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

B. Tech in Electronics and Telecommunication Engineering with Multidisciplinary Minor

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
							Theory (Marks)		Practical (Marks)	
		L	T	P	Credits	Scheme	Max	Min. % for passing	Max.	Min.% for passing
EC259	Analog Circuits	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	---
						ESE	50	40	----	----
EC2014	Digital Design	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
EC2034	Analog Communication	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
EC2054	Network Theory	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
	Multidisciplinary Minor-I	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
SH2174	Environmental Science	1	-	2	2	ISE	50	40	--	---
						ESE	50	40	---	---
EC2074	Analog Communication Lab	-	-	2	1	ISE	----	----	50	50
						ESE	----	----	50	50
EC2094	Digital Design lab			2	1	ISE	----	----	50	50
						ESE	----	----	50	50
EC261	Analog Circuits and PCB Design Lab	-	-	2	1	ISE	----	----	50	50
						ESE	----	----	50	50
EC263	Network Theory Lab	-	-	2	1	ISE	----	----	100	50
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	----	----	100	50
	TOTAL	**16**	**-**	**12**	**22**					
	TOTAL CONTACT HOURS	**28**								

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

Total Contact Hours/week : 28

Total Credits : 22

Note: ISE of the Environment Science course will be the project on application of technology in Environmental concerns. If student fails in ISE (i.e. project), he/she will not be eligible for ESE of the course. In time table alloy one hour for theory and two hours for Environmental Science-project (batch wise).

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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 – III	SH2734
6.		Japanese Language – III	SH2714

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

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)	
							Max	Min.% for passing	Max	Min. % for passing
EC260	Mathematics for ECE	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
EC2024	Digital Communication	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
EC2044	Microcontroller	3	-	-	3	ISE	20	40	---	---
						UT1	15		--	---
						UT2	15		---	---
						ESE	50	40	---	---
EC2064	Linear Integrated Circuits	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
EC262	Signals and Systems	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Multidisciplinary Minor-II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
EC2084	Digital Communication Lab	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
EC2104	Microcontroller Lab	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
EC2124	Linear Integrated Circuits Lab	-	-	2	1	ISE	---	----	50	50
						ESE	---	---	50	50
EC2144	Programming with C++ Lab	-	-	2	1	ISE	---	---	100	50
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	-	-	100	50
	Total	**17**	**-**	**10**	**22**					
	Total Contact Hours	**27**								

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

Total Contact Hours/week : 27

Total Credits : 22

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.

Professional Skills Development and Foreign Languages:

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

Note:

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

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

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
EC313	Digital Signal Processing	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC3034	Electromagnetic Waves and Antenna Theory	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC317	Control Systems	2			2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Programme Elective-I	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Open Elective-I	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor-III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor-IV	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC323	Digital Signal Processing Lab	-	-	2	1	ISE	---	---	--	100	50
EC3194	Electromagnetic Waves and Antenna Theory Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---			50	50
EC319	Data Structure Lab	-	-	2	1	ISE	---	---	--	100	50
EC3234	Summer Internship	-	-	-	2	ISE	---	--- ---		100	50
EC321	Mini Project	-	-	2	Audit	ISE	100	50 (P/NP)		---	---
SH3035	Scholastic Aptitude-I	2*	-	-	Audit	ISE	100	50 (P/NP)		---	---
	Total	**21**	**-**	**8**	**24**						
	Total Contact Hours	**29**									

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Examination
P= Pass, NP= Not Pass

Total Contact Hours : 29
Total Credits : 24

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

Program Elective-I

Sr.No	Course Code	Domain	Course
1.	EC3054	Communication	Information Theory and Coding
2.	EC3074		Wireless Communication
3.	EC3094	VLSI and Signal Processing	RTL Simulation and Synthesis
4.	EC3114		Digital Image Processing
5.	EC3134	Embedded Systems and Automation	Real-Time Operating System
6.	EC3154		Computer Architecture and Organization

Open Elective-I

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

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks)			Practical (Marks)	
		L	T	P	Credits	Scheme	Max	Min. % for passing		Max	Min. % for passing
EC3024	CMOS Digital VLSI Design	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC3044	Power Electronics	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC3064	AI and ML	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC3084	Research Methodology	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective-II	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Open Elective-II	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor-V	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC3124	CMOS Digital VLSI Design Lab	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	--	50	50
EC3144	Power Electronics Lab	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
	Program Elective-II Lab	-	-	2	1	ISE	---	---		100	50
EC3184	Python Programming Lab	-	-	2	1	ISE	---	---		100	50
SH3065	Scholastic Aptitude-II	2*	-	-	Audit	ISE	100	50 (P/NP)		---	---
EC3204	Capstone Project Phase- I	-	-	2	1	ISE	---	---		100	50
	Total	**21**	**-**	**10**	**24**						
	Total Contact Hours	**31**									

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Examination, P= Pass, NP= Not Pass **Total Contact Hours/week: 31, Total Credits : 24 ,** * Note: Student should complete 5 days (30 Hours) of Scholastic Aptitude training program organized by the institute

Program Elective-II

Sr.No	Course Code	Domain	Course
1.	EC364	Communication	Advanced Mobile Communication
2.	EC3104		Microwave Engineering
3.	EC366	VLSI and Signal Processing	Computer-Aided Design for VLSI
4.	EC368		Speech Processing
5.	EC370	Embedded Systems and Automation	Embedded Processors
6.	EC372		Automotive Electronics

Program Elective-II Laboratory

Sr. No	Course Code	Domain	Course
1.	EC374	Communication	Advanced Mobile Communication Lab
2.	EC3164		Microwave Engineering Lab
3.	EC376	VLSI and Signal Processing	Computer-Aided Design for VLSI Lab
4.	EC378		Speech Processing Lab
5.	EC380	Embedded Systems and Automation	Embedded Processors Lab
6.	EC382		Automotive Electronics Lab

Open Elective-II

Open Elective-II			
Sr. No	Course Code	Course Name	Offered By Department
1	OE3024	Reliability Engineering	Robotics & Automation
2	OE3084	Materials Management	Civil Engineering
3	OE3182	Industrial Drives	Electrical Engineering
4	OE3284	Supply Chain Management	Mechanical Engineering
5	OE3324	Entrepreneurship Development	Mechanical Engineering
6	OE3401	Cyber Security	Computer Science and Information Technology
7	OE342	Data Mining	CSE(AI&ML)
8	OE344	Supply Chain Analytics	Mechatronics Engineering Dept.

Open Elective-II			
Sr. No	Course Code	Course Name	Offered By Department
9	OE346	Mobile Robotics	Mechatronics Engineering Dept.
10	OE348	Information Technology Foundation Program	Computer Science and Engineering
11	OE350	Operations Research	Civil Engineering
12	OE352	Image Processing	Electronics & Telecommunication Engineering
13	OE354	Fuzzy logic and Neural Network	Electronics & Telecommunication Engineering
14	OE356	Project Management	Mechanical Engineering
15	OE358	Plumbing (Water and Sanitation)	Civil Engineering
16	OE362	Flexible Manufacturing System	Robotics & Automation
17	OE364	AI for Manufacuring	Computer Science and Information Technology
18	OE366	AI for Cybersecurity	Computer Science and Engineering
19	OE368	AI for Agriculture	CSE(AI&ML)
20	OE370	AI for Sustainability	Electronics & Telecommunication Engineering
21	OE3242	Marketing for Engineers	MBA

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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
EC4014	Internet of Things	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC4034	Computer Communication Network	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC461	RTOS and Embedded Linux	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective-III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective-IV	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
EC475	RTOS and Embedded Linux Lab	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
	Program Elective-III Lab	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
EC4334	Capstone Project-II	-	-	6	3	ISE	--	---		50	50
						ESE	--	---		50	50
	TOTAL	**15**	**-**	**10**	**20**						
	TOTAL CONTACT HOURS	**25**									

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Examination
Total Contact Hours/week: 25
Total Credits : 20

Program Elective-III

Sr.No	Course Code	Domain	Course
1.	EC4054	Communication	Microwave Engineering
2.	EC4074		Wireless Sensor Network
3.	EC4094	VLSI and Signal Processing	System Verilog
4.	EC463		Biomedical Signal Processing
5.	EC4114	Embedded Systems and Automation	Industry Automation
6.	EC4134		Soft Computing

Program Elective-IV

Sr.No	Course Code	Domain	Course
1.	EC4154	Communication	Satellite Communication
2.	EC465		Radar and Optical Fiber Communication
3.	EC467	VLSI and Signal Processing	VLSI Testing
4.	EC469		Pattern Recognition
5.	EC471	Embedded Systems and Automation	Instrumentation for Robotics and Automation
6.	EC473		Renewable Energy Systems

Program Elective-III Laboratory

Sr.No	Course Code	Domain	Course
1.	EC4234	Communication	Microwave Engineering Lab
2.	EC4254		Wireless Sensor Network Lab
3.	EC4274	VLSI and Signal Processing	System Verilog Lab
4.	EC469		Biomedical Signal Processing Lab
5.	EC4294	Embedded Systems and Automation	Industry Automation Lab
6.	EC4314		Soft Computing Lab

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

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks)			Practical (Marks)	
		L	T	P	Credits	Scheme	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 Examination

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

Note:
1] Weekly Contact hours are not mentioned as student is expected to be in industry regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.
2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

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Model II: Research Internship (RI)

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks%)			Practical (Marks%)	
		L	T	P	Credits	Scheme	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 Examination

Total Contact Hours/week: ---

Total Credits : 16

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

Note:

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

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

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

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

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Model III: Entrepreneurial Internship (EI)

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

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

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test – II, ESE = End Semester Examination

Total Contact Hours/week: -

Total Credits : 16

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

Note:

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

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

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

3] A one week Entrepreneurship Development Program (EDP) will be conducted after completion of 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

Note:

- 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 BasketName	**Sr. No.**	**Course Code**	**Course Name**	**Semester**	**Offered by Department**
Construction Engineering	1	CEMD201	Building Construction and Planning	III	Civil Engineering
	2	CEMD202	Building Estimation and Valuation	IV	
	3	CEMD301	Infrastructure Engineering	V	
	4	CEMD303	Smart Cities and Sustainable Development	V	
	5	CEMD302	Environmental Engineering	VI	
Software Programming	1	CSMD201	Introduction to Data Structures	III	Computer Science& Engineering
	2	CSMD202	Problem solving using JAVA	IV	
	3	CSMD301	Fundamentals of Database Systems	V	
	4	CSMD303	Object-oriented Programming in Python	V	
	5	CSMD302	Artificial Intelligence	VI	
Electrical Power System	1	EEMD201	Electrical Power Generation	III	Electrical Engineering
	2	EEMD202	Power System	IV	
	3	EEMD301	Electrical Machines	V	
	4	EEMD303	Electrical Technology	V	
	5	EEMD302	Smart Grid	VI	

Electronics System Design	1	ECMD201	Electronics Devices and Applications	III	Electronics & Telecommunication Engineering
	2	ECMD202	Electronics Communication Systems	IV	
	3	ECMD301	Advanced Communication Systems	V	
	4	ECMD303	Electronic Product Design	V	
	5	ECMD302	Industrial Electronics	VI	
Software Development	1	CIMD201	Data Structures	III	Computer Science& Information Technology
	2	CIMD202	Computer Algorithms	IV	
	3	CIMD301	Introduction to DBMS	V	
	4	CIMD303	OOP using Java	V	
	5	CIMD302	Software Engineering	VI	
Product Design and Development	1	MEMD203	Design Thinking	III	Mechanical Engineering
	2	MEMD204	Behavioral Engineering and Design	IV	
	3	MEMD305	Product Design Tools and Techniques	V	
	4	MEMD307	Design and Prototyping	V	
	5	MEMD304	Marketing and Business Fundamentals for New Products	VI	
Mechatronics Engineering	1	MCMD201	Fundamentals of Mechatronics	III	Mechatronics Engineering
	2	MCMD202	Industrial Fluid Power	IV	
	3	MCMD301	Sensor and Instrumentation	V	
	4	MCMD303	Industrial Automation	V	
	5	MCMD302	Industrial Robotics	VI	
	1	AIMD201	Object Oriented Programming	III	Computer Science& Engineering (AI-

Artificial Intelligence	2	AIMD202	Data Structures and Algorithms	IV	ML)
	3	AIMD301	Machine Learning	V	
	4	AIMD303	Business Intelligence	V	
	5	AIMD302	Principles of AI	VI	
Robtocis & Automaiton	1	RAMD201	Fundamentals of Robotics & Automation	III	Robtocis & Automaiton
	2	RAMD202	Sensors and Actuators	IV	
	3	RAMD301	Kinematic & Dynamics for Robots	V	
	4	RAMD303	Robot Programming Lab.	V	
	5	RAMD302	Industrial Automation & Control	VI	

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

B.Tech. in Electronics and Telecommunication 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	ECDM3XXX
2	IV	DM – II	ECDM4XXX
3	V	DM – III	ECDM5XXX
4	VI	DM – IV	ECDM6XXX
5	VII	DM – V	ECDM7XXX
6	VIII	DM – VI	ECDM8XXX

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

B. Tech in Electronics and Telecommunication Engineering with Honor and Multidisciplinary Minor

B.Tech. in Electronics and Telecommunication 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	ECH3XXX
2	IV	Honor - II	ECH4XXX
3	V	Honor - III	ECH5XXX
4	VI	Honor - IV	ECH6XXX
5	VII	Honor - V	ECH7XXX
6	VIII	Honor - VI	ECH8XXX

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

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

Honors with Research and Multidisciplinary Minor

The student will work on Research Project or Dissertation for 18 Credits in the Fourth Year in respective discipline. The distribution of 18 Credits for Research project in Sem-VII and Sem-VIII is given below. To get B.Tech. in Electrical Engineering-Honors with Research and Multidisciplinary Minor degree Student need to earn total 188 Credits which consist 170 credits of regular Multidisciplinary Minor courses and 18 credits of Research courses.

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
REH401	Intellectual Property Rights	-	-	-	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, UT-I: Unit Test-I, UT-II: Unit Test-II, ESE: End Semester Exam

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

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

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

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


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Class: - S.Y. B. Tech	Semester-III
Course Code: EC259	Course Name: Analog Circuits

L	T	P	Credits
3	-	-	3

Course Description:
This course focuses on construction, working and characteristics of various electronic devices. This course also develops the capacity to analyze and interpret the different electronic circuits like diode circuits, BJT amplifier, power amplifier, oscillators, multivibrators & power supply.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Describe fundamentals of semiconductor devices.
2. Analyze performance of different analog circuits.
3. Apply small signal analysis to amplifier circuits.
4. Design various electronic circuits using semiconductor devices.

Prerequisite: Basic knowledge of Engineering Physics

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Diode and Its Applications** P-N junction diode, I-V characteristics of a diode, Diode current equation, Diode Applications: Half-wave Rectifier, Full wave Rectifier, Clipper and Clamper circuits, Voltage Multiplier.	06
2.	**Bipolar Junction Transistor** Construction & operation of transistor, BJT configuration, Input & Output characteristics of a BJT, Biasing circuits, Transistor Applications: Transistor as a Switch, Transistor as an amplifier: small signal equivalent circuits.	06
3.	**Field Effect Transistor** Field Effect Transistor & its types, JFET, Types of MOSFET, Construction & operation of MOSFET, drain & transfer characteristics of MOSFET, Biasing circuits.	06
4.	**Oscillators & Multivibrators**	06

	Classification of feedback amplifiers, general characteristics of negative feedback amplifier, Barkhausen Criteria, RC Phase shift Oscillator, Wien Bridge Oscillator, Multivibrators.	
5.	**Power Amplifiers** Power Amplifiers, Heat Sinks, Classes of Amplifiers: Class A, Class B, Class AB, Class C, Class AB push pull complementary output stage amplifier.	**06**
6.	**Power Supplies & Relays** Power Supply, need of voltage regulator, Stabilization factors, Series voltage regulation, Shunt voltage regulation, Zener diode as voltage regulator, Overload Protection circuit, IC based voltage regulators, Relays.	**06**

Text Books:

1. Donald Neamen, Electronic Circuit analysis, Mc-Graw Hill
2. Robert L. Boylestad, Electronic Devices and Circuit Theory, PHI

Reference Books:

1. Milliman Halkanes, Integrated Electronics, Prentice Hall

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Class: - **S.Y. B. Tech**	Semester-**III**
Course Code: **EC2014**	Course Name: **Digital Design**

L	T	P	Credits
3	-	-	3

Course Description:
Digital circuits are part of any electronics circuit today. This proposed course will cover all fundamental concepts in digital design The course will start with Boolean algebra followed by combinational circuits and sequential circuit, digital circuit design. It also focuses on prescribed gate syllabus of Electronics and Telecommunication Engg.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Describe fundamentals of Digital Design
2. Design combinational and sequential circuits
3. Analyze the combinational and sequential circuits
4. Apply fundamentals to create various applications of digital circuits

Prerequisite: Basic knowledge of number systems

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Logic Families** TTL, Open collector Gates, TTL subfamilies, Integrated Injection logic, Emitter coupled logic, MOS logic, CMOS Logic, Interfacing: TTL to ECL, ECL to TTL, TTL to CMOS, CMOS to TTL.	**06**
2.	**Boolean Algebra and Logic Gates** Logic Gates, Definitions of Boolean Algebra, Basic Theorems, Properties of Boolean Algebra, Boolean functions, Canonical and Standard forms, Karnaugh Maps, Gate level minimization, Circuits/Applications using gates	**06**
3.	**Combinational Logic** Combinational circuits, Analysis procedure, Design procedure, Adders, half adder, Full adder, Ripple carry Adder, Carry Look ahead Adder, Subtractors, Multiplier, BCD Adder	**06**
4.	**Decoders and Multiplexers**	**06**

	Magnitude comparator, Encoders and Decoders, Multiplexers & De-Multiplexer, BCD to 7 Segment Display Decoders, Application of Multiplexer and demultiplexer	
5.	**Sequential Logic** Latches, Flip flops, State table, State diagram, Transition Table, Excitation Table, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedure, Shift registers, Bidirectional Shift Registers, Universal Shift Registers	**06**
6.	**Asynchronous and Synchronous Counters** Asynchronous counter & Design, Effect of Propagation delay in ripple counters, decoding of ripple counters, Synchronous counters & design, Shift register counters, Sequence Detector, Sequence generator, Application of counters	**06**

Text Books:

1. Morris Mano, Digital Design, Pearson Prentice Hall
2. Anandkumar, Fundamentals of Digital Circuits, PHI
3. Charles Roth, Lizy K. John, Kil Lee, Byeong, Digital System Design Using Verilog, Cengage

Reference Books:

1. R P Jain, Modern Digital Electronics, TATA McGrawHill
2. Donald Givone, Digital Principles and Design, TATA McGrawHill

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Class: - **S.Y. B. Tech**	Semester-**III**	**L**	**T**	**P**	**Credits**
Course Code: **EC2034**	Course Name: **Analog Communication**	**3**	**-**	**-**	**3**

COURSE DESCRIPTION:
Analog Communication is a fundamental and core subject for B.Tech E&TC program. It introduces students to principles of communication systems. The course provides knowledge of analog modulation-demodulation schemes, Transmission and reception methods etc.

COURSEOUTCOMES:
After completion of this course students will be able to:
1. Describe different communication systems
2. Solve problems based on various communication systems.
3. Analyze different modulation-demodulation techniques.
4. Evaluate performance parameters of communication systems.

PREREQUISITE: Engineering Mathematics, Signal and Systems.

Unit No.	Description	Hrs
1.	**Amplitude Modulation & Demodulation** Electromagnetic spectrum, Introduction to communication system, Need for modulation. Amplitude Modulation, Definition, Time domain and frequency domain description, power relations in AM waves. Generation of AM waves, Detection of AM Waves.	06
2.	**Single Sideband Techniques** Suppression of Carrier, the balanced modulator, Suppression of Unwanted sideband- The filter system, the phase-shift method, Extensions of SSB- Forms of amplitude modulation, Carrier reinsertion – pilot carrier systems, independent sideband systems, Vestigial – sideband transmission. Demodulation of SSB using: product demodulator & diode balanced modulator.	06
3.	**Frequency Modulation & Demodulation** Introduction of FM, Description of systems, Mathematical representation of FM, Frequency Spectrum of FM wave, Phase modulation, Intersystem comparisons, Pre-emphasis and de-emphasis, Comparison of wideband and narrowband FM, Generation of Frequency Modulation- FM methods, Direct	08

	methods, reactance modulator - AFC, Indirect method, FM demodulators, Phase discriminator, Ratio Detector, PLL	
4.	**Radio Receivers** Function of AM receiver, receiver parameters: Sensitivity, Selectivity, dynamic range, image frequency, fidelity, Receiver types - Tuned radio-frequency (TRF) receiver, Super heterodyne receiver, RF section, Mixer, Intermediate Frequencies & IF amplifiers. FM and AM receivers, Amplitude limiting.	**06**
5.	**Pulse Modulation & Demodulation** Sampling theorem, comparison with CW Modulation, Generation and Demodulation of Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM).	**05**
6.	**Noise** Classification of Noise, White Noise, Effective Noise Temperature, Average Noise Figures, SNR, Noise Figure of cascaded networks. Noise in AM receiver, Noise in FM receiver, problems based on noise calculations, Multiplexing schemes: frequency division multiplexing, time division multiplexing.	**05**

Text Books:

1. Kennedy, Davis, Electronics Communication Systems, Tata McGraw Hill
2. R. P. Singh, S. D. Sapre, Communication Systems-Analog and Digital, Tata McGraw Hill.

Reference Books:

1. Tomasi, Electronic Communication Systems, Pearson Education.
2. Taub, Schilling, Principles of communication systems, Tata McGraw Hill.
3. Louis E Frenzel, Communication Electronics Principles & Applications, Tata McGraw Hill.
4. NPTEL Course - https://onlinecourses.nptel.ac.in/noc19_ee46/preview

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Class: **S.Y. B. Tech**	Semester-**III**
Course Code: **EC2054**	Course Name: **Network Theory**

L	T	P	Credits
3	-	-	3

Course Description:
This course introduces fundamental principles of circuit theory commonly used in engineering research and science applications. The course serves as a prerequisite of many advanced courses in electronics and telecommunication engineering. The course deals with various circuit analysis techniques and theorems for DC and AC circuit analysis. It also deals with the time domain and frequency domain analysis, two-port networks and network functions.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Apply circuit analysis techniques to simplify dc and ac circuits.
2. Analyze steady state and transient responses of the networks.
3. Determine parameters, functions and stability of the networks.
4. Design circuits for the given requirements.

Prerequisite: Basic Electrical Engineering, Engineering Mathematics.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Network Analysis** Review of voltage and current laws, mesh analysis, nodal analysis, source transformation technique, star-delta transformation, superposition, Thevenin's, Norton's, Millman's and maximum power transfer theorem, network topology.	**06**
2.	**Transient Analysis** Steady state and transient response, unit step forcing function, response of R-L, R-C and R-L-C circuit, review of Laplace transform, important theorems and properties, application of Laplace transformations. Introduction to state equations for networks. Simulation of circuits using PSpice.	**06**
3.	**Frequency Domain Analysis** Sinusoidal forcing function, phasor concept, steady state analysis using mesh and nodal analysis, application of network theorems to ac circuits, instantaneous and average power, complex power, average and effective values of voltage and current, power factor.	**06**
4.	**Resonance**	**06**

	Series resonance: impedance and phase angle of series resonant circuit, voltage and current in series resonant circuit, effect of resistance on frequency response curve, bandwidth, selectivity and quality factor. Parallel resonance: resonant frequency for tank circuit, variation of impedance with frequency, quality factor, reactance curves in parallel resonance. Magnetic coupled circuits.	
5.	**Two-port Networks** Open circuit impedance (Z) parameters, short circuit admittance (Y) parameters, Transmission (ABCD) parameters and hybrid (h) parameters, interrelationships of different parameters, interconnections of two-port networks, T and π representation, terminated two-port network, lattice networks.	**06**
6.	**Network Functions** Transfer functions, poles and zeros, restrictions on pole and zero locations in driving point functions and transfer functions, time-zero response from pole zero plot, amplitude and phase response, stability criterion for active network, Routh criteria for stability.	**06**

Text Books:

1. Sudhakar, Shyammohan S. Palli, Circuits and Networks- Analysis & Synthesis, Tata McGraw-Hill.
2. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, McGraw Hill Education.

Reference Books:

1. Chakrabarti, Circuit Theory Analysis and Synthesis, Dhanpat Rai & Co.
2. K. S. Suresh Kumar, Electric Circuit Analysis, Pearson Publications.
3. Ravish R Singh, Network Analysis and Synthesis, Tata McGraw-Hill.

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

L	T	P	Credits
3	-	-	3

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

Course Outcomes:
After successful completion of the course, student will be able to,
1. Suggest appropriate materials for building construction applications.
2. Prepare a functional design of components of the building.
3. Design and draw residential building using principles of planning and bye-laws.
4. Prepare plumbing and electrification plan for the building.
5. Explain properties of building finishing materials and application procedure.

Prerequisite:
- Basic knowledge of mathematics.

Course Content

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

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

References-

Text Books:

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

References Books: -

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

Government Rules & Regulations:-

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

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

L	T	P	Credits
3	-	-	3

Course Description:

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

Course Learning Outcomes:

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

1. Describe the characteristics of various data structures such as stacks, queues, trees, and graphs.
2. Explain the operations and applications of linear data structures.
3. Compare linear and non-linear data structures with respect to their structure, operations, and applications.
4. Determine and justify appropriate data structures for solving real-world problems effectively.

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

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction to Data Structures:** Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types (ADT).	06
2.	**Stack:** Definition & Concepts, Operations on Stack, Applications of Stack, Polish expressions, Reverse Polish Expression and conversions, Recursion.	06
3.	**Queue:** Queue and its sequential representation, Simple Queue, Circular Queue, Double Ended Queue, Priority Queue, Applications of Queue.	06
4.	**Linked List:** Definition and structure of singly linked list, doubly linked list and circular linked list. Operations: creation, traversal, insertion, deletion.	06
5.	**Tree:** Definitions and concepts, Terminology, Binary trees, Binary Tree Representations, Binary Tree Traversals, Binary Search Tree, Insertion and Deletion in BST, Applications of Tree.	06
6.	**Graph:** Definition and concepts, Graph Representation, Graph Terminology, Graph Traversals – Depth First Search and Breadth First Search. Applications of Graph.	06

References -

Text Books:

1. Data structures , Seymour Lipschutz (MGH), Schaum's Outlines.
2. Data Structures using C, A Practical Approach for Beginners by Amol M. Jagtap & Ajit S. Mali.

Reference Books:

1. Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (Addision- Wesely Series).
2. Data Structure using C -- ISRD Group (TMH) ACE series.
3. Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education).

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

L	T	P	Credits
3	--	--	3

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

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

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

Prerequisite:

- Basic Electrical Engineering
- Basic Mechanical Engineering
- Basic Civil Engineering
- Engineering Physics and Chemistry.

Course Content

Unit No.	Description	Hrs
1.	**Solar Power Generation:** Solar radiation, solar energy collectors, solar power plant, solar power tower, conversion of solar heat to electricity, PV cells, PV power generation, solar energy storage, solar-hydrogen energy cycle, future prospects of solar energy in India.	06
2.	**Wind Power Generation:** Wind speed and power relation, power extracted from wind, components of Wind power system, maximum power operation, operation and layout of standalone and grid connected Wind Turbine Generators (WTG).	06
3.	**Thermal Power Plant:** Main equipment, coal handling plant, pulverizing plant, draft system, boiler, super-heater, re-heater, steam turbine, ash handling plant, condenser and	06

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

References -

Text Books:

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

Reference Books:

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

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

L	T	P	Credits
3	--	--	3

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

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

Prerequisite:
- Fundamental concepts of Mathematics and Physics.

Course Content

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

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

References –

Text Books:

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

Reference Books:

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

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

L	T	P	Credits
3	--	--	3

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

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe the basic terminologies of data structures.
2. Examine the linear data structure array with its types.
3. Demonstrate the working of stack, queue performed on data structures.
4. Illustrate the working of linked list.
5. Discuss Tree terminologies and their Applications.
6. Elaborate Graph terminologies with their types.

Prerequisite:
- Basics of C language

Course Content

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

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

References –

Text Books:

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

Reference Books:

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

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

L	T	P	Credits
3	--	--	3

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

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

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

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

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

Course Content

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

	Understanding customer needs, Voice of the customer, Gathering customer needs, organizing and prioritizing needs, Product mission statement, establishing product function.	
4.	**Establishing Product Specification:** Product Teardown and Experimentation, Benchmarking, Quality Function Deployment (QFD)	**06**
5.	**Product Portfolios and Portfolio Architecture:** Product Architecture-types, establishing architecture, Modular design-basic clustering method, advanced functional methods	**06**
6.	**Product Concept Generation, Selection and Testing:** Concept generation process and methods, Concept selection mechanism and techniques, Concept Testing-Purpose, process and methods.	**06**

References: -

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

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

L	T	P	Credits
3	-	--	3

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

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

Prerequisite:
- The students should have knowledge of basic electronics.

Course Content

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

	Microcontroller and Microprocessor- Introduction, Comparison of Microcontroller and Microprocessor, Architecture – Pin configuration of 8051 Microcontroller, Assembly programming	
5.	**Signal Conditioning:** Operational amplifier circuits, filtering circuits, Analog, and Digital signal conversion.	**06**
6.	**Advanced applications in mechatronics:** Mechatronics in automated manufacturing, Artificial intelligence in mechatronics, Fuzzy logic in mechatronics, Case studies of mechatronics systems.	**06**

References -

Textbooks:

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

Reference Books:

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

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

L	T	P	Credits
3	--	--	3

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

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

Prerequisite:
- Basic Programming Skills

Course Content

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

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

References –

Text Books:

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

Reference Books:

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

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

L	T	P	Credits
3	-	--	3

Course Description:

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

Course Outcomes:

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

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

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

Course Content

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

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

References-

Text Books:

- Mittal R K & Nagrath, "Robotics and Control", 2nd Edition, McGraw Hill Publication TMH.
- S. K. Saha, "Introduction to Robotics", 2nd Edition, TMH, 2014.
- Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, "Industrial Robotics, Technology, Programming & Applications", Tata McGraw Hill Education Pvt. Ltd. New Delhi.

Reference Books:

- John J Craig, "Introduction to Robotics", Pearson Edu. 2005.
- Fu K.S, "Robotics", McGraw Hill, 2004.
- Niku SB, "Introduction to Robotics – Analysis, Control, Applications", 3rd Edition, John Wiley & Sons Ltd., 2020.

NPTEL Course on Robotics:

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

Class: – S.Y. B. Tech	Semester- III
Course Code: SH2174	Course Name: Environmental Science

L	T	P	Credits
1	--	2	2

Course Description:

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

Course Outcomes:

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

1. Apply interdisciplinary knowledge in environmental science by integrating concepts and principles from various fields of science and engineering to address environmental issues.
2. Evaluate environmental impacts of human activities on ecosystems and on the environment.
3. Use scientific approach to identify and solve environment related problems.
4. Design sustainable solutions to address environmental challenges by considering renewable energy sources, waste management strategies conservation measures, and environmental policies.
5. Participate in group work to become acquainted with the importance of teamwork, collaboration
6. Develop presentation and report writing skills.

Course Content

Unit No	Description	Hrs
1.	**Natural Resources and Ecosystem** Renewable and Non-renewable resources, Forest resources, water resources, Mineral resources, food resources, Energy resources, alternative energy resources Land resources, Structure and Functions of ecosystem, biotic and abiotic components, food chains, food web Biodiversity, types of biodiversity, conservation of biodiversity.	04
2.	**Environmental Pollution and Health** Environmental Pollution, types of pollution, Air pollution, Water Pollution, Noise Pollution, Soil Pollution, Marine Pollution, Radioactive Pollution,	04

	Thermal Pollution (Causes, sources and effects, abatement methods), Pollution Case Studies-Bhopal Gas Tragedy, Chernobyl Accident: A nuclear Disaster, Ganga Water Pollution. Solid Waste management (Causes, sources, effects & control measures), Hazardous waste management, Plastic waste management, E-waste management. Disaster management and risk analysis.	
3.	**Climate change and Sustainable development** From unsustainable to sustainable development, Urban problems related to energy, Water conservation: Rainwater harvesting, Watershed management, Climate change, Global Warming, Ozone layer depletion, Acid Rain, Consumerism & waste Products, Concepts of Eco-labeled products, Eco-mark, Awareness of Environmental Legislation.	**04**

Guidelines for Project:

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

Text Books:

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

Reference Books:

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

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Class: - **S.Y. B. Tech**	Semester-**III**	**L**	**T**	**P**	**Credits**
Course Code: E**C2074**	Course Name: **Analog Communication Lab**	-	-	2	1

Course Description:
Analog Communication is a fundamental and core subject for B.Tech E&TC program. It introduces students to principles of communication systems. The course provides knowledge of different analog modulation-demodulation systems.

Course Outcomes:
After completion of this course students will be able to:
1. Demonstrate different modulation and demodulation waveforms in time and frequency domain.
2. Analyze different modulation-demodulation techniques
3. Interpret result and prepare report.

Minimum 10 experiments will be conducted as per following list.		
Expt. No.	**Title of the Experiment**	**Hrs.**
1.	Perform and test Amplitude modulation	02
2.	Perform and test Amplitude demodulation.	02
3.	Perform and test Frequency modulation.	02
4.	Perform and test Frequency demodulation.	02
5.	Perform and test Sampling and reconstruction of signals.	02
6.	Perform and test Pulse amplitude modulation.	02
7.	Perform and test Pulse width modulation.	02
8.	Perform and test Pulse position modulation.	02
9.	Demonstrate AM/FM receiver.	02
10.	Simulate AM, FM.	02
11.	Simulate sampling theorem, Pulse modulation techniques	02
12.	Simulate pre-emphasis and de-emphasis.	02

Text Books:
1. Kennedy, Davis, Electronics Communication Systems, Tata McGraw Hill.
2. R. P. Singh, S. D. Sapre, Communication Systems-Analog and Digital, Tata McGraw Hill.

Reference Books:

1. Tomasi, Electronic Communication Systems Pearson Education.
2. Taub, Schilling, Principles of communication systems, Tata McGraw Hill.
3. Louis E Frenzel, Communication Electronics Principles & Applications, Tata McGraw Hill.
4. NPTEL Course - https://onlinecourses.nptel.ac.in/noc19_ee46/preview

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Class: - **S.Y. B. Tech**	Semester-**III**
Course Code: **EC2094**	Course Name: **Digital Design Lab**

L	T	P	Credits
-	-	2	1

Course Description:
Course focuses on combinational & sequential circuit design. It describes the physical model of all basic gates and constructs simple digital circuits to accomplish specific functions.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Apply fundamentals to design digital circuit
2. Demonstrate the operation of various combinational and sequential circuits
3. Interpret results and compare with experimental results
4.Communicate effectively through lab report

Prerequisite: Basic knowledge of number systems

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Study and verify truth tables of all basic gates	02
2.	Design and implementation of Boolean Equation using basic gates	02
3.	Design and verification of half adder and full adder	02
4.	Design and verify the working of Multiplexer and demultiplexer	02
5.	Implementation and verification of decoder and encoder using logic gates	02
6.	Design of flip-flops using logic gates (D-Flip-flop, S-R Flip-flop)	02
7.	Design and implement synchronous & asynchronous counter	02
8.	Design and implementation of shift register	02
9.	Design and implementation of magnitude comparator	02
10.	Design and implementation of sequence detector	02

Text Books:
1. Morris Mano, Digital Design, Pearson Prentice Hall
2.Anandkumar, Fundamentals of Digital Circuits, Prentice Hall
Reference Books:
1.R P Jain, Modern Digital Electronics, Tata McGraw Hill
2.Donald Givone, Digital Principles and Design, Tata McGraw Hill

Class: **S. Y. B. Tech**	Semester-**III**
Course Code: **EC261**	Course Name: **Analog Circuits and PCB Design Lab**

L	T	P	Credits
-	-	2	1

Course Description:
Course focuses on fundamentals of electronic devices, their working and VI characteristics. It also helps to develop ability to analyze electronic circuits, to interpret experimental results and to plot the responses. It also deals with PCB design and fabrication techniques, various types of PCB materials used, understand and design multilayer PCB & trace width calculations.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Design electronic circuits as per requirement
2. Analyze different parameters from experimental results and plot the response
3. Interpret results of experiment and compare with measured values
4. Develop Printed Circuit Boards for Electronic Circuits
5. Improve the ability to communicate effectively through written lab journals

Prerequisite: Basics of electronic components, specifications and its characteristics

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Study characteristics of PN Junction Diode	02
2.	Design Half wave and Full wave rectifier	02
3.	Analyze types of clipper & clamper circuits	02
4.	Study VI characteristics of BJT	02
5.	Plot frequency response of single stage RC coupled amplifier.	02
6.	Implementation of RC Phase shift oscillator	02
7.	Analyze Class AB Push Pull Complementary Output Stage Amplifier	02
8.	Design voltage regulator using Zener diode	02
9.	Analysis of emitter follower voltage regulator	02
10.	Design power supply and operate load using relay	02
11.	Verify types of PCB materials & trace width calculations.	02
12.	Develop schematic for electronic circuit.	02

13.	Design Single Layer PCB for electronic circuit.	02
14.	Design Double Layer PCB for electronic circuit.	02

Text Books:

1. Donald Neamen, Electronic Circuit analysis, Tata Mc-Graw Hill
2. Milliman Halkanes, Integrated Electronics, Prentice Hall

Reference Books:

1. Boylestad, Electronics Devices and Circuits, Prentice Hall

Class: **S. Y. B. Tech**	Semester-**III**
Course Code: **EC263**	Course Name: **Network Theory Lab**

L	T	P	Credits
-	-	2	1

Course Description:
This lab course provides hands-on experience to reinforce Network Theory concepts through circuit building, measurement, and analysis. Students will construct and simulate DC and AC circuits to validate mesh and nodal analysis, network theorems, transient and steady-state responses, resonance, and two-port parameters. Emphasis is placed on measuring electrical quantities using lab instruments, analyzing results, comparing with theoretical predictions, and interpreting circuit behavior in both time and frequency domains..

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Calculate circuit parameters using mesh/nodal analysis and network theorems, and validate results through experimentation and simulation.
2. Analyze the transient response of RC, RC and RLC circuits using theoretical calculations and validate with practical measurements and simulations.
3. Calculate power, impedance, and power factor in AC circuits and validate through experimental observations and simulation tools.
4. Determine resonance frequency, bandwidth, and quality factor in RLC circuits through calculation and confirm through laboratory experimentation.
5. Compute two-port network parameters and transfer functions, and validate system behavior using experimental setup and circuit simulation.

Prerequisite: Basic Electrical Engineering

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Calculation and Validation of Mesh Currents in Mult-loop Resistive Circuits	02
2.	Calculation and Validation of Node Voltages in Resistive Circuits with multiple sources	02
3.	Verification of Network Theorems	02
4.	Transient Response of R-L and R-C Circuits to Step Input	02
5.	Simulation and Analysis of RLC Circuits Using Laplace Transform in PSpice	02
6.	AC Steady-State Analysis using Mesh/Nodal Methods and Phasors	02
7.	Measurement and Calculation of Power and Power Factor in AC Circuits	02
8.	Analysis and Validation of Series Resonance Characteristics	02

9.	Determination of Z and Y Parameters for a Two-Port Network	02
10.	ABCD and h-Parameter Calculation and Verification of Interrelationships	02
11.	Determination of Transfer Function and Pole-Zero Plot of a Circuit	02

Text Books:

1. Sudhakar, Shyammohan S. Palli, Circuits and Networks- Analysis & Synthesis, Tata McGraw-Hill.
2. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, McGraw Hill Education.

Reference Books:

1. Chakrabarti, Circuit Theory Analysis and Synthesis, Dhanpat Rai & Co.
2. K. S. Suresh Kumar, Electric Circuit Analysis, Pearson Publications.
3. Ravish R Singh, Network Analysis and Synthesis, Tata McGraw-Hill.

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

L	T	P	Credits
-	-	2	1

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

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

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

Minimum 12 sessions will be conducted from the following list.

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

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

References -

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

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

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

L	T	P	Credits
-	-	2	1

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

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

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

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

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

References -

1. Spiritual Wisdom in Day-to-day life – Blogs by Mr. Pralhad Wamanrao Pai
2. Towards the goal of beautiful life – Book by Satguru Shri Wamanrao G. Pai
3. Power of your subconscious mind – Dr. Murphy
4. Seven people of highly effective people – Stephen Covey
5. How to Win Friends and Influence People – Dale Carnegie

6. S. Hariharan, et al; *Soft Skills*, MJP Publishers, Chennai
7. Gopalaswamy Ramesh et al. *The ACE of Soft Skills: Attitude, Communication and Etiquette for Success*, New Delhi: Pearson Education.
8. Masters, L. Ann et al. *Personal Development for Life and Work*, New Delhi: Cengage Learning.

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

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2023-27 and 2024-28 NEP Batch
Department of Electronics and Telecommunication Engineering

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

L	T	P	Credits
-	-	2	1

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

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

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

Minimum 12 sessions will be conducted from the following list.

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

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

References -

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

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

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

L	T	P	Credits
-	-	2	1

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

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

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

Minimum 12 sessions will be conducted from the following list.

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

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

References -

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

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

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

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

L	T	P	Credits
-	-	2	1

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

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

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

Course Content

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

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

References -

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

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

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

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

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

L	T	P	Credits
-	-	2	1

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

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

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

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

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

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

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

References -

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

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

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

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2023-27 and 2024-28 NEP Batch
Department of Electronics and Telecommunication Engineering

Class: **S.Y. B. Tech**	Semester-**IV**
Course Code: **EC260**	Course Name: **Mathematics for ECE**

L	T	P	Credits
2	-	-	2

Course Description:
Mathematics is a core subject introduced at first semester of second year B. Tech. Electronics and Telecommunication. This course intends to build the competency in the students to apply the knowledge of mathematics to the solution of engineering problems and to analyze it.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Apply various transformation techniques to solve engineering problems.
2. Solve linear differential equations & problems related to engineering application in electronics.
3. Determine expansion of functions by using Fourier series.
4. Apply the statistical techniques to solve various problems.

Prerequisite: Higher Secondary Mathematics, Engineering Mathematics-I & II.

Course Content		
Unit no.	**Description**	**Hrs.**
1.	**Linear Differential Equations and Its Applications** Introduction and definition, Complete solution of differential equations with constant coefficient, Application of LDE to LCR circuits.	**04**
2.	**Laplace Transform and Its Application** Definition, Laplace transforms of standard functions, Properties of Laplace transforms and inverse Laplace transforms, Laplace transforms of periodic functions, Application of Laplace transform to solve ODE.	**04**
3.	**Z –Transform** Definition, Z- Transform of standard functions, Properties of Z- Transform, Inverse Z-Transform.	**04**
4.	**Fourier series** Euler's Formula, Fourier series of periodic function with period 2c, Fourier series of even & odd function, Fourier series of periodic functions with arbitrary periods, Half range Fourier series.	**04**
5.	**Statistics** Coefficient of correlation by Karl Pearson's method, Lines of regression, Fitting of curve (Straight and Parabola) by least square method.	**04**

6.	**Probability** Probability of random variable, Discrete and Continuous probability distributions, Binomial distribution, Poisson distribution, Normal distribution, Application in communication to find rate error probability.	**04**

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

Reference Books:

1. Erwin Kreyszig, Advanced engineering mathematics, Wiley.
2. Raman B.V., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi.
3. N. P. Bali, Ashok Saxena and N. Ch. S. N. Iyengar, A Text Book of Engineering Mathematics, Laxmi Publications, New Delhi.
4. P. N. Wartikar and J. N. Wartikar, A Text book of Applied Mathematics, Vol. I, Vol. II, Vidyarthi Griha Prakashan, Pune.

Class: **S.Y. B. Tech**	Semester-**IV**
Course Code: **EC2024**	Course Name: **Digital Communication**

L	T	P	Credits
3	-	-	3

Course Description:
This course discusses the principles of digital communication which has applications in different telecommunication systems. It makes students acquainted with use of statistical techniques, source coding and error control in digital communication.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Explain different concepts of digital communication systems.
2. Calculate various parameters on statistical theory, source coding and channel coding.
3. Apply various theorems of encoding and error control on signals.
4. Analyze various digital modulation and channel coding techniques.

Prerequisite: Knowledge of Analog Communication, probability theory and statistics is essential

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Random Signal Theory** Discrete random variables, Continuous random Variables, Probability Mass Function, Probability Density Function & Statistical averages, Random Processes: Time average, Ergodicity, Power Spectral density of Stationary random processes	06
2.	**Information Theory** Entropy, Information Rate, Shannon's encoding theorem, communication channels- Discrete & Continuous, Rate of information transmission over a discrete channel, Shannon–Hartley theorem, Implication of Shannon's Theorem, Huffman's coding & Shannon-Fano Coding techniques	06
3.	**Source Coding** Quantization, Pulse code modulation (PCM), Differential pulse code modulation (DPCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM). Advantages and disadvantages of all these techniques, Comparison of all these techniques, Applications	06
4.	**Digital Modulation Techniques and Data Formats**	06

	Data Formats, ASK, FSK, PSK, coherent and non-coherent reception, BPSK, DPSK, QPSK, 16-QAM, MSK, Waveforms and Comparison of digital modulation techniques, Applications	
5.	**Baseband Transmission and Optimal Reception of Digital Signals** Pulse shaping for optimum transmissions, Baseband signal receiver, Probability of error. Optimum receiver, optimal of coherent reception. Signal space representation and probability of error, Eye diagrams, Cross talk	06
6.	**Channel Coding** Types of errors & codes, linear block codes, error detection & correction, hamming codes, Look-up table decoding. Binary Cyclic codes, Encoding using (n-k) bit shift registers, Syndrome calculation. Convolution codes, Encoders, Decoders, Code tree. Trellis diagram, Applications	06

References-

Text Books:

1. K.Sam Shanmugan, Digital & Analog Communication Systems, Wiley India
2. R P Singh, S D Sapre, Communication System-Analog & Digital, Tata Mc-Graw Hill

Reference Books:

1. Bernard Sklar, Digital Communication-Fundamentals and Applications, Pearson Education
2. Taub & Schiling, Principles of communication System, Tata Mc-Graw Hill

Class: - S. Y. B. Tech.	Semester-IV
Course Code: **EC2044**	Course Name: **Microcontroller**

L	T	P	Credits
3	-	--	3

Course Description:
PIC Microcontrollers are being extensively used in the field of Embedded Systems. The students studying this subject are supposed to learn the architecture of a PIC Microcontroller and also get acquainted about their use for control purpose. In addition, the course will provide the knowledge of applications and interfacing of PIC microcontrollers used in the field of instrumentation & control. Thus, this course is also very useful for instrumentation engineers working in the area of embedded systems.

Course Outcomes:
After completion of this course students will be able to:
1. Describe fundamentals of PIC microcontroller.
2. Write programs for PIC microcontroller
3. Interface peripherals with PIC microcontroller.
4. Develop embedded application using PIC microcontroller.

Prerequisite: Course on Digital Design

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**PIC Microcontrollers: History, Features and Architecture** Microcontrollers, Overview of the PIC18 Family, PIC18 PIN function, PIC18 Configuration Registers, SFR, PIC18 File Register and access Bank. Data and program memory, Stack and stack pointer, Status Register, PIC18 Data Format and Directives.	06
2.	**Classification of Instructions & I/O Port Programming** Addressing modes, Data transfer, Arithmetic Instructions, Logical, Compare, Rotate Instruction and Data Serialization, BCD and ASCII Conversion. Branch Instructions and Looping, CALL and RET Instructions with programming.	06
3.	**Concepts of Programming** I/O Port structure, Concepts of C Programming, Data types, Conditional statements & loops, arrays and string operations, rotate, bit manipulation,	06

	logical operation, functions, use of pointer, Embedded C programs for PIC microcontroller.	
4.	**PIC18 On Chip Block Programming in C** Programming Timers & counters 0, 1, 2 and 3, PIC18 Interrupts Programming, EPROM Read/write, RS232 basics, UART, ADC Programming in the PIC18,	06
5.	**PIC18 Interfacing** LCD Interfacing, Keyboard Interfacing, Relays and Stepper Motor Interfacing, DC Motor interfacing and speed control using PWM, I2C interface	06
6.	**Case Studies** Automatic porch light control, Room temperature control, Soil moisture control, antitheft system, Room light control frequency counter, Location finding using GPS, Mobile communication	06

Text Books:

1. Mazidi M. A., McKinlay, R. D., Causey D. PIC microcontrollers & Embedded Systems, Pearson education, International.
2. Peatman John B., Design with PIC Microcontrollers, Pearson education, International.

Reference Books:

1. Barnett R. H., Cox S., O' cull L, Embedded C Programming & The Microchip PIC, Cengage.
2. Matic Nebojsa, PIC Microcontroller, Mikroelektronika.

Class: **S. Y. B. Tech.**	Semester: **IV**
Course Code: **EC2064**	Course Name: **Linear Integrated Circuits**

L	T	P	Credits
3	-	--	3

Course Description:
This course focuses on working principles of operational amplifiers, electrical parameters of Op-Amp and its applications. This course also develops the capacity to analyze and interpret the different Op-Amp based circuits. It also deals with specialized ICs, their scope and their applications.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe fundamentals of Linear Integrated Circuits.
2. Analyze different AC and DC parameters of Operational Amplifier.
3. Design various applications of Operational Amplifier.
4. Elaborate fundamentals and applications of specialized Integrated Circuits.

Prerequisite: Basic knowledge of Mathematics, AC & DC circuits & Electronic Devices.

Course Content

Unit No.	Description	Hrs
1.	**Operational Amplifier Fundamentals** Block diagram of Op-Amp, characteristics of Op-Amp, equivalent circuit of Op- Amp, DC and AC analysis, ideal voltage transfer curve, electrical parameters of Op- Amp, open loop configuration, calculation of various parameters of Op-Amp, Overview of datasheet of IC 741.	06
2.	**Op-Amp Circuits with Feedback** Concept of feedback & their types, Inverting & Non inverting configurations, Current to Voltage converters, Voltage to Current converters, Summing amplifier, differential amplifier, Instrumentation amplifier.	06
3.	**Applications of Op-Amp** Integrators & differentiators, Comparators, Schmitt triggers, Precision rectifier, Peak detectors, Sample & hold circuit, square wave generator, Triangular wave generator, Saw tooth generator, Log Amplifier, V to F and F to V converters.	06
4.	**Active Filters and Oscillators**	06

	Low Pass Filter, High Pass Filter, Band Pass and Band Stop Filter, Filter design guidelines, frequency response of filters, Oscillator: Basic concept of oscillator, Barkhausen criterion, Phase shift oscillator, Wein bridge oscillator.	
5.	**Phase Locked Loops and Multipliers** Voltage control oscillator, block diagram of PLL, free running frequency, lock range, capture range, applications of PLL: Frequency synthesizer, Frequency Multiplier, Overview of datasheet of IC 565, IC 566, IC 4046.	06
6.	**Specialized Ic** Study of Timer IC 555: Working of A stable, Monostable & Bistable multivibrator, IC 8038, LM 324, IC 723, various applications design on above IC.	06

Text Books:

1. Ramakant Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata McGraw Hill.

Reference Books:

1. Coughlin & Driscoll, Operational Amplifiers and Linear Integrated Circuits, Prentice Hall
2. S. Salivahanan, Linear Integrated Circuits, Tata McGraw Hill.

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2023-27 and 2024-28 NEP Batch
Department of Electronics and Telecommunication Engineering

Class:- **S. Y. B. Tech.**	Semester-**IV**
Course Code : **EC262**	Course Name : **Signals and Systems**

L	T	P	Credits
3	-	-	3

Course Description:

Signals and systems as seen in everyday life, and in various branches of engineering and science. In modern age of technology, signals and systems plays vital role. It is core subject in Electronics and Telecommunication Engineering. It has diverse applications in areas such as signal and image processing, communication, control systems, etc. This course focuses on analyzing signals and the systems using transform theory techniques.

Course Learning Outcomes:

After completion of this course, students will be able to:

1. Classify continuous and discrete time signals and systems.
2. Illustrate use of convolution and impulse response in LTI systems.
3. Apply mathematical techniques to manipulate signals and systems.
4. Make use of transform theory techniques for system analysis in time and frequency domain.

Prerequisite: Basic knowledge of Engineering Mathematics that includes Calculus, Differential and Difference equations, Laplace and Z transform.

Course Content		
Unit no.	**Description**	**Hrs.**
1.	**Continues Time (CT) Signals and Systems** Introduction to Signals and Systems, Standard CT signals, Classification of CT signals, Operations on CT signals, Impulse signal and its properties, CT Systems, Classification of CT systems, LTI systems, Response of LTI-CT systems in time domain. Convolution of CT signals, Convolution integral and its properties.	06
2.	**Discrete Time (DT) Signals and Systems** Sampling and Aliasing, Standard DT signals, Classification of DT signals, Operations on DT signals, DT Systems, Classification of DT systems, LTI systems, Response of LTI-DT systems in time domain. Convolution of DT signals, Convolution sum and its properties.	06

3.	**Applications of Laplace Transform** Definition, application of Region of convergence (ROC) , Laplace Transform and properties, Poles and zeros of system, application of Laplace to system analysis, differential equations and system behavior, Analysis of LTI systems.	06
4.	**Applications of Z Transform** Definition, Region of convergence (ROC) and its properties, Properties of Z transform, application of Z transform in system analysis, difference equations and system behavior, application of Z transform in in system stability, Analysis of LTI systems.	06
5.	**Continuous Time Fourier Series and Transform** Introduction to Fourier Series, Definition and Need of CT Fourier Transform, Properties of FT, Fourier Transform of Some Important Signal, Frequency spectrum of FT, Analysis of LTI system using CTFT, Relation between Laplace Transform & CTFT.	06
6.	**Discrete Time Fourier Series and Transform** Fourier Series of DT signals, Discrete Time Fourier Transform, Comparison of CTFT and DTFT, Properties of CTFT, Analysis of LTI system using DTFT, Relation between Z Transform & DTFT.	06

References-

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky, Signals and Systems, Pearson Education.
2. A Nagoor Kani, Signals and Systems, McGraw Hill Publication.

Reference Books:

1. B.P. Lathi, Signal Processing and Linear Systems, Oxford University Press.
2. Simon Haykin, Barry van Veen, Signals and Systems, John Wiley and Sons (Asia) Private Limited.
3. P. Ramesh Babu, Signals and Systems, Scitech Publication.
4. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB.
5. Ashok Ambardar, Analog and Digital Signal Processing.
6. H.A. Hsu, Signals and Systems, Schaum's out lines.

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
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To be implemented for 2023-27 and 2024-28 NEP Batch
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Class: **S. Y. B. Tech.**	Semester-**IV**
Course Code: **CEMD202**	Course Name: **Building Estimation and Valuation**

L	T	P	Credits
3	--	--	3

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

Course Outcomes:
After successful completion of the course, student will be able to,
1. Explain the types and basic requirements of the estimate.
2. Explain measurement sheet, abstract sheet, and detailed specifications of different construction items.
3. Prepare detailed estimate of load bearing structure and framed structure.
4. Prepare rate analysis and bar bending schedule of different construction items.
5. Explain the tenders and contracts.
6. Describe basic terms of valuation.

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

Course Content

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

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

References –

References Books: -

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

I. S. Code:-

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

K. E. Society's
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Department of Electronics and Telecommunication Engineering

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

L	T	P	Credits
2	-	2	3

Course Description:
This lab course provides practical exposure to the fundamentals of Java programming and object-oriented principles such as classes, objects, inheritance, and polymorphism. Students will gain hands-on experience in implementing concepts such as abstraction, interfaces, packages, exception handling, and file operations. By practicing structured problem-solving using Java, students will be able to write modular, reusable, and robust code. The course promotes skill development through real-world coding exercises and mini-projects.

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

1. Describe the fundamental concepts of Java programming including variables, data types, control structures, arrays, and memory management.
2. Apply object-oriented principles such as classes, objects, constructors, access modifiers, and static members to develop Java programs.
3. Implement Inheritance, Polymorphism, Interfaces, Abstraction, and Nested Classes to build modular Java applications.
4. Manage packages and handle runtime errors using exception handling mechanisms.
5. Design and develop file-based Java applications using file handling classes and methods to perform basic CRUD operations.

Prerequisite: Basics of C programming, Fundamentals of Data Structures

Course Content		
Unit No	**Description**	**Hrs**
1.	**Fundamentals of Java:** Java: Overview, Features, JVM, JDK, JRE, Environmental Setup, Hello World Program, User Input, Comments, Variables, Data Types, Type Casting, Operator, Expression, Control loops and Statements, Arrays, Garbage Collection	4
2.	**Introduction to Object Oriented Programming:** Introduction to OOP, Class & Object, Methods and Variables, Constructor, this keyword, Access Modifiers, static keyword	4

3.	**Inheritance & Polymorphism:** Inheritance, super keyword, Polymorphism: Method Overloading and Overriding	4
4.	**Interfaces & Abstraction:** Abstraction, Encapsulation, Interface, Final keyword, Nested Classes	4
5.	**Package and Exception Handling:** **Package**: Organizing Classes and Interfaces in Packages, CLASSPATH setting for Packages, Naming Convention for Packages, **Exception Handling**: Exception and Errors, Types of Exception, Try-Catch Block, finally, throw and throws keyword, Java Built Exception and Custom Exception	4
6.	**File Handling** **File Handling**: CRUD Operations on File, File Methods	4

It should consist of 10 to 12 experiments based on the syllabus and experiment list mentioned below.

Experiment List		
Expt. No.	**Description**	**Hrs**
1.	Write a program using input, data types, type casting, loops, and arrays.	02
2.	Implement a class with methods, constructor.	02
3.	Demonstrate the use of access modifiers, static and this keyword in a program.	02
4.	Write a program for inheritance and its types.	02
5.	Demonstrate method overloading and overriding in Java.	02
6.	Create a program using abstract classes and encapsulated attributes.	02
7.	Implement interface and final keyword in a real-time use case.	02
8.	Create user-defined packages and access them with correct classpath settings.	02
9.	Handle built-in and custom exceptions using try-catch-finally.	02
10.	Perform file creation, read, write, and delete operations using File class.	02

References -

Text Books:

1. E. Balagurusamy, Programming with Java, , McGraw Hill
2. Herbert Schildt, Java: The Complete Reference, , McGraw Hill

Reference Books:

1. Kathy Sierra and Bert Bates, Head First Java, O'Reilly
2. Joshua Bloch, Effective Java, Addison-Wesley
3. Official Oracle Java Documentation – https://docs.oracle.com

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

L	T	P	Credits
3	--	--	3

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

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

1. Write the basic working principles of different generating sources.
2. Analyze different types of loads
3. Explain importance of power factor and tariffs in power system.
4. Identify various components in power transmission and distribution system.
5. Select substation equipments as per requirement.

Prerequisite: Basic Electrical Engineering, Basic Mathematics and Physics.

Course Content

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

References -

Text Books:

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

Reference Books:

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

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

L	T	P	Credits
3	-	-	3

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

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe different communication systems.
2. Explain applications of analog and digital modulation techniques.
3. Analyze different modulation and demodulation techniques.
4. Explain the use of satellite communication.

Prerequisite:
Fundamental concepts of engineering and Mathematics

Course Content

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

	And Data Formats Data Formats, ASK, FSK, PSK, coherent and non-coherent reception, BPSK, DPSK, QPSK, 16-QAM, MSK, Waveforms and Comparison of digital modulation	
5.	**Satellite Communication:** Basic concepts of Satellite Communications, Satellite subsystems, Satellite Link design, Orbital Mechanics,	**06**
6.	**Satellite Application:** DBS, VSAT, GPS, Case Studies – Mars Mission, Chandrayan.	**06**

References -

Text Books:

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

Reference Books:

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

Class:- **S.Y. B. Tech**	Semester-**IV**		**L**	**T**	**P**	**Credits**
Course Code : **CIMD202**	Course Name : **Computer Algorithms**		**3**	**--**	**--**	**3**

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

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

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

Prerequisite: Basic knowledge of Mathematics

Course Content

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

4.	**Dynamic Programming** General method, Multistage graphs, All pair shortest paths, 0/1 Knapsack problem, Reliability design, Traveling sales person problem.	07
5.	**Backtracking** General method, n-Queens problem, Subset sum problem, Graph coloring problem, Travelling sales person problem.	06
6.	**Introduction to Complexity Theory** The P and NP Classes, Polynomial, time reductions, NP- Hard and NP-Complete classes. NP-Hard graph problems- Clique decision problem, Vertex cover problem, Travelling sales person decision problem, Randomized algorithms.	06

References -

Text Books:

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

Reference Books:

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

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

L	T	P	Credits
3	--	--	3

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

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

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

Prerequisite: Course on Design Thinking

Course Content

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

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

References -

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

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

L	T	P	Credits
3	-	--	3

Course Description:

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

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

Course Learning Outcomes:

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

1. Explain the structure and function of common hydraulic and pneumatic components such as cylinders, valves, pumps, and motors etc.
2. Model and analyze common hydraulic and pneumatic components such as cylinders, valves, pumps, and motors.
3. Create & simulate basic hydraulic and pneumatic circuit diagrams for different applications.
4. Design, develop & analyze simple hydraulic and pneumatic systems for given task.

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

Course Content

Unit No.	Description	Hrs.
1.	**Fluid Power Systems And Fundamentals** Introduction to fluid power, Advantages of fluid power, Application of fluid power system, Types of fluid power systems, Properties of hydraulic fluids, General types of fluids, Fluid power symbols. (ISO/JIC), Use of Automation studio to draw circuits.	06
2.	**Hydraulic System And Components (Pumps And Actuators)** Pumping theory, Pump classification, Gear pump, Vane Pump,	06

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

References -

Textbooks:

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

Reference Books:

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

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

L	T	P	Credits
3	--	--	3

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

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

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

Course Content

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

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

References -

Text Books:

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

Reference Books:

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

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

L	T	P	Credits
3	-	-	3

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

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

1. Explain the functioning of various sensors and transducers
2. Calibrate the transducers such as accelerometers, microphones and strain gauges.
3. Explain the characteristics of various sensors and transducers
4. Describe the process and need for calibration.
5. Choose the sensor for measurement of few parameters.
6. Use the appropriate sensor and calibrate

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

Course Content:

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

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

References –

Text Book:

- DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
- D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
- S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
- Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill 1997.
- Patranabis. D, "Sensors and Transducers", Wheeler publisher, 1994.
- Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
- Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.

Reference Books:

- Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition.
- A.D. Helfrick and W.D. cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
- Hermann K.P. Neubert, "Instrument Transducers", Oxford University Press.

Class: **S.Y. B. Tech**	Semester-**IV**
Course Code: **EC2084**	Course Name: **Digital Communication Lab**

L	T	P	Credits
-	-	2	1

Course Description:
Digital communication laboratory is fundamental and core course for second year B Tech Electronics and Telecommunication program. Therefore, it introduces the knowledge of modulation and demodulation techniques in analog as well as digital communication.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Demonstrate different analog and digital modulation and demodulation techniques.
2. Write MATLAB code to calculate statistical parameters and generate waveforms
3. Analyze the results by comparing with interpreted values
4. Demonstrate and communicate effectively through lab write-ups

Prerequisite: Basic knowledge Analog Communication and MATLAB programming is required.

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Demonstrate the amplitude modulation and demodulation	02
2.	Demonstrate the frequency modulation and demodulation	02
3.	Demonstrate the phase modulation and demodulation	02
4.	Generate the waveforms of PAM/PPM/PWM	02
5.	Demonstrate Pulse Code Modulation	02
6.	Implement Delta modulation/Adaptive Delta Modulation	02
7.	Perform ASK/FSK/PSK	02
8.	Perform Quadrature Phase Shift Keying technique	02
9.	Write MATLAB program to calculate statistical parameters	02
10.	Write MATLAB program to generate ASK, FSK and PSK waveforms	02

Text Books:

1. K.Sam Shanmugan, Digital & Analog Communication Systems, Wiley India
2. R P Singh and S D Sapre, Communication System-Analog & Digital, Tata Mc-Graw Hill

Reference Books:

1. Bernard Sklar, Digital Communication-Fundamentals and Applications, Pearson Education
2. Taub and Schiling, Principles of communication System, Tata Mc-Graw Hill

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2023-27 and 2024-28 NEP Batch
Department of Electronics and Telecommunication Engineering

Class: - S. Y. B. Tech.	Semester-IV
Course Code: **EC2104**	Course Name: **Microcontroller Lab**

L	T	P	Credits
-	-	2	1

Course Description:
PIC Microcontrollers are being extensively used in the field of Embedded Systems. This course will cover the programming concepts of PIC Microcontroller. Students are introduced to software development concepts applicable to real-time PIC Microcontroller based systems. Particularly PIC18F4520 microcontroller will be studied as an embedded processor and embedded software development is carried out for above CPUs using MPLAB, PROTEUS-VSM, and PIC KIT programmer.

Course Outcomes:
After completion of this course students will be able to:
1. Write programs to perform given task/application for PIC microcontroller in assembly/Embedded C language.
2. Simulate/ emulate the program for PIC microcontroller using MPLAB software
3. Interpret the result and communicate effectively through lab report

Prerequisite: Basic knowledge of C programming

Expt. No.	Description	Hrs.
1.	Develop logic in assembly programming to perform 8/16-bit arithmetic operations	2
2.	Develop logic in assembly programming to perform block transfer using indirect addressing mode	2
3.	Develop logic in assembly programming to perform program memory table read operations.	2
4.	Develop a logic in C to blink LED on GPIO with variable time.	2
5.	Develop a logic to control LED using switch in C.	2
6.	Develop a logic in C to use interrupt programming	2
7.	Develop a logic in C to interface LCD to PIC 18	2
8.	Develop a logic in C to interface ADC to PIC 18	2
9.	Develop a logic in C to interface matrix keyboard	2
10.	Develop a logic in C to interface DC motor and control its speed using PWM	2

Text Books:
1. Mazidi M. A., McKinlay, R. D., Causey D. PIC microcontrollers & Embedded Systems, Pearson education, International.
2. Peatman John B., Design with PIC Microcontrollers, Pearson education, International.

Reference Books:
1. Barnett R. H., Cox S., O' cull L, Embedded C Programming & The Microchip PIC, Cengage.
2. Matic Nebojsa, PIC Microcontroller, Mikroelektronika.

K. E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
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Curriculum Structure and Evaluation Scheme
To be implemented for 2023-27 and 2024-28 NEP Batch
Department of Electronics and Telecommunication Engineering

Class: **S. Y. B. Tech.**	Semester: **IV**
Course Code: **EC2124**	Course Name: **Linear Integrated Circuits Lab**

L	T	P	Credits
-	-	2	1

Course Description:
This course focuses on working principles of operational amplifiers, electrical parameters of Op-Amp and its applications. This course also develops the capacity to analyze and interpret the different Op-Amp based circuits. It also deals with specialized ICs, their scope and their applications.

Course Outcomes:
After completion of this course, students will be able to:
1. Analyze different parameters of various configurations of Op-Amp.
2. Design various applications of Op-Amp.
3. Interpret theoretical and practical results.
4. Communicate effectively through lab journals.

Prerequisite: Basic knowledge of Mathematics, AC & DC circuits & Electronic Devices.

Course Content		
Expt. No.	**Title of the Experiment**	**Hrs.**
1.	Build and test inverting configuration of Op-Amp and inverter.	02
2.	Build and test non-inverting configuration of Op-Amp and voltage follower.	02
3.	Design & test inverting & non-inverting summing amplifier.	02
4.	Design & test differential amplifier.	02
5.	Build and test inverting & non inverting comparator and Zero crossing detector.	02
6.	Design & test integrator using Op-Amp.	02
7.	Design & test differentiator using Op-Amp.	02
8.	Design and test inverting Schmitt Trigger using Op-Amp.	02
9.	Design & test square wave generator & triangular wave generator.	02
10.	Design & plot frequency response of 1st order low pass filter.	02
11.	Design & plot frequency response of 1st order high pass filter.	02
12.	Design & test RC Phase shift & Wien Bridge oscillator using Op-Amp.	02
13.	Design square wave oscillator using IC 555.	02

Text Books:

1. Ramakant Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata McGraw Hill.

Reference Books:

1. Coughlin & Driscoll, Operational Amplifiers and Linear Integrated Circuits, Prentice Hall
2. S. Salivahanan, Linear Integrated Circuits, 3rd, Tata McGraw Hill.

Class: - **S.Y. B. Tech.**	**Semester-IV**
Course Code: **EC2144**	Course Name: **Programming with C++ Lab**

L	T	P	Credits
-	-	2	1

Course Description:

C++ is a general-purpose programming language that is free-form and compiled. It is regarded as an intermediate-level language, as it comprises both high-level and low-level language features. It provides imperative, object-oriented, and generic programming language. C++ is one of the most popular programming languages and is implemented on a wide variety of hardware and operating system platforms. The main objective of this course is to introduce students to the basic concepts of C++ and the ability to write simple correct programs. Students will demonstrate the ability to use C++ to design solution to problems.

Course Learning Outcomes:

After completion of this course, students will be able to:

1. Write, debug, and test basic C++ codes using the object-oriented approaches introduced in the course.
2. Discuss and analyze C++ problems in an object-oriented programming tool.
3. Evaluate the performance of developed C++ program.
4. Present and write laboratory reports in desired format in grammatically correct language.

Prerequisite: Programming in C knowledge.

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Introduction to C++, five programs based on arithmetic operations.	02
2.	Programs based on conditional statements (if-else, switch).	02
3.	Programs based on loop statements (while, do-while, for).	02
4.	Programs based on library functions.	02
5.	Programs based on functions with arguments and without arguments.	02
6.	Programs based on function overloading.	02
7.	Five programs based on class, functions declared inside and outside class, And objects declared in different types.	02
8.	Five programs' objects declared in different types.	02
9.	Programs based on constructors and destructors.	02
10.	Programs based on types of inheritance (single, multilevel, multiple)	02
11.	Programs based on types of inheritance (hierarchical, hybrid)	02
12.	Programs based on file handing.	02

Text Books:

1. E Balgurusamy, Object oriented programming with C++, Tata Mc-Graw Hill

Reference Books:

1. Herbert Schildt, 'The Complete Reference C++', Tata Mc-Graw Hill
2. Ravichandran D, Programming with C++, Tata Mc-Graw Hill
3. Robert Lafore, C++ Programming, Techmedia,

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

L	T	P	Credits
-	-	2	1

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

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

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

Course Content

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

9.	Explaining the pattern of the exam and explanation of each skill's exam requirement	**02**
10.	Practice for Skill "Writing" and "Speaking"	**02**
11.	Practice for skill "Reading" and "Listening"	**02**
12.	Solving exam set 1 Speaking practice	**02**
13.	Solving exam set 2 speaking practice	**02**

References -

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

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

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

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

L	T	P	Credits
-	-	2	1

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

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

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

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

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

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

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

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

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