

**B.E-ELECTRONICS AND COMMUNICATION
ENGINEERING
Regulation 2024
CURRICULUM & SYLLABI**

DEPARTMENT VISION

To provide quality education for students, to compete internationally and produce innovative solutions for the societal need and conscious to the universal moral values through training, imparting the entrepreneurial and leadership skills in the field of Electronics and Communication.

DEPARTMENT MISSION

As a department, we are committed

- ❖ To train the students to become knowledgeable and well-disciplined, by imparting quality education and ethical values.
- ❖ To produce prolific graduates with remarkable skills in envisaging, designing and effectively giving solutions for global needs of Electronics and communication industries.
- ❖ To provide comprehensive in-depth knowledge in various research fields and industrial exposure to the students.
- ❖ To encourage the students to become leaders, innovators and entrepreneurs in their profession.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- PEO 1:** Have a strong foundation to excel in the field of Electronics and Communication Engineering with the supporting knowledge of Mathematics, Science, Computer programming and engineering fundamentals.
- PEO 2:** Have necessary skills to design and implement real time projects along with the ability to formulate, analyze and execute innovative research projects.
- PEO 3:** Have the ability to initiate, coordinate, decode and share information through verbal and non-verbal communication to excel in leadership and entrepreneurship.
- PEO 4:** Be an ethical and responsible globally competent professionals as well as a good human being.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

- PO 1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO 2:** Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO 3:** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO 4:** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO 5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO 6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO 7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO 8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO 9:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO 10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO 11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Graduates will be able to:

- PSO 1:** Designing and Programming Skills: Design the Electronic circuits and communication systems in hardware and simulate it virtually.
- PSO 2:** Implementation and Controlling Skills: Implement the designed system into an electronic product and control it technically to meet the desired specifications and requirements.
- PSO 3:** Testing & Trouble Shooting Skills: Test and trouble shoot the faults and bugs in the designed system to enhance the throughput.

B.E-ELECTRONICS AND COMMUNICATION ENGINEERING
CURRICULUM AND SYLLABI (Regulation 2024)
(Applicable for students admitted from the Academic Year 2024-2025)
Minimum Credits to be Earned: 165

SEMESTER I											
S.No.	Course Code	Course	L	T	P	C	Prds./wk.	CA / ES	Course Type	Category	
1	24HS101	Technical English	2	0	2	3	4	50/50	TP	HSMC	
2	24MA101	Matrices and Calculus	3	1	0	4	4	40/60	T	BSC	
3	24PH101	Engineering Physics	3	0	2	4	5	50/50	TP	BSC	
4	24CY101	Engineering Chemistry	3	0	2	4	5	50/50	TP	BSC	
5	24GE101	Problem Solving using Python Programming	3	0	2	4	5	50/50	TP	ESC	
6	24GE111	Engineering Practices Laboratory	0	0	4	2	4	60/40	P	ESC	
7	24GE102	தமிழர்மரபு / Heritage of Tamils	1	0	0	1	1	40/60	T	HSMC	
8	24MC111	Induction Program	3 Weeks							MC	MC
TOTAL							22	28			

SEMESTER II											
S.No.	Course Code	Course	L	T	P	C	Prds./wk.	CA / ES	Course Type	Category	
1	24MA201	Transforms and Partial Differential Equations	3	1	0	4	4	40/60	T	BSC	
2	24CS201	Programming in C	H	0	2	4	5	50/50	TP	ESC	
3	24PH202	Physics of Semiconductors and Devices	3	0	0	3	3	40/60	T	ESC	
4	24EE202	Circuit Analysis	3	0	2	4	5	50/50	TP	ESC	
5	24EE203	Electrical and Instrumentation Engineering	3	0	0	3	3	40/60	T	ESC	
6	24CS301	Data Structures	3	0	2	4	5	50/50	TP	ESC	
7	24GE202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	1	0	0	1	1	40/60	T	HSMC	
8	24MC201	Environmental Science	2	0	0	0	2	0	MC	MC	
		Work Integrated Learning (Industrial Practice)	Regulation 2024, Clause 4.4								AP
TOTAL							23	28			

SEMESTER III										
S.No.	Course Code	Course	L	T	P	C	Prds./wk.	CA / ES	Course Type	Category
1	24HS301	Universal Human Values	2	0	0	2	2	100/0	T	HSMC
2	24MA304	Probability and Random Processes	3	1	0	4	4	40/60	T	BSC
3	24EC301	Digital System Design	3	0	2	4	5	50/50	TP	PCC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category	
4	24EC302	Signals and Systems	3	1	0	4	4	40/60	T	PCC	
5	24EC303	Electronic Circuits	3	0	2	4	5	50/50	TP	PCC	
6	24EC304	Electromagnetic Fields	3	0	0	3	3	40/60	T	PCC	
7	24SD311	Aptitude and Coding Skills -1	0	0	2	1	2	100/0	P	EEC	
8	24EL311	Innovation and Product Development -1 (Idea Generation)	0	0	2	1	2	100/0	EL	EEC	
		Work Integrated Learning (Industrial Training-I)	Regulation 2024, Clause 4.4								AP
TOTAL							23	27			

SEMESTER IV											
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category	
1	24EC401	Control Systems Engineering	3	0	0	3	3	40/60	T	PCC	
2	24EC402	Network and Security	3	0	2	4	5	50/50	TP	PCC	
3	24EC403	Communication Systems	3	0	2	4	5	50/50	TP	PCC	
4	24EC404	Linear Integrated Circuits	3	0	2	4	5	50/50	TP	PCC	
5	24EC405	Microprocessors and Microcontrollers	3	0	2	4	5	50/50	TP	PCC	
6	24SD411	Aptitude and Coding Skills -2	0	0	2	1	2	100/0	P	EEC	
7	24EL411	Innovation and Product Development -2 (Conceptualization)	0	0	2	1	2	100/0	EL	EEC	
8		Mandatory Course- 3 (Choose from list)	2	0	0	0	2	0	MC	MC	
		Work Integrated Learning (Industrial Training-II)	Regulation 2024, Clause 4.4								AP
TOTAL							21	29			

SEMESTER V										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24EC501	Digital Signal Processing	3	0	2	4	5	50/50	TP	PCC
2	24EC502	Transmission Lines And Wave Guides	3	0	0	3	3	40/60	T	PCC
3	24EC503	Wireless Communication	3	0	2	4	5	50/50	TP	PCC
	24EC504	VLSI and Chip Design	3	0	2	4	5	50/50	TP	PCC
5		PEC-1	3	0	0	3	3	40/60	T	PEC
6		OEC-1	3	0	0	3	3	40/60	T	OEC
7	24SD511	Advanced Aptitude and Coding Skills 1	0	0	2	1	2	100/0	P	EEC
8	24EL511	Innovation and Product Development-3 (Prototype Development and Testing)	0	0	2	1	2	100/0	EL	EEC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category	
9		Mandatory Course- 4 (Choose from list)	2	0	0	0	2	0	MC	MC	
		Work Integrated Learning (Industrial Problem Solving-I)	Regulation 2024, Clause 4.4								AP
TOTAL						23	30				

SEMESTER VI											
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category	
1	24MG601	Economics, Finance & Accounting	3	0	0	3	3	40/60	T	HSMC	
2	24EC601	Embedded Systems and IoT Design	3	0	2	4	5	50/50	TP	PCC	
3		PEC-2	3	0	0	3	3	40/60	T	PEC	
4		PEC-3	3	0	0	3	3	40/60	T	PEC	
5		OEC-2	3	0	0	3	3	40/60	T	PEC	
6	24SD611	Technical Proficiency -1	0	0	2	1	2	100/0	P	EEC	
	24SD612	Advanced Aptitude and Coding Skills 2	0	0	2	1	2	100/0	P	EEC	
8	24SD613	Corporate Communication Skills	0	0	4	2	4	100/0	P	EEC	
9	24EL611	Innovation and Product Development-4 (Patent Filing / Startup Registration)	0	0	2	1	2	100/0	EL	EEC	
		Work Integrated Learning (Industrial Problem Solving-II)	Regulation 2024, Clause 4.4								AP
TOTAL						21	27				

SEMESTER VII										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24IT402	Artificial Intelligence and Machine Learning	3	0	2	4	5	50/50	TP	PCC
2		PEC-4	3	0	0	3	3	40/60	T	PEC
3		PEC-5	3	0	0	3	3	40/60	T	PEC
4		PEC-6	3	0	0	3	3	40/60	T	PEC
5		OEC-3	3	0	0	3	3	40/60	T	OEC
6		OEC-4	3	0	0	3	3	40/60	T	OEC
7	24EC711	Mini Project	0	0	4	2	4	60/40	P	EEC
8	24SD711	Technical Proficiency -2	0	0	2	1	2	100/0	P	EEC
TOTAL						22	26			

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
SEMESTER VIII										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
1	24EC811	Project Work / Semester Internship	0	0	20	10	20	60/40	P	EEC
2	Personality and Character Development Activity Points (Refer Regulation 2024, Clause 4.2)									AP
3	Work Integrated Learning Activity Points (Refer Regulation 2024, Clause 4.4)									AP
TOTAL						10	20			

Humanities, Social Science and Management Courses (10 Credits)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
1	24HS101	Technical English	2	0	2	3	4	50/50	TP	HSMC
2	24GE102	தமிழர்மரபு / Heritage of Tamils	1	0	0	1	1	40/60	T	HSMC
3	24GE202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	1	0	0	1	1	40/60	T	HSMC
4	24HS301	Universal Human Values	2	0	0	2	2	100/0	T	HSMC
5	24MG601	Economics, Finance & Accounting	3	0	0	3	3	40/60	T	HSMC

Basic Science Courses (20 Credits)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
1	24MA101	Matrices and Calculus	3	1	0	4	4	40/60	T	BSC
2	24PH101	Engineering Physics	3	0	2	4	5	50/50	TP	BSC
3	24CY101	Engineering Chemistry	3	0	2	4	5	50/50	TP	BSC
4	24MA201	Transforms and Partial Differential Equations	3	1	0	4	4	40/60	T	BSC
5	24MA304	Probability and Random Processes	3	1	0	4	4	40/60	T	BSC

Engineering Science Courses (24 Credits)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
1	24GE101	Problem Solving using Python Programming	3	0	2	4	5	50/50	TP	ESC
2	24GE111	Engineering Practices Laboratory	0	0	4	2	4	60/40	P	ESC
3	24CS201	Programming in C	2	0	4	4	5	50/50	TP	ESC
4	24PH202	Physics of Semiconductors and Devices	3	0	0	3	3	40/60	T	ESC
5	24EE202	Circuit Analysis	3	0	2	4	5	50/50	TP	ESC
6	24EE203	Electrical and Instrumentation Engineering	3	0	0	3	3	40/60	T	ESC
7	24CS301	Data Structures	3	0	2	4	5	50/50	TP	ESC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
Professional Core Courses (57 Credits)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24EC301	Digital System Design	3	0	2	4	5	50/50	TP	PCC
2	24EC302	Signals and Systems	3	1	0	4	4	40/60	T	PCC
3	24EC303	Electronic Circuits	3	0	2	4	5	50/50	TP	PCC
4	24EC304	Electromagnetic Fields	3	0	0	3	3	40/60	T	PCC
5	24EC401	Control Systems Engineering	3	0	0	3	3	40/60	T	PCC
6	24EC402	Network and Security	3	0	2	4	5	50/50	TP	PCC
7	24EC403	Communication Systems	3	0	2	4	5	50/50	TP	PCC
8	24EC404	Linear Integrated Circuits	3	0	2	4	5	50/50	TP	PCC
9	24EC405	Microprocessors and Microcontrollers	3	0	2	4	5	50/50	TP	PCC
10	24EC501	Digital Signal Processing	3	0	2	4	5	50/50	TP	PCC
11	24EC502	Transmission Lines And Wave Guides	3	0	0	3	3	40/60	T	PCC
12	24EC503	Wireless Communication	3	0	2	4	5	50/50	TP	PCC
13	24EC504	VLSI and Chip Design	3	0	2	4	5	50/50	TP	PCC
14	24EC601	Embedded Systems and IoT Design	3	0	2	4	5	50/50	TP	PCC
15	24IT402	Artificial Intelligence and Machine Learning	3	0	2	4	5	50/50	TP	PCC

Professional Elective Courses - Vertical-1 (RF Technologies)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24ECE01	RF Transceivers	3	0	0	3	3	40/60	T	PEC
2	24ECE02	Signal Integrity	3	0	0	3	3	40/60	T	PEC
3	24ECE03	Antenna Design	3	0	0	3	3	40/60	T	PEC
4	24ECE04	MICs and RF System Design	3	0	0	3	3	40/60	T	PEC
5	24ECE05	EMI/EMC Pre Compliance Testing	3	0	0	3	3	40/60	T	PEC
6	24ECE06	RFID System Design & Testing	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses - Vertical-2 (Sensor Technologies And IoT)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24ECE07	IoT Processors	3	0	0	3	3	40/60	T	PEC
2	24ECE08	IoT Based System Design	3	0	0	3	3	40/60	T	PEC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
3	24ECE09	Wireless Sensor Network Design	3	0	0	3	3	40/60	T	PEC
4	24ECE10	Industrial IoT and Industry 4.0	3	0	0	3	3	40/60	T	PEC
5	24ECE11	MEMS Design	3	0	0	3	3	40/60	T	PEC
6	24ECE12	Fundamentals of Nanoelectronics	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses - Vertical-3 (High Speed Communications)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24ECE13	Optical Communication & Networks	3	0	0	3	3	40/60	T	PEC
2	24ECE14	Wireless Broad Band Networks	3	0	0	3	3	40/60	T	PEC
3	24ECE15	4G/5G Communication Networks	3	0	0	3	3	40/60	T	PEC
4	24ECE16	Massive MIMO Networks	3	0	0	3	3	40/60	T	PEC
5	24ECE17	Software Defined Networks	3	0	0	3	3	40/60	T	PEC
6	24ECE18	Advanced Wireless Communication Techniques	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses - Vertical-4 (Space Technologies)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24ECE19	Radar Technologies	3	0	0	3	3	40/60	T	PEC
2	24ECE20	Avionics Systems	3	0	0	3	3	40/60	T	PEC
3	24ECE21	Satellite Communication	3	0	0	3	3	40/60	T	PEC
4	24ECE22	Positioning and Navigation Systems	3	0	0	3	3	40/60	T	PEC
5	24ECE23	Remote Sensing	3	0	0	3	3	40/60	T	PEC
6	24ECE24	Rocketry and Space Mechanics	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses - Vertical-5 (Signal Processing)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24ECE25	Advanced Digital Signal Processing	3	0	0	3	3	40/60	T	PEC
2	24ECE26	Speech Processing	3	0	0	3	3	40/60	T	PEC
3	24ECE27	Image Processing	3	0	0	3	3	40/60	T	PEC
4	24ECE28	DSP Architecture and Programming	3	0	0	3	3	40/60	T	PEC
5	24ECE29	Software Defined Radio	3	0	0	3	3	40/60	T	PEC
6	24ADE04	Computer Vision	3	0	0	3	3	40/60	T	PEC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
Professional Elective Courses - Vertical-6 (Bio Medical Technologies)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24BME20	Medical Imaging Systems	3	0	0	3	3	40/60	T	PEC
2	24BME21	Brain Computer Interface and Applications	3	0	0	3	3	40/60	T	PEC
3	24BME24	Wearable Devices	3	0	0	3	3	40/60	T	PEC
4	24BME25	Body Area Networks	3	0	0	3	3	40/60	T	PEC
5	24BME31	Human Assist Devices	3	0	0	3	3	40/60	T	PEC
6	24BME35	Therapeutic Equipment	3	0	0	3	3	40/60	T	PEC

Open Elective Courses (12 Credits)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24CEO01	Environmental Science and Sustainability	3	0	0	3	3	40/60	T	OEC
2	24CEO02	Green Building Design	3	0	0	3	3	40/60	T	OEC
3	24CEO03	Municipal Solid Waste Management	3	0	0	3	3	40/60	T	OEC
4	24CEO04	Sustainable Infrastructure	3	0	0	3	3	40/60	T	OEC
5	24CEO05	Disaster Management	3	0	0	3	3	40/60	T	OEC
6	24CEO06	Geographical Information System	3	0	0	3	3	40/60	T	OEC
7	24CEO07	Environment and Agriculture	3	0	0	3	3	40/60	T	OEC
8	24CEO08	Earthquake Engineering	3	0	0	3	3	40/60	T	OEC
9	24CSO01	Introduction to Algorithms	3	0	0	3	3	40/60	T	OEC
10	24CSO02	Fundamentals of Software Engineering	3	0	0	3	3	40/60	T	OEC
11	24CSO03	Introduction to Cloud Computing	3	0	0	3	3	40/60	T	OEC
12	24CSO04	Principles of Block chain Technology	3	0	0	3	3	40/60	T	OEC
13	24CSO05	Machine Learning using Python for Beginner	3	0	0	3	3	40/60	T	OEC
14	24CSO06	Multimedia and Computer Graphics	3	0	0	3	3	40/60	T	OEC
15	24CSO07	Introduction to App Development	3	0	0	3	3	40/60	T	OEC
16	24CSO08	Data Analytics	3	0	0	3	3	40/60	T	OEC
17	24EEO01	Electrical Safety	3	0	0	3	3	40/60	T	OEC
18	24EEO02	Introduction to E-Vehicle	3	0	0	3	3	40/60	T	OEC
19	24EEO03	Hybrid Energy Technology	3	0	0	3	3	40/60	T	OEC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
20	24EE004	Solar Photovoltaic System	3	0	0	3	3	40/60	T	OEC
21	24EE005	Energy Forecasting, Modeling, and Project Management	3	0	0	3	3	40/60	T	OEC
22	24EE006	Energy Efficient Buildings Design	3	0	0	3	3	40/60	T	OEC
23	24EE007	Government Rules, Opportunities, Testing, and Certification of EV	3	0	0	3	3	40/60	T	OEC
24	24EE008	PLC and Automation	3	0	0	3	3	40/60	T	OEC
25	24MEO01	Introduction to MEMS and NEMS	3	0	0	3	3	40/60	T	OEC
26	24MEO02	Energy Conservation and Management	3	0	0	3	3	40/60	T	OEC
27	24MEO03	Fundamentals of Additive Manufacturing	3	0	0	3	3	40/60	T	OEC
28	24MEO04	Lean Six Sigma	3	0	0	3	3	40/60	T	OEC
29	24MEO05	Agriculture Technology	3	0	0	3	3	40/60	T	OEC
30	24MHO01	Robots and systems in smart Manufacturing	3	0	0	3	3	40/60	T	OEC
31	24MHO02	Robotics and Automation	3	0	0	3	3	40/60	T	OEC
32	24MHO03	Autonomous Mobile Robots	3	0	0	3	3	40/60	T	OEC
33	24MHO04	Introduction to Drone Technology	3	0	0	3	3	40/60	T	OEC
34	24MHO05	Medical Mechatronics	3	0	0	3	3	40/60	T	OEC
35	24MHO06	Sensors and Actuators	3	0	0	3	3	40/60	T	OEC
36	24MHO07	Micro Electro Mechanical System	3	0	0	3	3	40/60	T	OEC
37	24MHO08	Industry 4.0	3	0	0	3	3	40/60	T	OEC
38	24BMO01	Fundamentals of Radiological Equipments	3	0	0	3	3	40/60	T	OEC
39	24BMO02	Biomedical Instrumentation Basics	3	0	0	3	3	40/60	T	OEC
40	24BMO03	Medical Robotics	3	0	0	3	3	40/60	T	OEC
41	24BMO04	Principles of Telemedicine	3	0	0	3	3	40/60	T	OEC
42	24BMO05	Hospital Management	3	0	0	3	3	40/60	T	OEC
43	24BMO06	Bio MEMS and Applications	3	0	0	3	3	40/60	T	OEC
44	24BMO07	Fundamentals of Brain Computer Interface	3	0	0	3	3	40/60	T	OEC
45	24BMO08	Principles of Rehabilitation Engineering	3	0	0	3	3	40/60	T	OEC
46	24CHO01	Industrial pollution prevention and control	3	0	0	3	3	40/60	T	OEC
47	24CHO02	Petroleum Technology	3	0	0	3	3	40/60	T	OEC
48	24CHO03	Green Chemistry and Engineering	3	0	0	3	3	40/60	T	OEC
49	24CHO04	Bio-Energy Technology	3	0	0	3	3	40/60	T	OEC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
50	24CHO05	Carbon capture utilization and storage	3	0	0	3	3	40/60	T	OEC
51	24CHO06	Battery Technology	3	0	0	3	3	40/60	T	OEC
52	24CHO07	Energy Management	3	0	0	3	3	40/60	T	OEC
53	24CHO08	Environmental Audit	3	0	0	3	3	40/60	T	OEC
54	24ITO01	Introductions to Full Stack Web Development	3	0	0	3	3	40/60	T	OEC
55	24ITO02	Introduction to Digital Marketing	3	0	0	3	3	40/60	T	OEC
56	24ITO03	Social Media Marketing	3	0	0	3	3	40/60	T	OEC
57	24ITO04	Ethical Hacking	3	0	0	3	3	40/60	T	OEC
58	24ITO05	Information Storage Management	3	0	0	3	3	40/60	T	OEC
59	24ITO06	Introductions to Cyber Security	3	0	0	3	3	40/60	T	OEC
60	24ITO07	Software Testing Essentials	3	0	0	3	3	40/60	T	OEC
61	24ITO08	Introductions to UI and UX Design	3	0	0	3	3	40/60	T	OEC
62	24ADO01	Introduction to Machine Learning	3	0	0	3	3	40/60	T	OEC
63	24ADO02	Introduction to Artificial Intelligence	3	0	0	3	3	40/60	T	OEC
64	24ADO03	Introduction to Big Data	3	0	0	3	3	40/60	T	OEC
65	24ADO04	Basics of Data Science	3	0	0	3	3	40/60	T	OEC
66	24ADO05	R Programming	3	0	0	3	3	40/60	T	OEC
67	24ADO06	Fundamentals of Deep Learning	3	0	0	3	3	40/60	T	OEC
68	24ADO07	AI in Healthcare Applications	3	0	0	3	3	40/60	T	OEC

Employability Enhancement Courses (24 Credits)										
S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
1	24SD311	Aptitude and Coding Skills -1	0	0	2	1	2	100/0	P	EEC
2	24EL311	Innovation and Product Development -1 (Idea Generation)	0	0	2	1	2	100/0	EL	EEC
3	24SD411	Aptitude and Coding Skills -2	0	0	2	1	2	100/0	P	EEC
4	24EL411	Innovation and Product Development -2 (Conceptualization)	0	0	2	1	2	100/0	EL	EEC
5	24SD511	Advanced Aptitude and Coding Skills 1	0	0	2	1	2	100/0	P	EEC
6	24EL511	Innovation and Product Development-3 (Prototype Development and Testing)	0	0	2	1	2	100/0	EL	EEC
7	24SD611	Technical Proficiency -1	0	0	2	1	2	100/0	P	EEC
8	24SD612	Advanced Aptitude and Coding Skills 2	0	0	2	1	2	100/0	P	EEC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
9	24SD613	Corporate Communication Skills	0	0	4	2	4	100/0	P	EEC
10	24EL611	Innovation and Product Development-4 (Patent Filing / Startup Registration)	0	0	2	1	2	100/0	EL	EEC
11	24EC711	Mini Project	0	0	4	2	4	60/40	P	EEC
12	24SD711	Technical Proficiency -2	0	0	2	1	2	100/0	P	EEC
13	24EC811	Project Work / Semester Internship	0	0	20	10	20	60/40	P	EEC

MANDATORY COURSES -1 & 2

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category	
1	24MC111	Induction Program	3 Weeks							MC	MC
2	24MC201	Environmental Science	2	0	0	0	2	100/0	MC	MC	

MANDATORY COURSES - 3

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
1	24MC301	Introduction to Women and Gender Studies	2	0	0	0	2	100/0	MC	MC
2	24MC302	Elements of Literature	2	0	0	0	2	100/0	MC	MC
3	24MC303	Film Appreciation	2	0	0	0	2	100/0	MC	MC
4	24MC304	Well, Being with Traditional Practices Yoga, Ayurveda and Siddha	2	0	0	0	2	100/0	MC	MC
5	24MC305	History of Science and Technology in India	2	0	0	0	2	100/0	MC	MC
6	24MC306	Political and Economic Thought for a Humane Society	2	0	0	0	2	100/0	MC	MC
7	24MC307	Indian Constitution	2	0	0	0	2	100/0	MC	MC
8	24MC308	Bureau of Indian Standards (BIS)	2	0	0	0	2	100/0	MC	MC

MANDATORY COURSES - 4

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA/ ES	Course Type	Category
1	24MC401	Japanese Language	2	0	0	0	2	100/0	MC	MC
2	24MC402	German Language	2	0	0	0	2	100/0	MC	MC
3	24MC403	Korean Language	2	0	0	0	2	100/0	MC	MC
4	24MC404	French Language	2	0	0	0	2	100/0	MC	MC
5	24MC405	Hindi Language	2	0	0	0	2	100/0	MC	MC
6	24MC406	Industrial Safety	2	0	0	0	2	100/0	MC	MC
7	24MC407	Disaster Risk Reduction and Management	2	0	0	0	2	100/0	MC	MC

S.No.	Course Code	Course	L	T	P	C	Prds. /wk.	CA / ES	Course Type	Category
8	24MC408	State, Nation Building and Politics in India	2	0	0	0	2	100/0	MC	MC

B.E-ELECTRONICS AND COMMUNICATION ENGINEERING
CURRICULUM AND SYLLABI (Regulation 2024)

SEMESTERWISE CREDITS DISTRIBUTION									
Category	I	II	III	IV	V	VI	VII	VIII	Credits
HSMC	4	1	2			3			10
BSC	12	4	4						20
ESC	6	18							24
PCC			15	19	15	4	4		57
PEC					3	9	9		21
OEC					3		6		9
EEC			2	2	2	5	3	10	24
MC									
Total	22	23	23	21	23	21	22	10	165

Semester-I

Course Code	24HS101	Course Name	TECHNICAL ENGLISH	Course Category	TP	Humanities, Social Science and Management Courses	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Science & Humanities	Data Book / Codes Standards	Nil		

Course Objective: <i>The purpose of learning this course is :</i>																													
<ul style="list-style-type: none"> To improve the communicative competence of learners To learn to use basic grammatical structures in suitable contexts To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text To help learners use language effectively in professional contexts To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals 																													
														Program Outcomes (PO)			Program Specific Outcome (PSO)												
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Employ grammar and appropriate terminologies for day-to-day situations													U								2	2	3		2	2		
CO-2:	Understand the nuances within both spoken and written interactions													U								3	2	3		2	2		
CO-3:	Utilize vivid and analytical vocabulary, expressions, and sentence structures													R								2	2	3		2	2		
CO-4:	Read various forms of writing and grasp both their literal and implied interpretations													E								2	2	3		2	2		
CO-5:	Compose various kinds of writing employing suitable structures													AP								2	2	3		2	2		

Unit-1	BASICS OF COMMUNICATION	6 Periods
Grammar – Simple present tense, Present continuous tense, Asking questions (Wh-questions); Vocabulary: One-word substitutions, Synonyms; Writing: Personal profile		
Unit-2	NARRATION	6 Periods
Grammar – Subject – verb agreement, Simple past, Past continuous tense; Vocabulary – Antonyms, Word formation (Prefixes and Suffixes). Writing – Narrative (Event: Festivals, Birthday, personal experience)		
Unit-3	DESCRIPTION	6 Periods
Writing – Definitions, Descriptive writing, Checklists; Grammar: Future tense, Perfect tense, Preposition; Vocabulary: Adjectives and Adverbs		
Unit-4	CLASSIFICATION	6 Periods
Writing – Note-making, Note-taking; Grammar: Connectives, Transition words (linkers); Vocabulary: Contextual vocabulary, Words used Both as Noun and Verb, Classification-related words		
Unit-5	EXPRESSION OF VIEWS	6 Periods
Writing – Letter writing / Email writing (Enquiry / Permission, Letter to Editor); Grammar: Question tags, Indirect questions, Yes / No questions; Vocabulary: Compound words, Phrasal verbs.		
Total Theory: 30 Periods		

List of Experiments	Total Practical: 30 Periods
1. Listening – Telephone conversation & Writing message, gap filling 2. Reading – Telephone message, bio-note; Writing – Personal profile 3. Listening – Travel podcast / Watching a travel documentary 4. Reading – An excerpt from a travelogue, Newspaper Report 5. Writing – Narrative (Event: Festivals, Birthday, and personal experience: Excursion, Sports, Conference, etc.) 6. Listening – Conversation, Radio/TV advertisement, Commentary 7. Reading – A tourist brochure and planning an itinerary, descriptive article / excerpt from literature 8. Listening – Announcements and filling a table, Catalogue, List of Equipments 9. Reading – An article, social media posts and classifying (channel conversion – text to table) 10. Listening – Debate / Discussion; Reading – Formal letters, Letters to the Editor, Opinion articles / Blogs	

	Text Books	References
Learning Resources	1. Using English: A Course book for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015. 2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai, 2011.	1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage, New Delhi, 2008. 2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford, 2007.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%				

Course Code	24MA101	Course Name	MATRICES AND CALCULUS	Course Category	T	Basic Science Courses	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Science and Humanities		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is:*

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines..

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Use the matrix algebra methods for solving practical problems.	U	3	2	2	2								2	2		
CO-2:	Use differential calculus ideas on several variable functions.	R	3	2	2	2								2	2		
CO-3:	Apply different methods of integration in solving practical problems by using Beta and Gamma functions.	AP	3	2	2	2								2	2		
CO-4:	Apply multiple integral ideas in solving areas and volumes problems.	AP	3	2	2	2								2	2		
CO-5:	Apply the concept of vectors in solving practical problems.	AN	3	2	2	2								2	2		

Unit-1	MATRICES	12 Periods
Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues - Cayley-Hamilton theorem (excluding proof) – Diagonalization of matrices - Reduction of Quadratic form to canonical form by using orthogonal transformation - Nature of a Quadratic form - Applications: Stretching of an elastic membrane.		
Unit-2	FUNCTIONS OF SEVERAL VARIABLES	12 Periods
Limit, continuity, partial derivatives – Homogeneous functions and Euler’s theorem - Total derivative – Differentiation of implicit functions - Taylor’s formula for two variables - Errors and approximations – Lagrange’s method of undetermined multipliers - Applications of Maxima and Minima in Temperature problems.		
Unit-3	INTEGRAL CALCULUS	12 Periods
Improper integrals of the first and second kind and their convergence – Differentiation under integrals - Evaluation of integrals involving a parameter by Leibnitz rule –Beta and Gamma functions - Properties – Evaluation of integrals by using Beta and Gamma functions – Error functions.		
Unit-4	MULTIPLE INTEGRALS	12 Periods
Double integrals – Change of order of integration – Double integrals in polar coordinates – Triple integrals – Volume of Solids –Change of variables in double and triple integrals-Area enclosed by plane curves using MATLAB.		
Unit-5	VECTOR CALCULUS	12 Periods
Gradient of a scalar field, directional derivative – Divergence and Curl – Solenoidal and Irrotational vector fields - Line integrals over a plane curve - Surface integrals – Area of a curved surface – Volume Integral - Green’s theorem, Stoke’s and Gauss divergence theorems – Applications and Verification in evaluating line, surface and volume integrals.		
Total:		60 Periods

Learning Resources	Text Books	References
	1. Joel Hass, Christopher Heil, Maurice D. Weir "Thomas' Calculus", Pearson Education., New Delhi, 2018. 2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017. 3. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009. 4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012. 5. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010	1. Erwin Kreyszig "Advanced Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015. 2. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education 2nd Edition, 5th Reprint, Delhi, 2009. 3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24PH101	Course Name	ENGINEERING PHYSICS	Course Category	TP	Basic Science Courses				L	T	P	C
										3	0	2	4

Pre-requisite Courses	Nil.	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Science & Humanities		Data Book / Codes Standards	Nil		

Course Objective: <i>The purpose of learning this course is to:</i>																													
<ul style="list-style-type: none"> • Make the students effectively to achieve an understanding of mechanical properties of materials. • Enable the students to gain knowledge of oscillations, sounds and applications of thermal physics. • Introduce the basics of optics and lasers and its applications. • Equipping the students to successfully understand the importance of quantum physics. • Introduce the significance and structure of crystal physics. 																													
														Program Outcomes (PO)			Program Specific Outcome (PSO)												
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand the important mechanical properties of materials.													U	3	2	2		2				1			2	3		
CO-2:	Analyze and apply the principles of oscillations, sound, and thermal physics to solve real-world problems.													AN	3	2	2		2				1			2	3		
CO-3:	Applying the principles of optics and lasers to analyze and design optical systems and devices.													AP	3	2	2		2				1			2	3		
CO-4:	Apply quantum mechanical principles to analyze and predict the behavior of particles and systems at the atomic and subatomic levels.													AP	3	2		2								2	3		
CO-5:	Understanding and predicting material properties based on crystal structure and symmetry principles.													U	3	2			2							2	3		

Unit-1	MECHANICS OF MATERIALS	9 Periods
Rigid Body – Centre of mass – Rotational Energy - Moment of inertia (M.I)- Moment of Inertia for uniform objects with various geometrical shapes. Elasticity –Hooke’s law - Poisson’s ratio -stress-strain diagram for ductile and brittle materials – uses- Bending of beams – Cantilever - Simply supported beams - uniform and non-uniform bending - Young’s modulus determination- I shaped girders and application in Engineering field –Twisting couple – Shafts. Viscosity – Viscous drag – Surface Tension.		
Unit-2	OSCILLATIONS, SOUND AND THERMAL PHYSICS	9 Periods
Simple harmonic motion - Torsional pendulum -- Damped oscillations –Shock Absorber –Forced oscillations and Resonance –Applications of resonance.- Waves and Energy Transport –Sound waves – Intensity level – Standing Waves - Doppler effect and its applications - Speed of blood flow. Ultrasound – applications - Echolocation and Medical Imaging. Thermal Expansion– Expansion joints – Bimetallic strip – Seebeck effect – thermocouple -Heat Transfer Rate – Conduction – Convection and Radiation.		
Unit-3	OPTICS AND LASERS	9 Periods
Interference - Thin film interference - Air wedge- Applications -Interferometers–Michelson Interferometer -- Diffraction - CD as diffraction grating – Diffraction by crystals - Polarization -polarizers -- Laser – characteristics – Spontaneous and Stimulated emission- population – inversion - Metastable states - optical feedback - Nd-YAG laser, CO2 laser, Semiconductor laser -Industrial and medical applications - Optical Fibers – Total internal reflection – Numerical aperture and acceptance angle – Fiber optic communication – Fiber sensors – Fiber lasers.		

Unit-4	QUANTUM MECHANICS	9 Periods
Black body radiation (Qualitative) – Planck’s hypothesis – Einstein’s theory of Radiation - Matter waves–de Broglie hypothesis - Electron microscope – Uncertainty Principle – The Schrodinger Wave equation (time-independent and time-dependent) – Meaning and Physical significance of wave function - Normalization -Particle in an infinite potential well-particle in a three-dimensional box - Degenerate energy states - Barrier penetration and quantum tunneling - Tunneling microscope and its application in nano field.		
Unit-5	CRYSTAL PHYSICS	9 Periods
Crystal Bonding – Ionic – covalent – metallic and vander Walls’s/ molecular bonding. Crystal systems -unit cell, Bravais lattices, Miller indices - Crystal structures - atomic packing density of BCC, FCC and HCP structures. NaCl, Diamond, Graphite, Graphene, Zincblende and Wurtzite structures – crystal imperfections- point defects - edge and screw dislocations – grain boundaries. Crystal Growth – Czocharalski method – vapor phase epitaxy – Molecular beam epitaxy- Introduction to X-Ray Diffractometer.		
Total Theory: 45 Periods		

List of Experiments	Total Practical: 30 Periods
<ol style="list-style-type: none"> 1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects. 2. Non-uniform bending - Determination of Young’s modulus 3. Uniform bending – Determination of Young’s modulus 4. Simple harmonic oscillations of cantilever. 5. Laser- Determination of the wavelength of the laser using grating 6. Air wedge - Determination of thickness of a thin sheet/wire 7. Optical fibre -Determination of Numerical Aperture and acceptance angle 8. Compact disc- Determination of width of the groove using laser. 9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids. 10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids 11. Post office box -Determination of Band gap of a semiconductor. 12. Photoelectric effect 13. Michelson Interferometer. 14. Melde’s string experiment 15. Experiment with lattice dynamics kit. 	

	Text Books	References
Learning Resources	<ol style="list-style-type: none"> 1. Raymond A. Serway, John W. Jewett, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2013. 2. D. Halliday, R. Resnick and J. Walker, Principles of Physics. John Wiley & Sons, 2011. 3. N. Garcia, A. Damask and S. Schwarz, Physics for Computer Science Students, Springer Verlag, 2012. 4. Alan Giambattista, Betty McCarthy Richardson and Robert C. Richardson, College Physics, McGraw-Hill Higher Education, 2012. 	<ol style="list-style-type: none"> 1. R. Wolfson, Essential University Physics. Volume 1 & 2. Pearson, 2016. 2. D. Kleppner and R. Kolenkow. An Introduction to Mechanics, McGraw Hill Education, 2017. 3. K. Thyagarajan and A. Ghatak. Lasers: Fundamentals and Applications. Springer, 2012.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 				

Course Code	24CY101	Course Name	ENGINEERING CHEMISTRY	Course Category	TP	Basic Science Courses				L	T	P	C
										3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Science & Humanities		Data Book / Codes Standards	NIL	

Course Objective: The purpose of learning this course is :

- To inculcate knowledge on different types of polymers, their properties and preparation techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of different types of corrosion and its control methods.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand and apply basic knowledge on different types of polymeric materials, their properties and various techniques of their fabrication.	U	3	2	1		2			1				2	2		
CO-2:	Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technological applications.	AP	3	3	3		3							2	2		
CO-3:	Proficiently identify corrosion mechanisms, select control methods, and apply protective coatings.	AP	3	3	2	2		2			1			1	2		
CO-4:	Analyze and compare energy sources, discerning characteristics and applications.	AN	3	2	2		3					1			2		
CO-5:	Develop competence in assessing water quality, applying treatment methods, and implementing conditioning techniques.	AP	3	2	2		1		3	2	1			2	2		

Unit-1 POLYMER CHEMISTRY 9 Periods

Introduction: Functionality-degree of polymerization. Classification of polymers (Source, Structure, Synthesis and Intermolecular forces). Mechanism of free radical addition polymerization. Properties of polymers: Tg, tacticity, molecular weight-number average, weight average, viscosity average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

Unit-2 NANO CHEMISTRY 9 Periods

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties (optical, electrical, mechanical, magnetic and catalytic). Types – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, chemical vapour deposition and electrospinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Applications of nanomaterials - medicine, agriculture, electronics and catalysis.

Unit-3 CORROSION AND ITS CONTROL 9 Periods

Introduction to corrosion - chemical and electrochemical corrosions-mechanism of electrochemical and galvanic corrosions-differential aeration corrosion-pitting, water line corrosions, factors influencing corrosion. Corrosion control-material selection and design- - sacrificial anodic protection and impressed current cathodic protection. Protective coatings-metallic coatings (galvanizing, tinning), organic coatings (paints). Paints: Constituents and functions

Unit-4 ENERGY SOURCES 9 Periods

Batteries - Characteristics - types of batteries – primary battery (dry cell), secondary battery (lead acid, lithium-ion-battery)- emerging batteries – nickel-metal hydride battery,

aluminum air battery, batteries for automobiles and satellites - Fuel cells (Types) – H ₂ -O ₂ fuel cell - Supercapacitors-Types and Applications, Renewable Energy:Solar- solar cells, DSSC
Unit-5 WATER TECHNOLOGY 9 Periods
Water – sources and impurities – water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD, BOD and heavy metals. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - demineralization. Municipal water treatment (screening, sedimentation, coagulation, filtration and disinfection-ozonolysis, UV treatment, chlorination), Reverse Osmosis.
Total Theory: 45 Periods

List of Experiments	Total Practical: 30 Periods
<ol style="list-style-type: none"> 1. Estimation of HCl using Na₂CO₃ as primary standards 2. Determination of alkalinity in water sample. 3. Determination of hardness of water by EDTA method. 4. Determination of DO content of water sample by Winkler's method 5. Determination of chloride content of water sample by Argentometric method. 6. Determination of strength of given hydrochloric acid using pH meter. 7. Determination of strength of acids in a mixture of acids using conductivity meter 8. Estimation of iron content of the given solution using potentiometer. 9. Estimation of iron content of the water sample using spectrophotometer (1, 10 - Phenanthroline/thiocyanate method). 10. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer 11. Determination of strength of an acid using conductivity meter. 12. Estimation of nickel content of the given solution by EDTA method 	

	Text Books	References
Learning Resources	<ol style="list-style-type: none"> 1. Jain P. C. & Monica Jain., "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015. 2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012. 3. Dara S.S., "A Textbook of Engineering Chemistry", Chand Publications, 2004. 	<ol style="list-style-type: none"> 1. Sachdeva M.V., "Basics of Nano Chemistry", Anmol Publications Pvt Ltd, 2011. 2. Friedrich Emich, "Engineering Chemistry", Medtech, 2014. 3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science" New AGE International Publishers, 2009.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 				

Course Code	24GE101	Course Name	PROBLEM SOLVING USING PYTHON PROGRAMMING	Course Category	TP	Engineering Science Courses	L	T	P	C
							3	0	2	4

Pre-requisite Courses		Co-requisite Courses		Progressive Courses	
Course Offering Department	Computer Science and Engineering		Data Book / Codes Standards		

Course Objective: *The purpose of learning this course is to:*

- Understand the basics of algorithmic problem solving.
- Learn to solve problems using Python conditionals and loops
- Define Python functions and use function calls to solve problems
- Use Python data structures – lists, tuples, and dictionaries to represent complex data.
- Perform input/output operations with files in Python

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Develop algorithmic solutions to simple computational problems	AP	3	2	2	2	3								3	2	
CO-2:	Develop and execute simple Python programs	AP	3	2	2	2	3								3	2	
CO-3:	Develop Python programs using conditionals and loops for solving problems and decompose a Python program into functions.	AN	3	2	2	2	3								3	2	
CO-4:	Represent compound data using Python lists, tuples, dictionaries etc.	AP	3	2	2	2	3								3	2	
CO-5:	Read and write data from/to files in Python programs	AP	3	2	2	2	3								3	2	

Unit-1 COMPUTATIONAL THINKING AND PROBLEM SOLVING	9 Periods
Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).	
Unit-2 DATA TYPES, EXPRESSIONS, STATEMENTS	9 Periods
Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments.	
Unit-3 CONTROL FLOW, FUNCTIONS, STRINGS	9 Periods
Conditionals: Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.	
Unit-4 LISTS, TUPLES, DICTIONARIES	9 Periods
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension.	
Unit-5 FILES, MODULES, PACKAGES	9 Periods
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages;	
Total Theory: 45 Periods	

Suggested List of Experiments	Total Practical: 30 Periods
<ol style="list-style-type: none"> 1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. 2. Python programming using simple statements and expressions. 3. Scientific problems using Conditionals and Iterative loops. 4. Implementing real-time/technical applications using Lists, Tuples. 5. Implementing real-time/technical applications using Dictionaries. 6. Implementing programs using Functions. 7. Implementing programs using Strings. 8. Implementing programs using written modules and Python Standard Libraries 9. Implementing real-time/technical applications using File handling. 10. Implementing real-time/technical applications using Exception handling. 11. Exploring Pygame tool. 12. Developing a game activity using Pygame. 	

	Text Books	References
Learning Resources	<ol style="list-style-type: none"> 1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016. 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017 	<ol style="list-style-type: none"> 1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021. 2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021. 3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021 4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019. 5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 				

Course Code	24GE111	Course Name	ENGINEERING PRACTICES LABORATORY	Course Category	P	Engineering Science Courses	L	T	P	C
							0	0	4	2

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mechanical Engineering		Data Book / Codes /Standards	Nil	

Course Objective: <i>The purpose of learning this course is to:</i>																														
<ul style="list-style-type: none"> To identify tools, work material and measuring instruments useful for welding, Machining, Plumbing and carpentry To provide exposure to the students with hands on experience on various wiring system To provide exposure to the students with hands on experience on various Electronic Components 																														
														Program Outcomes (PO)			Program Specific Outcome (PSO)													
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Understand the concepts of welding safety protocols, equipment operation essential for successful welding practices in engineering applications.													U	3	2				1	1						2	3		
CO-2:	Make simple metal joints using welding equipment and wooden joints using carpentry tools													AP	3	2				1	1						2	3		
CO-3:	Apply the knowledge of pipeline connections to household fittings.													AP	3	2				1	1						2	3		
CO-4:	Demonstration on centrifugal pump and air conditioning working principles													U	3	2				1	1						2	3		
CO-5:	Apply the skills of basic electrical engineering for house wiring practice													AP	3	2				1	1						2	3		

List of Experiments	60 Periods
<p>1. PLUMBING WORK:</p> <p>a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.</p> <p>b) Preparing plumbing line sketches.</p> <p>c) Laying pipe connection to the suction & delivery side of a pump</p> <p>d) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.</p> <p>2. WOOD WORK:</p> <p>a) Sawing, b) Planing and c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.</p> <p>3. Wood Work Study:</p> <p>a) Studying joints in door panels and wooden furniture b) Studying common industrial trusses using models.</p> <p>4. WELDING WORK:</p> <p>a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. b) Practicing gas welding</p> <p>5. BASIC MACHINING WORK:</p> <p>a) (simple)Turning. b) (simple)Drilling. c) (simple)Tapping.</p> <p>6. ASSEMBLY WORK:</p> <p>a) Assembling a centrifugal pump. b) Assembling an air conditioner</p>	

7. SHEET METAL WORK:
 - a) Making of a square tray
8. FOUNDRY WORK:
 - a) Demonstrating basic foundry operations.
9. ELECTRICAL ENGINEERING PRACTICES
 - a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
 - b) Staircase wiring
 - c) Fluorescent Lamp wiring with introduction to CFL and LED types.
 - d) Energy meter wiring and related calculations/ calibration
 - e) Study of Iron Box wiring and assembly
 - f) Study of Fan Regulator (Resistor type and Electronic type using DIAC/TRIAC/QUADRAC)
 - g) Study of emergency lamp wiring/Water heater
10. ELECTRONIC ENGINEERING PRACTICES- SOLDERING WORK:
 - a) Soldering simple electronic circuits and checking continuity.
11. ELECTRONIC ASSEMBLY AND TESTING WORK:
 - a) Assembling and testing electronic components on a small PCB.
12. ELECTRONIC EQUIPMENT STUDY:
 - a) Study elements of smart phone.
 - b) Assembly and dismantle of LED TV.
 - c) Assembly and dismantle of computer/ laptop

Learning Assessment		
Continuous Learning Assessment (CLA) (60% weightage)		End Semester Examination (40% weightage)
Evaluation of Laboratory Observation, Record (45%)	Model Lab Exam (15%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24GE102	Course Name	தமிழர்மரபு /HERITAGE OF TAMILS	Course Category	T	Humanities, Social Science and Management Courses	L	T	P	C
							1	0	0	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Science & Humanities	Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- Explore the history, significance, and classical status of the Tamil language and analyze the timeless management principles found in Thiruvalluvar's Thirukural.
- Learn about the development of Tamil art and sculpture over time, including temple arts, traditional crafts, and musical instruments.
- Familiarize the students with various Tamil folk dances, performances, and martial arts, and their significance in Tamil culture.
- Get the ancient Tamil way of classifying landscapes and life, their connection to nature, and the trade and conquests of the Chola dynasty.
- Explore the role of Tamils in India's freedom movement, their cultural influence across India, the Self-Respect Movement, and contributions to traditional medicine and literature.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Gain comprehensive knowledge about the linguistic diversity in India and the Dravidian language family and appreciate the classical status of Tamil and its rich literary heritage.	U															
CO-2:	Students will learn about the development of Tamil art and sculpture over time, including temple arts, traditional crafts, and musical instruments.	U															
CO-3:	Students will become familiar with various Tamil folk dances, performances, and martial arts, and their significance in Tamil culture.	U															
CO-4:	Students will understand the ancient Tamil way of classifying landscapes and life, their connection to nature, and the trade and conquests of the Chola dynasty.	U															
CO-5:	Students will learn about the role of Tamils in India's freedom movement, their cultural influence across India, the Self-Respect Movement, and contributions to traditional medicine and literature.	U															

Unit-1 மொழி மற்றும் இலக்கியம் /LANGUAGE AND LITERATURE

3 Periods

இந்தியாவில் உள்ள மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழில் செம்மொழி இலக்கியம் - சங்க இலக்கியத்தின் மதச்சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல்அறம் - திருக்குறளில் மேலாண்மைக் கோட்பாடுகள் - தமிழ் இதிகாசங்கள் மற்றும் தமிழ் நிலத்தில் பௌத்தம் மற்றும் சமணத்தின் தாக்கம் - பக்தி இலக்கியம் ஆழ்வார்களும் நாயன்மார்களும் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கிய வளர்ச்சி - பாரதியார் மற்றும் பாரதிதாசன் பங்களிப்பு
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

Unit-2 மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை/ HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE

3 Periods

<p>நடுகல் முதல் நவீன சிற்பம் - ஐம்பொன்சிற்பங்கள் - பழங்குடியினர் மற்றும் அவர்களின் கைவினைப்பொருட்கள் - கோவில் தேர் செய்யும் கலை - - சுடுமண் சிற்பங்கள், கிராம சிறுதெய்வங்கள், கன்னியாகுமரியில் திருவள்ளுவர் சிலை, இசைக்கருவிகள் தயாரித்தல் - மிருதங்கம், பறை, வீணை, யாழ் மற்றும் நாதஸ்வரம். தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் கோவில்களின் பங்களிப்பு.</p> <p>Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.</p>	
Unit-3	<p>நாட்டுப்புற மற்றும் தற்காப்பு கலைகள்/ FOLK AND MARTIAL ARTS 3 Periods</p> <p>தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியன் கூத்து, ஓயிலாட்டம், தோல் பொம்மலாட்டம், சிலம்பாட்டம், வளரி, புலி நடனம் - தமிழர்களின் தனி மற்றும் குழு விளையாட்டுகள்.</p> <p>Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.</p>
Unit-4	<p>தமிழர்களின் திணைக் கோட்பாடுகள்/THINAI CONCEPT OF TAMILS 3 Periods</p> <p>தமிழக தாவரங்கள் மற்றும் விலங்கினங்கள் & தொல்காப்பியம் மற்றும் சங்க இலக்கியம் குறிப்பிடும் அகம் மற்றும் புறம் பற்றியக் கோட்பாடுகள் - தமிழர்களின் அறக் கோட்பாடுகள் - சங்க காலத்தில் கல்வி மற்றும் எழுத்தறிவு - பண்டைய நகரங்கள் மற்றும் சங்க காலத்தில் துறைமுகங்கள் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - சோழர்களின் வெளிநாட்டு வெற்றி.</p> <p>Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.</p>
Unit-5	<p>இந்திய தேசிய இயக்கத்திற்கும் இந்திய கலாச்சாரத்திற்கும் தமிழர்களின் பங்களிப்பு/CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3 Periods</p> <p>இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பு - இந்தியாவின் பிற பகுதிகளில் தமிழர்களின் கலாச்சார தாக்கம் - சுயமரியாதை இயக்கம் - சுதேச மருத்துவ முறைகளில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள் மற்றும் கையெழுத்துப் பிரதிகள் - தமிழ் புத்தகங்களின் அச்சு வரலாறு.</p> <p>Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.</p>
Total: 15 Periods	

	Text Books	References
Learning Resources	<p>1.தமிழக வரலாறு – மக்களும் பண்பாடும் – கே .கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).</p> <p>2.கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்). கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)</p> <p>3.பொருளை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)</p> <p>4.Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)</p> <p>5.Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.</p>	<p>1.Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).</p> <p>2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)</p> <p>3.Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</p> <p>4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)</p> <p>5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</p> <p>6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.</p>

Learning Assessment	
Continuous Learning Assessment (CLA) (40% weightage)	End Semester Examination

Average of Internal Test (20%)	Critical Thinking Assessment (20%)	(60% weightage)
* The expected levels for Bloom's Taxonomy should be: <ul style="list-style-type: none">- Lower-order thinking skills: not more than 40%- Higher-order thinking skills: not less than 60%		

Course Code	24MC111	Course Name	INDUCTION PROGRAMME	Course Category	P	Humanities and Management Courses	L	T	P	C

Pre-requisite Courses		Co-requisite Courses		Progressive Courses	
Course Offering Department	Science & Humanities (First year)		Data Book / Codes / Standards		

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

“

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don't's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering

/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

Guide to Induction program from AICTE

Semester-II

Course Code	24MA201	Course Name	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	Course Category	T	Basic Science Courses	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Science and Humanities		Data Book / Codes / Standards	Nil	

Course Objective: The purpose of learning this course is:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in a wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand how to solve the given standard partial differential equations.	U	3	3	2										2		
CO-2:	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.	AP	3	3	2	2	1								2		
CO-3:	Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations	AP	3	3	2	2									2		
CO-4:	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.	U	3	3		3	2							1	2		
CO-5:	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.	AN	3	3		2	3							2	2		

Unit-1 PARTIAL DIFFERENTIAL EQUATIONS	12 Periods
Formation of partial differential equations–Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous using MATLAB.	
Unit-2 FOURIER SERIES	12 Periods
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series–Root mean square value–Parseval’s identity–Practical Harmonic analysis in signal processing and Quantum mechanics.	
Unit-3 APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	12 Periods
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction– Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).	
Unit-4 FOURIER TRANSFORMS	12 Periods
Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity- Application of Transform to boundary value Problems in Digital signals.	

Unit-5	Z-TRANSFORMS AND DIFFERENCE EQUATIONS	12 Periods
Z-transforms - Elementary properties – Convergence of Z-transforms – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Applications: Formation of difference equations–Solution of difference equations using Z-transforms.		
		Total: 60 Periods

Learning Resources	Text Books	References
	1.Grewal B.S.,“Higher Engineering Mathematics” 44 th Edition, Khanna Publishers, NewDelhi,2018. 2.Kreyszig E, "Advanced Engineering Mathematics", 10 th Edition, John Wiley, New Delhi, India, 2016 3.Narayanan.S.,Manicavachagom Pillay.T.K and Ramanaiah.G" Advanced Mathematics for Engineering Students", Vol.II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai,1998. 4.Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd,NewDelhi,2018.	1.Andrews. L.C and Shivamoggi.B, "Integral Transforms for Engineers" SPIE Press,1999. 2.Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics",10th Edition, Laxmi Publications Pvt .Ltd,2015. 3.James.G.,"Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, NewDelhi,2016. 4.Wylie.R.C.and Barrett.L.C.,“Advanced Engineering Mathematics“ Tata McGraw Hill Education Pvt. Ltd, 6th Edition, NewDelhi,2012

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom’s Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24CS201	Course Name	PROGRAMMING IN C	Course Category	TP	Professional Core Course	L	T	P	C
							3	0	2	4

Pre-requisite Courses		Co-requisite Courses		Progressive Courses	
Course Offering Department	Computer Science and Engineering		Data Book / Codes Standards		

Course Objective: <i>The purpose of learning this course is to:</i>																
<ul style="list-style-type: none"> • Understand the constructs of C Language and basic C programming • Develop C programs using arrays and strings • Develop modular applications in C using functions and pointers • Develop applications in C using structures and unions • Perform input/output operations and file handling in C 																

														Program Outcomes (PO)				Program Specific Outcome (PSO)												
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Develop simple applications in C using basic knowledge on C Programming constructs													AP	3	2	2	2	3									3	2	
CO-2:	Design and implement applications using arrays and strings													AP	3	2	2	2	3									3	2	
CO-3:	Develop and implement modular applications in C using functions and pointers													AN	3	2	2	2	3									3	2	
CO-4:	Develop applications in C using structures and union													AP	3	2	2	2	3									3	2	
CO-5:	Design applications using sequential and random access file processing.													AP	3	2	2	2	3									3	2	

Unit-1	BASICS OF C PROGRAMMING	9 Periods
Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process		
Unit-2	ARRAYS AND STRINGS	9 Periods
Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search		
Unit-3	FUNCTIONS AND POINTERS	9 Periods
Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions –Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference		
Unit-4	STRUCTURES AND UNION	9 Periods
Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility		

Unit-5 FILE PROCESSING	9 Periods
Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments	
Total Theory: 45 Periods	

Suggested List of Experiments	Total Practical: 30 Periods
<ol style="list-style-type: none"> 1. I/O statements, operators, expressions 2. Decision-making constructs: if-else, goto, switch-case, break-continue 3. Loops: for, while, do-while 4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal 5. Strings: operations 6. Functions: call, return, passing parameters by (value, reference), passing arrays to function. 7. Recursion 8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers 9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions. 10. Files: reading and writing, File pointers, file operations, random access, processor directives. 	

	Text Books	References
Learning Resources	<ol style="list-style-type: none"> 1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016. 2. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2015. 	<ol style="list-style-type: none"> 1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018. 2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. 3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996. 4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013. 5. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
<p>* The expected levels for Bloom’s Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 				

Course Code	24PH202	Course Name	PHYSICS OF SEMICONDUCTORS AND DEVICES	Course Category	T	Basic Science Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Science & Humanities		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is :*

- To equip students with a deep understanding of the electronic properties and behaviors of materials at the atomic and molecular levels.
- To provide students with a detailed understanding of charge carriers in semiconductors and the effects of doping on their properties.
- To impart knowledge on the principles, operation, and applications of PN diodes and bipolar junction transistors (BJTs).
- To provide a comprehensive understanding of the principles, types, and applications of field-effect transistors (FETs).
- To provide in-depth knowledge of advanced semiconductor devices and their specialized applications.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Analyze and predict the electronic properties and behaviors of materials based on their atomic and molecular structures.	AN	3	2		1								2	3		
CO-2:	Analyze the behavior of charge carriers in doped semiconductors and their impact on electronic device performance.	AN	3	2		1	2							2	3		
CO-3:	Understand and analyze the functioning and characteristics of PN diodes and BJTs in electronic circuits.	U	3	2	2	2	2					1		2	3		
CO-4:	Analyze and design electronic circuits using various types of field-effect transistors.	AN	3	2	2	2	2					1		2	3		
CO-5:	Understand and implement advanced semiconductor devices in complex electronic systems.	U	3	2	2	2	2					1		2	3		

Unit-1 ELECTRONIC STATES

9 Periods

Quantum free electron theory - Fermi distribution and energy – Density of states Dynamics of electrons in periodic potential – Electron in a periodic potential – Energy bands in solids–Conductors – Semiconductors – Insulators – application of Tight Binding Approximation – Electron effective mass– the concept of hole – properties of conduction and valence bands.

Unit-2 CARRIERS AND DOPING

9 Periods

Intrinsic concentration – intrinsic Fermi level – n and p type doping – density of carriers in extrinsic semiconductors and their temperature dependence – extrinsic semiconductor Fermi energy level – degenerate and non-degenerate semiconductors – Direct and Indirect band gap semiconductors - band- gap engineering – electrons and holes in quantum wells and superlattices-application.

Unit-3 PN DIODE AND BIPOLAR JUNCTION TRANSISTOR

9 Periods

PN junction diode, current equations, V-I characteristics, Bipolar Junction Transistor- bipolar transistor action, minority carrier, distribution, low frequency common base, current gain, non-ideal effects, equivalent circuits, Ebers Moll Model, Hybrid-pi model, frequency limitations, large signal switching characteristics, Si, Ge and hetero-junction-application.

Unit-4 FIELD EFFECT TRANSISTORS

9 Periods

Two terminal MOS structures, threshold voltage and charge distribution, capacitance-voltage characteristics, MOSFET structures, I-V relationships, transconductance and

substrate effects, frequency limitations, non-ideal effects, MOSFET scaling, threshold voltage modification due to short and narrow channel effects, avalanche breakdown, drain induced barrier effects.

Unit-5	SPECIAL SEMICONDUCTOR DEVICES	9 Periods
SCR, IGBT, LED, LCD, Photo transistor, Opto Coupler, Solar cell, MESFET, Schottky barrier diode- Zener diode-Varactor diode –Tunnel diode-Gallium Arsenide device, application of LASER diode, UJT, LDR.		
Total:		45 Periods

Learning Resources	Text Books	References
	<ol style="list-style-type: none"> 1. R.F.Pierret. Semiconductor Device Fundamentals. Pearson, 2006. 2. D.Neamen and D.Biswas. Semiconductor physics and devices. McGraw Hill Education, 2017. 3. F.H. Mitchell, „ Introduction to Electronics Design” Prentice Hall of India Pvt. Lt, 1995. 4. Robert L. Boylestad, Louis Nashelsky “Electronic devices and circuit theory”, Pearson, 2009. 	<ol style="list-style-type: none"> 1. N.Garcia, A. Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012. 2. Umesh Mishra and Jasprit Singh. Semiconductor Device Physics and Design. Springer,2008. 3. Nandita Dasgupta and Amitava Dasgupta. Semiconductor Devices: Modelling and Technology. PHI Learning Pvt. Ltd. 2004.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom’s Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24EE202	Course Name	CIRCUIT ANALYSIS	Course Category	TP	Engineering Science Courses	L	T	P	C
							2	1	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Electrical And Electronics Engineering		Data Book / Codes Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- Understand the fundamentals of DC circuit analysis, including basic components, Ohm's law, Kirchoff's laws, series and parallel circuits, and analysis techniques such as nodal and mesh analysis.
- Learn network theorems and duality concepts, including Thevenin and Norton equivalent circuits, maximum power transfer theorem, and dual circuits.
- Develop proficiency in sinusoidal steady-state analysis, including phasor representation, impedance, nodal and mesh analysis for AC circuits, and power analysis in AC circuits.
- Gain knowledge of transient analysis and resonance phenomena in RLC circuits, including response to unit-step function, driven circuits, resonance, and quality factor.
- Explore coupled circuits and topology, including magnetically coupled circuits, transformers, and network analysis techniques such as two port networks, T and networks.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Apply fundamental concepts of DC circuit analysis to solve complex circuit problems	AP	3	3	3	2	2		2	1		1		3	3	2	
CO-2:	Demonstrate proficiency in applying network theorems and duality concepts to analyze and design electrical circuits	AP	3	3	3	3	2		2	1		1		3	3	2	
CO-3:	Analyze and interpret sinusoidal steady-state circuits using phasor representation and impedance concepts	AN	3	3	3	3	2		2	1		1		3	3	2	
CO-4:	Evaluate transient analysis and resonance phenomena in RLC circuits to understand their behavior and performance	E	3	3	3	3	2		2	1		1		3	3	2	
CO-5:	Synthesize knowledge of coupled circuits and network analysis to design and optimize complex electrical networks	C	3	3	3	3	2		2	1		1		3	3	2	

Unit-1 DC CIRCUIT ANALYSIS	9 Periods
Basic Components of electric Circuits, Charge and current- Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff's Laws, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.	
Unit-2 NETWORK THEOREM AND DUALITY	9 Periods
Useful Circuit Analysis techniques - Linearity and superposition, Source transformation - Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Duals, Dual circuits.	
Unit-3 SINUSOIDAL STEADY STATE ANALYSIS	9 Periods
Sinusoidal Steady State analysis, Characteristics of Sinusoids, The Phasor- Phasor relationship for R, L, and C- impedance and Admittance, Nodal and Mesh Analysis, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power	

Unit-4	TRANSIENTS AND RESONANCE IN RLC CIRCUITS	9 Periods
Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Parallel Resonance, Series Resonance, Quality Factor and Bandwidth.		
Unit-5	COUPLED CIRCUITS AND TOPOLOGY	9 Periods
Magnetically Coupled Circuits- self and mutual Inductance - Linear Transformer- Ideal Transformer-Two port networks- Z parameters , Y parameters, H parameters, ABCD parameters – Symmetrical properties of T & π networks.		
Total Theory: 45 Periods		

List of Experiments	Total Practical: 15 Periods
<ol style="list-style-type: none"> Simulation and experimental Verifications of KVL & KCL Simulation and experimental Verifications of Thevenin & Norton theorem Simulation and experimental Verifications of Superposition Theorem Simulation and experimental Verifications of maximum power transfer Theorem Determination of Resonance Frequency of Series & Parallel RLC Circuits Transient analysis of RL and RC circuits 	

	Text Books	References
Learning Resources	<ol style="list-style-type: none"> William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9th edition, New Delhi, 2020. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013. 	<ol style="list-style-type: none"> Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai & Sons, New Delhi, 2020. Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 2015. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraw Hill, 2015.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
* The expected levels for Bloom's Taxonomy should be:				
<ul style="list-style-type: none"> Lower-order thinking skills: not more than 40% Higher-order thinking skills: not less than 60% 				

Course Code	24EE203	Course Name	ELECTRICAL AND INSTRUMENTATION ENGINEERING	Course Category	T	Engineering Science Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electrical And Electronics Engineering		Data Book / Codes / Standards	Nil	

Course Objective: <i>The purpose of learning this course is to:</i>																													
<ul style="list-style-type: none"> Impart knowledge in types, construction and working of transformers Impart knowledge in types, construction and working of DC machines Impart knowledge in types, construction and working of AC rotating machines Introduce the functional elements and working of measuring instruments. Introduce the basics of power system and protection schemes 																													
														Program Outcomes (PO)			Program Specific Outcome (PSO)												
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Apply principles of transformer operation and testing to analyze and solve practical engineering problems.													AP	3	2	1	1	2	1	2	-	-	-	-	3	3	2	
CO-2:	Demonstrate proficiency in operating and controlling DC machines for various engineering applications.													AN	3	2	1	1	2	1	2	-	-	-	-	3	3	2	
CO-3:	Analyze and interpret the behavior of AC rotating machines to optimize their performance in engineering systems.													AN	3	2	1	1	2	1	2	-	-	-	-	3	3	2	
CO-4:	Evaluate and apply measurement principles and instrumentation techniques to design and implement effective measurement systems.													E	3	1	1	1	2	1	2	-	-	-	-	3	3	2	
CO-5:	Synthesize knowledge of power systems to design and ensure the safety and efficiency of electrical networks.													C	3	1	1	1	2	1	2	-	-	-	-	3	3	2	

Unit-1	TRANSFORMER	9 Periods
Introduction - Ideal and Practical Transformer – Phasor diagram– Per Unit System – Equivalent circuit- Testing- Efficiency and Voltage Regulation– Three Phase Transformers –Applications- Auto Transformers, Advantages- Harmonics.		
Unit-2	DC MACHINES	9 Periods
Introduction – Constructional Features– Motor and Generator mode - EMF and Torque equation – Circuit Model – Methods of Excitation- Characteristics – Starting and Speed Control – Universal Motor- Stepper Motors – Brushless DC Motors- Applications		
Unit-3	AC ROTATING MACHINES	9 Periods
Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit, Speed Control - Single phase Induction motors -Construction– Types– starting methods. Alternator: Working principle–Equation of induced EMF – Voltage regulation, Synchronous motors- working principle-starting methods – Torque equation.		
Unit-4	MEASUREMENTS AND INSTRUMENTATION	9 Periods
Functional elements of an instrument, Static and Dynamic characteristics, Errors in an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition		
Unit-5	BASICS OF POWER SYSTEMS	9 Periods

Power system structure -Generation, Transmission and distribution, Various voltage levels, Earthing – methods of earthing, protective devices- switch fuse unit- Miniature circuit breaker- Moulded case circuit breaker- Earth leakage circuit breaker, safety precautions and First Aid

Total: 45 Periods

Learning Resources	Text Books	References
	<ol style="list-style-type: none"> 1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017. 2. P. S. Bimbhra, "Electric Machinery", Khanna Publishers, 2nd Edition, 2021. 3. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 2015. 4. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International pvt.ltd.,2003 5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010 	<ol style="list-style-type: none"> 1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 6th Edition 2017. 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2018. 3. M. G. Say, "Performance and design of AC machines", CBS Publishers, First Edition 2008. 4. Sahdev S. K. "Electrical Machines", Cambridge University Press, 2018. 5. Dennis Neitzel, Al Winfield, "Electrical safety Handbook" McGraw-Hill Education, 4th Edition, 2012.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24CS301	Course Name	Data Structures	Course Category	TP	Professional Core Courses				L	T	P	C
										3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Computer Science and Engineering		Data Book / Codes Standards	Nil		

Course Objective: <i>The purpose of learning this course is to:</i>																															
<ul style="list-style-type: none"> • Understand the concepts of ADTs and list operations • Learn linear data structures – Stacks and queues • Understand non-linear data structures – trees and graphs • Understand multiway search tree and graph structures • Understand sorting, searching and hashing algorithms 																															
														Program Outcomes (PO)			Program Specific Outcome (PSO)														
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Develop ADT using arrays and lists													AP	3	2	2	2	3									3	2		
CO-2:	Implement abstract data types with stacks and queues													AP	3	2	2	2	3										3	2	
CO-3:	Develop and implement non-linear data structures using trees													AP	3	2	2	2	3										3	2	
CO-4:	Construct non-linear data structures using multi-way search trees and graphs													AP	3	2	2	2	3										3	2	
CO-5:	Analyze the searching, sorting and hashing algorithms													AN	3	3	2	2	3										3	2	

Unit-1	LISTS	9 Periods
Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists		
Unit-2	STACKS AND QUEUES	9 Periods
Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues		
Unit-3	TREES	9 Periods
Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap		
Unit-4	MULTIWAY SEARCH TREES AND GRAPHS	9 Periods
B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm		
Unit-5	SEARCHING, SORTING AND HASHING TECHNIQUES	9 Periods
Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing		
Total Theory: 45 Periods		

List of Experiments	Total Practical: 30 Periods
1. Array implementation of Stack, Queue and Circular Queue ADTs 2. Implementation of Singly Linked List 3. Linked list implementation of Stack and Linear Queue ADTs 4. Implementation of Polynomial Manipulation using Linked list 5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion 6. Implementation of Binary Search Trees 7. Implementation of AVL Trees 8. Implementation of Heaps using Priority Queues 9. Implementation of Dijkstra's Algorithm 10. Implementation of Prim's Algorithm 11. Implementation of Linear Search and Binary Search 12. Implementation of Insertion Sort and Selection Sort 13. Implementation of Merge Sort	

	Text Books	References
Learning Resources	1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2010. 2. Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007	1. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015. 2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022. 3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Data Structures and Algorithms, 1st edition, Pearson, 2002. 4. Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%				

Course Code	24GE202	Course Name	தமிழரும் தொழில்நுட்பமும் / TAMILS AND TECHNOLOGY	Course Category	T	Humanities, Social Science and Management Courses	L	T	P	C
							1	0	0	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Science & Humanities	Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- Provide a comprehensive understanding of the weaving industry and ceramic technology during the Sangam Age, with a particular focus on Black and Red Ware (BRW) Potteries and the graffiti found on these artifacts..
- Students will gain insight into the cultural, technological, and socio-political contexts that shaped temple constructions..
- Study of the iron and steel industries, coin minting, and bead making, alongside archaeological evidence and literary references Silappathikaram.
- Understand the ancient agricultural practices and irrigation technologies, focusing on various water management systems, animal husbandry, and agro-processing. It also explores ancient knowledge of the sea, including fisheries, pearl and conch diving, and oceanic knowledge.
- Learn the knowledge and skills to engage with modern technologies for the preservation and advancement of the Tamil language.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand the technological and cultural developments of the Sangam Age, particularly in the areas of weaving and ceramics	U															
CO-2:	Appreciate the cultural and technological advancements reflected in the structural designs and materials used.	U															
CO-3:	Understand the technological and industrial advancements in ancient societies, particularly in the areas of metallurgy, shipbuilding, coin minting, and bead making.	U															
CO-4:	Gain the knowledge about the agricultural and irrigation technologies of ancient societies, as well as their maritime knowledge and practices,	U															
CO-5:	Understand the development and application of Scientific Tamil and Tamil computing.	U															

Unit-1 நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் / WEAVING AND CERAMIC TECHNOLOGY 3 Periods

சங்க காலத்தில் நெசவுத் தொழில் - பீங்கான் தொழில்நுட்பம் - கருப்பு மற்றும் சிவப்பு பாத்திரங்கள் (BRW) - மட்பாண்டங்கள் மீது கீறல் குறியீடுகள்.
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

Unit-2 வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம்/ DESIGN AND CONSTRUCTION TECHNOLOGY 3 Periods

சங்க காலத்தில் வீடு வடிவமைத்தல், கட்டுமானம் மற்றும் வீட்டு உபயோகப் பொருட்களின் வடிவமைப்புகள் - சங்க காலத்தில்கட்டுமானப் பொருட்களும் நடுகலலும் -சிலப்பதிகாரத்தில் மேடை பற்றிய பற்றிய விவரங்கள்-மாமல்லபுரத்தின் சிற்பங்கள் மற்றும் கோவில்கள் - சோழர்களின் பெரிய கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் -நாயக்கர் கால கோவில்கள் -மாதிரி கட்டமைப்புகள் பற்றி அறிதல்-மதுரை மீனாட்சி கோயில்- திருமலை நாயக்கர் மஹால் - செட்டி நாடு வீடுகள், இந்தோ - பிரிட்டிஷ் காலத்தில் மதராஸில் உள்ள சரசனிக் கட்டிடக்கலை.

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Unit-3	உற்பத்தி தொழில்நுட்பம் /MANUFACTURING TECHNOLOGY	3 Periods
<p>கப்பல் கட்டும் கலை - உலோகவியல் ஆய்வுகள் - இரும்புத் தொழில் - இரும்பு உருக்குதல், எஃகு - தாமிரம் மற்றும் தங்கம் - வரலாற்றின் ஆதாரமாக நாணயங்கள் - நாணயங்கள் - மணிகள் செய்யும் தொழில்கள் கல் மணிகள் - கண்ணாடி மணிகள் - டெரகோட்டா மணிகள் - ஷெல் மணிகள் / எலும்பு துடிப்புகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் விவரிக்கப்பட்டுள்ள ரத்தினக் கற்கள்.</p> <p>Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beads - Archeological evidences - Gem stone types described in Silappathikaram.</p>		
Unit-4	வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம்/AGRICULTURE AND IRRIGATION TECHNOLOGY	3 Periods
<p>அணை, ஏரி, குளங்கள், மதகு-சோழர் கால குமிழித் தூம்பு முக்கியத்துவம், கால்நடை பராமரிப்பு - கால்நடை பயன்பாட்டுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - விவசாயம் மற்றும் வேளாண் செயலாக்கம் - கடல் அறிவு - மீன்வளம் - முத்து - முத்துக்குளித்தல் - கடல் பற்றிய பண்டைய அறிவு - அறிவு சார்ந்த சமூகம்.</p> <p>Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.</p>		
Unit-5	அறிவியல் தமிழ் & கணினித்தமிழ்/ SCIENTIFIC TAMIL & TAMIL COMPUTING	3 Periods
<p>அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி- தமிழ் நூல்கள் மின்பதிப்பு செய்தல்- தமிழ் மென்பொருள் உருவாக்கம் - தமிழ் இணைய கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணைய தமிழ் அகராதி - சொற்குவைத்திட்டம்.</p> <p>Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.</p>		
Total:		15 Periods

	Text Books	References
Learning Resources	<p>1.தமிழக வரலாறு – மக்களும் பண்பாடும் – கே .கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).</p> <p>2.கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்). கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)</p> <p>3.பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)</p> <p>4.Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)</p> <p>5.Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.</p>	<p>1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).</p> <p>2. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)</p> <p>3.. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</p> <p>4. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)</p> <p>5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</p> <p>6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)</p>

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be:		

- Lower-order thinking skills: not more than 40%
- Higher-order thinking skills: not less than 60%

Course Code	24MC201	Course Name	ENVIRONMENTAL SCIENCE	Course Category	T	Mandatory Course	L	T	P	C
							2	0	0	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Science & Humanities		Data Book / Codes / Standards	Nil	

Course Objective: The purpose of learning this course is :

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of the global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human rights, value education and role of technology in monitoring human and environmental issues.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>			Program Outcomes (PO)												Program Specific Outcome (PSO)		
			BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO-1:	Understand the functions of the environment, ecosystems and biodiversity and their conservation.	U						3	2					2	1		
CO-2:	Analyze the causes and effects of environmental pollution and contribute to the preventive measures in the immediate society.	AN						3	2	1					1		
CO-3:	Identify various natural resources and their contribution to mankind and apply sustainable measures to preserve them for future generations.	AP						3			2			2	1		
CO-4:	Identify the various sustainable measures for environmental protection against climatic changes and apply them for sustainable and societal development.	AP	3		2			3							1		
CO-5:	Demonstrate the knowledge of environmental issues and analyse the effect of population dynamics and role of technology in environmental issues.	U						3	3	2			2		1		

Unit-1 ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

6 Periods

Definition, scope and importance of environment -concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem– Introduction to biodiversity definition: genetic, species and ecosystem diversity –value of biodiversity-hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Unit-2 ENVIRONMENTAL POLLUTION

6 Periods

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies.

Unit-3 NATURAL RESOURCES

6 Periods

Forest resources: Use and over-exploitation, deforestation, Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral

resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

Unit-4 SOCIAL ISSUES AND THE ENVIRONMENT 6 Periods

From unsustainable to sustainable development, rain water harvesting, Environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products.

Unit-5 HUMAN POPULATION AND THE ENVIRONMENT 6 Periods

Population growth, variation among nations – population explosion – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health.

Total: 30 Periods

	Text Books	References
Learning Resources	<ol style="list-style-type: none"> Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers (2018). Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2016). Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004). 	<ol style="list-style-type: none"> R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005). Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

Learning Assessment		
Continuous Learning Assessment (CLA) (100% weightage)		End Semester Examination (0% weightage)
Average of Internal Test (50%)	Critical Thinking Assessment (50%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

III Semester

Course Code	24MA304	Course Name	PROBABILITY AND RANDOM PROCESSES	Course Category	T	PROFESSIONAL CORE COURSE	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	ECE		Data Book / Codes / Standards	STATISTICAL TABLE	

Course Learning Objective (CLO):	<i>The purpose of learning this course is to:</i>																													
CLO-1:	To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering																													
CLO-2:	To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.																													
CLO-3:	To understand the basic concepts of random processes which are widely used in IT fields.																													
CLO-4:	To understand the concept of correlation and spectral densities																													
CLO-5:	To understand the significance of linear systems with random inputs.																													
														Program Specific Outcome (PSO)																
Course Outcomes (CO):	<i>At the end of this course, learners will be able to:</i>														1	2	3													
CO-1:	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.														3	3	0	0	0	0	0	0	0	3	0	0	2	-	-	-
CO-2:	Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.														3	3	0	0	0	0	0	0	0	3	0	0	2	-	-	-
CO-3:	Apply the concept random processes in engineering disciplines.														3	3	0	0	0	0	0	0	0	3	0	0	2	-	-	-
CO-4:	Understand and apply the concept of correlation and spectral densities.														3	3	0	0	0	0	0	0	0	3	0	0	2	-	-	-
CO-5:	The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.														3	3	0	0	0	0	0	0	0	3	0	0	2	-	-	-

Unit-1 – PROBABILITY AND RANDOM VARIABLES	(9+3) Hour
Probability – Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.	
Unit-2 - TWO - DIMENSIONAL RANDOM VARIABLES	(9+3) Hour
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables)	
Unit-3 - RANDOM PROCESSES	(9+3) Hour
Classification – Stationary process – Markov process - Markov chain - Poisson process – Randomtelegraph process.	
Unit-4 - CORRELATION AND SPECTRAL DENSITIES	(9+3) Hour
Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.	
Unit-5 - LINEAR SYSTEMS WITH RANDOM INPUTS	(9+3) Hour
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output	

Learning Resources	<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Ibe, O.C., " Fundamentals of Applied Probability and Random Processes ", 1st Indian Reprint, Elsevier, 2007. 2. Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGrawHill, 4th Edition, New Delhi, 2002. 	<p>REFERENCES:</p> <ol style="list-style-type: none"> 1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", OxfordUniversity Press, New Delhi, 3rd Indian Edition, 2012. 2. Hwei Hsu, "Schaum’s Outline of Theory and Problems of Probability, RandomVariables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004. 3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to SignalProcessing and Communications ", Academic Press, 2004. 4. Stark. H. and Woods. J.W., "Probability and Random Processes with Applications to SignalProcessing ", Pearson Education, Asia, 3rd Edition, 2002. 5. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012
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Learning Assessment							
	<i>Bloom’s Level of Thinking</i>	Continuous Learning Assessment (CLA)				<i>End Semester Examination (60% weightage)</i>	
		<i>CLA-1 Average of Internal Test (20%)</i>		<i>Critical Thinking Assessment (20%)</i>			
		<i>Theory</i>	<i>Practice</i>	<i>Theory</i>	<i>Practice</i>	<i>Theory</i>	<i>Practice</i>

Level 1	<i>Remember</i>	15%	-	15%	-	15%	-
Level 2	<i>Understand</i>	25%	-	20%	-	25%	-
Level 3	<i>Apply</i>	30%	-	25%	-	30%	-
Level 4	<i>Analyze</i>	30%	-	25%	-	30%	-
Level 5	<i>Evaluate</i>	-	-	10%	-	-	-
Level 6	<i>Create</i>	-	-	5%	-	-	-
	<i>Total</i>	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts

Course Code	24EC301	Course Name	Digital System Design	Course Category	TP	Professional Core Courses	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To present the fundamentals of digital circuits and simplification methods
- To practice the design of various combinational digital circuits using logic gates
- To bring out the analysis and design procedures for synchronous and asynchronous Sequential circuits
- To learn integrated circuit families
- To introduce semiconductor memories and related technology

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Use Boolean algebra and simplification procedures relevant to digital logic	U	3	2	2	2	-	2	-	-	-	-	-	3	3	3	3	2
CO-2:	Design various combinational digital circuits using logic gates.	U	-	-	-	-	-	-	-	-	-	-	-	2	1	2	3	2
CO-3:	Analyse and design synchronous sequential circuits.	AN	-	3	3	2	-	2	-	-	-	-	2	2	3	3	2	
CO-4:	Analyse and design asynchronous sequential circuits. .	AN	-	-	-	-	-	-	-	-	-	-	3	2	2	3	1	
CO-5:	Build logic gates and use programmable devices	AP	-	3	3	3	-	-	-	-	-	-	2	2	3	3	2	

Unit-1 BASIC CONCEPTS

9 Periods

Review of number systems-representation-conversions, Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions-Karnaugh map, completely and incompletely specified functions, Implementation of Boolean expressions using universal gates ,Tabulation methods

Unit-2 COMBINATIONAL LOGIC CIRCUITS

9 Periods

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Case study: Digital trans-receiver / 8 bit Arithmetic and logic unit, Parity Generator/Checker, Seven Segment display decoder

Unit-3 SYNCHRONOUS SEQUENTIAL CIRCUITS

9 Periods

Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, lock - out condition circuit implementation - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. Model Development: Designing of rolling display/real time clock

Unit-4 ASYNCHRONOUS SEQUENTIAL CIRCUITS

9 Periods

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits, Design of Hazard free circuits

Unit-5 LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES

9 Periods

Logic families- Propagation Delay, Fan - In and Fan - Out - Noise Margin - RTL, TTL,ECL, CMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL, basic memory, static ROM,PROM,EPROM,EEPROM EAPROM

Total Theory: 45 Periods

List of Experiments

Total Practical: 30 Periods

1. Design of adders and subtractors & code converters.
2. Design of Multiplexers & Demultiplexers.
3. Design of Encoders and Decoders.
4. Design of Magnitude Comparators
5. Design and implementation of counters using flip-flops
6. Design and implementation of shift registers.

	Text Books	References
Learning Resources	M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 5th Edition, 2013.(Unit - I -V)	1. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002. 2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice-Hall of India, 1980. 3. Floyd T.L., "Digital Fundamentals", Charles E. Merrill publishing company, 1982. 4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4 th Edition, 2007.

Learning Assessment

Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	

* The expected levels for Bloom's Taxonomy should be:
 - Lower-order thinking skills: not more than 40%
 - Higher-order thinking skills: not less than 60%

Course Code	24EC302	Course Name	Signals and Systems	Course Category	T	Professional Core Courses				L	T	P	C
										3	1	0	4

Pre-requisite Courses	Matrices and Calculus, Transforms and Partial Differential Equations	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To understand the basic properties of signal & systems
- To analyze continuous-time signals using Fourier series, Fourier transform, and Laplace transform techniques
- To analyze the behavior of continuous-time LTI systems using impulse response, convolution, and transform methods
- To analyze discrete-time signals using DTFT and Z-transform techniques and understand their properties
- To analyze discrete-time LTI systems using convolution, difference equations, and transform techniques

			Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>			BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Classify signals and systems based on their properties and characteristics		AP	3	3	3	-	-	-	-	-	-	-	-	3	3	2	2
CO-2:	Analyze continuous-time signals in the time and frequency domain		AN	3	3	3	3	2	-	-	-	-	-	-	3	3	2	2
CO-3:	Evaluate continuous-time system response using convolution and transform techniques		E	3	3	3	3	3	-	-	-	-	-	-	3	3	2	2
CO-4:	Analyze discrete-time signals in the time and frequency domain		AN	3	3	3	3	2	-	-	-	-	-	-	3	3	2	2
CO-5:	Evaluate discrete-time system response using convolution and transform techniques		E	3	3	3	3	3	-	-	-	-	-	-	3	3	2	2

Unit-1	CLASSIFICATION OF SIGNALS AND SYSTEMS	12 Periods
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals -Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.		
Unit-2	ANALYSIS OF CONTINUOUS TIME SIGNALS	12 Periods
Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties		
Unit-3	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	12 Periods
Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in analysis of CT systems - Systems connected in series / parallel		
Unit-4	ANALYSIS OF DISCRETE TIME SIGNALS	12 Periods
Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT- Z Transform & Properties		
Unit-5	LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS	12 Periods
Impulse response–Difference equations-Convolution sum- Discrete Fourier Transform and Z-Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel		
Total:		60 Periods

Learning Resources	Text Books	References
	1. Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, 2015 (Units I - V). 2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2002.	1. B. P. Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford, 2009. 2. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018. 3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24EC303	Course Name	Electronic Circuits	Course Category	TP	Professional Core Courses				L	T	P	C
										3	0	2	4

Pre-requisite Courses	24PH202 PHYSICS FOR SEMICONDUCTOR AND DEVICES	Co- requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes Standards	Nil		

Course Objective: <i>The purpose of learning this course is to:</i>																														
<ul style="list-style-type: none"> To learn about biasing of BJT and MOSFET circuits To analyze the frequency response of small signal amplifiers To design and analyze single stage and multistage amplifier circuits To study about feedback amplifiers and oscillators principles To study about power amplifiers and power supply 																														
														Program Outcomes (PO)			Program Specific Outcome (PSO)													
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Choose appropriate biasing circuits for BJT and MOSFET discrete amplifiers													AP	3	3	3	3	2	1							1	2	1	1
CO-2:	Design and analyze amplifiers.													AN	3	2	2	3	2	2							1	2	1	1
CO-3:	Analyze frequency response of BJT and MOSFET amplifiers													AN	3	3	3	2	1	2							1	2	1	1
CO-4:	Design and analyze feedback amplifiers and oscillator principles.													AN	3	3	2	3	2	2							1	2	1	1
CO-5:	Design and analyze power amplifiers and supply circuits													AN	3	2	3	2	2	1							1	2	1	1

Unit-1	BIASING OF DISCRETE BJT AND MOSFET	9 Periods
DC Load line, operating point, Various biasing methods for BJT-Design-Stability-Bias compensation, Thermal stability, DC bias analysis of MOSFET circuits.		
Unit-2	AMPLIFIERS	9 Periods
BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS, CG and Source follower – Gain and frequency response- High frequency analysis.		
Unit-3	MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER	9 Periods
Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response – Neutralization methods.		
Unit-4	FEEDBACK AMPLIFIERS AND OSCILLATORS	9 Periods
Advantages of negative feedback – Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.		
Unit-5	POWER AMPLIFIERS AND DC/DC CONVERTERS	9 Periods
Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.		
Total Theory: 45 Periods		

List of Experiments	Total Practical: 30 Periods
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1. Characteristics of PN Junction Diode and Full Wave Rectifier with Filters.
2. Common Emitter input-output Characteristics
3. MOSFET Drain current and Transfer Characteristics
4. Frequency response of CE and CS amplifiers.
5. Frequency response of CB and CC amplifiers.
6. CMRR measurement of Differential Amplifier
7. RC Phase shift oscillator and Wien Bridge Oscillator
8. Hartley Oscillator and Colpitts Oscillator
9. Class A Transformer Coupled Power Amplifier
10. To simulate Frequency response of Cascode Amplifier
11. To simulate Series and Shunt feedback amplifiers-Frequency response, Input and output impedance

	Text Books	References
Learning Resources	1. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3 rd Edition, 2010 2. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7 th Edition, 2014. 2. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5 th Edition, 2010.	1. .Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008. 2. D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3 rd Edition, 1989 3. Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI , 2004.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%				

Course Code	24EC304	Course Name	Electromagnetic Fields	Course Category	T	Professional Core Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Engineering Physics, Physics of Semiconductors and Devices	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To impart knowledge on the basics of static electric field and the associated laws
- To impart knowledge on the basics of static magnetic field and the associated laws
- To give insight into coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To gain the behaviour of the propagation of EM waves
- To study the significance of Time varying fields

			Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>			BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Relate the fundamentals of vector, coordinate system to electromagnetic concepts	AP	3	3	2	2	2	2	1	-	-	-	-	2	3	2	2	
CO-2:	Analyze the characteristics of Electrostatic field	AN	3	3	3	2	2	2	1	-	-	-	1	2	3	2	2	
CO-3:	Interpret the concepts of Electric field in material space and solve the boundary conditions	AN	3	3	3	2	2	2	1	-	-	-	1	2	3	2	2	
CO-4:	Explain the concepts and characteristics of Magneto Static field in material space and solve boundary conditions	AP	3	3	2	2	2	2	1	-	-	-	1	2	3	2	2	
CO-5:	Determine the significance of time varying fields	AP	3	3	2	2	2	2	1	-	-	-	1	2	3	2	2	

Unit-1 INTRODUCTION 9 Periods

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem, Verify theorems for different path, surface and volume.

Unit-2 ELECTROSTATICS 9 Periods

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Electrostatics boundary value problems, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law.

Unit-3 MAGNETOSTATICS 9 Periods

Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Calculation of magnetic field intensity for various current distributions Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques.

Unit-4	TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS	9 Periods
Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields, Observing the Phenomenon of wave propagation with the aid of Maxwell's equations.		
Unit-5	PLANE ELECTROMAGNETIC WAVES	9 Periods
Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary.		
		Total: 45 Periods

Learning Resources	Text Books	References
	1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 2002. 2. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford (Asian Edition), 2015.	1. Edward C. Jordan & Keith G. Balmain, Electromagnetic waves and Radiating Systems, Second Edition, Prentice-Hall Electrical Engineering Series, 2012. 2. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006. 3. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24EL311	Course Name	INNOVATION AND PRODUCT DEVELOPMENT-1 (Idea Generation)	Course Category	P	Employability Enhancement Courses				L	T	P	C
										0	0	2	1
Pre-requisite Courses	Nil		Co-requisite Courses	Nil		Progressive Courses	24EL411						
Course Offering Department				Data Book/Codes/Standards	Nil								

Course Objective: *The purpose of learning this course is:*

The students will understand the concepts of idea generation to develop the market driven product by generating, assessing, and refining creative ideas using structured brainstorming, feedback integration, and feasibility evaluation.

					Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>					<i>BL</i>	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Generate creative ideas to address specific problems through structured brainstorming sessions.				C	3	3	3	3		2			3			2			
CO-2:	Assess and refine initial ideas by integrating feedback and evaluating feasibility.				E	3	3	3	3		2			3			2			
CO-3:	Analyze problems and articulate solutions using the Problem Statement and Value Proposition Canvas.				AN	3	3	3	3		2			3			2			
CO-4:	Conduct SWOT analyses to evaluate strengths, weaknesses, opportunities and threats of their ideas, effectively assessing viability and potential impact.				AN	3	3	3	3		2			3			2			
CO-5:	Construct comprehensive documentation detailing key features, functionalities, and target audience of refined concepts.				U	3	3	3	3		2			3			2			

List of Activity

Team of three to five members preferably from a multi-disciplinary department initiates the innovative Product development journey by fostering creative idea generation and Strategic planning. They shall follow the below activities but not limited to;

Week1-2: Engage in brainstorming sessions with a focus on addressing specific problems or fulfilling particular needs.

Week 3-4: Iterate on the initial ideas by incorporating feedback and assessing their feasibility.

Week 5-6: Make the Problem Statement Canvas and the Value Proposition Canvas to articulate and refine the problem being addressed and the unique value proposition offered by the concept.

Week 7-8: Conduct the SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) of each idea to assess its viability and potential impact.

Week 9-10: Document the refined concept comprehensively, outlining its key features, functionalities, and target audience.

Key Deliverables: Problem Statement Canvas, Value Proposition Canvas and SWOT analysis reports.

Learning Assessment		
Continuous Learning Assessment (CLA) (100 % weightage)		
Report 40%	Presentation 40%	Viva-Voce 20%

IV Semester

Course Code	24EC401	Course Name	Control Systems Engineering	Course Category	T	Professional Core Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Signal Systems	Co-requisite Courses		Progressive Courses	
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes / Standards		

Course Objective: *The purpose of learning this course is to:*

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems
- To learn the various approach for the state variable analysis

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Compute the transfer function of different physical systems.	AP	3	3	3	2	2	2					2	3	3	3	3
CO-2:	Analyse the time domain specification and calculate the steady state error.	AP	3	3	3	3	2	3					2	2	3	3	3
CO-3:	Illustrate the frequency response characteristics of open loop and closed loop system response.	AP	3	2	3	3	2	2					2	3	3	2	3
CO-4:	Analyse the stability using Routh and root locus techniques.	AP	3	3	3	2	2	2					2	2	3	3	3
CO-5:	Illustrate the state space model of a physical system and discuss the concepts of sampled data control systems.	AP	2	2	3	3	2	3					2	3	2	2	3

Unit-1	SYSTEMS COMPONENTS AND THEIR REPRESENTATION	9 Periods
Control System: Terminology and Basic Structure- Feedforward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models.DC and AC servo Systems-Synchronous -Multivariable control system		
Unit-2	TIME RESPONSE ANALYSIS	9 Periods
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system using MATLAB Simulation - type number-PID control-Analytical design for PD, PI,PID control systems.		
Unit-3	FREQUENCY RESPONSE AND SYSTEM ANALYSIS	9 Periods
Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation using MATLAB Simulation.		
Unit-4	CONCEPTS OF STABILITY ANALYSIS	9 Periods
Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept using MATLAB-Guidelines for sketching root locus-Nyquist stability criterion.		
Unit-5	CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS	9 Periods
State variable representation-Conversion of state variable models to transfer functions- Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations.		
Total:		45 Periods

Learning Resources	Text Books	References
	M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.	<ol style="list-style-type: none"> 1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007. 2. K.Ogata, "Modern Control Engineering", PHI, 5th Edition, 2012. 3. S.K.Bhattacharya, "Control System Engineering", Pearson, 3rd Edition, 2013. 4. Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition, 1995.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24EC402	Course Name	Network and Security	Course Category	TP	Professional Core Courses				L	T	P	C
										3	0	2	4

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL	
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes Standards			

Course Objective: <i>The purpose of learning this course is to:</i>																														
<ul style="list-style-type: none"> To learn the Network Models and datalink layer functions. To understand routing in the Network Layer. To explore methods of communication and congestion control by the Transport Layer. To study the Network Security Mechanisms. To learn various hardware security attacks and their countermeasures. 																														
														Program Outcomes (PO)			Program Specific Outcome (PSO)													
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Explain the Network Models, layers and functions.													R	3	2	2	1	2	1							3	2	1	2
CO-2:	Categorize and classify the routing protocols													AN	2	3	3	2	3	1							2	3	2	3
CO-3:	List the functions of the transport and application layer													R	3	2	2	1	2	1							3	2	1	2
CO-4:	Evaluate and choose the network security mechanisms													AN	2	2	3	3	3	2							3	3	3	3
CO-5:	Discuss the hardware security attacks and countermeasures.													U	2	2	2	3	3	2							3	3	3	3

Unit-1	UNIT I NETWORK MODELS AND DATALINK LAYER	9 Periods
Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introduction to Datalink Layer – Error Detection and Correction – Ethernet(802.3)- Wireless LAN – IEEE 802.11, Bluetooth – Flow and Error Control Protocols – HDLC – PPP.		
Unit-2	UNIT II NETWORK LAYER PROTOCOLS	9 Periods
Network Layer – IPv4 Addressing – Network Layer Protocols (IP,ICMP and Mobile IP) Unicast and Multicast Routing – Intradomain and Interdomain Routing Protocols – IPv6 Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6.		
Unit-3	UNIT III TRANSPORT AND APPLICATION LAYERS	9 Periods
Transport Layer Protocols – UDP and TCP Connection and State Transition Diagram - Congestion Control and Avoidance(DEC bit, RED)- QoS - Application Layer Paradigms – Client – Server Programming – Domain Name System – World Wide Web, HTTP, Electronic Mail.		
Unit-4	UNIT IV NETWORK SECURITY	9 Periods
OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption –Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions – Secure Hash Algorithm – Digital Signature Algorithm		
Unit-5	UNIT V HARDWARE SECURITY	9 Periods

Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – Physical Attacks and Countermeasures – Design for Security. Introduction to Blockchain Technology.

Total Theory: 45 Periods

List of Experiments

Total Practical: 75 Periods

1. Implement the Data Link Layer framing methods, (i) Bit stuffing, (ii) Character stuffing
2. Implementation of Error Detection / Correction Techniques (i) LRC, (ii) CRC, (iii) Hamming code
3. Implementation of Stop and Wait, and Sliding Window Protocols
4. Implementation of Go back-N and Selective Repeat Protocols.
5. Implementation of Distance Vector Routing algorithm (Routing Information Protocol).
6. Implementation of Link State Routing algorithm (Open Shortest Path First) with 5 nodes
7. Data encryption and decryption using Data Encryption Standard algorithm.
8. Data encryption and decryption using RSA (Rivest, Shamir and Adleman) algorithm
9. Implement Client Server model using FTP protocol.
10. Implement and realize the Network Topology - Star, Bus and Ring using NS2 / any other Open Source Software.
11. Implement and perform the operation of CSMA/CD and CSMA/CA using NS2 / any other Open Source Software.

	Text Books	References
Learning Resources	1.Behrouz.A.Forouzan, Data Communication and Networking, Fifth Edition, TMH, 2017.(Unit– I,II,III) 2.William Stallings, Cryptography and Network Security, Seventh Edition, Pearson Education, 2017(Unit- IV) 3.Bhunia Swarup, Hardware Security –A Hands On Approach,Morgan Kaufmann, First edition, 2018.(Unit – V).	1.James.F.Kurose and Keith.W.Ross, Computer Networking – A Top – Down Approach, Sixth Edition, Pearson, 2017. 2.Douglas .E.Comer, Computer Networks and Internets with Internet Applications, Fourth Edition, Pearson Education, 2008.

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
* The expected levels for Bloom’s Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%				

Course Code	24EC403	Course Name	Communication Systems	Course Category	TP	Professional Core Courses	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Signals and Systems, Random Process	Co-requisite Courses	Digital Signal Processing	Progressive Courses	Nil
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To introduce the concepts of various amplitude modulations and their spectral characteristics.
- To analyze the concepts of angle modulation
- To study various Digital techniques
- To introduce the importance of sampling & quantization
- To impart knowledge in demodulation techniques

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>			Program Outcomes (PO)												Program Specific Outcome (PSO)		
			BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO-1:	Gain knowledge in amplitude modulation techniques	AP	3	3	3	3	2	1	1				1	1	1		1
CO-2:	Design Angle modulated communication systems	AP	3	3	3	3	2	1	1				1	1	1	1	1
CO-3:	Gain knowledge in digital techniques	AP	3	3	3	3	3	1	1				1	1	1	1	1
CO-4:	Gain knowledge in sampling and quantization	R	3	3	3	3	3	1	1				1	1	1		1
CO-5:	Understand the importance of demodulation techniques	R	3	3	3	3	2	1	1				1	1	1	1	1

Unit-1 AMPLITUDE MODULATION 9 Periods

Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, SSB Generation – Filter and Phase Shift Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope AM techniques, Superheterodyne Receiver.

Unit-2 ANGLE MODULATION 9 Periods

Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation, Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

Unit-3 DIGITAL TECHNIQUES 9 Periods

Pulse modulation Differential pulse code modulation. Delta modulation, Noise considerations in PCM,, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes -Convolutional codes - Viterbi Decoder.

Unit-4 DIGITAL MODULATION SCHEME 9 Periods

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Spectrum Analysis – Occupied bandwidth – Adjacent channel power, EVM, Principle of DPSK.

Unit-5 DEMODULATION TECHNIQUES 9 Periods

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference, Optimum demodulation of digital signals over band-limited channels.

Total Theory: 45 Periods

List of Experiments

Total Practical: 30 Periods

1. AM- Modulator and Demodulator
2. FM – Modulator and Demodulator
3. Pre-Emphasis and De-Emphasis.
4. Signal sampling and TDM.
5. Pulse Code Modulation and Demodulation.
6. Pulse Amplitude Modulation and Demodulation.
7. Pulse Position Modulation and Demodulation and Pulse Width Modulation and Demodulation.
8. Digital Modulation – ASK, PSK, FSK.
9. Delta Modulation and Demodulation.

	Text Books	References
Learning Resources	1. Simon Haykins, "Communication Systems", Wiley, 5th Edition, 2009.(Unit I - V) 2. B.P.Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2011.	1. Wayner Tomasi, Electronic Communication System, 5th Edition, Pearson Education, 2008. 2. D.Roody, J.Coolen, Electronic Communications, 4th edition PHI 2006 3. A.Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, 3rd edition, 1991. 4. B.Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition Pearson Education 2007 5. H P Hsu, Schaum Outline Series - "Analog and Digital Communications" TMH 2006 6. Couch.L., "Modern Communication Systems", Pearson, 2001

Learning Assessment

Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%				

Course Code	24EC404	Course Name	Linear Integrated Circuits	Course Category	TP	Professional Core Courses	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Electronic Devices and Circuits	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes Standards	Nil	

Course Objective: The purpose of learning this course is to:

- To introduce the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To introduce the theory and applications of analog multipliers and PLL
- To learn the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs

														Program Outcomes (PO)				Program Specific Outcome (PSO)		
Course Outcomes (CO): At the end of this course, learners will be able to:					BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Design linear and nonlinear applications of OP – AMPS				U	3	3	3	3	2	3	-	-	-	-	1	2	3	3	3
CO-2:	Design applications using analog multiplier and PLL				AP	3	2	2	3	2	1	-	-	-	-	1	2	3	2	1
CO-3:	Design ADC and DAC using OP – AMPS				AP	3	2	3	2	2	2	-	-	-	-	1	1	2	-	3
CO-4:	Generate waveforms using OP – AMP Circuits				AP	3	2	2	2	3	1	-	-	-	-	1	1	1	-	-
CO-5:	Analyze special function ICs				AN	2	2	3	2	3	2	-	-	-	-	1	1	-	3	3

Unit-1 BASICS OF OPERATIONAL AMPLIFIERS 9 Periods

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier – General operational amplifier stages -and internal circuit diagrams of IC741, DC and AC performance characteristics, slewrate, Open and closed loop configurations –MOSFET Operational Amplifiers – LF155 and TL082.

Unit-2 APPLICATIONS OF OPERATIONAL AMPLIFIERS 9 Periods

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

Unit-3 ANALOG MULTIPLIER AND PLL 9 Periods

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization.

Unit-4 ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9 Periods

Analog and Digital Data Conversions, D/A converter specifications – weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R – 2R Ladder types – switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage-to-Time Conversion – Over-sampling A/D Converters, Sigma – Delta converters.

Unit-5 WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS 9 Periods

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator – Monolithic switching regulator, Low Drop – Out (LDO) Regulators – Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters.

Total Theory: 45 Periods

List of Experiments

Total Practical: 30 Periods

1. RC Integrator and Differentiator circuits using Op-Amp
2. Clippers and Clampers
3. Instrumentation amplifier
4. Active low-pass, High pass & Band pass filters
5. PLL Characteristics and its use as frequency multiplier, clock synchronization
6. R-2R ladder type D-A converter using Op-Amp
7. Tuned Collector Oscillator using SPICE
8. Twin -T Oscillator / Wein Bridge Oscillator using SPICE
9. Double and Stagger tuned Amplifiers using SPICE
10. Bistable Multivibrator using SPICE
11. Schmitt Trigger circuit with Predictable hysteresis using SPICE
12. Analysis of power amplifier using SPICE

	Text Books	References
Learning Resources	1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V) 2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016 (Unit I – V)	1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015 2. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001. 3. S. Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", TMH, 2nd Edition, 4th Reprint, 2016.

Learning Assessment

Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	

* The expected levels for Bloom's Taxonomy should be:
 - Lower-order thinking skills: not more than 40%
 - Higher-order thinking skills: not less than 60%

Course Code	24EC405	Course Name	Microprocessors and Microcontrollers	Course Category	TP	Professional Core Courses	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Digital System Design	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electronics & Communication Engineering		Data Book / Codes Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To study the architecture of 8085, 8086 , 8051 and ARM.
- To study the addressing modes and instruction set of 8085, 8086 8051 and ARM .
- To explore the need and use of Peripherals and Interfacing.
- To develop skill to explore system design technique.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Ability to analyze and develop the assembly language program for microprocessor 8085 and 8086	AP	3	3	2	1	-	-	-	1	-	1	-	-	1		1
CO-2:	Ability to interface peripherals with Microprocessors and Microcontrollers	AN	3	3	2	1	-	-	-	1	-	1	-	-	1	1	1
CO-3:	Ability to analyze and develop the assembly language program for microprocessor 8051	AP	3	3	2	1	1	-	-	1	-	1	-	-	1	1	1
CO-4:	Ability to design and create microcontroller based system	E	3	3	2	1	-	-	-	1	-	1	-	-	1		1
CO-5:	Ability to analyze architecture and develop assembly language program for ARM 32 bit processor	AP	3	3	3	-	3	-	-	1	-	1	-	-	1	1	1

Unit-1 8 - BIT and 16 - BIT MICROPROCESSOR 9 Periods

8085 Architecture, Instruction set, Addressing modes, Interrupts, Timing diagrams, Memory and I/O interfacing. 8086 Architecture, Instruction set and programming, Minimum and Maximum mode configurations.

Unit-2 PERIPHERALS AND INTERFACING 9 Periods

Programmable Peripheral Interface (8255), Keyboard display controller (8279), ADC0808 and DAC0808 Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251).

Unit-3 MICROCONTROLLER 9 Periods

8051 – Architecture, Special Function Registers (SFRs), Instruction set, Addressing modes, Assembly language programming, I/O Ports, Timers / counters, Interrupts and serial communication , Differences between microprocessor and microcontroller.

Unit-4 MICROCONTROLLER BASED SYSTEM DESIGN 9 Periods

Interfacing to: matrix display, (16x2) LCD, high power devices, optical motor shaft encoder, Stepper Motor, DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol.

Unit-5 32- BIT ARM PROCESSOR 9 Periods

RISC Vs CISC Architecture, ARM Processor Architecture, ARM Core data flow model, Barrel Shifter, ARM processor modes and families, pipelining , ARM instruction Set and its Programming.

Total Theory: 45 Periods

List of Experiments

Total Practical: 30 Periods

Assembly Language Programming of 8086:

1. Programs for 8 / 16 bit Arithmetic, Sorting, Searching and String operations
2. Programs for Digital clock, Interfacing ADC and DAC
3. Interfacing and programming 8279, 8259, and 8253.
4. Serial Communication between two microprocessors kits using 8251.
5. Interfacing Stepper Motor, Speed control of DC Motor
6. Parallel communication between two microprocessors kits using Mode 1 and Mode 2 of 8255.
7. Macro assembler Programming for 8086.

8051 based experiments using assembly language and C programming:

8. Programming using Arithmetic, Logical and Bit Manipulation instructions of the 8051 microcontroller.
9. Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller.
10. Interfacing – DAC and ADC and 8051 based temperature measurement
11. Interfacing – LED and LCD
12. Interfacing – Stepper motor and traffic light control system
13. Communication between 8051 Microcontroller kit and PC.
14. Programming ARM processor using Embedded C.

	Text Books	References
Learning Resources	<ol style="list-style-type: none"> 1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Penram International Publishing reprint, 6th Edition, 2017. 2. Douglas V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill, Revised 2 nd Edition 2006, 11th reprint 2015. 	<ol style="list-style-type: none"> 1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education 2008. 12th impression 2018 2. Krishna Kant, "Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096", PHI, 2007, 7th Reprint, 2015. 3. Kenneth J. Ayala., "The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning", 2012. 4. A.K. Ray, K.M. Bhurchandi, "Advanced Microprocessor and Peripherals", Tata McGraw-Hill, 2 nd Edition, 2010. 5. Barry B. Brey, "The Intel Microprocessors Architecture, Programming and Interfacing", Pearson Education, 2007, 2 nd impression, 2010.

Learning Assessment

Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	

* The expected levels for Bloom's Taxonomy should be:

- Lower-order thinking skills: not more than 40%
- Higher-order thinking skills: not less than 60%

Course Code	24EL411	Course Name	INNOVATION AND PRODUCT DEVELOPMENT - 2 (CONCEPTUALIZATION)	Course Category	P	Employability Enhancement Courses							L	T	P	C				
														0	0	2	1			
Pre-requisite Courses	Nil			Co-requisite Courses	Nil			Progressive Courses	24EL511											
Course Offering Department				Data Book/Codes/Standards	Nil															
Course Objective: <i>The purpose of learning this course is to:</i>																				
The students will learn to transform conceptual ideas into tangible designs and viable product concepts with focusing on customer needs and aspirations. This course focuses on the early stages of the product development process, emphasizing ideation, market analysis, conceptual design, and feasibility assessment																				
												Program Outcomes (PO)						Program Specific Outcome (PSO)		
Course Outcomes(CO): <i>At the end of this course, learners will be able to:</i>					BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Enumerate detailed product specifications, including dimensions, materials, software, and technical requirements				C	3	3	3	3	3	2			3			2			
CO-2:	Create sketches or digital renderings to visualize and refine the product design.				C	3	3	3	3	3	2			3			2			
CO-3:	Integrate insights from the Business Model Canvas to align the product concept with the business strategy.				AP	3	3	3	3	3	2			3			2			
CO-4:	Outline prototype development steps and resources with the Prototype Planning Canvas.				AP	3	3	3	3	3	2			3			2			
CO-5:	Determine the key features and functionalities of the MVP with the MVP Canvas, focusing on delivering maximum value to early adopters				AP	3	3	3	3	3	2			3			2			

List of Experiments

Students shall continue their semester 1 ideation to conceptualization focussing on shaping the product concept into a tangible design aligned with customer needs. They shall follow the below activities but not limited to;

Week 1-2: Defining detailed product specifications, covering aspects such as dimensions, materials, Software specifications and technical requirements

Week 3-4: Sketching or digital rendering/wireframe to visualize the design of a product, facilitating communication and idea refinement

Week 5-6: Incorporate insights from the Business Model Canvas to align the product concept with the overall business strategy, considering aspects such as revenue streams, cost structure, and customer segments.

Week 7-8: Utilize the Prototype Planning Canvas to outline the steps and resources required for prototype development, ensuring a systematic and efficient approach.

Week 9-10: Define the key features and functionalities of the Minimum Viable Product (MVP) using the MVP Canvas, focusing on delivering maximum value to early adopters with minimal resources.

Key Deliverables: Detailed product specifications, Initial sketches or digital renderings, Aligned Business Model Canvas, and a Structured Prototype Planning Canvas.

Learning Assessment

Continuous Learning Assessment (CLA) (100 % weightage)

Report 40%	Presentation 40%	Viva Voce 20%
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