B. Tech. in Mechatronics Engineering with Multidisciplinary Minor

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering
Rev: MC Course structure/RIT/02/2022-26

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Theory (Marks %) Min. for passing	Practical (Marks %) Max.	Practical (Marks %) Min. for passing
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	---	---
SH2174	Environmental Science	1	-	2	2	ISE	50	40		
						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 Modeling Lab	-	-	2	1	ISE	---	---	100	50
MC2591	Engineering Mechanics Lab			2	1	ISE	---	---	100	50
MC2611	Technical Aptitude-I	-	-	2	1	ESE	---	---	100	50
	Professional Skills Development and Foreign Languages-I	-	-	2	1	ISE	---	---	100	50
	TOTAL	**15**	-	**16**	**23**					
	TOTAL CONTACT HOURS	**31**								

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

Total Contact Hours/week : **31**
Total Credits : **23**
Technical Aptitude Courses : Engineering Mathematics for Mechatronics Engineering, Analog and Digital Electronics, Industrial Fluid Power, Engineering Mechanics.

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 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 Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering

Rev: MC Course structure/RIT/02/2022-26

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %) Max.	Min. for passing		Practical (Marks %) 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	2*	-	-	2	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		---	---
	Multi-Disciplinary Minor-II	3	-	-	3	ISE	20	40		---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Modern Indian Language	2	-	-	2	ISE	100	50	---	---	
MC2501	Microcontrollers and Embedded Systems Lab	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
MC2521	Python Programming Lab	-	-	2	1	ISE	---	---		100	50
MC2541	Workshop Practice – II	-	-	2	1	ISE	---	---		100	50
MC2561	Technical Aptitude-II	-	-	2	1	ESE	---	---		100	50
	Professional Skills Development and Foreign Language	-	-	2	1	ISE	--	---		100	50
	TOTAL	**16*+1**	**-**	**10**	**21**						
	TOTAL CONTACT HOURS	**27**									

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

Total Contact Hours/week : 27
Total Credits : 21
Technical Aptitude Courses : Strength of Material, Microcontrollers and Embedded Systems, Kinematics & Dynamics of Machines, Manufacturing Technologies

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 • Rajaramnagar • Mechatronics Dept. 415 414

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**

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

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering

Rev: MC Course structure/RIT/02/2022-26

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		---	---
	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		---	---
SH3034	Scholastic Aptitude I	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	---	---	---	50	50
						ESE				50	50
MC3571	Technical Aptitude-III	-	-	2	1	ESE	---	---		100	50
MC3591	Summer Internship	-	-	-	2	ISE	---	---	---	100	50
	TOTAL	**18**	**-**	**8**	**24**						
	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 : **27**
Total Credits : **24**
Technical Aptitude Courses : Industrial Automation, Sensors and Instrumentation.

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

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

Program Elective-I

Sr. No	Course Code	Course Name	Domain
1.	MC3051	Control Engineering	Automation
2.	MC307	Data Base Management System	Intelligent Systems
3.	MC3091	Condition Monitoring	Design & Manufacturing
4.	MC3111	Battery And Fuel Cell Technology	Advanced Mobility System
5.	MC3131	Industrial Organization and Management	Design & Manufacturing
6.	MC3151	Material Handling Systems	Design & Manufacturing

Open Elective –I

Open Elective – I			
Sr. No	**Course Code**	**Course Name**	**Offered By Department**
1	OE345	Soft Computing	Computer Science & Information Technology
2	OE361	Object Oriented Modeling & Design	Computer Science & Information Technology
3	OE343	Data Science	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
4	OE347	New Product Design & Development	Mechanical Engineering
5	OE349	Non-Conventional Energy Sources	Mechanical Engineering
6	OE351	Hydrogen & Fuel Cell Technology	Mechanical Engineering
7	OE3044	Renewable Energy Sources	Automobile Engineering
8	OE353	Factory Automation	Mechatronics Engineering
9	OE355	Cyber Physical Systems	Mechatronics Engineering
10	CS3104	Network Administration	Computer Science & Engineering
11	OE3064	Environmental Impact Assessment	Civil Engineering
12	OE350	Operations Research	Civil Engineering

13	OE341	Energy Auditing and Management	Electrical Engineering
14	OE357	Internet of Things	Electronics & Telecommunication Engineering
15	OE359	Drone Technology	Electronics & Telecommunication Engineering

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering
Rev: MC Course structure/RIT/02/2022-26

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Theory (Marks %) Min. for passing	Practical (Marks %) Max	Practical (Marks %) Min. for passing
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	---	---
SH3064	Scholastic Aptitude II	2	-	-	2	ISE	20	40	---	----
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
MC3501	Workshop Practice – III	-	-	2	1	ISE	---	----	100	50
MC3521	Power Electronics and Drive Lab	-	-	2	1	ISE	---	---	50	50
						ESE	---	---	50	50
MC3541	Data Preprocessing & Visualization Lab	-	-	2	1	ISE	--- ---	--- ---	100	100
MC3561	Technical Aptitude- IV	-	-	2	1	ESE	---	---	100	50
MC3581	Capstone project -Phase I	-	-	2	1	ISE	----	----	100	50
	TOTAL	**19**	-	**10**	**24**					
	TOTAL CONTACT HOURS	**29**								

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

Total Contact Hours/week : **29**
Total Credits : **24**
Technical Aptitude Courses: Machine Design, Power Electronics and Drives

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

Program Elective - II

Sr. No.	Course Code	Course	Domain
1.	MC3081	Finite Element Methods	Design & Manufacturing
2.	MC310	Thermal Management of Mechatronic System	Design & Manufacturing
3.	MC312	Additive Manufacturing	Design & Manufacturing
4.	MC3141	Digital Signal Processing	Automation
5.	MC316	Industry 4.0 Technologies and IIOT	Design & Manufacturing & Intelligent Systems
6.	MC3181	Wireless Sensor Network	Automation
7.	MC3201	Microelectromechanical Systems	Automation
8.	MC322	Process Control	Design & Manufacturing

Open Elective –II

Open Elective -II			
Sr. No.	**Course Code**	**Course Name**	**Offered By Department**
1	OE3401	Cyber security	Computer Science & Information Technology
2	OE360	Distributed Systems	Computer Science & Information Technology
3	OE342	Data Mining	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
4	OE3024	Reliability Engineering	Automobile Engineering
5	OE344	Supply Chain Analytics	Mechatronics Engineering
6	OE346	Mobile Robotics	Mechatronics Engineering
7	OE348	Information Technology Foundation Program	Computer Science & Engineering
8	OE3381	Disaster Management	Civil Engineering
9	OE3084	Materials Management	Civil Engineering
10	OE358	Plumbing (Water & Sanitation)	Civil Engineering
11	OE3182	Industrial Drives	Electrical Engineering

12	OE352	Image Processing	Electronics & Telecommunication Engineering
13	OE354	Fuzzy logic and Neural Network	Electronics & Telecommunication Engineering
14	OE3284	Supply Chain Management	Mechanical Engineering
15	OE3324	Entrepreneurship Development	Mechanical Engineering
16	OE356	Project Management	Mechanical Engineering

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering
Rev: MC Course structure/RIT/02/2022-26

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		---	---
MC403	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. Society's Rajarambapu Institute of Technology Rajaramnagar Autonomous 415411

Program Elective-III

Sr. No.	Course Code	Course Name	Domain
1.	MC4071	Building Automation	Automation
2.	MC409	Basics of Cloud Computing	Intelligent Systems
3.	MC4111	Machine Tool Design	Design & Manufacturing
4.	MC4131	Fuzzy Logic & Neural Networks	Intelligent Systems
5.	MC4151	Hybrid and Electric Vehicle	Advanced Mobility System
6.	MC4171	Industrial Engineering	Design & Manufacturing
7.	MC421	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 Aerial Vehicles	Advance 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 Aerial Vehicles Lab	Advance Mobility System

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering
Rev: MC Course structure/RIT/02/2022-26

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 • Rajaramnagar • Mechatronics Dept. 415 414

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering
Rev: MC Course structure/RIT/02/2022-26

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

Model III: Entrepreneurial Internship (EI)

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

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

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**
Automobile Engineering	1	ATMD201	Automobile Systems	III	Automotive Technology
	2	ATMD202	I. C. Engines	IV	
	3	ATMD301	Automotive Safety & Ergonomics	V	
	4	ATMD303	Automotive Engineering Lab.	V	
	5	ATMD302	Electric Vehicles	VI	
Construction Engineering	1	CEMD201	Building Construction and Planning	III	Civil Engineering
	2	CEMD202	Building Estimation and Valuation	IV	
	3	CEMD301	Infrastructure Engineering	V	
	4	CEMD303	Smart Cities and Sustainable Development	V	
	5	CEMD302	Environmental Engineering	VI	
Software Programming	1	CSMD201	Introduction to Data Structures	III	Computer Science & Engineering
	2	CSMD202	Problem solving using JAVA	IV	
	3	CSMD301	Fundamentals of Database Systems	V	

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

	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	Advance Communication Techniques	V	
	4	ECMD303	Electronics 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	
	1	MEMD201	Materials and Applications	III	Mechanical Engineering

Elements of Mechanical Engineering	2	MEMD202	Design and Drawing of Machine Components	IV	
	3	MEMD301	Manufacturing and Assembly Processes	V	
	4	MEMD303	Refrigeration and Air Conditioning	V	
	5	MEMD302	Power Plant Engineering	VI	
Mechatronics Engineering	1	MCMD201	Fundamentals of Mechatronics	III	Mechatronics Engineering
	2	MCMD202	Industrial Fluid Power	IV	
	3	MCMD301	Sensor and Instrumentation	V	
	4	MCMD303	Industrial Automation	V	
	5	MCMD302	Industrial Robotics	VI	
Artificial Intelligence	1	AIMD201	Object Oriented Programming	III	Computer Science & Engineering (AI-ML)
	2	AIMD202	Data Structures and Algorithms	IV	
	3	AIMD301	Machine Learning	V	
	4	AIMD303	Business Intelligence	V	
	5	AIMD302	Principles of AI	VI	

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 recommendation of BOS of the department.
7.Student will get the credits of respective DM course in following conditions,

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

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

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

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 occur.
6. Platform and course selection must be as per recommendation of BOS.
7. Student will get the credits of respective Honor course in following conditions,
   a. In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
   b. In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA (oral) exam.
8. While selecting online course, following points must be taken care of,
   a. Selected course must be of advanced level and not basic or fundamental level.
   b. Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective).
   c. Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for COURSERA, UDEMY courses.

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

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering
Rev: MC Course structure/RIT/02/2022-26

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 of 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

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 Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2022-26
Department of Mechatronics Engineering
Rev: MC Course structure/RIT/02/2022-26

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.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class: - **Final Year B. Tech**	Semester-**VII**
Course Code: **MC4011**	Course Name: **Design of Mechatronics System**

L	T	P	Credits
2	-	--	2

Course Description:
Most mechanical engineering systems today involve significant amounts of electrical and electronic control systems. Effectively, most modern mechanical engineering systems are *mechatronic* systems. Thus, it is essential for the mechanical engineer to have a strong understanding of the composition and design of mechatronic systems, which is the goal of this course. Mechatronic systems are around us everywhere. A car contains many mechatronic systems, such as anti-lock braking systems, traction control, the engine control unit and cruise control, to name a few. A satellite dish position control unit is another example of a mechatronic system. Modern industrial automated processes would not be possible without the discipline of mechatronics, covering areas such as vehicle manufacturing, pharmaceutical industries, and food processing plants. Robotic systems are interesting and complex examples of mechatronic systems that contain many sensors and actuators and that require very fast and sophisticated controllers.
This course will represent a gateway into the world of electrical, electronic, and control engineering.

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

1. Demonstrate key elements of mechatronics system design process.
2. Apply a systematic approach to the design process of mechatronics systems.
3. Create system modelling of basic models & analyse.
4. Realize the concept of real time interfacing and data acquisition.

Prerequisite:
Basic knowledge in subjects like mechanics, electromagnetism, measurements, system design & dynamics and control engineering.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Design of Mechatronics System-**	04

	Key elements – Mechatronics design process – design parameters – mechatronics and traditional design – Advanced approaches in mechatronics design – Introduction to industrial design, modelling, simulation and analysis – Ergonomics and safety.	
2.	**Basic System Modelling** Introduction – model categories – model development – Simulation using software – verification and validation – Mathematical modelling: Basic system modelling – mechanical electrical, fluid and thermal.	**04**
3.	**Mechatronic System Modelling** Engineering systems: Rotational – translational, electro-mechanical, pneumatic-mechanical, hydraulic-mechanical, micro electro mechanical system – Dynamic responses of system: first order, second order system – Performance measures	**04**
4.	**Real-Time Interfacing** Introduction – Selection of interfacing standards- elements of data acquisition and control systems – Overview of I/O process – general purpose I/O cards and its installation – Data conversion process – Application software – Man machine interface	**04**
5.	**Case Studies on Design of Mechatronics System** Motion control using DC Motor, AC Motor and Servomotor – Temperature control of hot/cold reservoir – Pick and place robot – Car parking barriers – Motion and temperature control of washing machine – Auto focus camera, exposure control	**04**
6.	**Practice-** Demonstration of three different Modular Production System- (pick &place, testing, sorting) (Construction and working) Practice- Hands on session thorough operating and finding the working of different sensors, mechanism and program of the stations.	**04**

References -

Text Books:

1. Devdas Shetty & R. A. Kolk, Mechatronics System Design, Cenage Learning.
2. Georg pelz, "Mechatronic Systems: Modeling and simulation".

Reference Books:

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press.

2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes"..
3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint.

Class: - **Final Year B. Tech**	Semester- **VII**
Course Code: **MC403**	Course Name: **Machine Learning**

L	T	P	Credits
3	--	--	3

Course Description: The objective of this course is to provide third-year Mechatronics Engineering students with a comprehensive understanding of machine learning principles, algorithms, and applications. Machine learning has emerged as a transformative technology with wide-ranging applications in various domains, including computer vision, natural language processing, robotics, healthcare, finance, and more. Through theoretical discussions, practical exercises, and hands-on projects, students will develop the skills necessary to apply machine learning techniques to solve real-world problems and lay the foundation for further study or research in the field

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

1. Classify machine learning techniques
2. Implement machine learning techniques suitable for problem solving
3. Solve the problem using various deep learning techniques
4. Describe various basic concept of Artificial Neural Networks

Prerequisite: Basic concepts of computer algorithm

Course Content

Unit No	Description	Hrs
1.	**Introduction:** Supervised and unsupervised learning, Hypothesis space, Applications of machine learning, Feature selection and extraction, Principal component analysis.	06
2.	**Supervised Learning:** Bias-Variance Dichotomy, Linear regression in one variable: Cost Function, Gradient descent; Linear Regression with Multiple Variables: Gradient descent; Logistic regression, KNN. Bayesian Learning and	06

	Decision Trees, SVM, Ensemble Methods, Reinforcement learning: Elements, Types, Difference between Supervised and reinforced learning.	
3.	**Unsupervised Learning:** Clustering algorithms: K-means, hierarchical clustering, DBSCAN Dimensionality reduction techniques: Principal Component Analysis (PCA), t-distributed Stochastic Neighbor Embedding (t-SNE) Association rule learning: Apriori algorithm Evaluation metrics for unsupervised learning models: silhouette score, Davies-Bouldin index	**06**
4.	**Deep Learning:** Introduction to neural networks: perceptron's, activation functions Building blocks of deep learning: layers, neurons, weights, biases Popular deep learning architectures: Convolutional Neural Networks (CNNs) for image classification, Recurrent Neural Networks (RNNs) for sequential data, and their variants	**06**
5.	**Evaluation of Learning Algorithms:** Cross-validation, learning curves, and statistical hypothesis testing. Ensemble learning methods: bagging, boosting, stacking Hyper parameter tuning techniques: grid search, random search, Bayesian optimization	**06**
6.	**Machine Learning based Artificial Neural Networks:** Fundamentals of Artificial Neural Networks, Perceptron, Model of Neuron in an ANN, Backpropagation.	**06**

References -

Links:

1. Coursera online course byAndre NG, on Machine Learning.
2. http://www.stanford.edu/class/cs229/materials.html

Text Books:

1. T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning (2ed.), 2008.

Reference Books:

1. Christopher Bishop, "Pattern Recognition and Machine Learning", 2016
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "Introduction to Statistical Learning", Springer, 2013
3. Richard Duda, Peter Hart, David Stork, "Pattern Classification", John Wiley & Sons, Second edition 2001.
4. NPTEL online course by Prof. Balaraman Ravindran on Introduction to Machine Learning.

Class: - **Final Year B. Tech**	Semester-**VII**	**L**	**T**	**P**	**Credits**
Course Code: **MC4051**	Course Name: **Industrial Robotics**	**3**	**-**	**-**	**3**

Course Description:
Industrial robots are nearly on the verge of revolutionizing Manufacture as they end up noticeably more intelligent, quicker, and less expensive, they are being called upon to accomplish more. They are going up against more "human" abilities and attributes, for example, detecting, expertise, memory, and trainability. Accordingly, they are going up against more employments for example, picking and packaging, testing, or investigating items, or assembling minute gadgets.

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

1. Explain the basic concepts of Robots.
2. Select an end effector and sensor for application.
3. Explain drives and controls for robotic system.
4. Develop program for robot to perform tasks in industrial applications.

Prerequisite: KDoM, Sensor and Instrumentation

Course Content

Unit No.	Description	Hrs.
1	**Fundamentals of Industrial Robotics:** History of Robotics, Definitions of Industrial Robot, Type and Classification of Robots, Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision, and accuracy of robot, ISO Standards for Industrial Robots.	**06**
2	**Grippers for Industrial Robotics:** Grippers, Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper systems, Concept of Automatic Tool Changing	**06**
3	**Sensors and Drives for Industrial Robotics:** Types of Sensors used in Robotics, Touch Sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Application of Sensors, Characteristics of Sensing devices, Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system, Types of Controllers, Wireless control for welding robots.	**06**

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

4	**Robot Kinematics and Dynamics:** Forward Kinematics, Inverse Kinematics, Differential Motion: link velocity and Acceleration analysis, Jacobian matrix and Singularity. Introduction, Linear trajectory function, polynomial trajectory function, Link forces and moments; Recursive formulation, Gravity Compensation, Role of Jacobian: Force and Velocity ellipsoid, Robot Dynamics: Euler-Lagrange formulation, Newton-Euler formulation.	**06**
5	**Programming and Languages for Robotics:** Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, ROS.	**06**
6	**Application of Robotics in Industry:** Application of robot in welding, machine tools, material handling, and assembly operations, parts sorting and parts inspection, AI in robotics, Autonomous Robots, Introduction to Swarm Robots, Introduction to Cobots, Future Application and Challenges and Case Studies.	**06**

References-

Text Books:

- Richard D Klafter, Thomas Achmielewski and Mickael Negin, Robotic Engineering - An Integrated Approach, Prentice Hall Department of Industrial Design Detail Syllabi 318NIT Rourkela India, New Delhi, 2001.
- Mikell P Groover, Industrial Robotics - Technology, Programming and Applications, McGraw Hill.
- Introduction to Robotics- John J. Craig, Addison Wesley Publishing.

Reference Books:

- James A Rehg, Introduction to Robotics in CIM Systems, Prentice Hall of India.
- Deb S R, Robotics Technology and Flexible Automation, Tata McGraw Hill, New Delhi, 1994.
- Janaki Raman P A, Robotics and Image Processing, Tata McGraw Hill.
- Robotics for Engineers -Yoram Koren, McGraw Hill International.

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Program Elective-III

Class: - **Final Year. B. Tech**	Semester-**VII**
Course Code: **MC4071**	Course Name: **Building Automation**

L	T	P	Credits
3	-	--	3

Course Description: This course will enable you to identify and describe the major components in a BAS along with the basic mechanical components and controls in an HVAC control system. You will be able to describe and explain the basic functions of Digital direct Control systems and HMI basics, reference codes and standards applicable to BAS, and justify control components for project work. This course will help you explain the process of implementing BAS, and Energy Conservation Control Strategies.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Design building automation system by applying basic knowledge of electrical and electronics.
2. Design HVAC system for buildings.
3. Apply different techniques for fire alarm techniques.
4. Access control system for building automation systems.
5. Introduce digital simulation for development of application-oriented logic circuits.

Prerequisite: Basic Chemistry, Basic Electrical Engineering.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Building Automation System and Basic Electricals and Electronics**. Familiarize with the components and technologies involved in a typical Building Automation System, Concepts of Current, Voltage, Power Factor & Power, Ohms Law, Kirchhoff's laws, Concepts of AC & DC Current and Voltage, Line & Neutral, Single and Three phase systems, Basic electronic components - Diodes, Triodes, Transistors, Resistors, Capacitors, Inductors, LEDs, Thermistors etc. Basic electrical components Push Buttons, Indicating	06

	Lamps, Selector/Key Switches, Limit Switches, and Proximity Switches etc. Recall of Transformers (CT/PT), Voltmeter, Ammeter, Energy meter, Terminal Blocks & Din Rails, Concept of Relays and Contactors (NO/NC) Recall of Power Supplies, Earthing & Grounding practices.	
2.	**Basics of HVAC:** Refrigeration Cycle, Components of an A/C system, Fixed Air Volume & Variable Air Volume Applications, Psychometric Able to perform: Capture the requirements of HVAC Systems by site survey Suggest and taking approval from the customer for HVAC Systems Install approved HVAC components as per site requirements, Wire Electrical and Electronics components as per the requirements, Test of HVAC systems, Provide Technical Support for HVAC Systems.	**06**
3.	**Fire Alarm system:** Fire Lifecycle, Detection Technologies, Fire Panel Technologies, Input / Output Devices, Detector & Device Wiring Schema, Fireman's Telephony & Talkback system, NFPA, Guidelines, Fire Safety Strategies Able to perform: Capture the requirements of Fire Alarm Systems by site survey, Suggest and taking approval from the customer for Fire Alarm Systems, Install approved Fire Alarm components as per site requirements, Wire Electrical and Electronics components as per the requirements, Test of new systems at customer site, Provide Technical Support for Fire Alarm Systems at the site	**06**
4.	**Access Control Systems:** Access Control systems, Access Control Technologies, Data Encryption & Security, Access Control Strategy, Access Controllers, Biometrics, Barriers, Reporting & Operations Able to perform: Capture the requirements of Access Controls Systems by site survey Suggest and taking approval from the customer for Access Controls System Install approved Access Controls components as per site requirements Wire Electrical and Electronics components as per specifications Test Access Control systems at customer premises, Provide Technical Support for Access Controls Systems, Achieve Quality and Productivity as per company norms.	**06**
5.	**CCTV Surveillance:** Optics in Cameras, Types of Camera Technologies, Types of Cameras, Video Analytics, Integration Able to perform: Capture the requirements of CCTV Surveillance Systems by site survey, Suggest and taking approval from the customer for CCTV System to be installed, Install approved CCTV components as per site requirements, Wire Electrical and	**06**

	Electronics components as per specifications, Test CCTV Components at customer premises, Provide Technical Support for CCTV, Systems, Achieve Quality and Productivity as per company norms	
6.	**Basic BAS & HMI Components** Understanding Components of a Building Automation system, Understanding Types of I/Os (Analog, Digital, HS Pulse), Managing DDC Instructions & Programming, Understanding DDC Networking & Architecture, Understanding Peer-to-peer & Daisy Chain Networks, Understanding Ethernet I/P & Industrial Networks, Uploading & Downloading Programs, Creating BMS Graphics Screen & Tags, Wiring for I/Os, Source and Sink Connections, Testing of I/O Terminations (Point Testing)	**06**

References –

Text Books:

- Stephen J. Chapman, _Electric Machinery Fundamentals, McGraw Hill Education Pvt. Ltd.
- P.C. Sen Principles of Electric Machines and Power Electronics 'John Wiley & Sons.
- Nagrath, I.J. and Kothari., Electric Machines ', McGraw-Hill Education.

Reference Books:

- David Paper, WaiMok, James Rodger, —Building Automation into Existing Business Processes, Pearson Education.
- B.R. Gupta, 'Fundamental of Electric Machines'New age International Publisher.
- S.K. Bhattacharya, _Electrical Machines 'McGraw – Hill Education, New Delhi.
- Vincent Del Toro, _Basic Electric Machines 'Pearson India Education.
- Surinder Pal Bali, _Electrical Technology Machines & Measurements, Vol.II, Pearson.
- Fitzgerald. A.E., Charles Kingsley, Stephen D.Umans, _Electric Machinery', Sixth edition, McGraw Hill Books Company.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

Class: - **Final Year B.Tech.**	Semester-**VII**
Course Code: **MC409**	Course Name: **Basics of Cloud Computing**

L	T	P	Credits
3	-	--	3

Course Description: Cloud computing is the on-demand availability of computers system resources, especially data storage and computing power, without direct active management by the user. The term is generally used to describe data centers available to many users over the Internet. Clouds may be limited to a single organization (enterprise clouds) or be available to many organizations (public cloud).

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

1. Describe fundamental concepts of cloud computing and its Architecture.
2. Differentiate and analyze the components of various cloud platforms.
3. Analyze the Key Components of Amazon Web Services (AWS)
4. Analyze the applications of Cloud Computing in different domains.

Prerequisite:

- ✧ Fundamental knowledge of Operating System.
- ✧ Basics of Client Server Programming and Network Protocols.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Cloud Computing** Introduction to Cloud Computing, Roots of Cloud Computing, Desired Features of Cloud Computing, Challenges and Risks, Benefits and Disadvantages of Cloud Computing.	06
2.	**Virtualization** Introduction to Virtualization Technology, Load Balancing and Virtualization, Understanding Hypervisor, Seven Layers of Virtualization, Types of Virtualization, Server, Desktop, Application Virtualization.	06

3.	**Cloud Architecture, Services and Storage:** NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, laaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage.	**06**
4.	**Resource Management and Security in Cloud:** Introduction, Ten advanced optimizations of cache performance, Memory technology and optimizations, Protections, virtual memory and virtual machines, The design of memory hierarchies, Memory hierarchies in the ARM Cortex-A8 and Intel Corei7, Fallacies and pitfalls.	**06**
5.	**Cloud Platforms and Applications:** Cloud platforms: Overview of Amazon Web Services, Google App Engine, Microsoft Azure, Aneka cloud. Applications: scientific, business and educational applications.	**06**
6.	**Advanced Topics in Cloud Computing:** Scientific applications: Healthcare, Biology, Geo Science, Business and Consumer Applications: CRM and ERP, Productivity, Social Networking, Media applications, Energy Efficiency in clouds, Market based management of cloud.	**06**

References -

Text Books:

1. Rajkumar Buyya, "Mastering Cloud Computing", McGraw Hill Publication, ISBN 978-1-25-902995-0.
2. im Mather, S. Kumaraswammy, S. Latif, "Cloud Security & Privacy", SPD, O'REILLY, ISBN- 978-0-596-80276-9

Reference Books:

1. "Maozhen Li, Mark Baker, "The Grid Core Technologies", John Wiley & Sons, ISBN: 978-81-265-2728-1
2. Daniel Minoli, "A networking Approach To Grid Computing", John Wiley & Sons, INC Publication, ISBN 0-471-68756-1
3. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A practical approach", McGraw Hill Education, ISBN:978-0-07-068351-8.

Mechatronics Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

Class: **-Final Year B. Tech**	Semester-**VII**
Course Code: **MC4111**	Course Name: **Machine Tool Design**

L	T	P	Credits
3	--	--	3

Course Description:
This course aims to prepare students for developing their careers in design engineering especially in Machine Tool Design. The course will impart students the capability to design machine tools by understanding functional and operational requirements. This course will provide thorough understanding and application of the concepts of design of machine tools, design and/or selection of drives for machine tools; will impart knowledge to design machine tool structures, Design of beds, columns and housings, all types of guide ways, power screws, spindle, spindle supports and other parts of machine tools. It will also impart the knowledge of the dynamics of machine Tools and select the proper control system.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Select & design drive system for machine tool.
2. Decide layout of machine tool.
3. Design machine tool structure, guide ways and power screws.
4. Determine dynamic characteristics of machine tool & carry stability analysis.
5. Demonstrate control systems in machine tools and SPM.

Prerequisite:
Students should have,
1. A good understanding of different types of drives and their selection.
2. Strong understanding of Analysis of mechanical elements, strength of materials and mechanical component design.

Course Content

Unit No	Description	Hrs.
1.	**Design of Machine Tool Drives:** General requirements of machine tool design, Layout of machine tools, Working and auxiliary motions in machine tools. Selection of Electric Motor,	06

	Types of Speed and feed regulation, Classification of speed and feed boxes, Design of feedbox, Speed box, Development of gearing diagram, Stepless Drives: Stepless Regulation of Speed & Feed Rates through Hydraulic, Electric & Mechanical means, Positively Infinitely Variable Drive.	
2.	**Design of Machine Tool Structure:** Functional requirements of machine tool structures, Design criteria & procedure for machine tool structures, Materials for machine tool structures, Design of beds, columns, housings, and other parts of machine tools. Design Case Studies of a) Bed of Lathe, b) Column & Base of Milling Machine, c) Housing of Speed Gearbox	**06**
3.	**Design of Guide ways and Power Screws:** Function & Types of Guideways, Types of Slideways & Antifriction Ways, Functional features of Slideways, its Shapes & Materials, Methods of adjusting Clearance, Design Criteria (Wear Resistance & Stiffness) and Calculations for Sideways, operating under semi liquid friction condition, 'Stick Slip' phenomena affect accuracy of setting & working motions. Design of sliding friction Power Screw for Wear Resistance, Strength, Stiffness & Buckling Stability.	**06**
4.	**Design of Spindle and Spindle Supports:** Function & Requirements of Spindle Units, their Materials, Effect of Machine Tool Compliance on Machining accuracy Design of Spindle for Bending Stiffness: Deflection of Spindle Axis due to a) Bending, b)-due to Compliance of Spindle Supports, c)-due to Compliance of the Tapered Joint; Optimum Spacing between Spindle Supports Permissible Deflection & Design for stiffness: Additional Check for Strength like Additional Supports, Location of Bearings and Drive elements, balancing, Requirements of Spindle Supports, Bearings for spindles.	**06**
5.	**Dynamics of Machine Tools:** Machine Tool Elastic System-cutting Process Closed-loop System, General Procedure for Assessing Dynamic Stability of EES—Cutting Process Closed-Loop System, Dynamic Characteristics of Elements and Systems, Dynamic Characteristic of the Cutting Process, Stability Analysis, Forced Vibrations of Machine Tools.	**06**
6.	**Control Systems in Machine Tools:**	**06**

	Functions, requirements and classification, Control systems for speeds, feeds and various motions, Manual & automatic control systems, adoptive control systems Numerical Control of machine tools- fundamental concept, classification and structure of NC system, CNC, DNC Machining Centers	

References-

Textbook:

- N. K. Mehta, Machine tool design and numerical control, Tata McGraw Hill Publication.

Reference Books:

- S. K. Basu, Design of Machine Tools, Oxford and IBH publishing, New Delhi
- P. H. Joshi, Machine tools handbook-Design and operation, McGraw Hill, New Delhi
- Sen and Bhattacharya, Principles of machine Tools, New age central book agency
- Koenigs-Berger, Principles of machine Tools, Oxford, New York, Pergamon Press
- T H Wentzell, Machine Design Cengage Learning, New Delhi.
- G. K. Grover, Mechanical Vibration, Nemchand & Brothers, Roorkee.
- Dr. V. P. Singh, Mechanical Vibration,S. Chand & Sons New Delhi.
- N/A Central Machine Tool Institute, Machine Tool Design Handbook Hardcover

Class: **-Final Year B. Tech**	Semester-**VII**	**L**	**T**	**P**	**Credits**
Course Code: **MC4131**	Course Name: **Fuzzy Logic and Neural Network**	**3**	**--**	**--**	**3**

Course Description:
To master the various fundamental concepts of fuzzy logic and artificial neural networks. This will help you to get sufficient knowledge to analyze and design the various intelligent control systems.

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

1. Explain the basic concept of fuzzy sets, fuzzy logic & defuzzification.
2. Demonstrate the basics of Artificial Neural theory and programming of Microprocessors.
3. Analyze various techniques in feedback and feed forward Neural networks.
4. Explain the principle of competitive neural networks and Adaptive resonance theory.
5. Demonstrate the architecture and algorithm of Cognitron, Neo cognitron, the concepts of fuzzy associative memory and fuzzy systems.

Prerequisite:
Students should have,

1. Fundamental of Computing

Course Content

Unit No	Description	Hrs.
1.	FUNDAMENTALS OF FUZZY LOGIC Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets- complements- union intersection- combination of operation- general aggregation operations- fuzzy relations- compatibility relations-orderings- morphisms- fuzzy relational equations- fuzzy set and systems.	**06**
2.	ARCHITECTURE OF NEURAL NETWORKS Architectures: motivation for the development of natural networks-artificial neural networks-biological	**06**

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

	neural networks-area of applications-typical Architecture-setting weights-common activations functionsBasic learning rules- Mcculloch-Pitts neuron-Architecture, algorithm, applications-single layer net for pattern classification-Biases and thresholds, linear separability - Hebb'srule- algorithm -perceptron - Convergence theorem-Delta rule.	
3.	BASIC NEURAL NETWORK TECHNIQUES Back propagation neural net:standard back propagation-architecture algorithm- derivation of learning rulesnumber of hidden layers--associative and other neural networks- hetro associative memory neural net, auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine	**06**
4.	COMPETITIVE NEURAL NETWORKS Neural network based on competition: fixed weight competitive nets- Kohonenself organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2	**06**
5.	SPECIAL NEURAL NETWORKS Cognitron and Neocognitron - Architecture, training algorithm and application-fuzzy associate memories, fuzzy system architecture- comparison of fuzzy and neural systems	**06**
6.	Applications Neural network applications: Process identification, control, fault diagnosis and load forecasting.	**06**

References-

Textbook:

1. T1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India.
2. Lawrence Fussett- fundamental of Neural network Prentice Hall.
3. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
4. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH

Reference Books:

1. Bart Kosko, —Neural network and Fuzzy System‖ - Prentice Hall.
2. J.Klin and T.A.Folger, —Fuzzy sets‖ University and information- Prentice Hall.
3. J.M.Zurada, —Introduction to artificial neural systems‖-Jaico Publication house.
4. VallusuRao and HayagvnaRao , —C++ Neural network and fuzzy logic‖-BPB and Publication.

Class: - **Final Year B. Tech**	Semester-**VII**
Course Code: **MC4151**	Course Name: **Hybrid and Electric Vehicle**

L	T	P	Credits
3	-	--	3

Course Description:
Introduction to Hybrid Electric Vehicles, Conventional Vehicles, Hybrid Electric Drive-trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor, Energy Storage Requirements in Hybrid and Electric Vehicles, Sizing the drive system, Design of a Hybrid Electric Vehicle , Energy Management Strategies.

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

1. Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.
2. Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
3. Choose proper energy storage systems for vehicle applications.
4. Identify various communication protocols and technologies used in vehicle networks.

Prerequisite:
Nil

Course Content

Unit No	Description	Hrs
1.	Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.	06
2.	Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train	06

	topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.	
3.	Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives	**06**
4.	Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.	**06**
5.	Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power 7 20% electronics, selecting the energy storage technology,	**06**
6.	Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies	**06**

References -

Text Books:

1) Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press,

Reference Books:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained.
2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajarammagar

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

Class: - Final Year B. Tech	Semester-VII
Course Code: **MC4171**	Course Name: **Industrial Engineering**

L	T	P	Credits
3	-	--	3

Course Description:
The courses in industrial engineering are designed to produce engineers specializing in problem solving and decision-making functions. This course gives an overview of industrial engineering methodologies with particular reference to classical industrial engineering and ergonomics. The subject areas covered include: work methods and measurement, engineering economics, plant layout, material handling, production planning and control and project management. Due emphasis will be given to the application of the methodologies in an industrial environment.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply industrial engineering tools to improve productivity
2. Establish standard methods for job and compute standard times
3. Decide the plant location and design appropriate type of layout and recommend suitable material handling system
4. Plan production activities using tools like capacity and aggregate planning
5. Design the inventory system using appropriate inventory model
6. Implement project management knowledge, tools and techniques to achieve project success.

Prerequisite:
Study of operational research

Course Content

Unit No	Description	Hrs
1.	**Work System Design and Time Study** Definition, Scope, and Historical Development, Role and responsibility of IE, Key Metrics: Efficiency, Productivity, Utilization, Time Study: Stopwatch Techniques, Standard Time Calculation, Allowances	08

	Work Study: Method Study, Process Charts, Flow Process Charts, String Diagrams, Advanced Tools: Motion Capture Systems, Digital Twin Applications in Process Analysis	
2.	**Quality and Reliability Engineering** Total Quality Management (TQM) and Six Sigma, Statistical Process Control (SPC), Control Charts, Process Capability Analysis, Failure Modes and Effects Analysis (FMEA), Mean Time Between Failures (MTBF), Reliability Prediction Models, Quality Standards: ISO 9001, Six Sigma Methodology, Case Studies: Quality Management in Automated Manufacturing Systems	**04**
3.	**Facilities Design** Facility location factors and evaluation of alternate locations; types of plant layout and design of product and process layout. Assembly line balancing Computerized layout design techniques; assembly line balancing; materials handling systems, Automated Guided Vehicles (AGVs), conveyors, robotics, Tools for layout planning: CRAFT, Systematic Layout Planning (SLP), Sustainable facility design principles	**06**
4.	**Production Planning and Control** Functions and objectives of PPC, Forecasting methods for demand planning, Aggregate planning and scheduling, Inventory control: EOQ, ABC, and JIT systems, Integration of mechatronics systems in PPC	**06**
5.	**Inventory Management** Demand forcasting, Inventory models-basic model, production model, price discount model, Inventory systems ROL system and Periodic review systems. Application problems. Materials requirement planning (MRP), MRP I, MRP II.	**06**
6.	**Project Management** Project Life Cycle: Initiation, Planning, Execution, Monitoring, and Closure Tools and Techniques: Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Gantt Charts, Agile and Lean Project Management Risk Management and Mitigation Strategies	**06**

References -

Text Books:

1. K C Jain and L N Agarwal, Production Planning and Control, 6th edition, Khanna Publishers, 2008.

2. M Mahajan, Production Planning and Control, Dhanpat Rai & Co., 2010.
3. Martand Telsang, Industrial Engineering and Production Management, , S. Chand & Co. New Delhi, 2000.

Reference Books:

1. R Paneerselvam, Production & Operations Management, 2nd edition, PHI Publications.
2. O P Khanna, Industrial Engineering and Management, Dhanpat Rai & Co.
3. Maynard. H.B, Industrial Engineering Hand Book, McGraw Hill Book Company, New York.

Class: - **Final Year. B. Tech**	Semester-**VII**
Course Code: **MC421**	Course Name: **Emerging Smart Materials for Mechatronics Applications**

L	T	P	Credits
3	-	--	3

Course Description:
The syllabus for "Emerging Smart Materials for Mechatronics Applications" typically covers a range of topics related to smart materials and their applications in mechatronics systems. Here's a brief overview of what you might expect:

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

1. Develop familiarity with various smart materials and their applications.
2. Design sensors and actuators using smart materials like piezoelectric materials and shape memory alloys (SMAs).
3. Analyze vibration control and damping structures using smart materials.
4. Interpret emerging technical literature related to smart materials and structures.

Prerequisite: Nil

Course Content

Unit No	Description	Hrs
1.	**Introduction to Smart Materials**: Overview of smart materials and their applications in sensing and actuation.	06
2.	**Piezoelectric Materials**: Piezoelectricity, constitutive equations, types of piezoelectric materials, control of piezoelectric actuators, and applications.	06
3.	**Shape Memory Alloys (SMAs)**: Properties of SMAs, shape memory effects, pseudo-elasticity, design of SMA actuators, and applications in precision equipment.	06
4.	**Magnetostrictive Materials**: Basics of magnetic properties, magnetostriction, types of magnetostrictive materials, design and control of magnetostrictive actuators, and applications for active vibration control.	06

5.	**Optical fibers** These fibers are transparent and flexible, and are often made of glass or plastic. They are used to transmit light between two ends, and are commonly used in fiber-optic communications	**06**
6.	**Ionic polymer–metal composites** These composites are made of a hydrated ionomer membrane sandwiched between metal electrodes. They are used in architecture for sensor and actuator applications.	**06**

References -

Text Books:

1. Jose L. Pons, Emerging Actuator Technologies, a MicromechatronicsApproach, John Wiley & Sons Ltd.
2. Ralph Smith, Smart Material Systems: Model Development, SIAM, Societyfor Industrial and Applied Mathematics.
3. F. Carpi, D. De Rossi, R. Kornbluh, R. Pelrine, P. Sommer-Larsen, Dielectric Elastomers as Electromechanical Transducers, Elsevier, Hungry.
4. Y. B. Cohen, Electroactive Polymer (EAP) Actuators as Artificial MusclesReality, Potential and Challenges, SPIE press.

Program Elective-IV

Class: - **Final Year B. Tech**	Semester- **VII**
Course Code: **MC4231**	Course Name: **Computer Network and Cyber Security**

L	T	P	Credits
3	--	--	3

Course Description: Computer networking is the engineering discipline concerned with the communication between computer systems and devices. While cyber security aims to equip students with the knowledge and skills required to defend computer operating systems, networks and data from cyber-attacks. This course is an introduction to the basic networking principles, protocols and concepts that make today's internet work. Also, it encompasses how to safeguard against threats to computer hardware, software and data including theft, hacking, virus and more.

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

1. Describe the various networking components and topologies.
2. Illustrate the concepts, services and protocols used in Computer networks.
3. Solve problems related to Ipv4 addressing.
4. Describe fundamental terms in cybercrime and compare various cyber-attacks & offences.
5. Demonstrate cyber forensics using modern tools & techniques.
6. Construct a strategy for creating awareness about cyber security for e-bankong and legal issues among the social community.

Prerequisite: Basic of computer fundamentals.

Course Content

Unit No	Description	Hrs
1.	**Networking Fundamentals**:	06

	Data communication, Transmission, Media, Guided Media, Unguided media, Network topologies, Introduction to LAN, WAN, MAN, Networking Devices, Switches, Bridges, Routers, Hubs, Repeaters, OSI model and TCP/IP reference models.	
2.	**Internet Layer Addresses and Protocols:** IPv4 Addresses; Introduction, classful Addressing And other issues, Subnetting and Super netting, Classless Addressing, Special Addresses. Interworking Protocol (IP),Address Resolution Protocol (ARP),Internet Control Message Protocol (ICMP).	**06**
3.	**Application Layer Protocols:** File Transfer Protocol (FTP), Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Electronic Mail: Architecture and Mail protocols.	**06**
4.	**Cyber Security Fundamentals:** Cyberspace, Evolution of Computer Technology, Cybercrime and Information Security, Classification of Cybercrimes, Cybercrime: Legal & Indian approach. Introduction to the Indian IT Act 2002, Indian IT act 2008, Challenges faced in designing cyber laws.	**06**
5.	**Cyber Forensics:** Cyber forensics: Cryptography, Cyber Investigations Essentials, Cyber Forensics Essentials. Web Investigation, Email Forensics, Browser Forensics, Investigating Server Logs, OS Forensics, Password Forensics, Disk Forensics, Network Forensics, Mobile Device Forensics, Live Forensics, and Multimedia Forensics.	**06**
6.	**E-Banking and advanced issues:** e-Transactions, Cryptocurrencies, Relevant Sections of the Reserve Bank of India Act, Relevant Sections of the Bankers Book Evidence Act, Laws related to Credit cards, Investigating Financial Crimes.	**06**

References -
Text Books:

1. Behrouz A. Forouzen, "Data Communications and Networking with TCPIP Protocol Suite",Tata Mag. Hill, lndjan Edition.
2. Nina Godhole, Sunit Belapure, Cyber Security, Wiley India
3. Farooq Ahmad, Cyber Law in India, Pioneer Books

Reference Books:

1. Behrouz A. Forouzen, "TCP/IP Protocol Suite", Tata Mag. Hill
2. Behrouz A. Forouzen, "Data communications and Net\vorking", Tata Mag. Hill.
3. Andrew S. Tanenbaw11, "Computer Networks", Pearson Education, Fourth Edition.
4. James Graham, Ryan Olson, Cyber Security Essentials,

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Class: - **Final Year. B. Tech**	Semester-**VII**
Course Code: **MC433**	Course Name: **Unmanned Aerial Vehicle**

L	T	P	Credits
3	-	--	3

Course Description: This course will cover the instruction in, and deployment of, key knowledge and skills associated with the characterization, operation, design, analysis and testing of unmanned air vehicles (UAVs). Primary focus will be given toward UAV flight mechanics. The course explores the essential underlying physics, configuration issues, system development, guidance, navigation, control, and sensors of UAV problems, including autopilot for stability, control and functions of path planning. The course material and text lead the student from rigid-body dynamics through aerodynamics, stability augmentation, and state estimation using onboard sensors, to maneuvering through desired paths. To facilitate understanding, the intent is to augment traditional homework assignments with a simulation project utilizing a MATLAB modeling environment.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Elaborate drone technology.
2. Explain fundamentals and design principles of UAV.
3. Understand Mechanical and Electrical components of UAV.
4. Discuss the wide range of applications of drone.
5. Classify various propulsion and controlling techniques for drone.

Prerequisite: Basic Chemistry, Basic Electrical Engineering.

Course Content

Unit No	Description	Hrs
1.	**Introduction** Definitions and Terminology, Aviation History and Unmanned Flight, Classification of UAVs, Military and Civilian Unmanned Aircraft.	06

2.	**UAV Design Principles** Introduction to UAV Design Principles, Computational and Experimental Design of a Fixed-Wing UAV, Payload Design of Small UAVs, Small UAV Design Development and Sizing, Systematic Design Methodology and Construction of Micro Aerial Quadrotor Vehicles.	**06**
3.	**UAV Fundamentals** Kinematics and Dynamics of Fixed-Wing UAVs, Dynamic Model for a Miniature Aerobatic Helicopter, Quadrotor Kinematics and Dynamics, Dynamics and Control of Flapping Wing MAVs, Principles of Guidance, Navigation, and Control of UAVs.	**06**
4.	**UAV Propulsion** UAV Propulsion: Introduction, Power Managements of a Hybrid Electric Propulsion System Powered by Solar Cells, Fuel Cells, and Batteries for UAVs.	**06**
5.	**UAV Control** Linear Flight Control Techniques for UAV, Nonlinear Flight Control Techniques for UAV, Adaptive Control of UAV: Theory and Flight Tests, Robust and Adaptive Control Methods for Aerial Vehicles.	**06**
6.	**UAV Applications** Survey of UAVs for Traffic Monitoring, Cooperative Unmanned Aerial Systems for Fire Detection, Monitoring, and Extinguishing.	**06**

References-

Text Books:

1. Kimon P. Valavanis, George J. Vachtsevanos, Handbook of Unmanned Aerial Vehicles, Springer

Reference Books:

1. Neeraj Kumar Singh, Porselvan Muthukrishnan, Industrial System Engineering for Drones, Apress
2. Sachi Nandan Mohanty, J.V.R. Ravindra, Drone Technology: Future Trends and Practical Applications, Wiley

Rajaramnagar Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

Class: - **Final Year B. Tech**	Semester- **VII**
Course Code: **MC4271**	Course Name: **VLSI Design**

L	T	P	Credits
3	--	--	3

Course Description: This course emphasizes on basic and advanced high performance Digital techniques. As the technology is scaling down, more and more devices are being implemented on a single chip leading to more complex system on a chip a challenging design task as millions of transistors are integrated. Design methodology such as top-down systhesis approach, fabrication process, design and analysis of MOS VLSI circuits in term area, speed and power is incorporated in this course.

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

1. Describe fundamentals of MOS circuits
2. Analyze the static and dynamic characteristics of CMOS circuit
3. Apply knowledge of MOS circuit and fabrication process to solve the problems
4. Design and implementation of combinational and sequential circuits
5. Evaluate the performance of CMOS circuits

Prerequisite: Basic knowledge of MOS circuit

Course Content

Unit No	Description	Hrs
1.	**Overview of VLSI Design:** Historical perspective, overview of VLSI design methodologies, VLSI design flow, design hierarchy, concepts of regularity, modularity, and locality, VLSI design styles, design quality, packaging technology, CAD technology, Steps of CMOS Fabrication process.	**06**
2.	**MOS Transistor Theory:** Introduction to The metal oxide semiconductor (MOS) structure, Long channel I-V characteristics, C-V characteristics, non-linear I-V effects, DC transfer characteristics. Introduction to ASIC and SoC, Overview of ASIC flow, functional verification, RTL-GATE level	**06**

	synthesis, synthesis optimization techniques, pre-layout timing verification, static timing analysis, floor-planning, placement and routing, extraction, post layout timing verification, extraction.	
3.	**CMOS Process Technology:** Fabrication process flow- basic steps, the CMOS n-Well process, layout design rules, stick diagram, full-custom mask layout design MOS Inverter (Static Characteristics): Resistive-load inverter, inverter with n-type 16 MOSFET load, CMOS inverter MOS Inverters (Switching Characteristics and Interconnects effects): Delay-time definitions, calculation of delay times, logical efforts, inverter design with delay constraints, estimation of interconnect parasitics, calculation of interconnect delay, Bus vs. Network-onChip (NoC), switching power dissipation of CMOS inverters.	**06**
4.	**Combination CMOS Logic Circuits:** MOS logic circuits with depletion nMOS loads, CMOS logic circuits, complex logic circuits, CMOS transmission gates (pass gates), ratioed, dynamic and pass transistor logic circuits.	**06**
5.	**Sequential MOS logic circuits:** Behaviour of bi-stable elements, SR latch circuits, clocked latch and flip-flop circuits, CMOS D-latch and edge-triggered flip-flop. Timing path, Setup time and hold time static, example of setup and hold time static, setup and hold slack, clock skew and jitter, Clock, reset and power distributions.	**06**
6.	**Semiconductor Memories:** Memory Design, SRAM, DRAM structure and implementations Recent Trends in VLSI Design & its research issues in industry: System case studies. Design automation of VLSI Systems: basic concepts. Deep Sub-micron Technologies: Some Design Issues	**06**

References -

Text Books:

- VLSI Design Black Book Paperback. by Kattula Shyamala Dr. ...
- Cmos Vlsi Design: A Circuits And Systems Perspective, 3/E by Weste Neil H.E., David Hurris.
- Principles CMOS VLSI Design by Weste H.E.

Reference Books:

- N. H. E. Weste and C. Harris, "Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007.
- J. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, 2nd Edition, Prentice Hall 2004.

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, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class: -: **Final Year B. Tech**	Semester: **VII**	**L**	**T**	**P**	**Credits**
Course Code: **MC4511**	Course Name: **Industrial RoboticsLab**	-	-	2	1

Course Description:

Industrial robots are changing the way of manufacturing and it also increasing the production capacity of the industry. Current robots come with intelligent systems to collaboratively work with the humans for flexible manufacturing systems. Due to this increasing demand of industrial robotics in industries the students should learn this course for practical

Course Learning Outcomes:

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

1. To explain the basic principles of Robotic technology, configurations, control, and programming of Robots.
2. To choose the appropriate Sensor and Machine vision system for a given application
3. To explain the basic principles of programming and apply it for typical Pick &place,

Prerequisite:

Course Content

Expt. No.	Description	Hrs.
1.	Introduction to Industrial Robots with Demonstration of 06 Axis and 07 Axis Articulated Robots: Basic robotic structure, classification, key components of 6 and 7-axis articulated robots, sensors, grippers, work design & safety protocols and applications	02
2.	Introduction to the Teach pendant and its interface, understanding coordinate systems (Joint, World, Tool, and User), Configuring tool center points (TCP) and work objects.	02
3.	Creating and modifying robot programs: Basic programming commands: MoveJ, MoveL, MoveC, Path planning and interpolation, Motion commands, delays, and loops.	02
4.	Program for Linear and circular motion on 6-axis articulated robot and Programming simple pick-and-place tasks.	02
5.	Program for Pick and place and palletizing application on 6-axis	02

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

	and 7-axis articulated robot.	
6.	Program for welding application on 7-axis articulated robot.	**02**
7.	Design and execute a given robotic automation task using a 6-axis or 7-axis robot.	**02**
8.	Using simulation software for offline programming and task validation, simulating industrial operations and optimizing robot paths.	**02**
9.	Industrial Visit	**02**

References –

Textbooks:

1. Manual by Fanuc Robotics India Pvt. Ltd.
2. Robotics, control vision and intelligence-Fu, Lee and Gonzalez. McGraw Hill international
3. Introduction to Robotics- John J. Craig, Addison Wesley Publishing.

Reference Books:

1. Robotics for Engineers -YoramKoren, McGraw Hill International
2. Industrial Robotics-Groover, Weiss, Nagel, McGraw Hill International.

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

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

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class: - **Final Year B. Tech**	Semester- **VII**
Course Code: **MC4531**	Course Name: **Circuit Simulation and PCB Design Lab**

L	T	P	Credits
--	--	2	1

Course Description: In the era of miniature electronic gadgets and automation, it is required to have electronic circuit simulation for better design and cost-effective PCB layout for better performance. This course aims to teach students about how to simulate the electronic circuit and how to design PCB layout of given circuit using available circuit simulation and PCB layout design tools (free or licensed). This course helps the student to simulate the circuit and develop complete hardware circuit on PCB.

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

1. Compare different circuit simulation and PCB layout design software
2. Make schematic electronic circuits in the software
3. Fabricate PCB using various tools
4. Design and develop layout of PCB using PCB layout design tool with fabrication (free or licensed).

Prerequisite: Basic concepts of Electronics, Digital Electronics

Course Content		
Experiment No.	**Description**	**Hrs.**
1.	Verify V-I Characteristics of diode using simulation tool	**02**
2.	Implementation of clipper and clamper using simulation tool	**02**
3.	Connect, simulate and test the RC, LC, and RLC based electronic circuit using circuit simulation software.	**02**
4.	Connect, simulate and test the Diode, Transistor, MOSFET based electronic circuit using circuit simulation software.	**02**
5.	Design 2-bit comparator using simulation tool	**02**

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

6.	Design BCD counter using simulation tool	**02**
7.	Synthesize and transfer an electronic circuit using circuit simulation software to the PCB layout design software for transistor as a switch (Dip Trace).	**02**
8.	Design PCB layout for Op-Amp based application	**02**
9.	Design and fabricate of PCB layout for Linear Power Supply using simulation tool and dip trace	**02**
10.	Synthesize complete PCB for a given electronic circuit (mini project)	**02**

References -

1. Robert L. Boylestad, Louis Nashel Sky "Electronic Devices and Circuit Theory", Person Publication
2. Anand Kumar, "Fundamental of Digital Circuits", PHI Publication

Text Books:

1. Printed Circuit Boards: Design and Technology Bossart TMH, New Delhi 2008 or latest edition
2. Ultiboard user manual National Instruments www.ni.com
3. Orcade online manual Cadence www.cadence.com

Program Elective-IV Lab

Class: - **Final Year B.Tech**	Semester-**VII**
Course Code: **MC4551**	Course Name: **Computer Network and Cyber Security Lab**

L	T	P	Credits
-	-	2	1

Course Description:
Computer networking is the engineering discipline concerned with the communication between computer systems or devices. Cyber security aims to equip students with the knowledge and skills required to defend computer operating systems, networks, and data from cyber-attacks. This course is an introduction to the basic networking principles, protocols, and concepts that make today's Internet work. Also, It encompasses how to safeguard against threats to computer hardware, software, and data including theft, hacking, viruses, and more.

Course Learning Outcomes:
1. After successful completion of the course, students will be able to,
2. l. Demonstrate the use of various networking tools and utilities.
3. Use the CISCO packet tracer and Packet Capturing and Analyzing tool i.e Wireshark.
4. Configure and test the different network services.
5. Install and configure the Kali Operating system
6. Demonstrate different cyber-attacks using Kali Linux.
7. Demonstrate cyber forensic techniques using windows GUI Based tools and Kali Linux.

Prerequisite:
Basics of Computer Fundamentals.

Course Content

Experiment No	Description	Hrs
1.	Networking Components and their simulation using CISCO packet tracer	02

2.	Networking Topologies and its simulation using CISCO packet tracer	**02**
3.	Demonstration of Network Connectivity Testing Tools/Utilities	**02**
4.	Network Service configuration and testing: DHCP, DNS, FTP, SMTP etc.	**02**
5.	Demonstration of Network Packet Capturing and Analysis Tool (Wireshark)	**02**
6.	Installation and configuration of Kali Linux Operating System.	**02**
7.	Demonstration of Cyber Attacks: Social Engineering, Phishing, DOS/DDOS, SOL Injection using Kali Linux	**02**
8.	Demonstration of Browser Forensics & Security	**02**
9.	Demonstration of Operating System (OS) Forensics & Security	**02**
10.	Demonstration of Cryptographic techniques	**02**

References -

Text Books:

1. Behrouz A. Forouzen, "Data Communications and Networking with TCPIP Protocol Suite", 6th Edition, Tata Mag. Hill, Indian Edition.
2. The Basic of Digital forensics by John Sammons, Syngress Edition: 02
3. Kali Linux Penetration Testing Bible by Gus Khawaja Wiley

Reference Books:

5. Behrouz A. Forouzen, "TCP/IP Protocol Suite", 4th edition, Tata Mag. Hill, 2010.
6. Behrouz A. Forouzen, "Data communications and networking" 5th edition, Tata Mag. Hill.
7. Andrew S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition.
8. The Ultimate Kali Linux Book by Author: Glen D. Singh Packt Publishing 2nd Edition.

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

Class: - **Final Year B. Tech**	Semester- **VII**
Course Code: **MC4571**	Course Name: **VLSI Design Lab**

L	T	P	Credits
--	--	2	1

Course Description: This course emphasizes on basic and advanced high performance Digital techniques. As the technology is scaling down, more and more devices are being implemented on a single chip leading to more complex system on a chip a challenging design task as millions of transistors are integrated. Design methodology such as top-down systhesis approach, fabrication process, design and analysis of MOS VLSI circuits in term area, speed and power is incorporated in this course.

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

1. Design and simulate schematic of various digital circuits
2. Sketch layout of various digital block in cad tools.
3. Analyze various parameters of VLSI logic circuits
4. Interpret results and communicate effectively through written lab journals

Prerequisite: Basic knowledge of MOS circuit

Course Content		
Experiment No.	**Description**	**Hrs.**
1.	Study of MOS fabrication process and introduction of CAD tools	**02**
2.	Design and verify physical layout of basic logic gates.	**02**
3.	Design and verify physical layout of combinational circuits	**02**
4.	Design and verify physical layout of sequential circuits	**02**
5.	Design and verify physical layout of digital shifters.	**02**
6.	Model and analyze inverter equivalent of multiple input complex logic gate	**02**

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

7.	Model and analyze various parameters of resistive load inverter	**02**
8.	Design and verify the memory circuit	**02**
9.	Design, model and verify ring oscillator circuit	**02**
10.	Design and verify the magnitude comparator	**02**

References -

Text Books:

1. Sung MO Kang, CMOS Digital Integrated Circuit Design, TATA McGraw HILL.

Reference Books:

1. N. H. E. Weste and C. Harris, "Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007.
2. J. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, 2nd Edition, Prentice Hall 2004.

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class:- **Final Year B. Tech.**	Semester-**VII**
Course Code : **MC467**	Course Name: **Unmanned Aerial Vehicles Lab**

L	T	P	Credits
-	-	2	1

Course Description: This lab introduces students to the design, simulation, control, and flight operations of Unmanned Aerial Vehicles (UAVs). It includes practical training on assembly, sensor integration, flight controllers, mission planning, and computer vision applications.

Course Learning Outcomes:

1. Identify and assemble components of UAVs.
2. Simulate and analyze drone flight using MATLAB or similar tools.
3. Integrate and calibrate sensors for drone navigation.
4. Perform autonomous missions using mission planner software.
5. Apply basic computer vision techniques in drone operations.

Prerequisite: Basics of Electronics, Control Systems, and Embedded Programming

Course Content

Experiment No	Description	Hrs
1.	Study of drone types, architecture, components, and flight dynamics.	02
2.	Assembly and wiring of quadcopter using flight controller (e.g., Pixhawk/KK2.1.5).	02
3.	Configuration and calibration of flight controller using Mission Planner/QGroundControl.	02
4.	Simulation of quadcopter flight using MATLAB/Simulink or open-source drone simulator(liftoff).	02
5.	Tuning of PID controller for drone stability and altitude control.	02
6.	Interfacing and calibration of IMU and GPS modules, test safety protocols (return-to-home, low battery, GPS loss, battery drop).	02
7.	Manual and semi-autonomous flight tests using RC and telemetry module.	02
8.	Autonomous mission planning and execution using waypoint GPS navigation.	02

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

9.	Integrate and test Object detection and tracking using onboard camera and OpenCV(ultrasonic or LiDAR sensors).	**02**
10.	Battery health monitoring, UAV Data Analysis(altitude, velocity, GPS track) and power management during flight.	**02**

References -

Text Books:

- Austin, R. 'Unmanned Aircraft Systems: UAVS Design, Development and Deployment,' Wiley.
- Valavanis, K. P., & Vachtsevanos, G. J., 'Handbook of Unmanned Aerial Vehicles,' Springer.

Reference Books:

- Pounds, P. E., & Mahony, R. E., 'Modeling and Control of Mini-Flying Machines.'
- Quan, Q., 'Introduction to Multicopter Design and Control,' Springer.
- Drone Build and Fly Manuals – PX4/Ardupilot Documentation.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

Class: - **Final Year B. Tech.**	Semester-**VIII**
Course Code: **MC4711**	Course Name: **Capstone Project Phase II**

L	T	P	Credits
-	-	06	03

Course Description:

A capstone project is designed to encourage the students to think critically, solve challenging problems, and develop skills such as communication, research, teamwork, project management and planning, self-sufficiency, goal setting, etc. In most cases, the projects are also interdisciplinary, in the sense that students must apply skills or investigate issues across many different subject areas or domains of knowledge. Capstone projects also tend to encourage students to connect their projects to community issues or problems and to integrate outside-of-school learning experiences. Ultimately, a capstone project represents new work and ideas, allowing students to demonstrate the knowledge and skills they have gained during past academic years. The students in a group of not more than four will work under the project supervisor's guidance on the project they undertake.

The objective is to prepare the students to examine any design, process, or phenomenon from all angles, encourage independent thinking and working, and expose them to industry. Also, it allows students to integrate and apply knowledge from different Mechatronics engineering disciplines to conduct an open-ended engineering project requiring team collaboration.

Course Learning Outcomes:

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

1. Select and apply the appropriate design of experiments, experimental setup, models, or simulation technique for the project task.
2. Fabricate project or experimental setup or model and analyze the output of models/simulations to provide information for decisions
3. Perform feasibility analysis and uses results to choose candidate solutions and evaluate the quality of solutions to select the best one
4. Collaborates with team members of diverse backgrounds and perspectives to achieve a common goal.
5. Write a technical report and communicate effectively.

Prerequisite:

1. In-depth understanding of all the subjects learned so far.
2. Two weeks of in-plant training must be completed.

3. Capstone project phase-I must be completed.

Course Content

The project work may consist of,

1. To search and select an appropriate topic for capstone project work in view of innovations, new products, and solutions to long-standing problems.
2. A comprehensive and up-to-date survey of literature related to the study of a phenomenon or product.
3. Prepare and refine the project proposal to the point where the student should demonstrate that it is worthy of the undertaking and should be completed in time.
4. Prepare a well-defined project plan with a budget linked to project activities and outcomes.
5. Apply appropriate methodology to solve critical engineering problems.
6. Design and development of equipment, components, and test setup.
7. Conduct experiments, test products, and processes for various parameters, and interpret the results.
8. Write the technical report.

Students should complete the following work during semester-VIII

Design of Product or Process, Analysis, Experimentation/Fabrication, Testing, Modification, and Final Report Preparation.

Course Assessment-

Projects will be evaluated using Rubrics that assess

- the design, development, and final solution assets
- the final written report
- the final oral presentation

Each student's performance should be assessed individually with the team's overall performance by the supervisor, Group chairman, and committee using the rubrics provided in the Appendices. The project committee should consist of at least four academic staff with a project supervisor. The average scores of all supervisors for each rubric are combined using the following percentages to get a weighted average grade point.

Design, development & solution assets - 60%
Project report and presentation - 40%

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

Industry Internship (II)

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **OE4382**	Course Name: **Finance for Engineers (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
In today's workplace, it is nearly impossible for an engineer to perform without considering the financial impact of every action on the organization's bottom line. Engineers need to be aware of issues such as cost reduction and capital investment and how their decisions can affect the financial statements. This course introduces basic financial management to engineers and technical personnel who need this knowledge to manage a profit center effectively. The course aims at providing students with an in-depth coverage of the various aspects of financial management.
It covers the assessing the financial health of the organization through ratio and cash flow analysis, sources of long term as well as short term finance. Decisions concern with financing, working capital and long term investment. Class will focus on both the academic theories underlying the management of funds and the practical aspects of financial management.

Course Learning Outcomes:
After successful completion of this course, students will be able to,
1. Discuss the fundamental aspects of accounting and finance.
2. Apply theoretical knowledge and information for preparing various financial statements.
3. Analyze the financial information for solving managerial problems.
4. Evaluate financial performance of the organization for effective decision making.

Prerequisite:
Basics of Mathematics

Course Contents

Unit No	Description	Hrs
1.	**Finance Terminologies & Financial Statement**	4

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

	Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements	
2.	**Analyzing Health of a Firm** Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows	4
3.	**The Management of Working Capital** Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement	4
4.	**Investment Decision Rules** Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis	4
5.	**Long Term Financing** Long Term Financing: Shares, Debentures, Loan capital, foreign capital, FDI, Euro issues & external borrowings, Venture capital financing.	4
6.	**Financing Decisions and Cost of Capital** Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital	4

References:

Reference Books:

1. Paul Kimmel, J. Weygandt, D. Kieso, Financial Accounting
2. S.N. Maheshwari & S.K. Maheshwari, Problems & Solutions in Advanced Accountancy, Vikas Publishing House Pvt. Ltd., New Delhi
3. M.C. Shukla, T.C. Grewal & S. C. Gupta, Advanced Accounts, S. Chand
4. M. Y. Khan & P. K. Jain, Financial Management, Tata McGraw-Hill Publishing Company Limited, New Delhi
5. Prasanna Chandra, Financial Management, Tata McGraw-Hill Publishing Company Limited.

Note: Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam.
Final exam will be held at college campus.

Class: **Final Year B. Tech.**	Semester- **VIII**
Course Code: **OE4362**	Course Name: **Engineering Management & Economics (Online Course)**

L	T	P	Credits
2	-	-	2

Course Description:
Engineering management is the integration of management principles with engineering practices. It is a specialized field that focuses on effectively leading engineering teams and managing technical projects. This course is structured into two key modules: Engineering Management and Engineering Economics. The first module is centered on building the managerial skills necessary to guide, mentor, and inspire technical professionals in their engineering roles. The second module delves into engineering economics, a vital area for engineering firms to maintain their competitive advantage and market presence, focusing on economic decision-making.

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

1. Develop administrative, organizational, and planning skills to effectively manage and execute engineering projects.
2. Create bar charts and milestone charts to track and manage project progress.
3. Analyze profit and cost data, conducting economic evaluations to make informed, optimal decisions.
4. Calculate depreciation using various methods.

Prerequisite: Basics of Mathematics

Course Content

Unit No	Description	Hrs
1	**Managerial skills** Theories of Management Principles of Management (by Henry Fayol), Functions of Management, Planning, Organizing, Staffing, Directing, Co-Ordination, Communication, Motivation and Controlling	04
2	**Organizational skills** Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04

3	**Planning Tools** Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gant Chart	**04**
4	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method	**04**
5	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis	**04**
6	**Depreciation** Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	**04**

References:

Text Books:

1. Gilbert Daniel R, Freeman R. Edward and Stoner James A. F, "Management" Pearson Education.
2. Harold Kerzner, "Project Management- A system approach to planning, scheduling and controlling", John Wiley & Sons Inc.
3. Punmia B. C. and Khandelwal K. K, "Project Planning, Scheduling and controlling with PERT and CPM", Laxmi Publications Pvt. Ltd.
4. Paneerselvam R, "Engineering Economics", Prentice Hall India Learning Private Limited.

Reference Books:

6. Cannice Mark V, Koontz Harold and Weihrich Heinz, "Management", McGraw Hill Education (I) Pvt. Ltd.
7. Blank Leland and Tarquin Anthony, "Basics of Engineering Economy", Tata McGraw-Hill.
8. Mithani D. M, "Managerial Economics- Theory & Applications", Himalaya Publishing House-New Delhi.

Note: Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final examination.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

Rajarambapu Institute of Technology Rajaramnagar 415414

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **IP4024**	Course Name: **Industry Internship & Project**

L	T	P	Credits
-	-	--	12

Course Description:
Internship is designed to expand the depth and breadth of academic learning of students in their particular areas of study. It is an opportunity for students to receive experience in applying theories learned from the classroom to specific experiences with the community and work world. An internship can also heighten awareness of community issues, motivate students to create opportunities, embrace new ideas, and give direction to positive change. A successful internship can give valuable information in making decisions about the direction of future studies or employment. An internship is an opportunity not only to use and develop industry-related knowledge and skills, but also to enhance some of the skills that are transferable to any professional work setting. Students from Final year B.Tech are eligible to do this internship. Selected candidates by college will be permitted for internship of minimum 20 weeks in 8th semester. During this Internship, it is expected that students should identify the problems arising in the industry related to Engineering, and they have to give the solution to the company.

Course Learning Outcomes:

1. **Internship**
   After the successful completion of the IIP- II the student should be able to
   1. Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)
   2. Develop an attitude to adjust with the company culture, work norms, code of conduct.
   3. Recognize and follow the safety norms, Code of conduct.
   4. Demonstrate the ability to observe, analyse and document the details as per the industry practices.
   5. Interpret the processes, systems and procedures and to relate to the theoretical concepts-studies.
   6. Develop the leadership abilities, communication.
   7. Demonstrate project management and finance sense
2. **Project**
   After the successful completion of the project, the student should be able to;
   1. Identify the project/problem in the domain of a program relevant for the company.

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

2. Compile the information to the pertaining to the problem identified.
3. Analyse the information using the statistical tools/ techniques.
4. develop the feasible solution for given problem.
5. Analyse the impact of the project on the performance of company/department.

Course Content

I. Internship :

During Internship, Students should follow guidelines given below.

1. After joining the industry students should learn all the departments and their workings. Furthermore, student should understand how each department of industry is interlinked with one another.
2. Student should correlate the theoretical aspects learned in academics with industry practices.
3. Students should gain a knowledge of new technologies which industry follows.
4. Students should follow the professional codes and ethics.
5. Students should follow all rules and regulations of industry. Special care should be taken regarding safety.

- **Work Diary:**

  Work Diary will be provided to each student, which contains details regarding internship, do's and don'ts and evaluation scheme. Student is required to write the Diary regularly and get it signed by the industry guide periodically. During the visit of Mentor, assigned to the student should be able to go through the Diary to access the work done and write the remarks/ instruction. At the end of internship, student should submit the duly completed diary to the department.

- **Duration:**

  The internship duration is of one complete semester (approximately 20 weeks) between 1st January to 30th May of the respective academic year. Biometric attendance on working days is compulsory.

II. Project :

Students should select technical problems occurring within the industry as a project in consult with industry & Institute mentors.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

- **Evaluation**

Faculty Mentor will be assigned to each student by the Institute who will monitor the progress of internship and project and help the student to sort-out any issues/ problems arising. Mentor of student from college will visit the industry as per the schedule given below.

Sr.No.	Evaluation	Period
1.	At the beginning of the program for orienting Students to the company and finalize the project	During 2nd Week
2.	Review-I (ISE-1)	During10thweek
3.	Review-II (ISE-2)	During15thweek
4.	Review-III (ESE)	During20thweek

*Review-III is End Semester Examination (ESE), which will be conducted at institute.

*During ESE, students should submit, Project & internship report, Work diary, Internship & project completion certificate issued by industry etc. to respective departments.

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Research Internship (RI)

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **OE4382**	Course Name: **Finance for Engineers (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
In today's workplace, it is nearly impossible for an engineer to perform without considering the financial impact of every action on the organization's bottom line. Engineers need to be aware of issues such as cost reduction and capital investment and how their decisions can affect financial statements. This course introduces basic financial management to engineers and technical personnel who need this knowledge to manage a profit center effectively. The course aims at providing students with an in-depth coverage of the various aspects of financial management.

It covers the assessing the financial health of the organization through ratio and cash flow analysis, sources of long term as well as short term finance. Decisions concern with financing, working capital and long term investment. Class will focus on both the academic theories underlying the management of funds and the practical aspects of financial management.

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

1. Discuss the fundamental aspects of accounting and finance.
2. Apply theoretical knowledge and information for preparing various financial statements.
3. Analyze the financial information for solving managerial problems.
4. Evaluate financial performance of the organization for effective decision making.

Prerequisite:
Basics of Mathematics

Course Contents

Unit No	Description	Hrs
1.	**Finance Terminologies & Financial Statement**	4

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

	Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements	
2.	**Analyzing Health of a Firm** Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows	4
3.	**The Management of Working Capital** Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement	4
4.	**Investment Decision Rules** Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis	4
5.	**Long Term Financing** Long Term Financing: Shares, Debentures, Loan capital, foreign capital, FDI, Euro issues & external borrowings, Venture capital financing.	4
6.	**Financing Decisions and Cost of Capital** Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital	4

References:

Reference Books:

1. Paul Kimmel, J. Weygandt, D. Kieso, Financial Accounting
2. S.N. Maheshwari & S.K. Maheshwari, Problems & Solutions in Advanced Accountancy, Vikas Publishing House Pvt. Ltd., New Delhi
3. M.C. Shukla, T.C. Grewal & S. C. Gupta, Advanced Accounts, S. Chand
4. M. Y. Khan & P. K. Jain, Financial Management, Tata McGraw-Hill Publishing Company Limited, New Delhi
5. Prasanna Chandra, Financial Management, Tata McGraw-Hill Publishing Company Limited.

Note: Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam.
Final exam will be held at college campus.

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

Department of Mechatronics Engineering

Class: **Final Year B. Tech.**	Semester- **VIII**
Course Code: **OE4362**	Course Name: **Engineering Management & Economics (Online Course)**

L	T	P	Credits
2	-	-	2

Course Description:
Engineering management is the integration of management principles with engineering practices. It is a specialized field that focuses on effectively leading engineering teams and managing technical projects. This course is structured into two key modules: Engineering Management and Engineering Economics. The first module is centered on building the managerial skills necessary to guide, mentor, and inspire technical professionals in their engineering roles. The second module delves into engineering economics, a vital area for engineering firms to maintain their competitive advantage and market presence, focusing on economic decision-making.

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

1. Develop administrative, organizational, and planning skills to effectively manage and execute engineering projects.
2. Create bar charts and milestone charts to track and manage project progress.
3. Analyze profit and cost data, conducting economic evaluations to make informed, optimal decisions.
4. Calculate depreciation using various methods.

Prerequisite: Basics of Mathematics

Course Content

Unit No	Description	Hrs
1	**Managerial skills** Theories of Management Principles of Management (by Henry Fayol), Functions of Management, Planning, Organizing, Staffing, Directing, Co-Ordination, Communication, Motivation and Controlling	04
2	**Organizational skills** Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04

3	**Planning Tools** Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gant Chart	**04**
4	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method	**04**
5	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis	**04**
6	**Depreciation** Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	**04**

References:

Text Books:

1. Gilbert Daniel R, Freeman R. Edward and Stoner James A. F, "Management" Pearson Education.
2. Harold Kerzner, "Project Management- A system approach to planning, scheduling and controlling", John Wiley & Sons Inc.
3. Punmia B. C. and Khandelwal K. K, "Project Planning, Scheduling and controlling with PERT and CPM", Laxmi Publications Pvt. Ltd.
4. Paneerselvam R, "Engineering Economics", Prentice Hall India Learning Private Limited.

Reference Books:

6. Cannice Mark V, Koontz Harold and Weihrich Heinz, "Management", McGraw Hill Education (I) Pvt. Ltd.
7. Blank Leland and Tarquin Anthony, "Basics of Engineering Economy", Tata McGraw-Hill.
8. Mithani D. M, "Managerial Economics- Theory & Applications", Himalaya Publishing House-New Delhi.

Note: Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final examination.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **RE4044**	Course Name: **Research Internship**

L	T	P	Credits
-	-	-	**12**

Course Description:
Research experience for undergraduates is important not only for conducting research on a topic that has an impact on a current research activity, but also as a tool to enhance undergraduate education. For the engineering technology students, research experiences allow them to carry out in-depth study of engineering concepts, while emphasizing hands-on experiences and practical applications. Participating in research projects strengthens the student's resume, and fulfills the requirements of present day employers, who demand sound engineering skills in their employees.

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

1. Investigate the technical literature.
2. Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.
3. Design a research problem and develop a methodology.
4. Develop and implement an advanced original research or creative project.
5. Develop the ability to explain the conceptual viability of the project and describe the major components involved.
6. Develop advanced discipline-relevant skills and competencies.
7. Write a research report and paper.

Course Content

Students should carefully discuss with their research advisor about time expectations to complete the research project.

Degree to which students meet expectations: The following is a minimum set of expectations for every student enrolled for this course for credit:

i) perform a background literature search and review,
ii.) Develop a project plan,
iii.) Perform experimental work or applied experimental work,

iv.) Write and present a research report.
iv) Write and submit research paper to any reputed journal/international conference.

- **To submit or publish the research paper in any reputed journal/international conference is a necessary criterion to become eligible for End semester Examination (ESE).**

Quality of the final report and oral presentation: The research advisor will provide clear expectations of the desired format, content, and deadlines of the final report. The research advisors will grade the final report.

Attendance: In order to provide the measure of performance, the research advisor is expected to complete a two-mid-term evaluation with the student, accompanied by recommendations for improvement for the remainder of the term. The mid-term evaluation with the student should be accompanied by a one-on-one meeting between the research advisor and the student.

Absences and Make-up Work: Requirements for attendance is as per RR of the Institute

- **Evaluation**

Faculty guide will be assigned to each student by the Institute who will monitor the progress of research project and help the student to sort-out any issues/ problems arising. Schedule of evaluation will be as given below.

Sr.No.	Evaluation	Period
1.	Review-I (ISE-1)	During10thweek
2.	Review-II (ISE-2)	During15thweek
3.	Review-III (ESE)	During20thweek

*Review-III is End Semester Examination (ESE).

*During ESE, students should submit research Project report, proof of submission of research paper to reputed journal/international conference to respective departments.

*If student is doing research project in outside organization (Research Lab/ institutes), he/she should submit project completion certificate given by outside organization.

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Entrepreneurial Internship (EI)

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **ED4104**	Course Name: **Project Management (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
To improve and update knowledge of new entrepreneurs in the areas of project preparation & appraisal techniques; decision-making process in the sector of industrial, infrastructure & sustainable opportunities that would lead to improved viability, returns and effective investment decisions. Writing a business plan which can gain interest of the fund providers like venture capitalists and other sources of funding.

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

1. Develop a Comprehensive Business Plan for selected business.
2. Evaluate Project Viability Through Financial Appraisal.
3. Analyze the Environmental and Technical Aspects of a Project.
4. Apply Project Management Techniques.
5. Assess the Commercial Feasibility of a Business Opportunity.

Prerequisite:
General knowledge of economics & clear concept about own business model.

Course Content

Unit No	Description	Hrs
1.	**Project appraisal** -Project Development Cycle, Preparation of feasibility studies, project formulation, screening for pre-feasibility studies, stages of feasibility report preparation, Project Analysis including Market Analysis, Technical Analysis & Financial Analysis, Various analytical techniques and integrating the data gathered into a full-fledged business plan.	04
2.	**Project Analysis**-Environmental Analysis, Risk Analysis, Infrastructure Development & Financing, Risk Management, Risk identification,	04

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

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

	Qualitative risk analysis, Quantitative risk analysis, Risk planning and control, National Cost-Benefit Analysis, Financing Sustainable Opportunities. Sustainability and Green Business Practices	
3.	**Business Plan:** What is business plan, Entrepreneurial opportunities and Business Plan. Preparing business plan. (Practical Exercises on preparation of business plan) Components of Business Plan, Executive summary, other components. Project report contents.	**04**
4.	**Commercial Appraisal:** Economic feasibility and commercial viability, market analysis, Market Research, Industry Analysis, Competitor analysis, defining the target market, market segmentation, market positioning, building a marketing plan, market strategy.	**04**
5.	**Technical Appraisal:** Operation and Production Plan: Types of production systems, Product design and analysis, New product development, location and layout decisions, project layout, plant and technology choices, product specification and customer needs, production planning and control, Commercializing Technologies	**04**
6.	**Financial Appraisal:** pro forma income statements, financial projections, working capital requirement, funds flow and Cash flow statements; Ratio Analysis. **Project Management Techniques**: Identifying organizational structures Estimating costs and budgeting Using critical path project management tools (WBS, Gantt chart, Project Network Diagram) Establishing the critical path Tracking project milestones Using the program evaluation and review technique (PERT tool) Using process improvement tools (Fishbone, SIPOC) Managing time Controlling quality	**04**

References :

Text Books:

1. Dwivedi, A.K.: Industrial Project and Entrepreneurship Development, Vikas Publishing House

Reference Books:

1. Bangs Jr., D.H., *The Business Planning Guide,* Dearborn Publishing Co.
2. Katz, J.A. and Green, R.P., Entrepreneurial Small Business, McGraw Hill
3. Mullins, J. and Komisar R., Getting to Plan B, Harvard Business Press

4. O'Donnell, M., The Business Plan: Step by Step, UND Center for Innovation.
5. Scarborough, N.M. and Zimmerer, T.W., Effective Small Business Management, Pearson
6. Pickle, H.B.and Abrahamson, R.L., Small Business Management, Wiley
7. Desai, V., Dynamics of Entrepreneurial Development & Management, Himalaya Publishing
8. Kao, J., Creativity & Entrepreneurship, Prentice Hall
9. Singh, Narendra, Project Management & Control, Himalaya Publications

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **ED4044**	Course Name: **Commercial Aspects of the Project (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
To familiarize students with accounting, mechanics of preparation of financial statements, understanding corporate financial statements, their analysis and interpretation.
The objectives of the course are to build the skills, frameworks and knowledge in entrepreneurial finance. Students will study the financing of small and medium sized businesses & Financial management from the perspective of both the entrepreneur and investors.
This course will also give overall understanding of marketing management which will help them in developing their own marketing decisions & in understanding the importance of market survey techniques. It will help them in conducting suitable market survey for their own selected products.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Interpret basic Accounting and Financial Terminologies.
2. Prepare & analyze financial statements.
3. Apply basic principles of marketing.
4. Apply knowledge of marketing mix for any organization.

Prerequisite:
General knowledge of economics & clear concept about own business model

Course Content

Unit No	Description	Hrs
1.	Accounting Terminologies: Meaning, nature, functions, types of accounting; generally accepted accounting concepts, principles and conventions; double	04

	entry system. Accounting Records: Fundamentals of record keeping, the accounting process, Computer-based accounting systems. Accounting cycle.	
2.	**Financial Management** – Definition, nature, objectives, functions and scope of financial management, Preparation of financial plan – its objectives, essential features, consideration in formulating financial plan	**04**
3.	Financial Statements: Balance sheet: assets, liabilities. Income statement: concept of income, concept of expenses, concept of gain and losses. Components of the income statement. Cash flow statements: purpose, components, concept, Process.	**04**
4.	**Nature & Scope of Marketing** – Evolution, core marketing concepts, selling concept, marketing concept, Holistic marketing concept, portfolio approach-BCG matrix. Marketing Research- Concept & practice, Steps in Marketing Research.	**04**
5.	**Marketing Environment and STP:** Demographic, economic, political, legal, socio cultural, technological environment (Indian context); environmental scanning to discover marketing opportunities, Segmentation, Targeting and Positioning, difference between segmentation, targeting and positioning.	**04**
6.	**Marketing Mix: Product, Price, Promotion and Place.** **Product Decisions:** Concept of Product, Levels of Product, Product Mix Decisions, Product Line Decisions, Individual Product Decisions, Branding, Product Life-cycle - Stages. **Pricing Decisions:** Meaning, Factors influencing Pricing Decisions, Methods of Pricing **Place Decisions:** Meaning, Channels of Distribution **Promotion Decisions:** Elements of Promotion Mix, Advertising, Publicity, Sales Promotion, Personal Selling, Direct Marketing and Public Relations,	**04**

References -

Text Books:

1. Maheshwari, S.N. and Maheshwari, S.K., Financial Accounting, Vikas Publishing House
2. Leach C.J. and Melicher, R.W. Entrepreneurial Finance, Thomson.

3. For B2C = Kotler, P., Keller, K.L., Koshy, A. and Jha, M.: Marketing Management, Pearson
4. For B2B = Sarin, S. Strategic Brand Management for B2B Markets, Sage

Reference Books:

1. Ghosh, T.P., Financial Accounting for Managers, Tax-mann Allied Services
2. Gupta, A., Financial Accounting for Management, Prentice Hall
3. Jain, S.P. and Narang, K.L., Advanced Accountancy, Kalyani Publishers.
4. Smith, J.K., Smith, R.L. and Bliss, R.T., Entrepreneurial Finance, Stanford University Press
5. Smith, J.K. and Smith, R.L., Entrepreneurial Finance, Wiley.
6. Rogers, S., Entrepreneurial Finance, McGraw Hill.
7. Chandra, P., Financial Management, McGraw Hill.
8. Kotler P. & Armstrong, G., Principles of Marketing, Pearson

Note:

- Lectures of this theory course will be conducted through online mode.
- Recorded videos will be made available to students on MOODLE platform.
- Faculty will upload three lectures per week and links will be shared on every Monday.
- Students need to appear in Unit Test-1, Unit Test-2 and ESE in college campus as per the regular practice.
- Faculty of concerned course will take the decision regarding modes of In-Semester Evaluation (ISE).

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **ED4064**	Course Name: **Entrepreneurship Development Program (EDP)**

L	T	P	Credits
-	-	--	1

Course Description:
Student will attend short term intensive EDP program organized either in house or by any authorized agency approved by CIIED.

Prerequisite: General knowledge of business & clear concept about own business model.

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

1. Apply knowledge of engineering, economics, marketing and finance for formulation of business plan, starting & managing new business.

Course Content:

1 Student will undergo training programs organized by CIIED.
Programs on marketing, Finance management, project report preparation by professional agencies. Students are required to apply this knowledge for preparing final project report.
2. Student will complete online certification course- **Entrepreneurial & Employability Skill Development Program** by Singapore polytechnic in association with Jugad Funda & Shivaji University, Kolhapur or any other approved agencies.
Evaluation- ISE **50** marks by mentor for-
1. Completion of online certification course- **Entrepreneurial & Employability Skill Development Program** by Singapore polytechnic in association with Jugad Funda & Shivaji University, Kolhapur or any approved agencies.
2. Active participation in programs by completing various activities/assignments in program.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajaramnagar

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

Class: **Final Year B. Tech**	Semester-**VIII**
Course Code: **ED4084**	Course Name: **Entrepreneurial Internship**

L	T	P	Credits
-	-	-	11

Course Description:
Student will prepare technically feasible and economically viable detailed project report including market survey.

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

1. Apply knowledge of engineering, economics, marketing and finance for preparation of project report.
2. Make commercial, technical and financial appraisal of project.

Course Content

Student will start working on collection of data required for business plan. During semester he may require to visit various support organizations, similar industries , suppliers of raw materials, machinery, special service providers. He has to conduct market survey. For this student can go out of campus with prior permission of mentor. Mentor should maintain this record .Students are required to work independently by taking guidance from mentor/Head CIIED/faculty on expert panel of CIIED.

Product prototype & execution of business operation is must & it should be validated by Departmental ED committee.

Continuous efforts taken by student should be observed by mentor for ISE evaluation. At the end of semester detailed project report will be presented before Expert committee for ISE evaluation of 100 marks.

Then student will appear for ESE. Project report evaluation & assessment will be done by a panel of experts appointed by COE.

Evaluation	Weightage	Particulars	converted Marks
ISE	10%	Preliminary project report	10

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajarammagar

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

	20%	Market Survey	20
	20%	Completion of Legal Aspects	20
	50%	Final Report	50
ESE	100%	ESE -Final Report	100

Class:-**Final Year B. Tech.**	Semester- **VII**
Course Code : **REH401**	Course Name : **Intellectual Property Rights**

L	T	P	Credits
-	-	-	2

Course Description:
This course provides a comprehensive introduction to the principles and practices of Intellectual Property Rights (IPR) with a focus on their application in the fields of science, technology, and engineering. Students will explore the various forms of intellectual property, including patents, copyrights, trademarks, trade secrets, and industrial designs, and understand their legal, economic, and ethical implications. The course covers the process of securing and enforcing IP rights, the role of international agreements and organizations, and the challenges posed by emerging technologies. Through case studies, practical exercises, and discussions, students will gain the knowledge and skills necessary to protect and manage intellectual property in a globalized and innovation-driven world.

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

1. Explain the basic concepts and importance of Intellectual Property Rights.
2. Identify different types of intellectual property and their relevance in the technology sector.
3. Analyze the legal aspects of IPR and its implications for innovation and business.
4. Apply IPR principles to protect inventions, designs, and creative works.
5. Evaluate the ethical and societal impact of IPR in a global context..

Prerequisite:
Write prerequisite required to study this course.

Course Content

Unit No	Description	Hrs
1	**Introduction to Intellectual Property Rights:** Definition and importance of Intellectual Property (IP); Historical evolution of IPR; Types of Intellectual Property: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Geographical Indications; Role of IPR in	

	innovation and economic development; Overview of global IPR systems (WIPO, WTO, TRIPS Agreement)	
2	**Patents:** Concept of patents and patentability criteria (novelty, inventive step, industrial applicability); Types of patents: Utility, Design, and Plant Patents; Patent application process: Filing, examination, and grant; Patent infringement and enforcement; Case studies on patent disputes in technology sectors; Introduction to Patent Cooperation Treaty (PCT) and international patent filing	
3	**Copyrights and Related Rights:** Concept of copyright and its scope; Subject matter of copyright: Literary, artistic, musical, and software works; Rights of copyright holders and limitations (fair use, public domain); Copyright registration and enforcement; Digital rights management and challenges in the digital era; Case studies on copyright infringement in software and media	
4	**Trademarks and Industrial Designs:** Concept of trademarks and their importance in branding; Types of trademarks: Word marks, logos, service marks, collective marks; Trademark registration process and infringement; Concept of industrial designs and their protection; Design registration and enforcement; Case studies on trademark and design disputes	
5	**Trade Secrets and Geographical Indications:** Concept of trade secrets and their protection; Legal framework for trade secrets (e.g., NDAs, confidentiality agreements); Geographical Indications (GIs): Concept and significance; Protection of GIs and their role in promoting local products; Case studies on trade secret theft and GI disputes	
6	**IPR Management, Ethics, and Global Perspectives:** IPR management in technology transfer and commercialization; Licensing and assignment of IP rights; IPR in open innovation and collaborative research; Ethical issues in IPR: Biopiracy, patenting life forms, and access to medicines; Global IPR trends and challenges: Counterfeiting, piracy, and cross-border enforcement; Role of IPR in startups and entrepreneurship; Future of IPR in emerging technologies (AI, blockchain, biotechnology)	

References -

Text Books:

- Roger E. Schechter, John R. Thomas, "Intellectual Property: The Law of Copyrights, Patents, and Trademarks", West Academic Publishing
- David Bainbridge, "Introduction to Intellectual Property", Oxford University Press

Reference Books:

- Robert Merges, John Duffy, "Patent Law and Policy: Cases and Materials", LexisNexis
- David Wright, "Intellectual Property Rights: A Practical Guide for Engineers", Wiley

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

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

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

Class:-**Final Year B. Tech.**	Semester- **VII**
Course Code : **REH403**	Course Name : **Research Project (Synopsis) Phase 1**

L	T	P	Credits
-	-	-	2

Course Description:

This course is designed to guide B. Tech. students through the initial phase of their research project, focusing on the development of a comprehensive research synopsis. Students will be introduced to the fundamentals of research methodology, including problem identification, literature review, research design, and ethical considerations. The course emphasizes the formulation of clear research questions, the selection of appropriate methodologies, and the preparation of a well-structured research proposal. Through mentoring sessions, students will learn to conduct systematic literature reviews, design research frameworks, and present their synopsis/proposal effectively. The course aims to equip students with the skills necessary to plan, propose, and defend their research projects, setting a strong foundation for the successful execution of their research in Phase 2.

The evaluation process is designed to assess students' understanding and application of research concepts. It includes in Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%) comprises presentation sessions.

Course Learning Outcomes:

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

1. Demonstrate an understanding of research methodology and project planning.
2. Identify a research problem with clear objectives and questions.
3. Conduct a systematic literature review using appropriate sources and tools.
4. Develop a research synopsis with a well-defined methodology and expected outcomes.
5. Present research synopsis/proposal effectively.

Rajarambapu Institute of Technology Mechatronics Dept. 415 414 Rajarammagar

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

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class:-**Final Year B. Tech.**	Semester- **VII**
Course Code : **REH405**	Course Name : **Research-Specific Core Course-1 (Online NPTEL Course)**

L	T	P	Credits
-	-	-	3

Course Description:

Student can opt for online certification course and produce certificate.

- The student should select the course in consultation with mentor on NPTEL platform related to project area.
- The course should be minimum 25 hours' duration and should have certification facility.

Student should complete course and get certificate. The certificate copy should be submitted to mentor. The evaluation process is designed to assess students' understanding of core concepts related to project area. It includes in Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%) comprises presentation sessions.

Course Learning Outcomes:

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

1. Explain the key concepts and insights gained from the NPTEL course
2. Apply concepts, tools, and methodologies learned from the NPTEL course into their ongoing research project
3. Analyze research-specific problems using the knowledge acquired from the online course.
4. Identify the real life applications and practices of courses studied

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, Sakharale
(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)
Syllabus
To be implemented for the **2022-26 Batch**

Department of Mechatronics Engineering

Rev: MC Course Structure/RIT/02/2022-26

Class:-**Final Year B. Tech.**	Semester- **VIII**
Course Code : **REH402**	Course Name : **Research Project Phase 2**

L	T	P	Credits
-	-	-	11

Course Description:

This course is designed to guide B. Tech. students through the execution and reporting phase of their research project, building on the foundation laid in Phase 1. Students will implement the research plan outlined in their synopsis, focusing on data collection, experimentation, analysis, and interpretation. The course emphasizes the application of research methodologies, tools, and techniques to address the research problem effectively. Through regular mentoring sessions, students will refine their research approach, troubleshoot challenges, and ensure adherence to ethical guidelines. The course also focuses on the preparation of a detailed research report and the presentation of findings.

The evaluation process is designed to assess students' ability to execute their research plan and communicate their results effectively. It includes In-Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%), comprising progress reviews, report submissions, and final presentations.

Course Learning Outcomes:

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

1. Apply appropriate analytical tools and techniques to process and interpret research.
2. Identify and address challenges encountered during the research process.
3. Prepare a comprehensive research report detailing the objectives, methodology, findings, and conclusions.
4. Communicate research outcomes effectively through written and oral presentations.
5. Demonstrate ethical guidelines and standards throughout the research process.

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

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