13809-0.

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 the various courses offered under Choice Based Professional Skills Development program. 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 Learning 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		
Unit 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 Behavior, 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 and Student Presentations	02
7.	**Business Meetings and Decision Making – I:** Preparing for the Meeting, Role of Chairperson and Participants in Meetings	02
8.	**Business Meetings and Decision Making – II:** Mock Meetings, Decision Making Case Studies, and Feedback	02
9.	**Conflict Management:** Types of Personalities, Possible Reasons for Conflicts at Workplace, 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 -

Reference Books:

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

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Second Year B. Tech Syllabus

To be implemented for 2024-28 NEP Batch

Department of Mechatronics Engineering

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

L	T	P	Credits
-	-	2	1

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

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

Course Description:

Jeevan means life and Vidya means knowledge. Jeevanvidya (JV) means science of life and art of successful and happy living. Achieving work-life balance is an art. The science behind work-life balance is based on the universal laws of nature. The aspects of it are applied to the art forms. At a high level, JV consists of management of health, wealth, mind, and life. This course offers the tips and techniques to lead a life full of success, prosperity, and happiness by changing the current mindset to that of positive and harmonious thinking. It further touches 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.
5. Apply Jeevan vidya wisdom in day-to-day 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.

Minimum 12 sessions will be conducted from the following list.

Course Content

Experiment No	Description	Hrs
1.	**Importance of Universal Laws of Nature in Human Life.-** Overview of Jeevanvidya's Philosophy, 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. Jeevanvidya's wisdom, living life in tune with laws of nature	02

2.	**'You are the Architect of your Destiny' -** This unit will make you aware that none else but you alone are responsible and accountable for what you achieve in your life , freedom of decisions, choices to make up your future, guiding powers to make the choices in your life, achieving life full of health, wealth, success, peace and happiness for yourself and all	**02**
3.	**Setting and Achieving Goals** – Defining your own goals in life , Concept of power of mind , concepts of interaction of conscious and 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	**02**
4.	**Work-life Balance** – What 'Jeevanvidya' 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 'Jeevanvidya' principles 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 -
1. Mr. P. W. Pai. JV's Spiritual Wisdom in Day-to-day life, Blog.
2. Satguru Shri W. G. Pai. Towards the goal of beautiful life, Nam Sampradaya Mandal Publication
2. Mr. P. W. Pai. JV's Spiritual Wisdom in Day-to-day life, Blog.
3. Satguru Shri W. G. Pai. Towards the goal of beautiful life, Nam Sampradaya Mandal Publication
4. Satguru Shri W. G. Pai. Master Key to Happy Life, Jeevanvidya Foundation
5. Satguru Shri W. G. Pai. Your Destiny In Your Thoughts: You Are The Architect Of your Destiny, Jeevanvidya Foundation
6. Satguru Shri W. G. Pai. Gift of Wisdom, Jeevanvidya Foundation
7. Satguru Shri W. G. Pai. Search For Happiness, Jeevanvidya Foundation
8. Satguru Shri W. G. Pai. Ideal Parents Ideal Students, Jeevanvidya Foundation
9. Satguru Shri W. G. Pai. Human Body - God Incarnate!, Jeevanvidya Foundation
10. Satguru Shri W. G. Pai. Shape Your Destiny, Jeevanvidya Foundation
11. Satguru Shri W. G. Pai. True Concept of Satguru, Jeevanvidya Foundation
12. Dr. J. Murphy. Power of your subconscious mind, Amazing Reads Publication
13. S. Covey. Seven highly effective people, Winx Club Publication
14. D. Carnegie. How to win friends and influence people, Fingerprint! Publishing

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

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

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 maps. 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. Analyse 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

A minimum of 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 brainstorming 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	**02**

	product/service. Step-by step process of UJM creation	
5.	**Competitor analysis:** Analysis of competitor and users for similar products, effectiveness of existing solutions and identifications of gaps	**02**
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, pitching 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	**02**

	k) Financials l) Team	
13.	**Revision -I**	**02**
14.	**Revision-II**	**02**

References -

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session student will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the students 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 the various courses offered under the Choice Based Professional Skills Development program. 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 a positive attitude.
2. Develop interpersonal skills characterized by effective communication and conflict resolution.
3. Discover ways to overcome procrastination.
4. Demonstrate responsiveness towards stress and health issues.
5. 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** Values: Punctuality, Honesty, Loyalty, Dependability, Reliability-Application of Life Skills in day - to- day life - Life Skills for Adolescents and Youth	**02**
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	**02**
9.	**Emotional Intelligence** Meaning –Components of Emotional Intelligence-Significance of managing Emotional intelligence –How to develop Emotional Quotient	**02**
10.	**Decision-making** Definition, Informed Decision Making, Consequences of Decision Making and Models of Decision Making	**02**
11.	**Creative Thinking** Out-of-the box thinking, Stages of Creative Thinking, Factors hindering creative thinking, Characteristics of Creative thinkers	**02**
12.	**Interpersonal skills** Meaning, need to develop interpersonal skills, components of interpersonal skills, techniques to improve skills, benefits with real life examples/case studies	**02**
13.	**Art of Communication** Verbal & Non-Verbal Communication, 7'Cs of Effective Communication Importance of Effective Communication	**02**
14.	**Body Language – I** Non-verbal codes: Kinesics, Proxemics	**02**
15.	**Body Language – II** Vocalics, Haptics, Appearance	**02**

References -

1. S. Hariharan, et al; *Soft Skills*, MJP Publishers, Chennai.
2. Gopalaswamy Ramesh et al. *The ACE of Soft Skills: Attitude, Communication and Etiquette for Success*, New Delhi: Pearson Education.
3. Jeff Butterfield, *Soft Skills for Everyone*, cengage Learning India Private Limited.

4. UNLESH the power within... Soft Skills – Infosys Training Manual *Module 1 to 5* (Infosys Campus Connect Programme)
5. Masters, L. Ann et al. *Personal Development for Life and Work*, New Delhi: Cengage Learning.
6. Covey, Stephen R., *Seven Habits of Highly Effective People*: *Powerful Lessons in Personal Change*
7.Barun K. Mitra, *Personality Development & Soft Skills*, Oxford Publishers, Third impression.

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

Class: - **S.Y. B. Tech.**	Semester-**III**
Course Code: **SH2734**	Course Name: **German Language-III**

L	T	P	Credits
-	-	2	1

Course Description: This course meets the requirements of a 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 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.	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 -

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

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

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

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

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 English 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 the following content delivery.

Course Content

Experiment No	Description	Hrs
1	Polite way of requesting 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 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 -

1. Minna No Nihongo I (3A Corporation, Japan), Publications: Goyal publishers.
2. 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 student 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: **MC2021**	Course Name: **Strength of Materials**

L	T	P	Credits
3	--	--	3

Course Description:
Strength of Materials 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 subject Strength of materials 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 different types of stresses and strains induced in any machine component.
2. Develop shear force and bending moment diagram for different types of beams.
3. Determine stress distribution for various cross sections of beam.
4. Estimate the deflection of beams by analytical and graphical method.
5. Analyze axially loaded column for different end conditions.

Prerequisite: Knowledge of Applied Mathematics and Engineering Mathematics.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Simple stresses and strains-** Concept of stress and strain (linear, lateral, shear and volumetric), Hooks law. Elastic constants and their relationship. Stress -strain diagrams, Stresses, strains and deformation in determinate homogeneous and composite bars under concentrated loads, stress concentration, Poisson's Ratio thermal stresses.	**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.	**Stresses due to Bending-**	**06**

	Stresses due to bending: Theory of simple bending, concept and assumptions, Derivation of Flexure formula. Bending stress distribution diagram for various cross sections of a beam.	
4.	**Slope and Deflection of Beams-** Concept and definition, relation between B.M., slope and deflection by double integration method and Moment area method for Simply Supported and cantilever beams.	**06**
5.	**Principal stresses and Torsion of Shaft-** **5.1 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) **5.2 Torsion of shaft:** Derivation of torsion formulae, stresses and deformation in determinate shafts of hollow, solid, and varying circular cross section subjected to twisting moments	**06**
6.	**Axially Loaded columns and strain energy method-** 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. Rankine's formulae, safe load on column, Limitation of Euler's formulae.	**06**

References:

Textbooks:

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

Reference Books:

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

Class: **S.Y. B. Tech.**	Semester: **IV**	L	T	P	Credits
Course Code: **MC2041**	Course Name: **Microcontrollers and Embedded systems**	**3**	**-**	**-**	**3**

Course Description:

In this course, the fundamentals of embedded system hardware and firmware design are explored. Issues such as embedded processor selection, hardware/firmware partitioning, development tools, firmware architecture, firmware design and firmware debugging will be discussed. The microcontroller architecture, peripheral programming and applications are discussed.

Course Learning Outcomes:

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

1. Explain the fundamentals of embedded systems.
2. Write embedded C programs for chip and off chip peripherals.
3. Interpret peripherals with microcontroller.
4. Design the embedded system using microcontroller.

Prerequisite: Knowledge of C language Programming.

Course Content

Unit No.	Description	Hrs
01	**Introduction to Embedded systems** Embedded systems and general-purpose computer systems, microprocessors and microcontrollers, digital signal processors, RISC and CISC controllers, big endian and little-endian processors, application specific ICs, programmable logic devices, COTS, sensors and actuators, communication interfaces, embedded firmware, other system components, PCB and passive components.	06
02	**Programming embedded systems-** Programming languages, structure of embedded program language overview, structure of a C program, identifiers, name spaces and scope, for and while loops, infinite loops, if and switch statements, embedded C data types, I/O port programming, bit manipulation, logic operations in C, modulus and shifting, macros.	06
03	**Embedded hardware-memories-** Memory map, I/O map, Interrupt map, types of memories, RAM, ROM and flash memory interfacing and memory testing, CRC.	06

04	**Peripheral programming-**Control status registers, device drivers, timers, watchdog timers, ADC signal conditioning, digital signal processing, RTOS, selection process.	**06**
05	**Peripheral Interfacing and programming** Programming timers, microcontroller interrupts programming, PWM, DC motor, stepper motor, servo motor programming, LCD, keyboard, ADC Programming, DAC Interfacing, Sensor interfacing and signal conditioning, EPROM Read/write, microcontroller connection to RS232, serial communication protocols UART, SPI, I2C programming in C.	**06**
06	**Design and development of embedded systems** Embedded system development environment-IDE, cross compilation, disassembler/decompiles, simulator, emulator and debugging, embedded product development lifecycle, recent trends in embedded industry, PCB design, component mounting and testing, case studies using microcontroller.	**06**

References:

Textbooks:

1. C programming for PIC microcontroller; demystifying coding with embedded programming by Hubert Henryward.
2. PIC microcontroller projects handson by Anbazhagan K.
3. Programming STM32 microcontroller circuit by Anbazhagan K.
4. Embedded systems with ARM CORTEX-M microcontrollers in assembly language and c fourth edition by Dr Yifeng Zhu

Reference Books:

1. Linux device driver development: everything you need to start with device driver development for Linux kernel and embedded linux by John Madieu, Packt publishing.
2. Embedded systems architecture: design and write software for embedded devices to build safe and connected systems by Daniele Lacamera, Packet publishing ltd.
3. Embedded systems architecture: a comprehensive guide for engineers and programmers by Tammy Noergaard, Elsevier.

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

Class: **S.Y. B. Tech.**	Semester: **IV**
Course Code: **MC2061**	Course Name: **Kinematics & Dynamics of Machines**

L	T	P	Credits
3	-	--	3

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

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Perform the mobility analysis of mechanism.
2. Determine kinematic analysis (Velocity, acceleration) for a given mechanism using analytically and graphically method
3. Construct different types of cam profile for a given condition
4. Apply appropriate power transmission method for mechanical system
5. Apply different techniques to balance the rotary and reciprocating systems
6. Evaluate and analyze the parameters affecting on stability of spinning and rotating bodies.

Prerequisite: Fundamental concepts of Engineering Mechanics, Graphical Analysis, Vectors representation.

Course Content

Unit No.	Description	Hrs.
1.	**Fundamentals of kinematics and Mechanisms** Kinematic links pairs, and chains, Machine & Structure, Constrained motions, Joints, Mechanism, and degree of freedoms, Kutzbach criteria, Grublers criteria, Inversion: definition, types of Inversions of four bar chain, Slider crank chain, double slider crank chain and its inversions.	06
2.	**Analysis of Mechanism** Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity acceleration analysis, instantaneous centers, Forces on mechanism, Velocity and acceleration analysis by Klein's Construction Method, Coriolis component of acceleration.	06

Rajarambapu Institute of Technology • Rajaramnagar • Mechatronics Dept. 415 414

3.	**Cams** Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, uniform acceleration, simple harmonic and cycloidal motions, Analysis of standard motions to the follower, Determination of cam profiles for given follower motion, Analysis of cams with specified contours cams and circular arc cam, Tangent cam, jumping of follower.	**06**
4.	**Mechanical Power Transmission:** Belts: Types of belts & rope drives, Velocity Ratio, calculation of length & power transmitted Belt tension ratio, sleep & creep of belt. Chain drive: Classification, length, angular speed ratio, classification of chains. Toothed Gears: Geometry of motion, Gear geometry, Types of profiles Involute & Cycloidal, theory of Spur, Helical and Spiral gears, Interference in involute tooth gears, path of contact, arc of contact, contact ratio. Gear trains.	**06**
5.	**Balancing** Static and dynamic balancing, balancing of single and several masses rotating in same and different planes, primary and secondary balancing of reciprocating masses, Balancing of single and multi-cylinder engines,	**06**
6.	**Gyroscope** Principle of Gyroscope, Gyroscopic couple, spinning & precessional motion, Gyroscopic couple, and its effect on – (i) Aero plane. (ii) Ship (iii) Two-Wheeler (iv) Four-Wheeler. Governors: Types of governors, Terms used in governors, Performance of governors.	**06**

References -

Textbooks:

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

Reference Books:

1. Thomas Bevan, Theory of Machines, CBS Publishers, New Delhi.
2. Shigley, Theory of Machines and Mechanism, McGraw Hill, New York.
3. J.S. Rao and R.V. Dukipatti, Theory of Machines and Mechanism, New Age Int. Publications Ltd. New Delhi.
4. Shah and Jadhawani, Theory of Machines, Dhanpat Rai& Sons.
5. Abdullah Shariff, Theory of Machines, McGraw Hill, New Delhi.

Class: **S.Y. B. Tech..**	Semester: **IV**	**L**	**T**	**P**	**Credits**
Course Code: **MC2081**	Course Name: **Manufacturing Technologies**	**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.

This course is focused on the study of introduction to manufacturing processes & machine tools. 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 tool, 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. Explain casting as manufacturing process suitable for the component design and production volume.
2. Select appropriate joining process for given application.
3. Select suitable Engineering forming process for production of component of required specification.
4. Select machine tools for metal cutting operations.
5. Describe the non-traditional machining processes.

Course Content

Unit No	Description	Hrs.
1.	**Casting Process: Pattern and mold making.** Importance of casting as manufacturing Process, advantages, and disadvantages of casting processes. General introduction to patterns, core boxes and gating systems. Introduction to permanent mold casting Process-Gravity and pressure die-casting, Centrifugal casting, Continuous casting. shell Molding, CO2 Molding, Investment casting, Solidification control devices: chills, ceramics bricks, directional solidification Pollution Control in foundries, Cleaning- fettling and inspection of casting, Defects in casting	07

2.	**Joining Processes** Welding processes: Arc, TIG, MIG, submerged arc welding and Resistance welding, Brazing and Soldering, Welding of dissimilar metals.	04
3.	**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 thermos-forming.	07
4.	**Machine Tools for Metal Cutting:** Introduction of Lathe, Capstan, turret lathe, Boring Machines, Drilling, shaping machine, planning machine and milling machine, surface finishing processes.	06
5.	**Numerical Control of Machine tools** NC and its components; Position and motion control in NC machine, Measurement system for control, NC Machine axis of motion, classification of NC system, NC Part Programming, computer aided NC language	05
6.	**Nontraditional Machining, CAD, CAM and CIM** Ultrasonic Machining, Electrochemical Machining, Electro discharge machining, Computer aided design, Geometric modelling, Computer aided manufacturing, Computer integrated manufacturing	06

References -

Textbooks:

1. Serope Kalpakjian, Manufacturing Engineering and Technology, Pearson.
2. P. N. Rao, "Manufacturing Technology- Foundry, Forming and Welding, Vol. I", Tata-McGraw-Hill, New Delhi.
3. P. L. Jain, "Principles of Foundry Technology", Tata McGraw-Hill, New Delhi.
4. P. C. Sharma, "A Textbook of Production Technology (Manufacturing Processes)", S. Chand and Company Pvt. Ltd, New Delhi.
5. O. P. Khanna, "Foundry technology", DhanpatRai Publications Pvt. Ltd, New Delhi.
6. O. P. Khanna, "Welding Technology". DhanapatRai Publications
7. 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:

1. Hein and Rosenthal, "Principles of metal casting", Tata McGraw-Hill Book, Company. New Delhi.
2. ASTM Volumes on Welding, casting, forming and material selection.
3. SM Handbook, Volume-15, 1988, Casting.

4. 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**	Semester-IV	L	T	P	Credits
Course Code: **MC210**	Course Name: **Robot Operating System**	2	-	--	2

Course Description:
This course offers a comprehensive introduction to robotics and Robot Operating System (ROS). It begins with fundamental robotics concepts, including types, applications, and kinematics. Students will gain hands-on experience with Ubuntu/Linux, learning essential commands, interfacing techniques, and Raspberry Pi integration. The course explores popular robot simulators like Webots and Gazebo, and introduces ROS architecture, tools, and programming using C++ and Python. Practical projects with TurtleSim help solidify ROS concepts, including transformations, frames, and object tracking. By the end, students will be equipped with the skills to develop and simulate robotic systems using modern tools and open-source platforms.

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

1. Demonstrate knowledge of operating system dedicated to Robot.
2. Analyze various case studies of ROS application.
3. Apply spatial transformation to obtain forward and inverse kinematics through programming.
4. Solve robot dynamics problems, generate joint trajectory for path planning and Programming.
5. Apply working principle of various ROS debugging process.
6. Identify applications of robots in industry.

Prerequisite:.Basic mechanics and kinematics.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Robotics and ROS2 framework**: 1.1 Basics of Robotics - Definition of a robot, types of robots-Components: sensors, actuators, controllers-Degrees of freedom, kinematics overview, 1.2 Introduction to Operating Systems & Ubuntu- Linux vs Windows for robotics-Ubuntu shell commands, file system-Installing ROS2 on Ubuntu, 1.3 ROS2 Overview-What is ROS and ROS2-Evolution from ROS1 to ROS2-ROS2 distributions and real-time capabilities, 1.4 Communication Concepts-ROS2 Computational Graph and Architecture-Nodes, Topics, Services, Actions- Publish-Subscribe model	04
2.	**ROS2 Architecture and Development Environment**: 2.1 ROS2 Filesystem and Workspaces-Creating and configuring ROS2 workspaces-Directory structure of packages 2.2 Writing Nodes in Python/C++-Writing simple publisher and subscriber-Activity/Assignment to create workspace, packages and nodes, 2.4 Creating Launch Files-Single and multi-node launch files- Create launch files to run multiple launch files combined	04

3.	**Robot Modeling and Simulation Integration**: 3.1 Introduction to URDF and XACRO-Structure of URDF files: links, joints-XACRO macros for simplification-Physical parameters (mass, inertia) 3.2 CAD to URDF using Fusion 360-Designing in Fusion 360-Using URDF Exporter Plugin-Visual and collision models. 3.3 Using RViz2 for Visualization-Displaying robot model and frames-TF2 transforms-Joint states and sensor data visualization 3.4 Launching Robots in Simulation-robot_state_publisher-Spawning robot in RViz2/Gazebo	**04**
4.	**Simulation using Gazebo and Environment Building**: 4.1 Introduction to Gazebo Simulator-Features and tools in Gazebo-Physics engines, plugins, SDF files 4.2 Spawning Robots and Objects-Launching worlds and adding models - Importing built-in models (tables, walls), 4.3 Environment Mapping and Camera Integration-Simulating sensors (LIDAR, Camera)-Adding dynamic objects-Adjusting lighting, physics parameters, 4.4 Gazebo and ROS2 Interfacing-Topics used in simulation-Gazebo plugins and ros2_control basics	**04**
5.	**Perception, Navigation, and Manipulation:** 5.1 Introduction to Computer Vision in ROS2-USB camera interfacing-Image transport, sensors-OpenCV integration 5.2 Object Detection & Tracking-Color filtering, contour detection-Tracking using HSV, centroids-Real-time demo applications 5.3 Navigation Stack (Nav2) and SLAM-Introduction to SLAM (slam toolbox, cartographer)-AMCL for localization-Global/local costmaps and planners, 5.4 Motion Planning with MoveIt-MoveIt architecture-Pick-and-place task planning.	**04**
6.	**Advanced Topics and Integration Projects**: 6.1 Autonomous Mobile Robots (AMR)-Types and structure of AMRs-Behavior trees-Applications in warehouse and service robotics 6.2 Hardware Integration-Using microcontrollers with ROS2 (e.g. STM32, Arduino)-ROS2 serial communication- Raspberry Pi setup for integration 6.3 ROS2 on Edge Devices-Running ROS2 on Jetson Nano, RPi-Resource optimization, offloading computation-Real-time navigation and sensor integration, 6.4 Final Project Execution Framework-System architecture of integrated robot- Assemble AMR components for Autonomous Navigation-code documentation, GitHub workflow	**04**

References - Text Books:

1. Robot Operating System for Absolute Beginners: Robotics Programming Made Easy".
2. Programming Robots with ROS" by Quigley, Gerkey and Smart.
3. The Linux Command Line" by William Shotts.
4. "It-Yourself Guide to the Robot Operating System: Volumes" by Patrick Goebel.

lass: **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.
- 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.

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

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

L	T	P	Credits
2	-	2	3

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

Course Learning Outcomes:

After successful completion of the course, students 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 a minimum of 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 a 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**

Rajarambapu Institute of Technology • Mechatronics Dept. 415 414 • Rajaramnagar

K.E. Society's Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

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 equipment 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 equipment 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:

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

Reference Books:

1. Bernard Sklar, Digital Communication-Fundamentals and Applications, Pearson Education
2. Tomasi, Electronic Communication Systems Pearson Education.
3. Taub, Schilling, Principles of communication systems, Tata McGraw Hill.
4. 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**	05

	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.	
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.

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

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

L	T	P	Credits
3	--	--	3

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

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

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

Prerequisite:
Course on Design Thinking

Course Content

Unit No.	Description	Hrs
1.	**Behavioral Engineering and Design for Product Innovation:** Overview of behavioral engineering and its relevance in product design, Key concepts and theoretical frameworks, Understanding the role of psychology in product development, Ethical considerations in designing products for behavior change	06
2.	**Human Behavior and Product Design:**	06

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

References -

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

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

L	T	P	Credits
3	-	--	3

Course Description:
Fluid power has the highest power density of all conventional power-transmission technologies. Learn the benefits and limitations of fluid power, how to analyse fluid power components and circuits, and how to design and simulate fluid power circuits using Automation Studio for applications.

In this course, you will be introduced to the fundamental principles and analytical modelling of fluid power components, circuits, and systems. You will learn the benefits and limitations of fluid power compared with other power transmission technologies; the operation, use, and symbols of common hydraulic & pneumatic components; how to formulate and analyse models of hydraulic & pneumatic components and circuits; and how to design and predict the performance of fluid power circuits.

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

1. 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** Introduction to fluid power, Advantages of fluid power, Application of fluid power system, Types of fluid power systems, Properties of hydraulic fluids, General types of fluids, Fluid power symbols. (ISO/JIC), Use of Automation studio to draw circuits.	**06**

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

References -

Textbooks: Fluid Power, Anthony Esposito, Prentice Hall Publications.

1. Industrial Hydraulics and Pneumatics, Stewart
2. Industrial Hydraulics and Pneumatics, H.P. Garg.
3. Oil Hydraulic Systems: Principles and Maintenance by S. R. Mujumdar.

Reference Books:

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

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

L	T	P	Credits
3	-	--	3

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

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

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

Course Content		
Unit No	**Description**	**Hrs**
1.	**Introduction to Data Structures:** Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types, Complexity Analysis	**05**
2.	**Linear Data Structures:** **Stack:** Definition, Representation and Applications of Stack. **Queue:** Definitions, Representation and Applications of Linear Queue, Circular Queue, and Priority Queue.	**06**

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

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.**	Semester: **IV**	**L**	**T**	**P**	**Credits**
Course Code: **RAMD202**	Course: **Sensors & Actuators**	**3**	**-**	**-**	**3**

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

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

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

Course Content:

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

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

References –
Text Book:

- DVS Murthy, Transducers and Instrumentation, PHI.
- D Patranabis, Sensors and Transducers, PHI.
- S. Gupta, J.P. Gupta, PC interfacing for Data Acquisition & Process Control, Instrument Society of America.

- Gary Johnson, Lab VIEW Graphical Programing II Edition, McGraw Hill.
- Patranabis. D, Sensors and Transducers, Wheeler publisher.
- Sergej Fatikow and Ulrich Rembold, Microsystem Technology and Microbotics, First edition, Springer –Verlag NEwyork, Inc.
- Jacob Fraden, Hand Book of Modern Sensors: Physics, Designs and Application, Fourth edition, Springer.

Reference Books:

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

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

L	T	P	Credits
1	--	2	2

Course Description:

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

Course Outcomes:

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

1. Apply interdisciplinary knowledge in environmental science by integrating concepts and principles from various fields of science and engineering to address environmental issues.
2. Evaluate environmental impacts of human activities on ecosystems and on the environment.
3. Use scientific approach to identify and solve environment related problems.
4. Design sustainable solutions to address environmental challenges by considering renewable energy sources, waste management strategies conservation measures, and environmental policies.
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	04

	abiotic components, food chains, food web Biodiversity, types of biodiversity, conservation of biodiversity.	
2.	**Environmental Pollution and Health** Environmental Pollution, types of pollution, Air pollution, Water Pollution, Noise Pollution, Soil Pollution, Marine Pollution, Radioactive Pollution, Thermal Pollution (Causes, sources and effects, abatement methods), Pollution Case studies-Bhopal Gas Tragedy, Chernobyl Accident: A nuclear Disaster, Ganga Water Pollution. Solid Waste management (Causes, sources, effects & control measures), Hazardous waste management, Plastic waste management, E-waste management. Disaster management and risk analysis.	**04**
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 teamwork consisting of 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 –
Textbooks:

1. D.K. Asthana, Meera Asthana, A Textbook of Environmental Studies, S. Chand Publication Revised edition, 2006.
2. S. Deswal & A. Deswal, Basic course in environmental Studies, Dhanpat Rai & Co ltd., Delhi, Second revised edition, 2009.

Reference Books:

1. Eldon D Enger, Bradley F. Smith, Environmental science – a study of inter-relationships Wm C Brown Publishers 1989.
2. Francois Ramade Ecology of Natural resources, John wiley & Sons
3. Robert Leo Smith, Ecology and field biology, Harper Collins Publishers
4. Gilbert M. Masters, Introduction to Environmental Engineering & Science, Prentice Hall International Inc. Second Edition.

Class: **S.Y. B. Tech.**	Semester: **IV**
Course Code**: MC2501**	Course Name: **Microcontrollers and Embedded Systems Lab**

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

Course Description:
In this course, the fundamentals of embedded system hardware and firmware design are explored. Issues such as embedded processor selection, hardware/firmware partitioning, development tools, firmware architecture, firmware design and firmware debugging will be discussed. The PIC microcontroller architecture is discussed.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Write embedded C programs for on chip and off-chip peripherals.
2. Interface peripherals with PIC microcontroller.
3. Compile debug and test logic on PIC microcontroller.

Prerequisite: Engineering Mathematics, Engineering Physics

Expt. No.	Name of Experiment	Hrs.
1.	Develop a logic to study I/O port using led and a switch.	**02**
2.	Develop a logic to study stepper motor interfacing.	**02**
3.	Develop a logic to study DC motor interfacing using PWM.	**02**
4.	Develop a logic to study timer in PIC microcontroller.	**02**
5.	Develop a logic to study External interrupts.	**02**
6.	Develop a logic to study 16x2 LCD interfacing.	**02**
7.	Develop a logic to study matrix keyboard interfacing.	**02**
8.	Develop a logic to study ADC interfacing.	**02**
9.	Develop a logic to study sensor interfacing.	**02**
10	Design and develop PCB using Diptrace software.	**02**

References:

Textbooks:

1. Embedded systems architecture programming and design by Rj Kmal, II edition, Tata MC Graw-Hill.
2. Designing embedded systems with PIC microcontroller: principles and applications by Tim Wilmshurt, Elsevier

Reference Books:

1. Embedded systems design by Steive Heath, II edition, Newnwess publications
2. Embedded systems architecture: A comprehensive guide for engineers and programmers by Tammy Neogaard, Elsevier.
3. Embedded systems, Rajkamal, Tata McGraw-Hill

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

Class: - **S.Y. B. Tech.**	Semester-**IV**
Course Code: **MC2541**	Course Name: **Workshop Practice –II**

L	T	P	Credits
-	-	2	1

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

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Demonstrate effect of variables such as speed, feed, and depth of cut on the machining process.
2. Produce given joint by MIG welding process.
3. Produce welding run on S.S. by TIG welding.
4. Produce given job with proper taper and V threading within dimensional tolerances ± 0.2 mm. on diameter and ± 0.5 mm. on length. (Job – A)

Course Content		
Experiment No	**Description**	**Hrs.**
1.	**Lathe Operations-** **Job Involving** Tool Grinding, Job Involving - Facing, Step Turning, Taper Turning, Knurling & V' Threading Operations	**06 Practical's**
2.	**Advance Welding Shop-** One Job - TIG Welding. One Job - MIG Welding. Demonstration of Stainless Steel & Aluminum Welding. One Job - Stainless Steel Welding One Job - Aluminum Welding Job on Plasma Arc Cutting Job on Submerged Arc Welding. Job on Soldering Job on Brazing	**06 Practical's**

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.**	Semester-**IV**
Course Code: **MC258**	Course Name: **Robot Operating System Lab**

L	T	P	Credits
-	-	2	1

Course Description:
This lab course provides hands-on experience with ROS, Linux commands, and robot simulation. Students will work with Turtlesim, Mitsubishi robotic arms, and Smorphy kits, performing tasks like node communication, object manipulation, and remote navigation. The course culminates in designing a voice-controlled humanoid robot project for real-world applications.

Course Learning Outcomes:
1. Illustrate the basics of Robot operating system simulation interface.
2. Explain basic Linux commands for ROS installation.
3. Demonstrate node concepts in multi-Robot system communication.
4. Apply basic robotic actions with Robotic arm.
5. Analyze the robotic prototypes used in various industries.
6. Demonstrate various actions using humanoid robots.

Prerequisite: Basics of programming.

Course Content

Experiment No	Description	Hrs
7.	Implement basic Linux commands for terminal operations in ROS environment.	02
8.	Implement virtual machine concepts and Installation of ROS environment.	02
9.	Creation of basic inter nodes communication between Talker listener nodes.	02
10.	Create ROS2 nodes using the Turtlesim simulator of the ROS environment.	02
11.	Executing Turtlesim for running nodes, teleoperations, swamping and remapping of nodes.	02
12.	Implementation of Mitsubishi Robotic Arm, calibration and Melfa programming basics.	02
13.	Perform object Pick and Drop operations through Mitsubishi robotic arm.	02

14.	Perform various operations on Smorphy robotic kit and implement its remote navigation process.	**02**
15.	Design a voice-based action synchronization for a humanoid Robot.	**02**
16.	Design project	**02**
	Reference Books: **Textbook:** 1. Robot Operating System for Absolute Beginners: Robotics Programming Made Easy". 2. Programming Robots with ROS" by Quigley, Gerkey and Smart. 3. The Linux Command Line" by William Shotts. 4. Robot Operating System for Absolute Beginners: Robotics Programming Made Easy". 5. Programming Robots with ROS" by Quigley, Gerkey and Smart. 6. The Linux Command Line" by William Shotts. 7. "It-Yourself Guide to the Robot Operating System: Volumes" by Patrick Goebel	

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.

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.	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 exam requirement	**02**
10.	Practice for Skill "Writing" and "Speaking"	**02**

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

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 -

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

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

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

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Second Year B. Tech Syllabus
To be implemented for 2024-28 NEP Batch
Department of Mechatronics Engineering

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 English 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

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

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 -
1. Minna No Nihongo I (3A Corporation, Japan), Publications: Goyal publishers.
2. 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 student will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.