



**HINDUSTAN**  
INSTITUTE OF TECHNOLOGY & SCIENCE  
(DEEMED TO BE UNIVERSITY)

**B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING**  
**(Duration: 4 Years)**

**REGULATION 2022**  
**(in line with NEP 2020)**

**REGULATION, CURRICULUM and SYLLABUS**  
**(Applicable for students admitted from 2024 onwards)**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**SCHOOL OF ENGINEERING AND TECHNOLOGY**  
**HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE**



## **MOTTO, VISION, MISSION AND VALUE STATEMENT OF INSTITUTE**

### **Motto**

To Make Every Man a Success and No Man a Failure.

### **Vision**

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

### **Mission**

- To create an ecosystem for learning and world class research.
- To nurture a sense of creativity and innovation.
- To instill highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

### **Value Statement**

Integrity, Innovation, Internationalization

## **DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

### **VISION**

To be a premier academic centre for quality education to meet the industrial standards and research in diverse areas of Electronics and Communication Engineering with social commitment.

### **MISSION**

- M1: To impart adequate engineering knowledge to transform students into highly professional engineers as well as good researchers.
- M2: To develop their interdisciplinary skills as per the need of the industry and society.
- M3: To inculcate Entrepreneurship and lifelong learning skills among the students with ethics and social commitment.

### **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

- PEO-I** : Graduates will be nurtured to become successful professionals suitable for cutting - edge communication technologies to meet the societal needs.
- PEO-II** : Graduates will exhibit creative multidisciplinary skills to cater the needs of digital revolution through industry enhanced training and design projects.
- PEO-III** : Graduates will focus towards sustainable electronic product development with entrepreneurship skills through ethical attitude and effective collaborative learning practices.
- PEO-IV** : Graduates will conduct problem-solving investigations on issues and concerns in the emerging areas of electronics and communication engineering

### **PROGRAMME OUTCOMES (PO's)**

**Engineering Graduates will be able to:**

- PO1** : **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2** : **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3** : **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.
- PO4** : **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.

- PO5** : **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.
- PO6** : **The Engineer & 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.
- PO7** : **Environment & Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8** : **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9** : **Individual & Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10** : **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.
- PO11** : **Project Management & 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.
- PO12** : **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: (PSO's)**

**Graduates of B. Tech ECE Engineering students will be able to**

**PSO1** : Able to analyze and design the advanced Communication and Digital Systems.

**PSO2** Able to analyze, design and validate the systems using hardware and software tools pertaining to VLSI and Signal Processing.

**PSO3** Able to apply interdisciplinary programming languages to develop, analyze and test the recent automation and autonomous systems.

**PEOs and POs:**

B. Tech ECE Engineering Program Outcomes (POs) leading to the achievements of the objectives (PEOs) are summarised in the following table.

Programme Educational Objectives (PEOs)	Programme Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
I	2	1	2	2	2	2	1	1	3	1	2	3	2	3	3
II	3	2	2	1	2	1	2	2	2	1	1	2	3	2	2
III	2	1	3	2	3	2	1	1	2	2	2	3	2	3	3
IV	3	2	2	1	2	1	2	2	1	1	2	2	3	2	2

YEAR 1	SEMESTER 1	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
		1	Matrices and Calculus	2.8	2.6	1.6	1.4	1.6	-	-	-	-	-	-	1.4	1.6	1.6	1.4
		2	Engineering Physics	3	3	1.4	1.4	1.8	-	-	-	2.6	-	-	2.2	1.4	1.4	2
			OR															
			Engineering Materials	3	2	1.4	-	-	-	1.6	-	-	-	-	2	1.6	1.6	1.6
		3	Communication Skills	-	-	-	-	-	-	-	1.4	0.4	2.8	1.8	2	1.2	1.4	1.4
			OR															
			Personality Development and Soft Skills	-	-	-	-	-	-	-	1.4	0.4	2.8	1.8	2	1.2	1.2	1.4
		4	Programming Fundamentals using C	2.4	2.4	2.4	1.2	1	1.4	-	1.2	1	0.8	0.8	1.2	1.8	1.4	1.4
			OR															
			Engineering Graphics and Computer Aided Design	2.4	1.4	1.2	-	1.6	-	-	1.4	1.6	1.8	-	2	1	1	0.8
		5	Design Thinking	1.4	1.2	1.6	-	1.8	2.8	2.8	2	2.4	2.4	0.8	2	2.4	2.6	2.6
		6	Engineering Practices Lab	3	2	-	2	-	1	-	-	-	-	-	-	2.3	2.3	1.3
			OR															
			Fab Lab for Circuit Engineering	1.4	1.4	1.6	1.6	1.4	-	-	-	-	-	-	1.4	1.6	1.6	1.6
		7	Outreach (NCC) – Level I #	-	-	-	-	-	-	-	-	-	3	-	-	--		-
			OR															
			Outreach (NSS, Y's Men, Rotaract) – Level I #	-	-	-	-	-	-	-	-	-	3	-	-	--	-	-
		8	Tamil (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Hindi (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Telugu (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			OR															
			French (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-

			German (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Spanish (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Korean (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Mandarin (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Japanese (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			OR															
			Universal Human Values	-	-	-	-	-	1	2	3	1	-	-	-	-	-	-
	9		Tamil Culture and Technology	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-

YEAR 1	SEMESTER 2	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
		1	Analytical Mathematics	3	3	2	1	2	-	-	-	-	-	-	2	3	2	0
		2	Engineering Physics	3	3	1.4	1.4	1.8	-	-	-	2.6	-	-	2.2	1.4	2	2
			OR															
		3	Engineering Materials	3	2	1.4	-	-	-	1.6	-	-	-	-	2	1.6	1.6	1.6
			Communication Skills	-	-	-	-	-	-	-	1.4	0.4	2.8	1.8	2	1.2	-1.2	1.4
			OR															
		4	Personality Development and Soft Skills	-	-	-	-	-	-	-	1.4	0.4	2.8	1.8	2	1.2	1.4	1.4
			Electric Circuits and Machines	3	2.8	2.2	0.8	1.8	0	0	0	0	0	0	1	1.6	2.4	0
		5	Programming Fundamentals using C	2.4	2.4	2.4	1.2	1	1.4	-	1.2	1	0.8	0.8	1.2	1.8	1.4	1.4
			OR															
			Engineering Graphics and Computer Aided Design	2.4	1.4	1.2	-	1.6	-	-	1.4	1.6	1.8	-	2	1	1	0.8
		6	Engineering Practices Lab	3	2	-	2	-	1	-	-	-	-	-	-	2.3	2	1.3
			OR															
			Fab Lab for Circuit Engineering	1.4	1.4	1.6	1.6	1.4	-	-	-	-	-	-	1.4	1.6	1.6	1.6

		7	Outreach (NCC) – Level 2 #	-	-	-	-	-	-	-	-	-	3	-	-	--	-	-
			OR															
			Outreach (NSS, Y's Men, Rotaract) – Level 2 #	-	-	-	-	-	-	-	-	-	3	-	-	--	-	-
		8	Tamil (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Hindi (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Telugu (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			OR															
			French (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			German (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Spanish (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Korean (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Mandarin (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			Japanese (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-	-
			OR															
			Universal Human Values	-	-	-	-	-	1	2	3	1	-	-	-	-	-	-
		9	Mandatory Course I															
			Mandatory Course I is a Non-credit course (Student shall select one course from the list given under Mandatory Course I)															

YEAR 2	SEMESTER 3	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
		1	Partial Differential Equations and Transforms	3	3	2	2	2	-	-	-	-	-	-	-	1.4	1.4	1.6
		2	Advanced Academic Writing	-	-	2	2	-	-	-	2.6	2	3	2	3	1.2	1.2	1.6
		3	Analog Electronics	2	2	3	1	1	1	0	0	0	0	2	1	3	2	1
		4	Digital System Design	3	3	3	0	2	0	0	1	2	0	0	2	3	1	0



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YEAR 3	SEMESTER 5	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
		1	Public Speaking	-	-	-	-	-	-	-	-	1.2	3	-	2	-	-	0.6
		2	Digital Signal Processing	2.8	2.6	1.4	1	2.2	1.8	0	2	2	0	1	1.8	1.6	1.8	0.4
		3	Communication Systems	1.4	1.8	1.6	0.6	0.2	0	0	0	0.6	0	0	0.6	1	1.2	1
		4	Control Systems	3	3	3	1.4	3	0.4	0.4	0	0	0	1	2	3	2	0
		5	Department Elective-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6	Non-Department Elective-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		7	Design Project – 3	3	3	3	2	3	2	2	3	3	3	3	1	0	0	2
		8	Entrepreneurship	2.75	2.5	1.75	2.5	2.25	2.75	1.75	1.5	2.75	2.5	2	3	2.5	2.5	3
		9	Internship -2 (to be evaluated in 5 <sup>th</sup> semester. To be carried out in summer after 4 <sup>th</sup> semester))	1	1	0	0	2	1	0	1	2	2	2	1	1	1	

YEAR 3	SEMESTER 6	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
		1	English for Competitive Examinations	-	-	-	-	-	-	0.4	0.4	0.8	3	0.8	-	-	0.6	0.6
		2	Antenna and Wave Propagation	3	2.6	2.8	1.2	2	1.4	1	0	0	1.2	0	1.8	3	0.4	0.4
		3	Automated Test Engineering for Electronics	3	3	1.6	0.4	0.4	0.4	0.4	0	0	0	0	0	1	1	1
		4	Computer Networks	2.75	0	2	1.4	1.4	1	0.2	0	0	0	0	1.2	3	0	0
		5	Department Elective-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6	Non-Department Elective-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		7	Case Study / Field Study / Product study	3	3	3	3	2	-	1	-	2	3	3	0.8	2	2	2

		8	Design Project – 4	3	3	2	2	3	2	2	3	3	3	3	1	3	3	3
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YEAR 4	SEMESTER 7	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
		1	Verbal Reasoning and Interview Skills	-	0.8	1.2	1.2	-	1.6	-	-	2	3	1	3	-	-	-
		2	Optical and Microwave Engineering.	3	1.8	2.4	1	1.4	0	0	0	0	0	0	1	3	1	1
		3	Machine Learning and Artificial Intelligence	3	2.8	2.4	2.8	2.2	0.6	1.2	0.6	0.6	1.8	0	1.6	1	1.4	1.4
		4	Next Generation Wireless Networks	3	3	2	3	3	2	2	2	2	2	3	2	3	3	3
		5	Department Elective-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6	Non-Department Elective-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		7	Research Methodology & IPR	2.4	2.8	1.2	1.2	3	2.4	1.8	2	2.2	2.6	2	3	2	2	2
		8	Project Phase - 1	3	3	2	3	3	2	2	2	2	2	3	2	3	3	3

YEAR 4	SEMESTER 8	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
		1	Project Phase - 2	3	3	2	3	3	2	2	2	2	2	3	2	3	3	3

**DEPARTMENT ELECTIVE COURSES: VERTICALS**

	Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5	Vertical 6	Vertical 7
SEM	Embedded System	Communication System and Signal Processing	VLSI Technology	SOFTWARE AND SYSTEM MODELLING	Underwater Communication and Sensors	Specialization in Electronics Manufacturing Technology	Specialization in Data Science
III	IDE Based Programming and its applications	Linear and Electronic Switching Circuits	Verilog HDL	Data Structures and Algorithms with C	Introduction to Ocean engineering	Tools, Components, equipment for Electronics Manufacturing	Statistics for Data Science using Python
	Interfacing Techniques for General Purpose Processors	Electronic Instrumentation	DSP Processor and Architecture	Circuit Simulation Using Pspice		Consumer and Industrial Electronics	
IV	Embedded System Software	Fundamentals of Nanoscience	Digital System Design Using FPGA Board	Object Oriented Programming Languages with C++	Ocean Acoustics	PCB Design, Layout and Placement	Machine Learning and Data Visualization
	Robotics and Control	Opto Electronic Devices	Semiconductor Modelling	PCB Design – Idea to Product		1D Simulation	
V	System Design Using Raspberry Pi Processor	Neural Networks	Analog VLSI	Advanced Python Programming	Nano Electronic Devices and Sensors	Design for Manufacturability	Data Analytics using R
	Embedded Automotive Systems	Virtual and Augmented Reality	ASIC Design	Optimization Techniques		Electronic Product Design – Industrial case study	Industrial Process Mining
VI	Wearable Sensors and Devices	Wireless Adhoc Sensor Networks	Low Power VLSI	RF Components and System Design	Underwater Robotics	PCB Design Verification	Data Science for Communication Networks
	IOT and its applications	Satellite and RADAR Communication	VLSI Signal Processing	Embedded C Programming		Electronic Packaging	Cloud and Distributed Computing for Data Analytics

VII	Electronic Standards, Codes and Specifications	Smart Antennas	System on Chip Design	Foundation of Quantum Computing	Marine Navigational Systems	Reliability on Electronic Systems	Deep Learning for Data Analytics
	Security Issues in IOT	High Speed Communication Networks	CAD for VLSI	Speech and Image Processing		Future trends in Electronics Manufacturing	Security in Data Science

#### VERTICAL 1: EMBEDDED SYSTEM

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	IDE Based Programming and its applications	3	2	3	2	2	3	3	2	3	3	3	3	3	3	3
2	Interfacing Techniques for General Purpose Processors	3	1	2	1	1	2	3	2	1	1	1	3	3	3	3
3	Embedded System Software	1.4	-	1.2	-	-	1.2	1.4	-	-	-	1.4	1.2	1.2	1.6	1.6
4	Robotics and Control	0.6	0.4	0.6	-	0.6	0.2	-	-	-	-	-	-	1	1.2	1.2
5	System Design Using Raspberry Pi Processor	2.2	2.2	1.8	2.8	2.2	2	1.8	1.6	1.6	2	1.8	1.8	3	3	3
6	Embedded Automotive Systems	3	2	3	2	2	3	3	2	3	3	3	3	3	3	3
7	Wearable Sensors and Devices	3	1	2	1	1	2	3	2	1	1	1	3	3	3	3
8	IOT and its applications	1.4	-	1.2	-	-	1.2	1.4	-	-	-	1.4	1.2	1.2		1.6
9	Electronic Standards, Codes and Specifications	0.6	0.4	0.6	-	0.6	0.2	-	-	-	-	-	-	1		1.2
10	Security Issues in IOT	2.2	2.2	1.8	2.8	2.2	2	1.8	1.6	1.6	2	1.8	1.8	3		3

#### VERTICAL 2: COMMUNICATION SYSTEM AND SIGNAL PROCESSING

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Linear and Electronic Switching Circuits	2.6	2.6	2.6	2.4	1.6	1	0.4	-	-	-	0.6	0	2.6	3	2.2
2	Electronic Instrumentation	1.8	2	1.2	2.2	0.4	0.6	0.4	1.2	0.4	1.4	1	1.4	1.4	3	1.6

3	Fundamentals of Nanoscience	2.6	2.6	2.6	2.4	1.6	1	0.4	-	-	-	0.6	-	2.6	1.6	2.2
4	Opto Electronic Devices	2.6	2.6	2.6	2.4	1.6	1	0.4	-	-	-	0.6	-	2.6	1.2	2.2
5	Neural Networks	2.6	1.2	2.2	-	-	2.4	2.8	-	-	-	1	2.6	1.8	3	2
6	Virtual and Augmented Reality														3	
7	Wireless Adhoc Sensor Networks	2.2	2.2	1.8	2.8	2.2	2	1.8	1.6	1.6	2	1.8	1.8	3	3	3
8	Satellite and RADAR Communication	0.6	0.4	0.6	-	0.6	0.2	-	-	-	-	-	1.4	1.4		1.6
9	Smart Antennas	1.6	1.2	1.4	1.2	-	1.8	1.2	-	1.2	2	1	1.6	1.6		1.2
10	High Speed Communication Networks	1.8	2	1.2	2.2	0.4	0.6	0.4	1.2	0.4	1.4	1	1.4	1.4		1.6

#### VERTICAL 3: VLSI TECHNOLOGY

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Verilog HDL	3	3	-	0.8	1.4	-	-	-	3	-	-	3	1.4	1.6	2.2
2	DSP Processor and Architecture	2.4	2.4	-	0.8	1.4	-	-	-	2.2	-	-	2.4	1.4	1.2	1.6
3	Digital System Design Using FPGA Board	3	3	-	0.8	1.4	-		-	3	-	-	3	1.4	2	2.2
4	Semiconductor Modelling	2.6	1.2	2.2	-	-	2.4	2.8	-	-	-	1.4	2.6	2.4	1.8	2.2
5	Analog VLSI	2.6	2.4	2.4	2.4	-	-	-	-	-	1.8	1.2	2.4	2.4	3	2
6	ASIC Design	1.4	0.8	1.4	0.8	1	0.2	-	-		-	-	1.4	1.4	1.6	
7	Low Power VLSI	1	1	1	1	2	2	2	2	2	2	1	1	1	1	3
8	VLSI Signal Processing	3	1.4	2	1.4	1	1.2	-	1.2	-	-	1	1	1	1	1.6
9	System on Chip Design	2.6	1.4	2.2	2.4	2.4	-	-	-	-	-	1.4	2.6	2.4	1.8	1.2
10	CAD for VLSI	2.6	1.4	2	3	1	2	2.4	0	0	0	1.4	2.6	2.4	2	1.6

#### VERTICAL 4: SOFTWARE AND SYSTEM MODELLING

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Data Structures and Algorithms with C	2.6	2.2	2.6	2	2.6	1.4	1.4	-	1.4	2.4	1.6	2	1.6	1.6	2.2
2	Circuit Simulation Using Pspice	3	2.8	3	2.8	3	2	2.8	2.8	2	3	2.4	-	1.4	1.2	1.6
3	Object Oriented Programming Languages with C++	1.4	1.6	1.4	1.2	2.6	0.6	-	-	2.4	1.4	2.4	1.4	1.4	1.4	2.2
4	PCB Design – Idea to Product	2.4	2.6	1.8	1.6	1.4	1.2	1.4	-	1.4	-	1.4	1.4	1.2	1.4	2.2
5	Advanced Python Programming	2.6	1.4	1.4	1.4	2.4	-	-	-	-	-	-	2.6	2.4	1.8	2
6	Optimization Techniques	3	3	3	3	2	2	2	2	1	1	1	1	3	3	
7	RF Components and System Design	1.6	1.2	1.4	-	0.2	-	-	-	-	0.4	-	1.4	1.4	1.2	3
8	Embedded C Programming	3	2.2	1.6	1.4	2.8	2.6	2.6	1.6	2.4	2.4	1.8	1.6	3	2	1.6
9	Foundation of Quantum Computing	2.2	2.6	2.2	2.8	2.4	2.2	2	2	1.8	2	1.8	2.2	3	3	1.2
10	Speech and Image Processing	3	3	3	3	2	2	2	2	2	2	1	1	3	3	1.6

**VERTICAL 5: UNDERWATER COMMUNICATION AND SENSORS**

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Introduction to Ocean engineering	2.6	2.2	2.6	2	2.6	1.4	1.4	-	1.4	2.4	1.6	2	1.6	1.6	1.6
2	Ocean Acoustics	3	2.8	3	2.8	3	2	2.8	2.8	2	3	2.4	-	1.4	1.2	2.2
3	Nano Electronic Devices and Sensors	1.4	1.6	1.4	1.2	2.6	0.6	-	-	2.4	1.4	2.4	1.4	1.4	1.4	2.2
4	Underwater Robotics	2.4	2.6	1.8	1.6	1.4	1.2	1.4	-	1.4	-	1.4	1.4	1.2	1.4	2
5	Marine Navigational Systems	2.6	1.4	1.4	1.4	2.4	-	-	-	-	-	-	2.6	2.4	1.8	1.8

**VERTICAL 6: SPECIALIZATION IN ELECTRONICS MANUFACTURING TECHNOLOGY**

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
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1	Tools, Components, equipment for Electronics Manufacturing	2.6	2.2	2.6	2	2.6	1.4	1.4	-	1.4	2.4	1.6	2	1.6	1.6	1.6
2	Consumer and Industrial Electronics	3	2.8	3	2.8	3	2	2.8	2.8	2	3	2.4	-	1.4	1.2	2.2
3	PCB Design, Layout and Placement	1.4	1.6	1.4	1.2	2.6	0.6	-	-	2.4	1.4	2.4	1.4	1.4	1.4	2.2
4	1D Simulation	2.4	2.6	1.8	1.6	1.4	1.2	1.4	-	1.4	-	1.4	1.4	1.2	1.4	1.4
5	Design for Manufacturability	2.6	1.4	1.4	1.4	2.4	-	-	-	-	-	-	2.6	2.4	1.8	1.2
6	Electronic Product Design – Industrial case study	3	3	3	3	2	2	2	2	1	1	1	1	3	3	2.4
7	PCB Design Verification	1.6	1.2	1.4	-	0.2	-	-	-	-	0.4	-	1.4	1.4	1.2	1.2
8	Electronic Packaging	3	2.2	1.6	1.4	2.8	2.6	2.6	1.6	2.4	2.4	1.8	1.6	3	2	2.4
9	Reliability on Electronic Systems	2.2	2.6	2.2	2.8	2.4	2.2	2	2	1.8	2	1.8	2.2	3	3	3
10	Future trends in Electronics Manufacturing	3	3	3	3	2	2	2	2	2	2	1	1	3	3	1.4

#### NON DEPARTMENT ELECTIVES

##### NON DEPARTMENT ELECTIVE-1

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Arduino Programming and Interfacing	3	2.4	-	-	3	2	2.8	2	3	2	-	-	2.8	2.8	2.8
2	Electronics in media Studies	1.8	1.8	0.2	1.8	0.4	1.8	0.4	0.2	0.6	-	0.2	1.8	1.4	1.4	1.4
3	Smart Health Care Systems	3	3	3	3									3	3	3
4	Introduction to Bio Inspired Robots	3	2	2	2.6	2.6	3	3	1	2	1	1.4	3	3	3	3

##### NON DEPARTMENT ELECTIVE- 2



Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Programming and Application using Matlab	2.6	2	2	2.6	2.6	3	3	1	2	1	1.4	3	3	3	2.8
2	Ocean Sensor Technology	2	-	2	-	-	2	3	-	-	-	-	3	-	-	1.4
3	Neural Networks and Fuzzy Logic	3	2	2	2.6	2.6	3	3	1	2	1	1.4	3	3	3	3
4	Medical Imaging, Signals and Informatics	3	1	2	1	1	2	3	2	1	1	1	3	3	3	3

#### NON DEPARTMENT ELECTIVE-3

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Fun with Electronics - PBL	2.2	2.2	1.8	2.8	2.2	2	1.8	1.6	1.6	2	1.8	1.8	3	3	3
2	Flexible Electronics	1.8	2	1.2	2.2	0.4	0.6	0.4	1.2	0.4	1.4	1	1.4	1.4	1.6	1.6
3	Radar Communication	2.6	1.4	2	3	-	-	-	-	-	-	1.4	2.6	2.4	2	2
4	Introduction to 5G Technology and IOT	0.8	0.8	0.4	0.6	0.4	0.4	0.2	0.2	-	0.2	-	-	0.8	1	1

#### NON DEPARTMENT ELECTIVE- 4

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	Music Signal Processing	3	2	-	1	2	-	2.6	-	-	-	2.6	-	2.2	-	-
2	Space Electronics	0.6	0.4	0.6	-	0.6	0.2	-	-	-	-	-	-	1	1.2	1.2
3	Project Management for Engineers	2.6	2.6	2.6	2.4	1.6	1	0.4	-	-	-	0.6	-	2.6	2.2	2.2
4	AI & ML in Oceanography	3	1.4	2	1.4	1	1.2	-	1.2	-	-	1	1	1	1	1

## B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING

### GENERAL COURSE STRUCTURE & THEME

#### A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

**B. Range of Credits:** In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 160 credits, we have adopted 165 credits.

**C. Structure of UG Program:** The structure of UG program shall have essentially the following categories of courses with the breakup of credits as given:

S. No.	Course Category	Course Category	Breakup of Credits
1.	HS	Humanities & Social Science Courses	16
2.	BS	Basic Science Courses	24
3.	ES	Engineering Science Courses	15
4.	PC	Program Core Courses	61
5.	DE	Department Elective Courses	15
6.	NE	Non Department Elective Courses	12
7.	EEC	Employment Enhancement Courses	22
8.	MC	Mandatory Courses	*
TOTAL			165
9.	HN	Honors Courses	12
10.	MN	Minors Courses	9

\*Non Credit Course

#### CURRICULUM COURSE DISTRIBUTION (BASED ON CREDITS)

Semester	HS	BS	ES	PC	DE	NE	EEC	Total Credits per semester
1	6	8	8					22
2	5	8	5	4				22
3	1	4	2	10	3		2	22
4	1	4		10	3	3	1	22
5	1		2	10	3	3	2	21
6	1			13	3	3	1	21
7	1		2	10	3	3	3	22
8							13	13
Total Credits	16	24	19	57	15	12	22	165

#### CURRICULUM COURSE DISTRIBUTION (BASED ON COURSE COUNT)

Semester	HS	BS	ES	PC	DE	NE	EEC	MC	Total Courses per semester
1	4	2	2	1					9
2	3	2	2	1				1	9
3	1	1	1	3	1		2	1	10
4	1	1		3	1	1	1	1	9
5	1		1	3	1	1	2		9
6	1			4	1	1	1		8
7	1		1	3	1	1	1		8
8							1		1
<b>Total Courses</b>	<b>12</b>	<b>6</b>	<b>8</b>	<b>17</b>	<b>5</b>	<b>4</b>	<b>8</b>	<b>3</b>	<b>63</b>

MC : Mandatory Course

**CREDIT COUNT**

Semester	Credit Count
1	21
2	21
3	22
4	24
5	22
6	20
7	22
8	13
	165

**B. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING**

**CURRICULUM FRAMEWORK FOR SEMESTERS I TO VIII**

FRAMEWORK OF CURRICULUM R2022 (in line with NEP 2020)									
SEMESTER – I									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	EMA51001	Matrices and Calculus	3	0	2	4	2	5
2	BS	Any One Course to be Opted		3	0	2	4	2	5
		EPH51001	Engineering Physics						
		ECT51001	Engineering Materials						
3	HS	GLS51018	Professional Communication	3	0	0	1	1	3
4	ES	Any One Course to be Opted		2	0	2	3	2	4
		ECS51009	Programming Fundamentals using C						
		OR							
		EME51001	Engineering Graphics and Computer Aided Design						
5	ES	EGE51002	Design Thinking	2	0	2	3	2	4
6	ES	Any One Course to be Opted		0	0	4	2	2	4
		EGE51406	Engineering Practices Lab						
		EGE51409	Fab Lab for Circuit Engineering						
7	HS	Any One Course to be Opted (Outreach)		0	0	2	1	4	2
		GGE51401	Outreach (NCC) – Level I #						
		GGE51402	Outreach (NSS, Y’s Men, Rotaract) – Level I #						
		Any One Course to be Opted (Indian / foreign language)							
8	HS	GLS51008	Tamil (Regional Language)	2	0	0	2	2	2
		GLS51009	Hindi (Regional Language)						
		GLS51010	Telugu (Regional Language)						
		GLS51011	French (Foreign Language)						
		GLS51012	German (Foreign Language)						
		GLS51013	Spanish (Foreign Language)						
		GLS51014	Korean (Foreign Language)						
		GLS51015	Mandarin (Foreign Language)						
		GLS51016	Japanese (Foreign Language)						
		OR							
		GGE51001	Universal Human Values						
9	HS	GLS51017	Tamil Culture and Technology	1	0	0	1	2	1
			Total	16	0	14	21	19	30

# Students should choose Level I and Level II of same outreach course in the semester 1 and 2 respectively.

SEMESTER – II									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	EMA51002	Analytical Mathematics	3	0	2	4	2	5
2	BS	Any One Course to be Opted		3	0	2	4	2	5
		EPH51001	Engineering Physics						
		ECT51001	Engineering Materials						
3	HS	Any One Course to be Opted		3	0	0	1	1	3
		GLS51019	Advanced Communication Skill						
		GLS51002	Personality Development and Soft Skills						
4	PC	EEC51001	Electric Circuits and Machines	3	0	2	4	2	5
5	ES	Any One Course to be Opted		2	0	2	3	2	4
		ECS51009	Programming Fundamentals using C						
		OR							
		EME51001	Engineering Graphics and Computer Aided Design						
6	ES	Any One Course to be Opted		0	0	4	2	2	4
		EGE51406	Engineering Practices Lab						
		EGE51409	Fab Lab for Circuit Engineering						
7	HS	Any One Course to be Opted		0	0	2	1	4	2
		GGE51403	Outreach (NCC) – Level II #						
		GGE51404	Outreach (NSS, Y's Men, Rotaract) – Level II #						
8	HS	Any One Course to be Opted (Indian / Foreign language)		2	0	0	2	2	2
		GLS51008	Tamil (Regional Language)						
		GLS51009	Hindi (Regional Language)						
		GLS51010	Telugu (Regional Language)						
		GLS51011	French (Foreign Language)						
		GLS51012	German (Foreign Language)						
		GLS51013	Spanish (Foreign Language)						
		GLS51014	Korean (Foreign Language)						
		GLS51015	Mandarin (Foreign Language)						
		GLS51016	Japanese (Foreign Language)						
		OR							
		GGE51001	Universal Human Values						
9	MC	*****	Mandatory Course I Mandatory Course I is a Non-credit course (Student shall select one course from the list given under Mandatory Course I)	3	0	0	-	2	3
			Total	18	0	15	22	19	33

# Students should choose Level I and Level II of same outreach course in the semester 1 and 2 respectively.

FRAMEWORK OF CURRICULUM R2022 (in line with NEP 2020)									
SEMESTER – III									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	EMA51003	Partial Differential Equations and Transforms	3	1	0	4	2	4
2	HS	GLS51400	Public Speaking and Group Discussion	0	0	3	1	1	3
3	PC	EEC51002	Analog Electronics	3	0	2	4	2	5
4	PC	EEC51003	Digital System Design	2	0	2	3	2	4
5	PC	EEC51004	Electromagnetic Fields and Transmission Lines	2	1	0	3	2	3
6	DE	EEC515**	Department Elective-1	2	0	2	3	2	4
7	ES	GGE51003	Environmental Science and Sustainable Development	2	0	0	2	2	2
8	EEC	EEC51800	Design Project – 1	0	0	2	1	6	2
9	EEC	EEC51801	Internship -1 (To be carried out in summer after 2 <sup>nd</sup> semester and evaluated in 3 <sup>rd</sup> semester)	#	#	#	1	2	0
10	MC	*****	Mandatory Course II Mandatory Course II is a Non-credit course (Student shall select one course from the list given under Mandatory Course II)	3	0	0	*	2	3
Total				17	2	11	22	23	30
SEMESTER – IV									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	EMA51008	Random Process	3	1	0	4	2	4
2	HS	GLS51004	Professional Editing and Project Writing	2	0	0	1	1	2
3	PC	EEC51005	Signals and Systems	3	0	2	4	2	5
4	PC	EEC51006	VLSI Design	2	0	2	3	2	4
5	PC	EEC51007	Microcontroller for Embedded System Design (Industry Collaborated Course)	2	0	2	3	2	4
6	DE	EEC515**	Department Elective-2	2	0	2	3	2	4
7	NE	Exx517**	Non-Department Elective-1	2	0	2	3	2	4
8	EEC	EEC51802	Design Project – 2	0	0	2	1	6	2

9	HS	ETP51853	Personality Development and Soft Skill Techniques	0	0	3	2	1	3
10	MC	*****	Mandatory Course III Mandatory Course III is a Non-credit course (Student shall select one course from the list given under Mandatory Course III)	3	0	0	*	2	3
<b>Total</b>				<b>19</b>	<b>1</b>	<b>15</b>	<b>24</b>	<b>22</b>	<b>35</b>

FRAMEWORK OF CURRICULUM R2022 (in line with NEP 2020)									
SEMESTER – V									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	HS	ETP51852	Logical Reasoning and Verbal Ability	1	0	2	1	1	3
2	HS	ETP51855	Problem Solving using Quantitative Techniques	1	0	2	1	1	3
3	PC	EEC51008	Digital Signal Processing	3	0	2	4	2	5
4	PC	EEC51009	Communication Systems	2	0	2	3	2	4
5	PC	EEC51010	Control Systems	2	1	0	3	2	3
6	DE	EEC515**	Department Elective-3	2	0	2	3	2	4
7	NE	Exx517**	Non-Department Elective-2	2	0	2	3	2	4
8	EEC	EEC51803	Design Project – 3	0	0	2	1	6	2
9	ES	EGE51004	Entrepreneurship	2	0	0	2	6	2
10	EEC	EEC51804	Internship -2 (to be evaluated in 5 <sup>th</sup> semester. To be carried out in summer after 4 <sup>th</sup> semester))	#	#	#	1	0	0
<b>Total</b>				<b>15</b>	<b>1</b>	<b>14</b>	<b>22</b>	<b>24</b>	<b>30</b>
SEMESTER – VI									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	MC	ETP51854	Professional Skill and Ethics	0	0	3	*	2	3
2	PC	EEC51011	Antenna and Wave Propagation	2	1	2	4	2	5
3	PC	EEC51012	Automated Test Engineering for Electronics	2	0	2	3	2	4
4	PC	EEC51013	Computer Networks	2	0	2	3	2	4

5	DE	EEC515**	Department Elective-4	2	0	2	3	2	4
6	NE	Exx517**	Non-Department Elective-3	2	0	2	3	2	4
7	PC	EEC51014	Electronics System Design(Case Study / Field Study / Product study)	2	0	2	3	6	4
8	EEC	EEC51805	Design Project – 4	0	0	2	1	6	2
<b>Total</b>				<b>12</b>	<b>1</b>	<b>17</b>	<b>20</b>	<b>24</b>	<b>30</b>

FRAMEWORK OF CURRICULUM R2022 (in line with NEP 2020)									
SEMESTER – VII									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	HS	GLS51006	English for Competitive Examinations	0	0	2	1	1	2
2	PC	EEC51015	Optical and Microwave Engineering.	2	1	2	4	2	5
3	PC	EEC51016	Machine Learning and Artificial Intelligence	2	0	2	3	2	4
4	PC	EEC51017	Next Generation Wireless Networks	2	0	2	3	2	4
5	DE	EEC515**	Department Elective-5	2	0	2	3	2	4
6	NE	Exx517**	Non-Department Elective-4	2	0	2	3	2	4
7	ES	EGE51005	Research Methodology & IPR	2	0	0	2	2	2
8	EEC	EEC51806	Project Phase 1	0	0	6	3	6	6
<b>Total</b>				<b>12</b>	<b>1</b>	<b>18</b>	<b>22</b>	<b>19</b>	<b>31</b>
SEMESTER – VIII									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	EEC	EEC51807	Project Phase - 2	0	0	26	13	10	26
<b>Total</b>				<b>0</b>	<b>0</b>	<b>26</b>	<b>13</b>	<b>10</b>	<b>26</b>
<b>Total Credits for the Program</b>							<b>165</b>		



**MANDATORY COURSES I**

SEMESTER – II									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	MC	GGE51011	Introduction to Women and Gender Studies	3	0	0	*	2	3
2	MC	GGE51012	Public and Personal Administration	3	0	0	*	2	3
3	MC	GGE51013	Constitution of India	3	0	0	*	2	3
4	MC	EGE51006	Law for Engineers	3	0	0	*	2	3
5	MC	GGE51015	Indian Knowledge System (IKS)	3	0	0	*	2	3

**MANDATORY COURSES II**

SEMESTER – III									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	MC	GGE51021	Traditional Indian Systems of Medicine and Therapies	3	0	0	*	2	3
2	MC	GGE51022	History of Science and Technology in India	3	0	0	*	2	3
3	MC	GGE51023	Political and Economic Thought for a Humane Society	3	0	0	*	2	3
4	MC	GGE51024	State, Nation-Building and Politics in India	3	0	0	*	2	3
5	MC	GGE51025	Industrial Safety	3	0	0	*	2	3

**MANDATORY COURSES III**

SEMESTER – IV									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	MC	GGE51031	Principles of Management	3	0	0	*	2	3
2	MC	GGE51032	Human Resource Management	3	0	0	*	2	3
3	MC	GGE51033	Green Technology	3	0	0	*	2	3
4	MC	GGE51034	Industrial Management	3	0	0	*	2	3
5	MC	GGE51035	Fintech and Financing new Business	3	0	0	*	2	3

**MANDATORY COURSES IV**

SEMESTER – VI									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	MC	ETP51854	Profesional Skill and Ethics	0	0	3	*	2	3

**DEPARTMENTAL ELECTIVES**

SL. NO	SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	III	DE -1	EEC51500	Integrated Software based Programming <sup>1</sup>	2	0	2	3	2	4
2	III	DE -1	EEC51501	Interfacing Techniques for General Purpose Processors <sup>1</sup>	2	0	2	3	2	4
3	III	DE -1	EEC51502	Linear and Electronic Switching Circuits <sup>2</sup>	2	0	2	3	2	4
4	III	DE -1	EEC51503	Electronic Instrumentation <sup>2</sup>	2	0	2	3	2	4
5	III	DE -1	EEC51504	Verilog HDL <sup>3</sup>	2	0	2	3	2	4
6	III	DE -1	EEC51505	DSP Processor and Architecture <sup>3</sup>	2	0	2	3	2	4
7	III	DE -1	EEC51506	Data Structures and Algorithms with C <sup>4</sup>	2	0	2	3	2	4
8	III	DE -1	EEC51507	Circuit Simulation Using Pspice - Project based learning <sup>4</sup>	2	0	2	3	2	4
9	III	DE -1	EEC51508	Introduction to Ocean engineering <sup>5</sup>	2	0	2	3	2	4
10	III	DE -1	EEC51509	Tools, Components, equipment for Electronics Manufacturing <sup>6</sup>	2	0	2	3	2	4
11	III	DE -1	EEC51510	Consumer and Industrial Electronics <sup>6</sup>	2	0	2	3	2	4

SL. NO	SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	IV	DE -2	EEC51511	Embedded System Software <sup>1</sup>	2	0	2	3	2	4
2	IV	DE -2	EEC51512	Robotics and Control <sup>1</sup>	2	0	2	3	2	4
3	IV	DE -2	EEC51513	Fundamentals of Nanoscience <sup>2</sup>	2	0	2	3	2	4

4	IV	DE -2	EEC51514	Opto Electronic Devices <sup>2</sup>	2	0	2	3	2	4
5	IV	DE -2	EEC51515	Digital System Design Using FPGA Board <sup>3</sup>	2	0	2	3	2	4
6	IV	DE -2	EEC51516	Semiconductor Modelling <sup>3</sup>	2	0	2	3	2	4
7	IV	DE -2	EEC51517	Object Oriented Programming Languages with C++ <sup>4</sup>	2	0	2	3	2	4
8	IV	DE -2	EEC51518	PCB Design – Idea to Product <sup>4</sup>	2	0	2	3	2	4
9	IV	DE -2	EEC51519	Ocean Acoustics <sup>5</sup>	2	0	2	3	2	4
10	IV	DE -2	EEC51520	PCB Design, Layout and Placement <sup>6</sup>	2	0	2	3	2	4
11	IV	DE -2	EEC51521	1D Simulation <sup>6</sup>	2	0	2	3	2	4

SL. NO	SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	V	DE-3	EEC51522	System Design Using Raspberry Pi Processor <sup>1</sup>	2	0	2	3	2	4
2	V	DE-3	EEC51523	Embedded Automotive Systems <sup>1</sup>	2	0	2	3	2	4
3	V	DE-3	EEC51524	Neural Networks <sup>2</sup>	2	0	2	3	2	4
4	V	DE-3	EEC51525	Virtual and Augmented Reality <sup>2</sup>	2	0	2	3	2	4
5	V	DE-3	EEC51526	Analog VLSI <sup>3</sup>	2	0	2	3	2	4
6	V	DE-3	EEC51527	ASIC Design <sup>3</sup>	2	0	2	3	2	4
7	V	DE-3	EEC51528	Advanced Python Programming <sup>4</sup>	2	0	2	3	2	4
8	V	DE-3	EEC51529	Optimization Techniques for Signal Processing <sup>4</sup>	2	0	2	3	2	4
9	V	DE-3	EEC51530	Nano Electronic Devices and Sensors <sup>5</sup>	2	0	2	3	2	4
10	V	DE-3	EEC51531	Design for Manufacturability <sup>6</sup>	2	0	2	3	2	4
11	V	DE-3	EEC51532	Electronic Product Design – Industrial case study <sup>6</sup>	2	0	2	3	2	4

SL. NO	SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	VI	DE -4	EEC51533	Wearable Sensors and Devices <sup>1</sup>	2	0	2	3	2	4

2	VI	DE -4	EEC51534	IOT and its applications <sup>1</sup>	2	0	2	3	2	4
3	VI	DE -4	EEC51535	Wireless Adhoc Sensor Networks <sup>2</sup>	2	0	2	3	2	4
4	VI	DE -4	EEC51536	Satellite and RADAR Communication <sup>2</sup>	2	0	2	3	2	4
5	VI	DE -4	EEC51537	Low Power VLSI <sup>3</sup>	2	0	2	3	2	4
6	VI	DE -4	EEC51538	VLSI Signal Processing <sup>3</sup>	2	0	2	3	2	4
7	VI	DE -4	EEC51539	RF Components and System Design <sup>4</sup>	2	0	2	3	2	4
8	VI	DE -4	EEC51540	Embedded C Programming <sup>4</sup>	2	0	2	3	2	4
9	VI	DE -4	EEC51541	Underwater Robotics - PBL <sup>5</sup>	2	0	2	3	2	4
10	VI	DE -4	EEC51542	PCB Design Verification <sup>6</sup>	2	0	2	3	2	4
11	VI	DE -4	EEC51543	Electronic Packaging <sup>6</sup>	2	0	2	3	2	4

SL. NO	SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	VII	DE -5	EEC51544	Electronic Standards, Codes and Specifications <sup>1</sup>	2	0	2	3	2	4
2	VII	DE -5	EEC51545	Security Issues in IOT <sup>1</sup>	2	0	2	3	2	4
3	VII	DE -5	EEC51546	Smart Antennas <sup>2</sup>	2	0	2	3	2	4
4	VII	DE -5	EEC51547	High Speed Communication Networks <sup>2</sup>	2	0	2	3	2	4
5	VII	DE -5	EEC51548	System on Chip Design <sup>3</sup>	2	0	2	3	2	4
6	VII	DE -5	EEC51549	CAD for VLSI <sup>3</sup>	2	0	2	3	2	4
7	VII	DE -5	EEC51550	Foundation of Quantum Computing <sup>4</sup>	2	0	2	3	2	4
8	VII	DE -5	EEC51551	Speech and Image Processing <sup>4</sup>	2	0	2	3	2	4
9	VII	DE -5	EEC51552	Marine Navigational Systems <sup>5</sup>	2	0	2	3	2	4
10	VII	DE -5	EEC51553	Reliability on Electronic Systems <sup>6</sup>	2	0	2	3	2	4
11	VII	DE -5	EEC51554	Future trends in Electronics Manufacturing <sup>6</sup>	2	0	2	3	2	4

### NON-DEPARTMENTAL ELECTIVES

LIST OF NON-DEPARTMENTAL ELECTIVES									
Non-Department Elective-1									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
4	NE	EEC51700	Arduino Programming and Interfacing	2	0	2	3	0	4
4	NE	EEC51701	Electronics in media Studies	2	0	2	3	0	4
4	NE	EEC51702	Smart Health Care Systems	2	0	2	3	0	4
4	NE	EEC51703	Introduction to Bio Inspired Robots	2	0	2	3	0	4
4	NE	EEC51704	Foundation on PCB Design and Testing	2	0	2	3	0	4

Non-Department Elective-2									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
5	NE	EEC51705	Programming and Application using Matlab	2	0	2	3	0	4
5	NE	EEC51706	Ocean Sensor Technology	2	0	2	3	0	4
5	NE	EEC51707	Neural Networks and Fuzzy Logic	2	0	2	3	0	4
5	NE	EEC51708	Medical Imaging, Signals and Informatics	2	0	2	3	0	4
5	NE	EEC51709	Smart materials for Electronics applications	2	0	2	3	0	4
5	NE	EEC51720	Smart Automation with Internet of Things - PBL	2	0	2	3	0	4

Non-Department Elective-3									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
6	NE	EEC51710	Fun with Electronics - PBL	2	0	2	3	0	4
6	NE	EEC51711	Flexible Electronics	2	0	2	3	0	4
6	NE	EEC51712	Radar Communication	2	0	2	3	0	4
6	NE	EEC51713	Introduction to 5G Technology and IOT	2	0	2	3	0	4
6	NE	EEC51714	Design and fabrication of Underwater Robot - Project based learning	2	0	2	3	0	4

Non-Department Elective-4									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
7	NE	EEC51715	Music Signal Processing	2	0	2	3	0	4
7	NE	EEC51716	Space Electronics	2	0	2	3	0	4
7	NE	EEC51717	Project Management for Engineers	2	0	2	3	0	4
7	NE	EEC51718	AI & ML in Oceanography	2	0	2	3	0	4

#### HONORS AND MINORS

SL. NO	SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	V	HN	EEC51900	ARM based Real Time Operating Systems	3	0	0	3	1	3
2	VI	HN	EEC51901	Embedded IOT and Security	3	0	0	3	1	3
3	VII	HN	EEC51902	Embedded System Design Verification and Testing	3	0	0	3	1	3
4	VII	HN	EEC51903	Embedded Software Testing	3	0	0	3	1	3
SL. NO	SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	V	MN	EEC51951	Basic Human Anatomy and Physiology	3	0	0	3	1	3
2	VI	MN	EEC51952	Bio- Sensors and Signal Processing	3	0	0	3	1	3
3	VII	MN	EEC51953	Biomedical Nanotechnology	3	0	0	3	1	3

Semester	Credits	S. No.	Category Code	Category	Breakup of Credits
I	22	1	HS	Humanities & Social Science Courses	16
II	22	2	BS	Basic Science Courses	24
III	22	3	ES	Engineering Science Courses	19
IV	22	4	PC	Programme Core Courses	57
V	21	5	DE	Department Elective Courses	15
VI	21	6	NE	Non Department Elective Courses	12
VII	22	7	EEC	Employment Enhancement Courses	22
VIII	13	8	MC	Mandatory Courses	*
Total	165	TOTAL			165
		9	HN	Honors Courses	12
		10	MN	Minors Courses	9

COURSE TYPE	
<b>TP</b>	Theory with Practical Course
<b>TH</b>	Theory Course
<b>PR</b>	Practical Course
<b>DP</b>	Design Project
<b>PJ</b>	Project
<b>IN</b>	Internship

# SYLLABUS

## SEMESTER - I

COURSE TITLE		MATRICES AND CALCULUS (Common to ALL B. Tech)						CREDITS		4					
COURSE CODE		EMA51001		COURSE CATEGORY			BS		L-T-P-S		3-0-2-1				
Version		1.0		Approval Details		37 <sup>th</sup> ACM				LEARNING LEVEL		BTL-3			
ASSESSMENT SCHEME															
CIA										ESE					
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments		Observation / Lab records as approved by the Department Examination Committee “DEC”		Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)			
15%		15%		10%		5%		5%		25%		25%			
Course Description		To make the student understand the basic concepts of matrices and calculus using MATLAB													
Course Objective		<div>1. To perform some simple operations on matrices</div> <div>2. To give a strong foundation on the basic concepts of differentiation and integration.</div> <div>3. To demonstrate the fundamental understanding of integrals</div> <div>4. To classify ordinary differential equations.</div> <div>5. To impart the knowledge of sequences and summation of series.</div>													
Course Outcome		<div>Upon completion of this course, the students will be able to</div> <div>1. Calculate the inverse of the matrix using Cayley Hamilton theorem and diagonalize the matrix</div> <div>2. Determine the derivative and higher derivatives of a given function explicitly and integrate the standard functions using suitable differentiation and integration formulae</div> <div>3. Evaluate surface area and volume using multiple integrals</div> <div>4. Compute the solution of second order the differential equations</div> <div>5. Determine the convergence and divergence of the sequence using the appropriate tests.</div>													
Prerequisites: Knowledge in calculus at high secondary level.															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	1	2	2	-	-	-	-	-	-	1	2	1	1
CO-2	2	3	2	1	1	-	-	-	-	-	-	1	1	2	2
CO-3	3	2	1	2	2	-	-	-	-	-	-	2	2	1	1
CO-4	3	2	2	1	1	-	-	-	-	-	-	2	1	2	1
CO-5	3	3	2	1	2	-	-	-	-	-	-	1	2	1	1



1: Weakly related, 2: Moderately related and 3: Strongly related	
<b>MODULE 1: MATRICES (9L+6P)</b>	
Characteristic equation – Eigen values and Eigenvectors – Properties – Cayley Hamilton theorem (Statement only) – Verification and inverse of the matrix using Cayley Hamilton theorem- Diagonalization of matrices using similarity transformation Suggested Reading: Basics of Matrices <b>Lab: Eigen values and Eigenvectors, Verification and inverse using Cayley Hamilton theorem- Diagonalization</b>	<b>CO-1</b> <b>BTL-3</b>
<b>MODULE 2: DIFFERENTIAL AND INTEGRAL CALCULUS (9L+6P)</b>	
Basic Concepts and Simple Problems in Differentiation and Integration-Partial differentiation – Total differentiation- Taylor's series – Maxima and minima of functions of two variables. Integration – Methods of integration – Substitution method – Integration by parts – Integration using partial fraction – Bernoulli's formula. Suggested Reading: Basics of differentiation and integration. <b>Lab: Taylor's series – Maxima and minima of functions of two variables, Integration using partial fraction</b>	<b>CO-2</b> <b>BTL-3</b>
<b>MODULE 3: MULTIPLE INTEGRAL (9L+6P)</b>	
Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian coordinates – Volume as a triple integral - Change of variables between Cartesian and polar coordinates. Suggested Reading: Line Integrals <b>Lab: Area and Volume of double integration and triple integration.</b>	<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: ORDINARY DIFFERENTIAL EQUATIONS (9L+6P)</b>	
Second order differential equations with constant coefficients – Particular integrals – $e^{ax}$ , $\cos ax$ , $\sin ax$ , $x^m$ , $e^{ax}\cos bx$ , $e^{ax}\sin bx$ , Solutions of homogeneous differential equations with variable coefficients – Variation of parameters. Suggested Reading: Basics of Differential Equations. <b>Lab: Solution of Second order differential equations.</b>	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: SEQUENCE AND SERIES (9L+6P)</b>	
Definition of Sequence and series with examples, Convergence, divergence and Oscillation of sequence and series, properties, Tests for convergence of series (Comparison test, Limit Comparison test, Integral test, Ratio test, D' Alembert's test, Alternating Series). Suggested Reading: Basics of sequence and series. <b>Lab: Test the convergence and divergence.</b>	<b>CO-5</b> <b>BTL-3</b>
<b>TEXT BOOKS</b>	
1.	A. Chandrasekaran, G Kavitha (2019), <i>Matrices and Calculus</i> , Dhanam Publications, 1 <sup>st</sup> Edition, Chennai.
2.	B.S. Grewal (2017), <i>Higher Engineering Mathematics</i> , Khanna Publishers, 43 <sup>rd</sup> Edition, New Delhi.
3.	A. P. Santhakumaran, P. Titus P (2017), <i>Engineering Mathematics – II</i> , NiMeric Publications, 2 <sup>nd</sup> Edition, Nagercoil, India.
<b>REFERENCE BOOKS</b>	

1.	D. G. Duffy (2021), <i>Advanced Engineering Mathematics with MATLAB (Advances in Applied Mathematics)</i> , Chapman and Hall Publisher, 5 <sup>th</sup> Edition, CRC Press, USA.
2.	M. D. Weir, Joel Hass, Thomas (2016), <i>Calculus</i> , Pearson Publication, 12 <sup>th</sup> Edition, India.
3.	Srimantha Pal and S.C. Bhunia (2015), <i>Engineering Mathematics</i> , Oxford University Press, 1 <sup>st</sup> Edition, New Delhi, India.
<b>E BOOKS</b>	
1.	<a href="https://www.elsevier.com/books/matrix-calculus/bodewig/978-1-4832-3214-0">https://www.elsevier.com/books/matrix-calculus/bodewig/978-1-4832-3214-0</a>
2.	<a href="https://www.ebooks.com/en-er/book/209983367/matrix-calculus-kronecker-product-and-tensor-product-a-practical-approach-to-linear-algebra-multilinear-algebra-and-tensor-calculus-with-software-implementations-third-edition/yorick-hardy/">https://www.ebooks.com/en-er/book/209983367/matrix-calculus-kronecker-product-and-tensor-product-a-practical-approach-to-linear-algebra-multilinear-algebra-and-tensor-calculus-with-software-implementations-third-edition/yorick-hardy/</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/learn/introduction-to-calculus">https://www.coursera.org/learn/introduction-to-calculus</a>
2.	<a href="https://nptel.ac.in/courses/111105035">https://nptel.ac.in/courses/111105035</a>

COURSE TITLE	ENGINEERING PHYSICS (Common to ALL branches of Engineering)			CREDITS	4
COURSE CODE	EPH51001	COURSE CATEGORY	BS	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL3
ASSESSMENT SCHEME					
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	End Semester Examination
15%	15%	10%	5%	5%	Theory 25% Practical 25%
Course Description	This course is based on the developing areas of physics integrating both the theoretical and practical training for engineering students. Application of the concepts to solve engineering problems, to acquire practical thinking and logical reasoning.				
Course Objective	1. To evaluate various types of modulus of elasticity and impart knowledge on production and application of ultrasonic wave in SONAR and NDT. 2. To provide a strong foundation on the concepts of crystal physics and thermal conductivity. 3. To illustrate theoretically and experimentally the wave – particle duality. 4. To evaluate the material properties based on energy band gap and magnetic moment. 5. To make the students understand the production of lasers and propagation of light through an optical fiber.				
Course Outcome	Upon completion of this course, the students will be able to 1. Evaluate the elastic properties of materials and apply the properties of ultrasonic waves for industrial applications				

			<div>2. Evaluate the characteristics of crystal structure and the thermal conductivity of good and bad conductors.</div> <div>3. Solve the Schrodinger’s wave equations and derive energy density based on Planck’s hypothesis</div> <div>4. Apply the fundamental concepts to classify magnetic and semiconducting materials and thereby, illustrate their applications.</div> <div>5. Apply lasers and optical fibers as engineering tools</div>												
<b>Prerequisites:</b> Knowledge in fundamentals of Physics at higher secondary level															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	2	-	-	2	1	2	1
CO2	3	3	2	2	3	-	-	-	3	-	-	3	2	1	1
CO3	3	3	1	1	1	-	-	-	2	-	-	2	1	2	2
CO4	3	3	1	2	1	-	-	-	3	-	-	1	1	3	1
CO5	3	3	2	1	3	-	-	-	3	-	-	3	2	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: PROPERTIES OF MATTER AND ULTRASONICS (9L + 6P)</b>															
<div>Elasticity – Hooke’s law – Elastic Moduli – Young’s modulus of elasticity – Rigidity modulus - Bulk modulus – Twisting couple on a wire – Torsional pendulum – Determination of rigidity modulus of a wire – Depression of a cantilever – Non-uniform bending – Uniform bending – I shape girder.</div> <div>Introduction – Production of ultrasonic waves (Magnetostriction and Piezoelectric methods) – Properties of ultrasonic – Applications in SONAR and NDT.</div> <div><b>Practical component:</b></div> <div>Torsional pendulum – Determination of rigidity modulus of thin wire and moment of inertia of regular objects</div> <div>Non-uniform bending – Determination of Young’s modulus of wooden beam</div>														<b>CO1 BTL3</b>	
<b>MODULE 2: CRYSTALLOGRAPHY AND THERMAL PHYSICS (9L + 6P)</b>															
<div>Amorphous and crystalline solids – Unit cell – Lattice parameters – Crystal system and Bravais lattices (Qualitative) – Miller indices – Interplanar spacing for cubic crystal system – Crystal structures SCC, BCC, FCC, HCP (no. of atoms, coordination number, atomic packing fraction calculations) – Bragg’s law – X-ray diffractometer.</div> <div>Thermal conductivity – Experimental determination of thermal conductivities of good and bad conductors – Forbe’s method (Theory and experiment) – Lee’s disc method for bad conductors.</div> <div><b>Practical component:</b></div> <div>Lee’s disc experiment – Determination of thermal conductivity of bad conductor</div>														<b>CO2 BTL3</b>	
<b>MODULE 3: QUANTUM PHYSICS (9L + 6P)</b>															
<div>Black body radiation – Planck’s hypothesis – Photoelectric effect – Compton effect – Theory and experimental verification</div> <div>Physical significance of wave function – Schrodinger’s wave equation – Time independent and time dependent equations – Particle in a 1D box – Quantum Well (no derivation)</div> <div><b>Practical component:</b></div>														<b>CO3 BTL3</b>	

Photoelectric effect – To plot the KE as a function of frequency for different metals.		
<b>MODULE 4: MAGNETISM AND SEMICONDUCTORS (9L + 6P)</b>		
Magnetic moment – Classification of magnetic materials (Dia, para, ferro, anti-ferro) – Domain theory of ferromagnetism – Hysteresis – Hard and soft magnetic materials – Memory applications. Classification of semiconductors – Direct and in-direct bandgap – Fermi energy level – Intrinsic and extrinsic semiconductors – <i>n</i> -type and <i>p</i> -type semiconductors (Qualitative) – Hall effect – Determination of Hall voltage (Theory and experiment) – Applications of Hall effect. <b>Practical component:</b> Current – Voltage (IV) characteristics of semiconductor diode		<b>CO4 BTL3</b>
<b>MODULE 5: MODERN OPTICS (9L + 6P)</b>		
Principles of laser – Stimulated absorption – Spontaneous emission – Stimulated emission – Population inversion – Pumping action – Active medium – Laser characteristics – Nd-YAG laser – CO <sub>2</sub> laser – Dye laser – Laser in Industrial applications. Optical fiber – Principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – Types of optical fibers – Optical fiber as temperature sensors. <b>Practical component:</b> Laser – Determination of the wavelength of the laser using grating Laser – Particle size determination using lycopodium powder		<b>CO5 BTL3</b>
<b>TEXT BOOKS</b>		
1	Rajendran V. (2017), <i>Engineering Physics</i> , Tata McGraw Hill Publications, 3 <sup>rd</sup> Edition, US.	
2	Gaur R. K. and Gupta S.L. (2014). <i>Engineering Physics</i> , 8 <sup>th</sup> edition, Dhanpat Rai publications (P) Ltd., New Delhi	
3	Mani P. (2016), <i>Engineering Physics</i> , Dhanam Publications, 13 <sup>th</sup> Edition, Chennai.	
<b>REFERENCE BOOKS</b>		
1.	Arthur Beiser (2017), <i>Concepts of Modern Physics</i> , Tata McGraw Hill Publications, 7 <sup>th</sup> Edition, US.	
2.	Halliday, Resnick and Walker (2021), <i>Fundamental of Physics Extended</i> , Wiley & Sons, 12 <sup>th</sup> Edition, US.	
3	Shaikh I. A, Kulkarni H. R, Mohril, S. F. and Khairnar (2018), <i>Engineering Physics</i> , Nirali Prakashan Publishers, 5 <sup>th</sup> Edition, Pune.	
<b>E BOOKS</b>		
1.	<a href="https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/042-Fundamentals-of-Physics-II-Electromagnetism-Optics-and-Quantum-Mechanics-R.-Shankar-Edisi-1-2016.pdf">https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/042-Fundamentals-of-Physics-II-Electromagnetism-Optics-and-Quantum-Mechanics-R.-Shankar-Edisi-1-2016.pdf</a>	
2.	<a href="https://zenodo.org/record/243407#.Y0EfilxBzIU">https://zenodo.org/record/243407#.Y0EfilxBzIU</a>	
3.	<a href="https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf">https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf</a>	
<b>MOOC</b>		
1.	<a href="http://nptel.ac.in/courses/115106061">http://nptel.ac.in/courses/115106061</a>	
2.	<a href="http://nptel.ac.in/courses/117101054/12">http://nptel.ac.in/courses/117101054/12</a>	

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL B.Tech.)			CREDITS	4
COURSE CODE	ECT51001	COURSE CATEGORY	BS	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					

First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	ESE										
15%	15%	10%	5%	5%	Theory 25%										
					Practical 25%										
Course Description	To expose the students to the basics of Engineering Materials and their applications.														
Course Objective	<ol style="list-style-type: none"><li>1. To make the students understand the basics of crystal structure and phase rule.</li><li>2. To provide a knowledge on the theoretical basis of the chemical composition, properties and applications of abrasives, adhesives, lubricants and refractories.</li><li>3. To give a strong foundation on the basic concepts of nanomaterials, the general synthetic methods with emphasis on their applications.</li><li>4. To provide an exposure on the fundamentals and applications of polymeric materials and composites.</li><li>5. To illustrate the applications of energy materials, liquid crystals and conducting polymers with a good exposure on their basic terminologies.</li></ol>														
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"><li>1. Propose and justify suitable metals/materials for alloying.</li><li>2. Distinguish and select a suitable material as abrasives / adhesives / lubricants / refractories based on its properties and applications.</li><li>3. Select an appropriate technique for nanomaterial synthesis and characterization.</li><li>4. State and select a suitable polymeric / composite material for industrial applications.</li><li>5. Develop the suitable organic/inorganic materials that can be employed in energy storage / production and electronic devices.</li></ol>														
Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	-	-	-	1	-	-	-	-	1	1	2	1
CO-2	3	2	1	-	-	-	2	-	-	-	-	2	2	2	2
CO-3	3	2	2	-	-	-	1	-	-	-	-	3	1	1	2
CO-4	3	2	1	-	-	-	2	-	-	-	-	2	2	2	1
CO-5	3	2	1	-	-	-	2	-	-	-	-	2	2	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: CRYSTAL STRUCTURE AND PHASE RULE (9L + 6P)															
Basic crystal systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure. Phase rule: Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system — Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule. Practical component: Construction of phenol-water phase diagram - Determination of													CO-1 BTL-3		

apparent density of porous solids.		
<b>MODULE 2: ABRASIVES, ADHESIVES, LUBRICANTS AND REFRACTORIES</b>		<b>(9L + 6P)</b>
Abrasives – Classification, Properties, Uses – Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications) – Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS <sub>2</sub> and Graphite - Refractories – Classification, Properties, Applications. Practical components: Preparation of urea-formaldehyde resin - Determination of porosity of a refractory		<b>CO-2 BTL-3</b>
<b>MODULE 3: NANOMATERIALS</b>		<b>(9L + 6P)</b>
Introduction – Scope of nanomaterials - Types of nanomaterials - Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Laser ablation, Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties – Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization – UV-Visible spectroscopy, FE-SEM and TEM (Principle and Applications only). Practical component: Preparation of ZnO nanoparticles by wet chemical method – Verification of Beer-Lambert’s law using silver nanoparticles.		<b>CO-3 BTL-3</b>
<b>MODULE 4: POLYMERS AND COMPOSITES</b>		<b>(9L + 6P)</b>
Introduction – Basic definitions – Classification of polymers – Structure and property relationship of polymers – Plastics – Synthesis, properties and applications of polycarbonates and phenol-formaldehyde - Biodegradable Polymers, examples and applications. Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites –Types and Applications. Practical components: Determination of molecular weight / viscosity of polymer using Ostwald Viscometer.		<b>CO-4 BTL-3</b>
<b>MODULE 5: MATERIALS FOR ENERGY AND ELECTRONIC APPLICATIONS</b>		<b>(9L + 6P)</b>
Energy storage materials – Metal-hydride batteries, Li-batteries - Materials for solar cells: Semi-conductors - Materials for hydrogen technology - production (electrolysis), storage (hydrides), fuel cells. Liquid Crystals - Introduction –Characteristics – Optical properties- Classification – Chemical constitution and liquid crystalline behaviour - Applications. Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications. Practical component: Preparation of polyaniline / Polypyrrole.		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Jain, P.C., Jain, M. (2018). <i>Engineering Chemistry</i> , Dhanpat Raj Publishing Company (P) Ltd, New Delhi, 17 <sup>th</sup> Edition.	
2.	Puri, B. R., Sharma, L. R., Pathania, M. S. (2020). <i>Principles of Physical Chemistry</i> , Vishal Publishing Co. Jalandhar, 47 <sup>th</sup> Edition.	
3.	Rangwala. (2017). <i>Engineering Materials</i> , Charotar Publishing House Pvt. Ltd, 43 <sup>rd</sup> Edition.	
<b>REFERENCE BOOKS</b>		
1.	Clyne, T. W., Hull, D. (2019). <i>An introduction to composite materials</i> , Cambridge University Press, 3 <sup>rd</sup> Edition.	
2.	Shah, M. A., Ahmad, T. (2021). <i>Nano Science &amp; Technology</i> , Dreamtech Press, 2021 Edition.	
3.	Palanna, O. G. (2018). <i>Engineering Chemistry</i> , Mc Graw Hill Education (India) Pvt. Ltd, 2 <sup>nd</sup> Edition.	
<b>E BOOKS</b>		

1.	<a href="http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html">http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html</a>
2.	<a href="https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf">https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.edx.org/course/materials-science-engineering-misix-mse1x">https://www.edx.org/course/materials-science-engineering-misix-mse1x</a>
2.	<a href="https://www.mooc-list.com/tags/materials-science">https://www.mooc-list.com/tags/materials-science</a>

COURSE TITLE		PROFESSIONAL COMMUNICATION			CREDITS	1
COURSE CODE		GLS51018	COURSE CATEGORY	HS	L - T - P - S	3- 0 -0- 1
Version	01	APPROVAL DETAILS	42 <sup>nd</sup> ACM, 26 <sup>th</sup> Oct. 2024		LEARNING LEVEL	BTL 4
ASSESSMENT SCHEME						
Continuous Internal Assessment (CIA)						ESE
First Periodical Assessment	Second Periodical Assessment	Weekly assignment as approved by the Department Examination Committee “DEC”	Surprise Test / Quiz., as approved by the Department Examination Committee “DEC”		Attendance	Theory
15 %	15 %	10 %	5 %		5 %	50 %
Course Description		The Communication Skills course is designed to enhance students' proficiency in verbal and written communication, with a strong emphasis on developing accurate and grammatically correct language usage. The focus is on grammar exercises, and practical application, students will learn to articulate ideas clearly while adhering to proper English syntax and conventions. The course covers essential aspects such as grammar review and practice, vocabulary building, pronunciation and articulation, writing skills, speaking practice, and error analysis and feedback, aiming to improve students' accuracy in language usage and enable them to communicate effectively in academic, professional, and social contexts.				
Course Objective		1. The course aims to enhance students' proficiency in verbal and written communication by improving their grammar usage and vocabulary. 2. It focuses on developing accurate and grammatically correct language usage through targeted grammar exercises and practical application. 3. Additionally, the course emphasizes the importance of pronunciation and articulation by practicing clear and effective communication. 4. Furthermore, it aims to improve students' writing skills by learning to write clearly and concisely in various forms of written communication. 5. By the end of the course, students will be able to communicate effectively and accurately in English for academic, professional, and social purposes.				
Course Outcome		Upon completion of this course, the students will be able to 1. Demonstrate the skills of framing simple sentences without grammatical errors. 2. Illustrate proficiency in using verb tenses, active and passive voice, and modal verbs accurately. 3. Apply their knowledge of future tenses, infinitives and gerunds, and conditionals to express hypothetical and real-life situations. 4. Make use of their knowledge of transforming, identifying, correcting and expressing to communicate accurately in various contexts. 5. Apply the knowledge of the different types of sentences in enhancing the clarity and coherence in their communication.				

Prerequisites: Plus Two English-Intermediate Level														
CO AND PO MAPPING														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	-	-	-	-	-	-	-	-	2	3	-	3	1	1
CO2	-	-	-	-	-	-	-	-	2	3	-	3	0	2
CO3	-	-	-	-	-	-	-	2	2	3	-	3	1	1
CO4	-	-	-	-	-	-	-	2	2	3	2	3	0	2
CO5	-	-	-	-	-	-	-	2	2	3	2	3	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1 : Basics of Communication														(9L)
<b>Grammar:</b> Parts of Speech – Identification and Transformation – suffixes. Kinds of Sentences – Identification and Transformation. Sentence Pattern – Identifying and Framing Simple Sentences. Articles. Prepositions <b>Vocabulary :</b> Computer terms; email and website terms - Adverbs Denoting updates -Adjectives for Compound Noun Time Management <b>Writing :</b> Writing a Self Introduction - Writing letters as a student in an institution <b>Reading :</b> Introduction to Communication - Communication Process <b>Lab : (Speaking) :</b> Self Introduction <b>(Listening) :</b> Various Self Introductions													CO-1 BTL-2	
MODULE 2 : Time Expressions														(9L)
<b>Grammar:</b> Tenses: Introduction to verbs - Types, Forms ; regular and irregular verbs. Tenses – Rules and its usage – Present tenses: simple present, present continuous, present perfect, present perfect continuous - Past tenses: simple past, past continuous, past perfect, past perfect continuous. – Time expressions <b>Vocabulary :</b> Verbs to Describe process - Vocabulary to talk about advertising and marketing. <b>Writing :</b> Topic Sentence - Paragraph Writing - Writing an essay <b>Reading:</b> Verbal & Nonverbal Communication - Types of Communication - Barriers in Communication <b>Lab: Practicum(Speaking) :</b> A Discussion on the impact of technology on human life. <b>(Listening) :</b> Talks on Technology													CO-2 BTL-2	
MODULE 3 : Expressing the Future														(9L)
<b>Grammar:</b> Future Tenses : simple future , future continuous, future perfect, future perfect continuous - Active and Passive Voice – Identifying the voices and Transforming Active to passive and passive to active - Modal Verbs to express modalities: in active and passive voices <b>Vocabulary :</b> Vocabulary for travel - Synonyms and Antonyms <b>Writing:</b> A letter(Email) of invitation – Accepting the invitation and declining the invitation - Writing a Product description <b>Reading :</b> Past and Present Technologies - The future of Technology: predictions. <b>Lab : (Speaking):</b> A Discussion on the future plans. <b>(Listening):</b> Describing a product													CO-3 BTL-3	
MODULE 4 : Contextualizing														(9L)
<b>Grammar:</b> Infinitives and gerunds – using infinitives and gerunds in sentences as different elements. - Conditionals – Three types of conditionals 3. Instructions and Recommendations – Transforming instruction to recommendation and recommendation to instruction <b>Vocabulary :</b> Affixes - Global Management - Reporting Verbs <b>Writing :</b> Writing a user manual - Email : Requesting information <b>Reading :</b> Barriers in Communication - Global Warming <b>Lab : (Speaking):</b> Role Play : Interviewing someone about a job change <b>(Listening)</b> Job Interviews													CO-4 BTL-3	
MODULE 5 : Clarity and Coherence														(9L)
<b>Grammar :</b> Concord: Identifying the error and Correcting the errors - Adjectives: Degrees of Comparison - Discourse Markers : application of discourse markers in the sentences. <b>Vocabulary :</b> Describing Trends - Finance Vocabulary - Phrasal Verbs <b>Writing:</b> Writing an Argumentative essay - Summary writing <b>Reading :</b> Describing Statistics - Company finances, investments and starting up <b>Lab : (Speaking) :</b> Discussing qualities needed in candidates for a job vacancy <b>(Listening)</b> Tips to enhance the employability skills													CO-5 BTL-4	
TEXT BOOK														



1	Doff, A., Thaine, C., Puchta, H., Stranks, J., & Lewis-Jones, P. (2023). <i>Empower Second Edition</i> . Cambridge University Press & Assessment. New Delhi.
<b>REFERENCE BOOKS</b>	
1.	Murphy, Raymond.(2021). <i>Essential English Grammar</i> , Cambridge University Press. India (Pages 300)
2.	Redman, Stuart.(2020). <i>English Vocabulary In Use: Pre - Intermediate And Intermediate</i> . Cambridge University Press. India (Pages 264)
3.	Bikram K. Das. et al.,(2019) <i>An Introduction to Professional English and Soft Skills with audio CD</i> , Cambridge University Press. India (Pages 272)
4.	John, Dolly., (2018), <i>English for Life and the Workplace Through LSRW&amp;T Skills</i> , Pearson Publications.India (Pages 263)
<b>E BOOKS</b>	
1.	<a href="https://www.cambridge.org/gb/files/9116/4138/4615/A1_Student_Book.pdf">https://www.cambridge.org/gb/files/9116/4138/4615/A1_Student_Book.pdf</a>
2.	<a href="https://www.cambridge.org/gb/files/1416/4138/4681/A1_Workbook.pdf">https://www.cambridge.org/gb/files/1416/4138/4681/A1_Workbook.pdf</a>
3.	<a href="https://www.cambridge.org/gb/files/7216/4138/1999/A2_Student_Book.pdf">https://www.cambridge.org/gb/files/7216/4138/1999/A2_Student_Book.pdf</a>
4.	<a href="https://www.cambridge.org/gb/files/6816/4138/2072/A2_Workbook.pdf">https://www.cambridge.org/gb/files/6816/4138/2072/A2_Workbook.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.edx.org/professional-certificate/tsinghuax-english-communication-skills">https://www.edx.org/professional-certificate/tsinghuax-english-communication-skills</a>
2.	<a href="https://www.britishcouncil.org/tr/en/english/mooc/english-for-the-workplace">https://www.britishcouncil.org/tr/en/english/mooc/english-for-the-workplace</a>

COURSE TITLE	PROGRAMMING FUNDAMENTALS USING C			CREDITS	3	
COURSE CODE	ECS51009	COURSE CATEGORY	EC	L-T-P-S	2- 0- 2- 2	
VERSION	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-5	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	Theory	Practical
15%	15%	10%	5%	5%	25%	25%
Course Description	To introduce computers and programming in C and also explore the power of computational techniques that are currently used by engineers and scientists and to develop programming skills with reasonable complexity.					
Course Objective	1. To acquire the basic knowledge in computer hardware, programming languages and Problem-solving techniques. 2. To learn the fundamentals of C programming. 3. To gain knowledge in Functions, arrays and strings in C programming. 4. To understand the pointers, Structures and Union in C programming 5. To gain knowledge on Embedded Programming and real time applications of C Programming.					
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basics of digital computer and programming languages.					

		2. Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem. 3. Design and Implement C program using Control Statements and Functions. 4. Design and Implement C program using Pointers and File operations. 5. Identify the need for embedded C and C Programming in real-time applications.													
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	2	2	-	-	2	-	2	-	-	1	2	2	1	2
CO-2	3	3	3	2	2	1	-	2	2	1	-	1	1	2	1
CO-3	3	3	3	2	2	2	-	1	3	3	2	1	2	1	2
CO-4	3	3	3	2	-	-	-	-	-	-	1	-	2	2	2
CO-5	1	1	1	-	1	2	-	1	-	-	-	2	2	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: PROGRAMMING LANGUAGES AND PROBLEM-SOLVING TECHNIQUES												(6 L+ 6 P =12 )			
Introduction – Fundamentals of digital computers - Programming languages - Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code. <b>Practical Component</b> Draw Flowcharts using E- Chart & Write pseudo code for the following problems 1. Greatest of three numbers 2. Sum of N numbers 3.Computation of nCr <b>Software Required:</b> GCC <b>Suggested Readings:</b> <a href="https://www.simplilearn.com/tutorials/programming-tutorial/problem-solving-in-programming">https://www.simplilearn.com/tutorials/programming-tutorial/problem-solving-in-programming</a>												CO-1 BTL-4			
MODULE 2: FUNDAMENTALS OF C												(6L+ 6P = 12)			
Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements. <b>Practical Component</b> 1. Program to illustrate arithmetic and logical operators 2. Program to read and print data of different types 3. Program to calculate area and volume of various geometrical shapes 4. Program to compute biggest of three numbers 5. Program to print multiplication table 6. Program to convert days to years, months and days 7.Program to find sum of the digits of an integer <b>Software Required:</b> GCC <b>Suggested Readings:</b> <a href="https://www.w3schools.com/c/c_intro.php">https://www.w3schools.com/c/c_intro.php</a>												CO-2 BTL-4			
MODULE 3: FUNCTIONS, ARRAYS, STRINGS												(6L+ 6P = 12)			

<p>Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements.</p> <p><b>Practical Component:</b></p> <p>1. Program to compute Factorial, Fibonacci series and sum of n numbers using recursion</p> <p>2. Program to compute sum and average of N Numbers stored in an array</p> <p>3. Program to sort the given n numbers stored in an array</p> <p>4. Program to search for the given element in an array</p> <p>5. Program to do word count</p> <p>6. Program to insert a substring in a string</p> <p>7. Program to concatenate and compare two strings</p> <p>8. Program using pre-processor statements</p> <p><b>Software Required:</b> GCC</p> <p><b>Suggested Readings:</b> <a href="https://cppguide.readthedocs.io/en/latest/cpp/array.html">https://cppguide.readthedocs.io/en/latest/cpp/array.html</a></p>		<p><b>CO-3</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 4: POINTERS, STRUCTURES AND UNION (6L+ 6P = 12)</b></p>		
<p>Pointers – Dynamic Memory allocation – Structure and Union – Files.</p> <p><b>Practical Component</b></p> <p>1. Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation</p> <p>2. Program to read and print records of a student/payroll database using structures</p> <p>3. Program to simulate file copy</p> <p>4. Program to illustrate sequential access file</p> <p>5. Program to illustrate random access file</p> <p><b>Software Required:</b> GCC</p> <p><b>Suggested Readings:</b> <a href="https://www.ibm.com/docs/en/zos/2.4.0?topic=types-structures-unions">https://www.ibm.com/docs/en/zos/2.4.0?topic=types-structures-unions</a></p>		<p><b>CO-4</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 5: APPLICATIONS OF C (6L+ 6P = 12)</b></p>		
<p>Structure of embedded C program - Data Types - Operators - Statements - Functions - Keil C Compiler.</p> <p>Game development using c - Analysing the environment - Snake game - Tic-Tac-Toe - flappy bird.</p> <p><b>Practical component:</b> Simple programs using embedded C-Game Development using C</p> <p><b>Software Required:</b> GCC</p> <p><b>Suggested Readings:</b> <a href="https://www.interviewbit.com/blog/applications-of-c-programming-language/">https://www.interviewbit.com/blog/applications-of-c-programming-language/</a></p>		<p><b>CO-5</b></p> <p><b>BTL-4</b></p>
<p><b>TEXT BOOKS</b></p>		
1.	Ashok Kamthane, “Computer Programming”, Pearson Education, 7th Edition, Inc 2017.	
2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.	
3.	Robert Marmelstein, “Programming Games in C”	
<p><b>REFERENCE BOOKS</b></p>		
1.	Jeyapoovan T, “Fundamentals of Computing and Programming in C”, Vikas Publishing house, 2015.	
2	Yashavant Kanetkar, “Let us C”, 15th edition, BPP publication, 2016.	
3	S. Sathyalakshmi, S.Dinakar, “Computer Programming Practicals – Computer Lab Manual”, Dhanam Publication, First Edition, July 2013.	

E BOOKS	
1.	<a href="https://en.wikibooks.org/wiki/C_Programming">https://en.wikibooks.org/wiki/C_Programming</a>
MOOC	
1.	<a href="https://onlinecourses.nptel.ac.in/noc18-cs10/preview">https://onlinecourses.nptel.ac.in/noc18-cs10/preview</a>
2.	<a href="http://nptel.ac.in/courses/106105085/2">http://nptel.ac.in/courses/106105085/2</a>
3.	<a href="https://www.udemy.com/c-programming-for-beginners/">https://www.udemy.com/c-programming-for-beginners/</a>
4.	<a href="https://www.coursera.org/specializations/c-programming">https://www.coursera.org/specializations/c-programming</a>

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
COURSE CODE	EME51001	COURSE CATEGORY	EC	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment (Theory + Practical)	Second Periodical Assessment (Theory + Practical)	Weekly assignment/Observation / lab records and viva as approved by the DEC	Surprise Test/ Quiz etc., as approved by the DEC	Attendance	ESE (Theory + Practical)
15%	15%	10%	5%	5%	50%
Course Description	This course broadly introduces the mechanical design using computer aided design tools and fundamentals of free hand sketching. It prepares the students to learn the basic concepts involved in technical drawing and computer graphics. It also emphasis on the principles of projections and visualization of part drawing.				
Course Objective	<div>1. To demonstrate the concepts of Engineering graphics and projection of straight lines using CAD software</div> <div>2. To visualize the solids in various orientations and to draw its projections</div> <div>3. To comprehend the concepts of isometric projections</div> <div>4. To draw the development of solid surfaces and to generate associated views of civil drawings.</div> <div>5. To visualize and draw views of the object by free hand sketch and to transform 3D models to 2D drawings using CAD tools</div>				
Course Outcome	<div>Upon completion of this course, the students will be able to</div> <div>1. Demonstrate the concepts of Engineering graphics and projection of straight lines using CAD software.</div> <div>2. Apply the acquired knowledge to solve simple problems of regular solids.</div> <div>3. Create solid objects in isometric view using CAD software</div> <div>4. Develop the simple solids and to sketch the plan and elevation of the building drawings.</div> <div>5. Visualize the objects and to draw by free hand sketching.</div>				
Prerequisites: Nil					
CO, PO AND PSO MAPPING					

[illegible]

1.	Jeyapoovan, T., Engineering Graphics and Design, Vikas Publishing House Pvt Ltd., New Delhi, 8 <sup>th</sup> Edition, 2022.
2.	P. Kannaiah, K. L. Narayana, K. Venkata Reddy, A Textbook on Engineering Drawing, BS Pub, 2016.
<b>REFERENCE BOOKS</b>	
1.	Alf Yarwood, Introduction to AutoCAD – 2D and 3D Design, Newnes Elsevier, 2011
2.	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2019.
3.	Kirstie Plantenberg, Engineering Graphics Essentials, SDC Publications., fifth Edition, 2016.
<b>E - Books</b>	
1.	<a href="https://www.amazon.in/Technical-Drawing-Engineering-Graphics-International-ebook/dp/B00IZ0FZHA">https://www.amazon.in/Technical-Drawing-Engineering-Graphics-International-ebook/dp/B00IZ0FZHA</a>
<b>MOOC</b>	
1.	<a href="http://nptel.ac.in/courses/112103019/">http://nptel.ac.in/courses/112103019/</a>
2.	<a href="https://nptel.ac.in/courses/112102304/">https://nptel.ac.in/courses/112102304/</a>

COURSE TITLE	DESIGN THINKING				CREDITS	3
COURSE CODE	EGE51002	COURSE CATEGORY		ES	L-T-P-S	2-0-2-0
Version	1.0	Approval Details		37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	Design, in a typical engineering context refers to the detailed plans & schemes developed through the application of best engineering practices for creating new products and systems. Design thinking, in this relevance, is the systematic methodology currently being adopted in industries and organizations for evolving optimal designs with innovative design approaches and strategies. In essence, it is truly about understanding a problem in an overall perspective taking into consideration of the customer needs, technology, businesses,					

	<p>environmental impact, safety and developing solutions. The design thinking methodology is essentially an iterative approach with cross-functional teams and adopted to wide ranging organizations right from engineering industries to service sectors. Hence this methodology is universal, holistic and non-domain centric. It opens a new world of problem-solving possibilities and helps the organizations to create new and innovative products, services, and processes.</p> <p>The design thinking course offered at our university is well structured with good numbers of case studies and projects which makes the new and innovative concepts discussed in lecture hours get assimilated in the minds of students. This course is intentionally offered in the very first semester for all undergraduate engineering branches to make the students understand this new philosophy of the design thinking process and adopt the guidelines for their project works they take up in subsequent semesters including start-up projects.</p>														
Course Objective	<ol style="list-style-type: none"><li>1. Inculcate the fundamental concepts of design thinking in students</li><li>2. Learn the different phases of design thinking</li><li>3. Use design thinking methods in every stage of the problem</li><li>4. Apply various methods of design thinking to different problems</li></ol>														
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"><li>1. Demonstrate the critical methods of design, systems thinking and key concepts of design thinking.</li><li>2. Understand the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices</li><li>3. Practice design thinking in all stages of problem solving.</li><li>4. Apply design thinking approach to real world problems</li><li>5. Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches</li></ol>														
Prerequisites: NIL															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	-	1	2	2	2	1	1	-	2	1	1	1
CO-2	1	1	1	-	2	3	3	2	2	2	-	2	2	3	1
CO-3	1	1	2	-	2	3	3	2	3	3	2	2	3	3	1
CO-4	2	2	2	-	2	3	3	2	3	3	-	2	3	3	1
CO-5	2	1	2	-	2	3	3	2	3	3	2	2	3	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION (3T + 6P =9)															

<p>Design process: Traditional design, Design Requirements, Design approach and Strategies. Design Thinking Concept for Innovative Design - Breaking of patterns, Reframe existing design problems, Principles of creativity. Elements of Design Thinking - Design Thinking Phases: Empathize (Customer Needs), Define, Ideate, Prototype, Testing and Implementation. Design Thinking Frameworks. Design Thinking Team.</p> <p><b>Practical Case Studies:</b> Enhancing the User Experience of a Digital Platform: Choose a popular digital platform or application and ask students to analyze its strengths and weaknesses from a user experience perspective. <i>Examples: Redesigning the platform's interface, functionality, or features to enhance usability, accessibility, and overall user satisfaction.</i></p>	<p><b>CO-1</b></p> <p><b>BTL-3</b></p>
<p><b>MODULE 2: UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM (3T + 6P =9)</b></p>	
<p>Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.</p> <p><b>Practical Case Studies:</b> Redesigning a Medical Device: Focus on medical engineering by selecting a specific medical device or equipment used in healthcare settings. Students can explore opportunities to improve its functionality, ergonomics, ease of use, and patient experience through innovative design solutions. <i>Examples: (i) Hand held Blood Glucose Testing Machine (ii) Blood Pressure Monitor</i></p>	<p><b>CO-2</b></p> <p><b>BTL-3</b></p>
<p><b>MODULE 3: IDEATION (3T + 6P =9)</b></p>	
<p>Ideation Phase - The creative process and creative principles - Principles of Decomposition, Association, Analogy &amp; Confrontation, Abstraction &amp; Imagination. Guide team - Personas with wide range of professional experiences, stronger collaboration dynamics. Creativity techniques – Intuitive creative techniques – brainstorming, Systematic Analytical techniques - SWOT Analysis, The 5 Whys iterative interrogative technique - Valuation of ideas.</p> <p><b>Practical Case Studies:</b> Redesigning an Educational Environment: Focus on improving the learning experience within a specific educational institution or classroom. Students can explore innovative design solutions that enhance collaboration, engagement, and personalized learning while considering factors such as classroom layout, educational technology, and accessibility. <i>Examples: (i) case study of Educational ERP (ii) Case study of Digital Learning Platform etc.</i></p>	<p><b>CO-3</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 4: PROTOTYPING AND VISUALIZATION (3T + 6P =9)</b></p>	
<p>Prototype Phase - Lean Startup Method for Prototype Development. Minimum Viable Product (MVP) – creation of MVPs, drawing and design models, wireframe, mockups, 3D Rapid prototyping. Visualization and presentation techniques. Visualization types – bar chart, pie chart, radar chart, mind mapping, affinity diagram, force field analysis, semantic differential (polarity analysis). Presentation Techniques – story telling, creative collages, design scenarios.</p> <p><b>Practical Case Studies:</b> Designing an Eco-Friendly Packaging Solution: With a growing concern for environmental sustainability, challenge students to design an eco-friendly packaging solution for a consumer product. They can explore alternatives to single-use plastics, optimize packaging materials and design for efficient production, transportation, and disposal. <i>Examples: City Waste Segregation and consolidation Device (ii) Used Car Destruction and consolidation Device etc..</i></p>	<p><b>CO-4</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 5: TESTING AND IMPLEMENTATION (3T + 6P =9)</b></p>	



Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking. Design Activism – Designing tomorrow. Entrepreneurship/business ideas. Technology Readiness Level (TRL) – 9 Levels.		CO-5  BTL-4
<b>Practical Case Studies:</b> Designing Assistive Technologies for People with Disabilities: Encourage students to develop innovative solutions to improve the quality of life for individuals with disabilities. They can focus on designing assistive technologies such as prosthetics, mobility aids, communication devices, or sensory enhancements to address specific challenges faced by this user group. <i>Examples: (i) Case study of patient assist mobile Robot (ii) Designing automated level control of overhead water tank etc.</i>		
TEXT BOOKS		
1.	Christian Mueller Roterberg, Handbook of Design Thinking, 2018.	
2.	Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media Inc, 2017.	
REFERENCE BOOKS		
1	Idris Mootee, “Design Thinking for Strategic Innovation”, Wiley, 2013	
2	Jeanne Liedtka and Tim Ogilvie, Designing for Growth: A design thinking tool kit for managers, Columbia university Press, 2011	
3.	Hasso Plattner, Christoph Meinel and Larry Leifer, "Design Thinking: Understand – Improve – Apply", Springer, 2010	
4	Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Collins, 2009	
5	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.	
E RESOURCES FOR REFERENCE		
1	<a href="https://www.design-thinking-association.org/explore-design-thinking-topics/design-thinking-case-studies">https://www.design-thinking-association.org/explore-design-thinking-topics/design-thinking-case-studies</a>	
2	<a href="https://makeiterate.com/design-thinking-case-studies/">https://makeiterate.com/design-thinking-case-studies/</a>	
3	<a href="https://www.toptal.com/project-managers/digital/a-design-thinking-case-study">https://www.toptal.com/project-managers/digital/a-design-thinking-case-study</a>	
4	<a href="https://venturewell.org/class-exercises">https://venturewell.org/class-exercises</a>	
MOOC		
1.	<a href="https://onlinecourses.nptel.ac.in/noc19_mg60/preview">https://onlinecourses.nptel.ac.in/noc19_mg60/preview</a>	
2.	<a href="https://onlinecourses.swayam2.ac.in/aic19_de02/preview">https://onlinecourses.swayam2.ac.in/aic19_de02/preview</a>	

COURSE TITLE	ENGINEERING PRACTICE LAB (Common to All Branches)			CREDITS	2
COURSE CODE	EGE51406	COURSE CATEGORY	ES	L-T-P-S	0-0-4-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME															
CIA								ESE							
80%								20%							
Course Description	This course is specifically designed to give the students a clear understanding of the mechanical engineering design and its process.														
Course Objective	<b>The course should enable the students to</b> 1. To Relate theory and practice of basic Mechanical and Civil Engineering. 2. To Learn basic concepts in Aeronautical and Automobile Engineering. 3. To Learn basic concepts in Electrical, Electronics, mechatronics and Computer Science.														
Course Outcome	<b>Upon completion of this course, the students will be able to</b> 1. To Identify the tools, and types of joints used in welding, carpentry and plumbing. 2. To Perform basic fabrication in welding, carpentry and plumbing, to make simple joints/connections. 3. To Make simple electrical and electronic circuit connections, and may assemble the hardware of a desktop computer. 4. To observe & demonstrate the working of a mechatronics systems like CNC machine, Robot, Pneumatic circuits. 5. To observe & demonstrate the working of a 3D printer and list its applications.														
Prerequisites: NIL															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PS O-1	PS O-2	PSO-3
CO-1	3	2	-	2	-	1	-	-	-	-	-	-	2	1	1
CO-2	3	2	-	2	-	1	-	-	-	-	-	-	3	2	1
CO-3	3	2	-	2	-	1	-	-	-	-	-	-	2	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
LIST OF EXPERIMENTS with expected Learning outcome															
Exp. No.	Experiment Name											CO / BTL			
1	To Perform a Fillet/Groove weld in a Welding Simulator											CO 1 & BTL 3			
2	To Fabricate a Butt joint/Lap Joint using Arc Welding											CO 1 & BTL 3			
3	To make basic pipe connections in Plumbing using valves, couplings and elbows											CO 1 & BTL 3			
4	To make a common joint using Carpentry											CO 1 & BTL 3			
5	Assembling and Dismantling of a gasoline/Diesel Engine											CO 2 & BTL 3			
6	Measurement of Force using a spring balance											CO 2 & BTL 3			
7	To make an Electrical Wiring for extension box											CO 3 & BTL 3			
8	Study of Active and Passive Components											CO 3 & BTL 3			
9	To make simple circuit using Electronic Components											CO 3 & BTL 3			

10	To Assemble a Desktop computer	CO 3 & BTL 3
11	To study the key elements of a Mechatronics system	CO 3 & BTL 3
12	Demo on linear actuator, using pneumatic circuit	CO 3 & BTL 3
13	Demo on Computerized Numerical Control (CNC) machine	CO 3 & BTL 3
14	Demo on a pick and place Robot	CO 3 & BTL 3
15	Demo on a 3D Printer	CO 3 & BTL 3

#### LIST OF EXPERIMENTS/TOOLS for 30 Students

1	Welding Rectifier – 5 Nos
2	Welding Simulator – 1 No.
3	Two Stroke Gasoline Engine – 1 No.
4	Spring balance – 5 Nos
5	PVC Pipes and its accessories – 5 sets
6	Saw, Planner, Chisel and its accessories – 5 sets
7	Extension box and its accessories – 5 sets
8	Electronic boards and its accessories – 5 sets
9	Active components – 5 sets
10	Passive components – 5 sets
11	Desktop Computer – 5 Nos
12	Linear Actuators and Pneumatic Kit– 1 Nos
13	Rotary Actuators and Pneumatic Kit– 1 Nos
14	CNC Machine – 1 No.
15	6 Axis Robot – 1 No.
16	3D Printer – 1 No.

#### REFERENCE

1	Jeyapoovan T and Saravanapandian M., (2015),Engineering practices lab manual, Vikas publishing House, New Delhi, 4th Edition.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K.,(2008), “Elements of Workshop Technology”, Vol.I ,Media promoters and publishers private limited, Mumbai.
3	Ibrahim Zeid,(2011) CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

COURSE TITLE	FAB LAB FOR CIRCUIT ENGINEERING (ECE & EEE)			CREDITS	2
COURSE CODE	EGE51409	COURSE CATEGORY	ES	L-T-P-S	0-0-4-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
Observation & Record		Practical Demonstration		VIVA	

						& Lab Test Report									
20%						60%						20%			
Course Description		The Fab Lab is intended to help the students to acquire the foundational knowledge necessary to comprehend the fundamentals of diodes, transistor. The course provide a comprehensive idea to the students to design, simulate and develop a simple electronic system prototype.													
Course Objective		<b>The course should enable the students</b> 1. To introduce the concepts of identification and testing of passive and active devices. 2. To interpret the VI characteristic of Diode and Transistor. 3. To have hands on experience in soldering. 4. To have hands on experience in design and prototyping of simple electronic system using perf-board. 5. To summarize the characteristics of electrical machines.													
Course Outcome		<b>Upon completion of this course, the students will be able to</b> 1. Interpret the specification and testing of active and passive devices. 2. Comprehend the diode and transistor characteristics using Multisim software. 3. Use soldering machines for assembly of active and passive devices in perf-board and test for the functionality. 4. Design and demonstrate simple electronic systems using dotted board. 5. Elucidate the basic characteristics of Electrical machines.													
Prerequisites: NIL															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	1	1	-	-	-	-	-	-	1	1	1	-
CO-2	2	2	2	2	3	-	-	-	--	-	-	1	1	1	1
CO-3	2	2	2	2	1	2	-	-	-	-	-	1	1	1	1
CO-4	2	2	2	2	2	1	1	-	1	-	-	1	1	1	1
CO-5	2	2	2	2	-	1	-	-	1	-	-	1	1	-	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
LIST OF EXPERIMENTS with expected Learning outcome															
Exp. No.		Experiment Name												CO / BTL	
1		Identification: Identification, specifications, testing of R, L, C components, potentiometers, bread boards, PCBs, identification. Software/Equipment Required: Passive Components ,Breadboard,PCB												CO 1 & BTL 3	
2		Identification: Identification, Testing and specifications of active devices, diodes, BJTs, JFETs, LEDs, LCDs. Software/Equipment Required:Digital Multimeter, ohmmeter												CO 1 & BTL 3	
3		Characteristics of Fluorescent, Tungsten and Carbon filament lamps.												CO 1 & BTL 3	

	<b>Software/Equipment Required:</b> Fluorescent, Tungsten and Carbon filament lamps.	
4	<b>V-I Characteristics of PN junction diode</b> <b>Software/Equipment Required:</b> MULTISIM software	CO 1 & BTL 3
5	<b>CB, CE and CC Configurations and their Input and Output Characteristics.</b> <b>Software/Equipment Required:</b> MULTISIM software	CO 2 & BTL 3
6	Soldering exercises through dotted boards using passive and active devices <b>Software/Equipment Required:</b> Soldering equipment, dotted boards, passive and active devices	CO 2 & BTL 3
7	Demonstrate a simple electronic system design using basic active and passive devices in dotted board.	CO 2 & BTL 3
8	Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement)	CO 2 & BTL 3
9	Demonstration of cut-out sections of machines: Transformer	CO 3 & BTL 3
10	Demonstration of cut-out sections of machines: Induction Machine (squirrel cage rotor).	CO 4 & BTL 3
<b>TEXT BOOKS</b>		
1	Satya Sai Srikant, Prakash Kumar Chaturvedi., (2020). Basic Electronics Engineering, Springer Singapore, 1st edition.	
2	John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, Al Winfield., (2018). Electrical Safety Handbook, McGraw-Hill Education, 4th Edition.	
<b>REFERENCE BOOKS</b>		
1	Jens Lienig, Hans Bruemmer., (2017). Fundamentals of Electronic Systems Design, Springer, 1st edition	

COURSE TITLE	OUTREACH (NCC) LEVEL 1 (ARMY WING)			CREDITS	01	
COURSE CODE	GGE51401	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4	
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

<b>Course Description</b>	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.														
<b>Course Objective</b>	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets’ immediate environment, and thereby enabling them for a brighter and progressive future.														
<b>Course Outcome</b>	(a) To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. (b) To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. (c) To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.														
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
CO-1	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-2	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-3	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-4	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-5	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: NCC GENERAL (9L+ 6P)</b>															
<b>NCC GENERAL:</b> NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC  Camps: Types & Conduct 2												<b>CO-1 BTL-3</b>			
<b>MODULE 2: NATIONAL INTEGRATION AND AWARENESS (9L+ 6P)</b>															
<b>NATIONAL INTEGRATION AND AWARENESS 4</b> NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1												<b>CO-2 BTL-3</b>			
<b>MODULE 3: PERSONALITY DEVELOPMENT. (9L+ 6P)</b>															
<b>PERSONALITY DEVELOPMENT 7</b> PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem												<b>CO-3 BTL-3</b>			

Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2		
<b>MODULE 4: LEADERSHIP</b>		<b>(9L+ 6P)</b>
<b>LEADERSHIP 5</b> L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2		<b>CO-4 BTL-3</b>
<b>MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</b>		<b>(9L+6P)</b>
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8</b> SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1		<b>CO-5 BTL-3</b>
<b><u>TEXT BOOKS</u></b>		
1.	NCC COMMON SUBJECT BOOK	
2.	RED BOOK (ARMY SPECIAL SUBJECTS)	

COURSE TITLE	OUTREACH (NCC) LEVEL 1 (AIR WING)			CREDITS	01	
COURSE CODE	GGE51401	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4	
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.					

<b>Course Objective</b>	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets' immediate environment, and thereby enabling them for a brighter and progressive future.														
<b>Course Outcome</b>	(a) To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. (b) To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. (c) To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.														
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-2</b>
<b>CO-1</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
<b>CO-2</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
<b>CO-3</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
<b>CO-4</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
<b>CO-5</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: NCC GENERAL</b>											<b>(9L+ 6P)</b>				
<b>NCC GENERAL:</b> NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2											<b>CO-1 BTL-3</b>				
<b>MODULE 2: NATIONAL INTEGRATION AND AWARENESS</b>											<b>(9L+ 6P)</b>				
<b>NATIONAL INTEGRATION AND AWARENESS 4</b> NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1											<b>CO-2 BTL-3</b>				
<b>MODULE 3: PERSONALITY DEVELOPMENT.</b>											<b>(9L+ 6P)</b>				
<b>PERSONALITY DEVELOPMENT 7</b> PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2											<b>CO-3 BTL-3</b>				
<b>MODULE 4: LEADERSHIP</b>											<b>(9L+ 6P)</b>				
<b>LEADERSHIP 5</b> L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhansi Ki Rani 2											<b>CO-4 BTL-3</b>				



<b>MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT (9L+6P)</b>	
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8</b> SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1	<b>CO-5</b> BTL-3
<b>TEXT BOOKS</b>	
NCC COMMON SUBJECT BOOK	
RED BOOK (ARMY SPECIAL SUBJECTS)	

COURSE TITLE	OUTREACH (NCC) LEVEL 1 (NAVY WING)			CREDITS	01	
COURSE CODE	GGE51401	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4	
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.					
Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets’ immediate environment, and thereby enabling them for a brighter and progressive future.					

Course Outcome	(a) To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country.														
	(b) To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation.														
	(c) To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-2	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-3	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-4	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-5	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: NCC GENERAL (9L+ 6P)															
NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2												CO-1 BTL-3			
MODULE 2: NATIONAL INTEGRATION AND AWARENESS (9L+ 6P)															
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1												CO-2 BTL-3			
MODULE 3: PERSONALITY DEVELOPMENT. (9L+ 6P)															
PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2												CO-3 BTL-3			
MODULE 4: LEADERSHIP (9L+ 6P)															
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2												CO-4 BTL-3			
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT (9L+6P)															
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8 SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1												CO-5 BTL-3			

<b>TEXT BOOKS</b>
<b>NCC COMMON SUBJECT BOOK</b>
<b>RED BOOK (ARMY SPECIAL SUBJECTS)</b>

COURSE TITLE	OUTREACH (NSS) LEVEL I			CREDITS	1
COURSE CODE	GGE51402	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	-
ASSESSMENT SCHEME					
CIA					ESE
Volunteering	Events attended	Awareness Programs attended		Attendance*	Report Submission
5	25	15		5	50
Course Description	<p>This course is designed to introduce students to the principles and practices of community service, social development, and active citizenship. The course aims to instill a sense of social responsibility and promote civic engagement among the participants. Through a combination of theoretical knowledge and practical experiences, students will develop essential skills and qualities required to make a positive impact on the community and society.</p> <p>Pre requisite: There are no specific prerequisites for enrolling in the NSS Semester 1 course. However, a genuine interest in community service, social development, and willingness to actively engage with diverse communities are essential.</p>				
Course Objective	<ol style="list-style-type: none"><li>1. To familiarize students with the objectives, history, and importance of the National Service Scheme (NSS) in community development, emphasizing the significance of social responsibility and civic engagement.</li><li>2. To develop essential leadership skills, teamwork, and effective project management techniques, preparing students to organize and execute community service projects successfully.</li><li>3. To cultivate empathy, compassion, and cultural sensitivity, enabling students to engage respectfully and effectively with diverse communities during their community service activities.</li><li>4. To promote environmental awareness and sustainable practices, encouraging students to integrate eco-friendly approaches into their community service initiatives.</li><li>5. To enhance students' communication, problem-solving, and decision-making skills, equipping them to engage with community members, stakeholders, and address challenges effectively.</li></ol>				

Course Outcome	1. students will gain a comprehensive understanding of the objectives, history, and significance of the National Service Scheme (NSS) in promoting community development and social responsibility.														
	2. Participants will demonstrate the ability to identify and assess prevalent social issues and challenges in the community, laying the groundwork for effective community service initiatives.														
	3. Through practical experiences and workshops, students will develop essential leadership skills, teamwork, and project management techniques necessary for organizing and executing successful community service projects.														
	4. By engaging with diverse communities, students will cultivate empathy, compassion, and cultural sensitivity, fostering meaningful and respectful interactions during their service activities.														
	5. Upon completion of Semester 1, students will have improved their communication, problem-solving, and decision-making skills, empowering them to actively and effectively engage in community development and service projects.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-2	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-3	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-4	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-5	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
TOPICS TO BE COVERED															
1. Introduction to National Service Scheme (NSS) and its Objectives 2. Understanding Social Issues and Needs Assessment in the Community 3. Project Planning and Management for Community Service 4. Leadership Development and Teamwork 5. Cultural Sensitivity and Interacting with Diverse Communities 6. Communication and Problem-Solving Skills for Community Engagement 7. Environmental Conservation and Sustainable Practices 8. Health, Hygiene, and Community Well-being 9. The Role of Arts and Culture in Community Development 10. Reflecting on Community Service Experiences and Personal Growth															
Suggest Activities															

<ol style="list-style-type: none"> <li>1. <b>Community Cleanliness Drive:</b> Organize a cleanliness drive in the local community, involving students and residents in cleaning public spaces and creating awareness about cleanliness and waste management.</li> <li>2. <b>Health Awareness Camp:</b> Conduct a health awareness camp where participants can provide basic health check-ups, distribute health-related information, and promote the importance of hygiene and sanitation.</li> <li>3. <b>Environmental Conservation Project:</b> Initiate an environmental conservation project, such as tree planting, creating green spaces, or implementing recycling programs, to raise awareness about environmental issues.</li> <li>4. <b>Teaching Assistance in Local Schools:</b> Collaborate with local schools to provide teaching assistance, conduct educational workshops, and help students with their studies.</li> <li>5. <b>Empowerment Workshops:</b> Organize workshops for women, youth, or other marginalized groups to empower them with skills and knowledge relevant to their needs, such as vocational training or financial literacy.</li> <li>6. <b>Cultural Exchange Program:</b> Arrange a cultural exchange event where NSS participants and local community members can share their traditions, dances, music, and food, fostering mutual understanding and appreciation.</li> <li>7. <b>Blood Donation Camp:</b> Partner with local healthcare institutions to organize a blood donation camp to address blood shortages and raise awareness about the importance of donating blood.</li> <li>8. <b>Community Survey and Needs Assessment:</b> Conduct a comprehensive community survey to understand the needs and priorities of the local residents, guiding the selection of future service projects.</li> <li>9. <b>Awareness Campaigns:</b> Create awareness campaigns on critical social issues like gender equality, education, or substance abuse through street plays, posters, and interactive sessions.</li> <li>10. <b>Disaster Preparedness Workshop:</b> Conduct workshops on disaster preparedness, including first aid training and emergency response, to equip the community with necessary skills.</li> <li>11. <b>Senior Citizens' Engagement:</b> Plan activities and events to engage and support senior citizens, such as organizing social gatherings or providing assistance with daily chores.</li> <li>12. <b>Digital Literacy Initiatives:</b> Set up digital literacy workshops to help community members, especially elders and underserved individuals, to learn basic computer and internet skills.</li> <li>13. <b>Community Sports Event:</b> Organize a community sports event to promote fitness, teamwork, and community bonding.</li> <li>14. <b>Skill Development Sessions:</b> Arrange skill development workshops in collaboration with local experts to teach practical skills like tailoring, painting, or handicrafts.</li> <li>15. <b>Awareness on Government Schemes:</b> Educate the community about various government schemes and programs that they may be eligible for, to ensure they can avail themselves of the benefits.</li> </ol>	
<b>REFERENCE BOOKS</b>	
1	National Service Scheme Manual, Government of India.
2	Orientation Courses for N.S.S. Programme officers, TISS.
3	Case material as Training Aid for field workers, Gurmeet Hans.
4	National Service Scheme Manual, Government of India.

5	Training Programme on National Programme scheme, TISS.
6	Social Problems in India, Ram Ahuja
7	Social service opportunities in Hospitals, Kapil K.Krishan, TISS.

COURSE TITLE		TAMIL (REGIONAL LANGUAGE)			CREDITS	2								
COURSE CODE		GLS51008	COURSE CATEGORY	HS	L - T - P - S	2 - 0 - 0 - 2								
Version	1.0	Approval Details	37 <sup>th</sup> ACM		LEARNING LEVEL	BTL- 3								
ASSESSMENT SCHEME														
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”		Attendance	End Semester Examination ESE								
15%	15%	10%	5%		5%	50%								
Course Description	This Tamil course improves Tamil language skills of the students’ Tamil letters and Grammar are included. This course provides an opportunity not only to get interest in learning Tamil Language but also, they can learn to converse easily.													
Course Objective	1. By studying this course, students will be able to write and speak Tamil easily in any situation, daily life and daily conversations. 2. Develops language and interest in learning in students. 3. Facilitates students to create opportunities for themselves in the society. 4. Students also learn Tamil literature by developing interest in language department. 5. This lesson plan helps the students to learn about the culture by learning the Tamil language.													
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the Letters and basic words of Tamil Language which are in daily use 2. Develops the listening skills of Tamil language 3. Utilize the letters and common words of the language for communication 4. Develop the conversational skills 5. Demonstrate the skill of reading and writing													
Prerequisites: Plus Two -Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-
CO5	-	-	-	-	-	-	-	-	2	3	2	3	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
அலகு - 1 தமிழ் எழுத்துக்கள் (6 L)														
தமிழ் எழுத்துகள் - ஒசைகள் - எண்கள் - வண்ணங்கள் - வடிவங்கள் - ஓர் எழுத்துச் சொற்கள் - பழங்கள் மற்றும் காய்கறிகள் - மலர்கள் - இயற்கை						CO-1 BTL-2								

<p>- மாதங்கள் சொற்கள் - பெயர்சொற்கள் - உரிச்சொற்கள் - வினைச்சொற்கள் - காலங்கள் - வாழ்த்துகள். வகுப்பறை செயல்முறைகள் : 1. வார்த்தைகளை வட்டமிடுதல். 2. விடுபட்ட எழுத்துகளை நிரப்புக. 3. வடிவங்களுக்கு வண்ணம் தீட்டுக.</p>		
<p><b>அலகு - 2 கேட்டல் மற்றும் உச்சரித்தல் (6L)</b></p>		
<p>உயிரெழுத்துகள், மெய்யெழுத்துகள் மற்றும் உயிர்மெய் எழுத்துகளை உச்சரித்தல் - சிறுகதைகள் வாசித்தல் - எதிர்ச்சொற்கள் - பொருள்தருக - வாக்கியத்தில் அமைத்து எழுதுதல் - ஒரு சொல்லில் விடையளித்தல். வகுப்பறை செயல்முறைகள் : 1. சொற்களைக் கேட்டு உச்சரிக்க செய்தல். 2. குழுவிவாதம் செய்தல். 3. கோடிட்ட இடங்களைச் சரியான சொற்களைக் கூறுதல்.</p>		<p>CO-2 BTL-2</p>
<p><b>அலகு -3 எழுத்துப் பயிற்சி (6 L)</b></p>		
<p>தமிழ் எழுத்துகளை எழுத கற்பித்தல் - உயிர் எழுத்துகள் - மெய் எழுத்துகள் - உயிர்மெய் எழுத்துகள் - ஆயுத எழுத்து - சார்பெழுத்துகள் - ஒற்றெழுத்துகள் - ஒரு சொல் - இருசொல் எழுதுதல் - ஒருவரி, இருவரி எழுதுதல். வகுப்பறை செயல்முறைகள்: 1. கோடிட்ட இடங்களை நிரப்புக. 2. சரியான எழுத்துகளை வட்டமிடுதல். 3. ஒருவரி சொற்களை எழுதுதல்.</p>		<p>CO-3 BTL-3</p>
<p><b>அலகு - 4 உரையாடல்கள் கற்பித்தல் (6L)</b></p>		
<p>சிறு உரையாடல்கள் கற்பித்தல் - வாழ்த்துக்கள் - வங்கியில் பணம் செலுத்துதல் - சந்தையில் கடைகாரரிடம் உரையாடுதல், பொது இடங்களில் உரையாடுதல். வகுப்பறை செயல்முறைகள்: 1. குறு நாடகங்கள் நடித்து உரையாடல்கள் கற்பித்தல். 2. விண்ணப்ப படிவங்கள் பூர்த்தி செய்தல். 3. மின்னல் அட்டைகள் காண்பித்தல்.</p>		<p>CO-4 BTL-2</p>
<p><b>அலகு - 5 தமிழ் வாசிக்க மற்றும் எழுத கற்பித்தல் (6 L)</b></p>		
<p>கடிதங்கள் வாசித்தல் மற்றும் எழுதுதல் - விண்ணப்ப கடிதம், வங்கிகணக்கு படிவங்கள், இரயில் முன்பதிவு விண்ணப்ப படிவம் பூர்த்திசெய்தல் - கவிதை வாசித்தல் - செய்திதாள் வாசித்தல். வகுப்பறை செயல் முறைகள்: 1. விண்ணப்ப படிவங்கள் பூர்த்திசெய்தல். 2. கவிதை வாசித்தல் போட்டிகள் 3. வகுப்பறை தேர்வுகள்</p>		<p>CO-5 BTL-3</p>
<p><b>TEXT BOOK</b></p>		
1.	Saidhai. P. Sundaramurthy (2018). Learn Tamil Through english. Manimekalai Prasuram. Chennai - 17. Pages 1 to 84	
2.	Pulavar Kulanthai (2020). Students Basic Tamil. Manimekalai Prasuram. Chennai -17. Pages1 to 84	
<p><b>REFERENCE BOOKS</b></p>		
1.	Lena tamil vanan. (2017). Easy Tamil Grammar. Manimekalai Prasuram, Chennai -17, Pages 11 to 21	
2.	Tamilnadu Board - NCERT/CBSE-Books Class – 6 <sup>th</sup> TO 9 <sup>th</sup> (2021-2022)	
<p><b>E-REFERENCES</b></p>		
1	<a href="https://cbsetamil.com/cbse-tamil-book/">https://cbsetamil.com/cbse-tamil-book/</a> , <a href="https://tamil.examsdaily.in/tnpsc-tamil-ilakkanam-material-pdf-download">https://tamil.examsdaily.in/tnpsc-tamil-ilakkanam-material-pdf-download</a>	

COURSE TITLE		HINDI (REGIONAL LANGUAGE)				CREDITS		2							
COURSE CODE		GLS51009		COURSE CATEGORY		HS		L - T - P - S		2 - 0 - 0 - 2					
VERSION	1.0		APPROVAL DETAILS		37 <sup>th</sup> ACM				BTL LEVEL		3				
ASSESSMENT SCHEME															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”etc.,				Attendance		End Semester Examination ESE			
15%		15%		10%		5%				5%		50%			
Course Description		This course has been designed to develop the regional language skills of the students. The course includes Hindi language, literature, vocabulary and grammar. This course teaches students how to communicate accurately, appropriately and fluently in regional language.													
Course Objective		1. To provide an environment to Speak and write in Hindi at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate. 2. To equip the students to Read, comprehend and answer questions based on literary texts. 3. To help student to become sensitive to the requirements of the society and respond to it in a constructive way. 4. To provide an environment to students to read and appreciate the literature.													
Course Outcome		Upon completion of this course, the students will be able to 1. Demonstrate the ability to write the grammatically correct sentences with accuracy. 2. Integrating various components of Hindi Language and determining it through reading and listening. 3. Organize and articulate ideas, concepts, and perceptions in a comprehensive manner in written correspondence, and speaking in formal and informal situations. 4. Infer details from after listening and reading and implement it in various professional situations. 5. Develop writing and speaking skills.													
Prerequisites: Plus Two -Intermediate Level															
CO, PO AND PSO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO-9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-	-



CO5	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
मॉड्यूल 1: हिंदी पत्र और लिपि (6 L)															
हिंदी स्वर और व्यंजन अक्षर - आश्रित स्वर सीखें - व्यंजन और व्यंजन समूह - अनुस्वर व्यंजन - संज्ञा - सर्वनाम - क्रिया (भविष्य) - संभावित विशेषण - काल - हिंदी के त्वरित नियम - अभिवादन - 2 अक्षर शब्द बनाना, 3 अक्षर शब्द - हर दिन शब्दावली - संख्याएं - रंग - परिवार - वस्त्र - बगीचा - घर - फल और सब्जियां - प्रकृति													CO-1		
सुझाई गई गतिविधियां:													BTL-2		
देशी वक्ताओं द्वारा स्वर और व्यंजन का उच्चारण सुनना															
स्वर और व्यंजन के वीडियो, 2 अक्षर और 3 अक्षर के शब्द, और प्रतिदिन प्रयोगार्थ शब्दावली															
मॉड्यूल 2: सुनने का कौशल (6 L)															
स्वर और व्यंजन का उच्चारण सुनना - लघु कथाएँ सुनना - साक्षात्कार - भाषण - सामाजिक मुद्दों पर पॉड वार्ता - निर्धारित पाठों को सुनना: इकाई 1 सभ्यता का रहस्य, इकाई 2 - युवावों से - वार्तालापों को सुनना - जानकारी सुनना - सम्मेलनों के भाषण															
सुझाई गई गतिविधियां:													CO-2		
सुनें और चुनें													BTL-3		
उम्मीदवार पाठ को सुनते हैं और तीन विकल्पों के साथ बहुविकल्पीय प्रश्न का उत्तर देते हैं।															
उम्मीदवार टीवी चैनलों में बातचीत - साक्षात्कार- अतिथि व्याख्यान, सम्मेलनों और कार्यशालाओं के दौरान विशेषज्ञों के भाषण सुनते हैं															
मॉड्यूल 3: बोलने का कौशल (6 L)															
औपचारिक संवाद - अनौपचारिक संवाद - लिंग रूपों के साथ बोलना - संख्या - काल - परिवार, शहर, त्योहारों, शौक आदि जैसे सामान्य विषयों पर बोलना - पसंद और नापसंद व्यक्त करना - ज़रूरतें और संपत्ति - भूमिका निभाना।													CO-3		
सुझाई गई गतिविधियां:													BTL-3		
प्रस्तुति – कार्यक्रमों का संचालन - भाषण देना															
मॉड्यूल- 4 : पढ़ने का कौशल (6 L)															
नमूना पढ़ना - नकल पढ़ना - अक्षरों और शब्दों का सही उच्चारण करना - पढ़ने में प्रवाह - कहानियाँ पढ़ना- संपादकीय, समाचारपत्र के लेख पढ़ना।													CO-4		
सुझाई गई गतिविधियां													BTL-3		
फ्लैशकार्ड का उपयोग - चार्ट - चित्रों की पहचान करना - शब्दों को पढ़ना															

मॉड्यूल-5 लेखन कौशल (6 L)	
सामान्य पत्राचार - पत्र लेखन: छुट्टी लेने पत्र, बैंक खाता खोलना, पुस्तकें मंगवाने के लिए पत्र, शिकायत पत्र - संकेत विकास - ज्ञापन - नोटिस	CO-5 BTL-3
<b>सुझाई गई गतिविधियां:</b> निर्धारित पाठ्यपुस्तक के अनुसार अभ्यास पूरा करना	
पाठ्य पुस्तक	
1.	Sashtri. S.R.(2019). Hindi Shikshak, Dakshina Bharat Hindi Prachar Sabha, Chennai (Pages 137)
संदर्भ पुस्तकें	
1.	Prathamatic Patya Pushthak. (2022), Dakshina Bharath Hindi Prachar Sabha, Chennai. (Pages 168)
2.	Madhyama Patya Pushthak. (2022) Dakshina Bharath Hindi prachar Sabha, Chennai (Pages 184)
ई-संदर्भ	
1.	<a href="https://www.hindipod101.com/">https://www.hindipod101.com/</a>

COURSE TITLE		REGIONAL LANGUAGE -TELUGU		CREDITS		2
COURSE CODE		GLS51010	COURSE CATEGORY	HS	L - T - P - S	2 - 0 - 0 - 2
Version	1.0	Approval Details	37 th ACM	BTL LEVEL		3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”etc.,		Attendance	ESE
15%	15%	10%	5%		5%	50%
Course Description	This course has been designed to meet students' current and future language and communication needs. It attempts to develop their proficiency in the four language skills and knowledge of grammar and vocabulary. This course teaches students how to communicate accurately, appropriately and fluently in professional and social situations.					
Course Objectives	1.This course is aimed to teach the basic Telugu language speaking skills. 2.It will introduce basic skills of the Telugu Language: its alphabets, essential words and simple sentence construction methods. 3.The course intends to facilitate students in acquiring foundational skills of reading, writing and speaking Telugu along with synonyms to expand vocabulary.					
Course Outcome	Upon completion of this course, the students will be able to 1.Demonstrate the basic skills of Letters and sounds in Telugu. 2.Develop the basic vocabulary for every day’s conversation. 3.Construct simple Telugu sentences with the simple words. 4.Utilize the words that have conjunct character, and can learn functional, everyday conversation. 5.Construct Simple sentences for delivering appropriate meaning.					

**Prerequisites: Plus Two Telugu-Intermediate Level**

**CO, PO AND PSO MAPPING**

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	2	-	-

**1: Weakly related, 2: Moderately related and 3: Strongly related**

**భాగము 1 : వినడం, చెప్పడం మరియు రాయడం (6L)**

తెలుగు అచ్చులు & హల్లులు శబ్దాలు ధ్వనిచిత్రంతో పాటు తెలుగు హల్లుల సంయోగాల పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	<b>CO-1</b>  <b>BTL-2</b>
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**భాగము 2 : పేర్ల పదాలకు, సంఖ్యలకు, మరియు వాటి గుణాల పరిచయం (6L)**

తెలుగు నామవాచకం పరిచయం తెలుగు సర్వనామం & దాని విషయం సంఖ్యలు దాని పరిచయం & తెలుగు విశేషణాలు పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	<b>CO-2</b> <b>BTL-3</b>
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**భాగము 3 : పదాలను విడదీసి వాక్యాలను రాయడం (6L)**

తెలుగు పూర్వ పదాలు - సంయోగాలు మరియు దాని ఉపయోగం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	<b>CO-3</b> <b>BTL-3</b>
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**భాగము 4 : పనులు, సమయం, క్రియ మరియు కాల వ్యవధుల పరిచయం (6L)**

వివిధ క్రియల యొక్క క్రియ & సమయం / కాల సంయోగాలనికీ పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	<b>CO-4</b> <b>BTL-3</b>
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**భాగము 5 : తెలుగు చదవడం, రాయడం మరియు ప్రశ్నించడం (6L)**

తెలుగులో సరళమైన వాక్యాలను రూపొందించడం (ప్రాథమిక వాక్య నిర్మాణ నియామాలు) తెలుగులో ప్రతీకూల వాక్యాలను రూపొందించడం తెలుగు బోధన అభ్యాస ప్రక్రియలో ప్రశ్నార్థకవాక్యాలను రూపొందించడం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	<b>CO-5</b> <b>BTL-3</b>
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**TEXT BOOK**

1.	Telugu Academy. (2018). Sampradaya Telugu Vyakaranalu. Telugu Academy. Vijayawada, Andhra Pradesh. India.
2.	Raghavendra. A. (2019). Telugu Vyakaranam. Prajasakti Book House. Tadepalli.
<b>REFERENCE BOOKS</b>	
1.	Ramarao, Chekuri. (2019). A Reference Grammar of Modern Telugu. Emesco Books. Hyderabad
2.	Vemuri, V. Rao. (2020). Learn Telugu with Its Grammar, Eco Foundation, Vijayawada.
<b>E-References</b>	
1	<a href="https://sarkarihelp.com/telugu-grammar-pdf-download/">https://sarkarihelp.com/telugu-grammar-pdf-download/</a>

COURSE TITLE		French (Foreign Language)				CREDITS	2
COURSE CODE		GLS51011	COURSE CATEGORY		HS	L - T - P - S	2 – 0 – 0 - 2
Version	1.0	Approval Details	37 th ACM			LEARNING LEVEL	BTL – 3
ASSESSMENT SCHEME							
CIA						End Semester Examination (ESE) Theory	
First Periodical Assessment	Second Periodical Assessment	Weekly assignment/ lab record and viva as approved by the Department Examination Committee “DEC”	Surprise Test / Quiz., as approved by the Department Examination Committee “DEC”	Attendance			
15 %	15 %	10 %	5 %	5 %	50%		
Course Description	Introduces students to the culture and language of the French-speaking world. Students develop an ability to communicate in real-life situations by acquiring reading, writing, listening, and speaking skills. The elementary courses prepare students to communicate successfully in some common basic social situations using the four language skills—listening, speaking, reading, and writing—within appropriate cultural contexts. The student will also acquire an understanding of cross-cultural awareness.						
Course Objective	1. To discover basic elements of the language, such as the different phonemes, the alphabet and its pronunciation 2. To discover the foundation of the language such as conjugations, auxiliaries, numbers, etc. 3. To learn how to form simple sentences about personal topics such as one's family 4.To start interacting with others by asking and answering simple questions 5. Understand your learning style and be able to check your own progress.						
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate advanced proficiency in spoken and written French. 2. Demonstrate the ability to read critically, interpret analytically, speak persuasively, and write coherently about visual and literary texts produced in the French-speaking world. 3. Demonstrate familiarity with methodological approaches in the study of literary and cultural texts, such as close reading, socio-historical contextualization, and literary and cultural theory. 4. Demonstrate knowledge of literary and cultural traditions, such as major movements, writers, and works of the French-speaking world, focusing on at least one and ideally multiple traditions: European, African, Caribbean, Asian, North American, and other Francophone cultures.						

5. Demonstrate the skills necessary for scholarly research and writing in the Humanities.														
Prerequisites: Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE – 1: INTRODUCTION FRANÇAISE (3Hrs.)														
.1 Introduction au cours de français - 1hr 1.2 La France et ses clichés - 2hr 1.3 Première rencontre (saluer, prendre congé, parler de son humeur) - 1hr 1.4 Qui es-tu? (se présenter, les chiffres 1-20, être et avoir) - 2hrs 1.5 Activité fiche d'identité													CO-1 BTL-2	
MODULE – 2: LE MONDE QUI M'ENTOURE (3Hrs.)														
2.1 Quel temps fait-il? (la météo, les chiffres 20-49) - 1hr 2.2 Mes couleurs préférées (la possession, le genre des articles) - 2hrs 2.3 Introduction à la Révolution Française - 2hrs 2.4 Me repérer dans le temps 1: la date (mois, jours, années) - 2hr 2.5 Me repérer dans le temps 2: l'heure (chiffres 49-60) - 2hrs													CO-2 BTL-3	
MODULE – 3: MES GOÛTS (3Hrs.)														
3.1 La nourriture en France - 2hrs 3.2 Exprimer ses goûts (verbes du 1er groupe, négation verbale) - 2hrs 3.3 Manger et boire en France - 1hr 3.4 Ma famille extraordinaire - 2hrs 3.5 Activité “qui est qui?” - 2hrs													CO-3 BTL-3	
MODULE – 4: MON QUARTIER EST UN MONDE (3Hrs.)														
4.1 Mon quartier idéal (lieux de la ville, prépositions de lieu, habiter et vivre) - 2hrs 4.2 C'est par où? (verbe aller, les directions, l'impératif, donner des indications) - 2hrs 4.3 Activité “où vont-ils?” trouver l'itinéraire - 1hr 4.4 On y va comment? (les transports, conduire et prendre, la préposition en/à) - 2hr 4.5 Montmartre, un quartier pas comme les autres. 2hrs													CO-4 BTL-3	
MODULE – 5: JOUR APRES JOUR (3Hrs.)														
5.1 Une journée ordinaire (verbes pronominaux, routine, emploi du temps) - 2hrs 5.2 Mes petites habitudes (la fréquence définie et indéfinie) - 1hr 5.3 Une carte postale de vacances - 2hrs 5.4 La provenance et la destination (prépositions in, from, to, le genre des pays) - 1hr 5.5 Mes vacances idéales (adjectifs démonstratifs) -2hr													CO-5 BTL-4	

TEXT BOOKS	
1	1. <i>Ego 1 Cahier d'Activités</i> , Annie BERTHET & Co, Hachette 2006 2. <i>Version Originale Cahier d'Exercices</i> , Monique DENYER & Co, ED. Maison des Langues, 2011
REFERENCE BOOKS	
1.	1. <i>Alter Ego 1</i>
2.	2. <i>Version Originale 1</i>
E Books	
1	1. <a href="http://www.lepointdufle.net">www.lepointdufle.net</a> 2. <a href="https://www.podcastfrancaisfacile.com/">https://www.podcastfrancaisfacile.com/</a> 3. <a href="https://didierfle.com/">https://didierfle.com/</a> 4. <a href="https://lebaobabbleu.com/">https://lebaobabbleu.com/</a> 5. <a href="https://leszexpertsfle.com/">https://leszexpertsfle.com/</a> 6. <a href="https://www.ressourcesfle.fr/">https://www.ressourcesfle.fr/</a> 7. <a href="https://lecafedufle.fr/">https://lecafedufle.fr/</a>

COURSE TITLE	German (Foreign Language)				CREDITS	2	
COURSE CODE	GLS51012		COURSE CATEGORY	HS	L - T - P - S	2 - 0 - 0 - 2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM		LEARNING LEVEL	BTL - 3	
ASSESSMENT SCHEME							
CIA					End Semester Examination (ESE) Theory		
First Periodical Assessment	Second Periodical Assessment	Weekly assignment/ lab record and viva as approved by the Department Examination Committee “DEC”	Surprise Test / Quiz., as approved by the Department Examination Committee “DEC”	Attendance			
15 %	15 %	10 %	5 %	5 %			50%
Course Description	The students shall understand the basic German Language concepts and cultural difference. They can manage to understand and communicate in German when they travel to Germany.						
Course Objective	1) This course aims to equip the students with a basic daily communication in German. 2) The students learn the spoken German required to communicate with native speakers 3) It helps them to understand the 4 different modules (Horen, Schreiben, Sprechen and Lesen) which is required to clear the A1 first level international certificate exam. 4) The students learn the concepts which is required for pursuing their PG or Job in Germany						
Course Outcome	Upon completion of this course, the students will be able to 1. Recall and recognize the facts and use familiar, everyday expressions, create very simple sentences, which relate to the satisfying of concrete needs.						

	2. Understanding the texts and trying to communicate in a simple manner provided the person they are speaking to speaks slowly and clearly and is willing to help. 3. Understanding and recalling the basic German Vocabulary, Verb conjugations with pronouns, expressions and connecting the learned facts to communicate in simple German sentences 4. Applying the above learned facts and trying to create own sentences, E-mails etc. as per the basic level achieved 5. Understand the native speaker and apply the knowledge (at basic level) in writing and speaking parts.													
Prerequisites: Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	2	-	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1 : SUPER! (3Hrs.)														
Jemanden vorstellen - Eine Hitliste internationaler Wörter schreiben - Nach dem Namen und der Herkunft fragen - Eine kursliste schreiben <u>Grammatik:</u> regelmäßige verben – möchten, sprechen,sein - Personalpronomen – ich,du,er,sie. - Definiter Artikel im nominative der,die,das - W -Ragen, Ja/Nein Fragen - Präpositionen – aus, in													CO-1 BTL-2	
MODULE 2 : Menschen (3Hrs.)														
Jemanden nach dem Befinden fragen - Sich verabschieden - <u>Interview:</u> Informationen über die Familie erfragen und darüber berichten - Über seine Freunde und die Freunde anderer schreiben und sprechen <u>Grammatik:</u> Indefiniter Artikel – ein/eine - Negativartikel – kein/keine... Possessiveartikel – mein,dein,sein..													CO-2 BTL-3	
MODULE 3 : Essen und Trinken (3Hrs.)														
Lebensmittel verglichen - Lieblingsfarbe und Lebensmittel zuordnen - Umfrage: mein Lieblingsfrühstück - Eine Einkaufsliste für ein Lieblingsessen schreiben <u>Grammatik:</u> Verb Konjugation – sein,haben - Imperative! Verbposition im Satz - W -Ragen, Ja/Nein Fragen													CO-3 BTL-3	
MODULE 4 : Mein Leben (3Hrs.)														
Sich über Leben, Beruf, Herkunft, etc.. austauschen - Eine Visitenkarte schreiben <u>Interview:</u> sich über den Tagensablauf austauschen - Die zahlen bis 100 <u>Grammatik:</u> Trennbaren verben_____ - “man” und “negation nicht” benutzen____ Akkusativ(definite/indefinite/negative Artikel) - Präpositionen – um, als, für,bei													CO-4 BTL-3	
MODULE 5 : Freizeit (3Hrs.)														
Ein kursposter mit Hobbys schreiben - Welche Hobbys habe ich,welche nicht - Notieren und sprechen – Was man selbst und die Familie am - Wochenende gerne macht- Über seinen Sonntag schreiben													CO-5 BTL-4	

<b>Grammatik:</b> Modalverben - Präpositionen – in,am		
<b>TEXT BOOKS</b>		
1	Rolf Bruseke, Starten Wir! (A1) ,Hueber Verlag,2018	
<b>REFERENCE BOOKS</b>		
1.	Stefanie Dengler, “Netzwerk neu A1.1 [Kurs und Übungsbuch]” ,Klett, 2015	
2.	Harmut Aufderstrasse,Heiko Bock, “Themen 1 aktuell kursbuch”,Hueber,2003	
<b>E Books</b>		
1.	<a href="https://www.learn-german-online.net/en/learning-german-resources/free-german-lessons-a1.htm">https://www.learn-german-online.net/en/learning-german-resources/free-german-lessons-a1.htm</a>	

COURSE TITLE			Spanish (Foreign Language)			CREDITS	2
COURSE CODE			GLS51013	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	1.0	Approval Details		37 <sup>th</sup> ACM		LEARNING LEVEL	BTL- 3
ASSESSMENT SCHEME							
CIA						ESE	
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”		Attendance		
15%	15%	10%	5%		5%		
Course Description	<p>This Spanish language course has been programmed to meet the grammatical and conversation needs of the student.</p> <p>Its content is very comprehensive and will also assist in the professional and personal language requirement of the student</p>						
Course Objective	<p>1. To facilitate the student in reaching out to international clients across the globe.</p> <p>2. To make an immediate connect by speaking to the prospective client/ company in their native language.</p> <p>3. To improve the overall personality of the student thereby making him/her more confident to communicate with global clients.</p> <p>4. To provide survival skills to students relocating In countries where Spanish is spoken. This includes USA, all the Latin American countries and Spain.</p>						
Course Outcome	<p>1. Understand spoken Spanish and construction of basic sentences.</p> <p>2. Creating conversations &amp; oral understanding.</p> <p>3. Enables the learners to decode a message and to give a suitable reply in the same manner.</p> <p>4. Understanding the perceptions, phrases, and other vocabulary.</p> <p>5. Understanding of not only the language but also culture, music, food and other aspects of the language.</p>						
Prerequisites: Plus Two -Intermediate Level							



CO, PO AND PSO MAPPING														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1: Introduction to Language & Communication (Part 1) (6 Hrs.)														
1. El Alfabeto – The Alphabets 2. Numeros – Numbers 3. Saludos - Salutations 4. La hora – The Time Suggested Readings: USO (Basico) Dele Gramatica Epanola Author by Francisca Castro													CO-1  BTL-1	
MODULE 2: Introduction to Language & Communication (Part 2) (6Hrs.)														
1. Los Meses, La Semana- The Month, The week and the days of the year 2. Los Estaciones Delan’o – the Seasons of the year 3. En el Aeropuerto, Cpger El Taxi – At the Airport, Booking tickets 4. Hola – Salutations and Greetings 5. Durante La Clase – During the class 6. Art’culos – Different Articles Suggested Reading: USO (Basico) Dele Gramatica Epanola Author by Francisca Castro													CO-2  BTL-2	
MODULE 3: Understanding of Basic verb and Introduction to Grammar (6 Hrs.)														
1. Verbp ser : Presente – Present tense of Verb “to be” 2. Estar / Hay – Conjugations of the verb “to be” and the verb there is / There are 3. Verbos En Presente: Regulares – Introduction to regular verbs 4. Ser / Estar / Tener – Conjugation of Irregular Verbs Suggested Reading: USO (Basico) Dele Gramatica Epanola Author by Francisca Castro													CO-3  BTL-3	
MODULE 4: Grammar and introduction to basic Concept (6 Hrs.)														
1. Posesivos – Possessive Adjectives and Nouns 2. Colores – Colours and Expressions 3. La Familia – The Family and its members 4. Nombres Y Adjetivos – Nouns and Adjectives Literary Readings: USO (Basico) Dele Gramatica Epanola													CO-4  BTL-2	

Author by Francisca Castro		
MODULE 5 :		(6 Hrs.)
1.Los nombres de la familia – Name of the Family Members 2. Relaciones – relations 3. Identificación de la tabla de familia - identification of the family table 4. Repaso del semestre entero - Full semester revision Literary Readings: <b>USO (Basico)</b> <b>Dele Gramatica Epanola</b> <b>Author by Francisca Castro</b>		CO-5  BTL-3
TEXT BOOK		
1.	Módulo Mind your Language Institute	
E-REFERENCES		
1	Open.umn.edu	
2	Pdfdrive.com/francisa-castro	

COURSE TITLE		Korean (Foreign Language)			CREDITS	2
COURSE CODE		GLS51014	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM		LEARNING LEVEL	BTL- 3
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance		
15%	15%	10%	5%		5%	50%
Course Description	One Paragraph.					
Course Objective	1. As Mandarin tops all global languages, the students get an upper hand in the prime industries of the world and direct access to the Chinese speaking community. 2. He/she will be able to create a direct connect thereby eliminating the requirement of a translator. 3. This will improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. The course will provide survival skills to students relocating to countries where Mandarin is spoken.					
Course Outcome	1. Understand spoken Mandarin and construction of advanced sentences. 2. Enhance conversations & oral understanding of few communication concepts. 3. Help in decoding a message and enable a suitable reply in the same manner. 4. Enable to construct phrases, and other vocabulary.					

5. Understand of language, culture, music, food and other aspects of the language.														
<b>Prerequisites:</b> Plus Two -Intermediate Level														
<b>CO, PO AND PSO MAPPING</b>														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1 – Introduction: Language and Culture (6 Hrs.)</b>														
<p>What kind of language is Korean?          Korea, philosophy of the Korean language &amp; GangNam Style! In this module, students will learn Korean culture, philosophy of creating Korean scripts, and the Korean alphabet or Korean writing system called 'Hangeul'. After completing the lessons, students will be able to understand the principles how each letter was invented. Also, students will be able to understand Korean sign languages as well.</p> <p><b>Suggested Activities:</b> Memory game</p>													<b>CO-1</b>  <b>BTL-1</b>	
<b>MODULE 2 – HANGEUL (6Hrs.)</b>														
<p>Greetings and Introducing phonics, the character system, Noun, Pronoun Basic Verb and Greetings &amp; Introducing. In this module, Students will learn how to greet, ask someone's nationalities / jobs and answer those questions in Korean. After completing the lessons, students will be able to introduce themselves, greet a person and talk about someone's nationalities and occupations.</p> <p><b>Suggested activities:</b> Introducing, Game with song, Flash cards game</p>													<b>CO-2</b>  <b>BTL-2</b>	
<b>MODULE – 3 : Restaurant &amp; Shopping (6 Hrs.)</b>														
<p>Reading simple sentence - to be able to comprehend sign board and name, ordering at a restaurant, counting units, Interrogative sentence.</p> <p>In this module, students will learn how to order food and make requests at a restaurant in Korean. After completing the lesson, students will be able to inquire about restaurant menus, order a specific portion of food at a restaurant, and order a drink at a café. After completing the lesson, you will be able to express prices per item, purchase a product from a store, and make a specific request while shopping.</p> <p><b>Suggested Activities:</b> Playing in the condition of restaurant and Shop, Dictation</p>													<b>CO-3</b>  <b>BTL-3</b>	
<b>MODULE – 4 : Daily Life &amp; Time (6 Hrs.)</b>														
<p>Talking about daily life, expressing movement, memo, simple message, object marker, expression of negation, &amp; writing.</p> <p>In this module, students will learn various Korean vocabulary regarding your daily lives. After completing the lessons, students will be able to utilize informal sentence endings, ask and answer about their everyday life.</p> <p>Students will learn about time and date in Korean. And students will also say the days of the week as well. After completing the lessons, students will be able to ask and respond time &amp; date using Korean numbers.</p> <p><b>Suggested activities:</b> Songs about numbers and family</p>													<b>CO-4</b>  <b>BTL-2</b>	
<b>MODULE 5 : MODULE 5 : Speaking and interaction with Natives (6 Hrs.)</b>														

Self-Introduction, conversations, finding out information about friends, talk with Korean, visit a Korean market or company. K-POP! Students are able to successfully handle a limited number of uncomplicated communicative tasks related to predictable topics for survival in Korea.		CO-5  BTL-3
Suggested Activities: Talk with Native Korean		
TEXT BOOK		
1.	세종한국어 1 The National Institute of The Korean Language	
REFERENCE BOOKS		
1	[ Active Korean 1 ] ,	
2	[ Practical Korean 1 ]	Darakwon, Korea, Korea
3	[ Korean Language for a Good Job ],	Darakwon (2007), Korea
E-REFERENCES		
1	<a href="https://www.amazon.in/Korean-Made-Simple-beginners-learning-ebook/dp/B00JHT4PCE">https://www.amazon.in/Korean-Made-Simple-beginners-learning-ebook/dp/B00JHT4PCE</a>	
2	<a href="http://www.twoponds.co.kr/en/snu">http://www.twoponds.co.kr/en/snu</a>	
3	<a href="https://www.koreantopik.com/2017/10/1-8-sejong-korean-textbook-pdfaudio69.html">https://www.koreantopik.com/2017/10/1-8-sejong-korean-textbook-pdfaudio69.html</a>	
MOOC Courses		

COURSE TITLE		MANDARIN (FOREIGN LANGUAGE)				CREDITS	2
COURSE CODE		GLS51015	COURSE CATEGORY		HS	L-T-P-C	2-0-0-2
Version	1.0	Approval Details		37 th ACM		LEARNING LEVEL	BTL - 3
ASSESSMENT SCHEME							
First Periodical Assessment		Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE
15%		15%	10%		5%	5%	50%
Course Description		This level of Mandarin language course has been programmed to understand more symbols and grammatical concepts. It simplifies the construction of sentences, making it easy to converse basic sentences. The student will be able to translate texts and also speak relating to weather, climate and self-introduction. An introduction to ‘My family’ and description using adjectives.					

<b>Course Objectives</b>	1. As Mandarin tops all global languages, the students get an upper hand in the prime industries of the world and direct access to the Chinese speaking community. 2. He/she will be able to create a direct connect thereby eliminating the requirement of a translator. 3. This will improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. The course will provide survival skills to students relocating to countries where Mandarin is spoken.
<b>Course Outcomes</b>	1. Learning the rules of Hanyu pinyin, pronunciation, Mandarin Chinese tones, character-based common vocabulary, fundamental grammar, and oral and writing practices. 2. Being able to differentiate the major tones of Chinese characters; Being able to differentiate the similar pronunciation of different vocabularies. 3. Practicing basic communicative skills in Mandarin Chinese; through repetition practices in class, students are to learn commonly used Chinese vocabulary, sentences structure and oral communicative skills. 4. Through in-class assignments, students are to recognize easy and basic Mandarin characters; in addition, students are to learn the regulation of expressing Mandarin Chinese in PinYin system and understand the specific adoption of borrowing from Alphabetic symbols. 5. Through in-class assignments, students are to practice the drawing of Mandarin Chinese strokes order and characters

**Prerequisites:** Plus Two -Intermediate Level

**CO, PO AND PSO MAPPING**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		

**1: Weakly related, 2: Moderately related and 3: Strongly related**

**MODULE – 1 Mandarin Chinese Character and Tones**

**(3 Hours)**

Basic strokes in Chinese - commonly used radicals - formation of vocabulary - pictograms - ideograms - compound ideographs - phono-semantic compounds  
 - derivative cognates - phonetic loans - 4 tones introduction - consonants - single vowel - double vowels - initial, medial and vowels

**Suggested activities:**

Direct lecturing, repeated themes lecturing

**CO-1  
BTL-2**

**MODULE - 2 Listening Skills**

**(3 Hours)**

Listening to native speaker's pronunciation of scripts, vocabularies. Tones differentiating trainings, one character with different pronunciation or tones, different characters with the same pronunciation or tones <b>Suggested activities:</b> Listening to native speaker's pronunciation and translate it into English.		<b>CO-2 BTL-3</b>
<b>MODULE - 3 Speaking Skills (3 Hours)</b>		
Imitating native speaker's pronunciations, tones and intonations to speak naturally <b>Suggested activities:</b> Reverse teaching, presentation, formal and informal conversations, singing Chinese songs, cultural activities, describing things		<b>CO-3 BTL-3</b>
<b>MODULE - 4 Reading Skills. (3 Hours)</b>		
50 vocabularies - easy to difficult - important and commonly used - <b>Suggested activities:</b> Flashcards to practice, word recognition competition		<b>CO-4 BTL-3</b>
<b>MODULE 5 Writing Skills (3 Hours)</b>		
15 vocabularies - easy to difficult - important and commonly used - Chinese Calligraphy <b>Suggested activities:</b> Only practiced in assignments, not tested in any exams, composition practice (optional)		<b>CO-5 BTL-3</b>
<b>TEXT BOOK</b>		
1.	National Taiwan Normal University Mandarin Training Center (2015). Linking publishing company. A Course in Contemporary Chinese (Textbook) 1	
<b>REFERENCE BOOK</b>		
1.	National Taiwan Normal University Mandarin Training Center (2017). Linking publishing company. Practical Audio-Visual Chinese Vol. 1, 3rd Edition	
<b>E-REFERENCE</b>		
1	<a href="http://chineseworksheetgenerator.org">http://chineseworksheetgenerator.org</a>	

COURSE TITLE			Japanese (Foreign Language)			CREDITS	2
COURSE CODE			GLS51016	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	1.0	Approval Details		37 th ACM		LEARNING LEVEL	BTL- 3
ASSESSMENT SCHEME							

CIA													ESE	
First Periodical Assessment	Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”				Attendance					
15%	15%		10%		5%				5%		50%			
Course Description		One Paragraph.												
Course Objective		1. By studying this course, students will be able to write and speak Tamil easily in any situation, daily life and daily conversations. 2. Develops language and interest in learning in students. 3. Facilitates students to create opportunities for themselves in the society. 4. Students also learn Tamil literature by developing interest in language department. 5. This lesson plan helps the students to learn about the culture by learning the Tamil language.												
Course Outcome		Upon the completion of this course, the students will be able to 1. Demonstrate the Letters and basic words of Tamil Language which are in daily use 2. Develops the listening skills of Tamil language 3. Utilize the letters and common words of the language for communication 4. Develop the conversational skills 5. Demonstrate the skill of reading and writing												
Prerequisites: Plus Two -Intermediate Level														
CO, PO AND PSO MAPPING														
COO O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1 – LANGUAGE AND CULTURE													(6 Hrs.)	
Greetings - -Self-Introduction - Numbers and Alphabets – Names of countries & Continents-Telling the time-Professions-Introduction about the language and country - Context based learning –At the Café, City orientation, Family, Daily routine, Weather and Clothing  挨拶--自己紹介-数字とアルファベット-国と大陸の名前-時間を伝える-職業-言語と国についての紹介-コンテキストベースの学習-カフェで、都市オリエンテーション、家族、日常、天気と服装													CO-1  BTL-1	
MODULE 2 : BASIC GRAMMAR													(6Hrs.)	
Definite and indefinite articles - Simple verbs and conjugation – Pronouns-Possessive Pronoun-W Questions-Adjectives –Separable verbs  明確な冠詞と不定冠詞-単純な動詞と活用-代名詞-所有代名詞-W質問-形容詞-分離動詞													CO-2  BTL-2	

MODULE 3 : READING & LISTENING SKILLS (6 Hrs.)	
Reading simple passages - to be able to comprehend advertisements and short texts - Listening comprehension of real time situation based dialogues	CO-3
簡単な文章を読む-広告や短いテキストを理解できるようにする-リアルタイムの状況に基づいた対話の理解を聞く	BTL-3
MODULE 4 : WRITING SKILLS (6 Hrs.)	
Small passages – Comprehension – Composition – Letter writing	CO-4
小さな文章-理解-作文-手紙の書き方	BTL-2
MODULE 5 : SPEAKING SKILLS (6 Hrs.)	
Introducing self- describing daily routine – engaging in dialogues about family, city, orientation, ordering food at the café and weather	CO-5
自己記述的な日常生活の紹介-家族、都市、オリエンテーション、カフェでの食事の注文、天気についての対話に参加する	BTL-3
TEXT BOOK	
1.	Minna no Nihongo: main textbook and translation book. (second edition, Elementary level 1-1) Publisher: Goyal Publishers
REFERENCE BOOKS	
E-REFERENCES	
MOOC Courses	

COURSE TITLE	UNIVERSAL HUMAN VALUES			CREDITS		2
COURSE CODE	GGE51001	COURSE CATEGORY	HS	L-T-P-S		2-0-0-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL		BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance		ESE
15%	15%	10%	5%	5%		50%



<b>Course Description</b>	This course is mandatory as per the AICTE for the UG students to motivate the students for focusing on the human values. The main aim is to focus on the sustainability of happiness with harmony and natural acceptance in the career. Lecture cum power points is provided as guidelines from AICTE.														
<b>Course Objective</b>	<ol style="list-style-type: none"><li>1. To create awareness to students on themselves and their surroundings (family, society, nature).</li><li>2. To create responsibility among students on life in handling problems with sustainable solutions</li><li>3. To prepare the students with human relationships and human nature in mind.</li><li>4. To Prepare the students on critical ability and sensitive to their commitment. (Human values, human relationship and human society).</li><li>5. To Apply the learning to their real life.</li></ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"><li>1. Demonstrate the necessity of relationship with family, society and nature. Familiarize with the challenges ahead and proposed solutions.</li><li>2. Formulate and design human cyber security policies, plans and procedures for organizations.</li><li>3. Apply standard security countermeasure tools to sustain human relationships and nature.es.</li><li>4. Recognize the necessity of human values and relationship.</li><li>5. Demonstrate the learning in their real life.</li></ol>														
<b>Prerequisites: Nil</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>P O -1</b>	<b>PO- 2</b>	<b>PO- 3</b>	<b>PO- 4</b>	<b>PO- 5</b>	<b>PO- 6</b>	<b>PO- 7</b>	<b>PO- 8</b>	<b>PO- 9</b>	<b>PO -10</b>	<b>PO- 11</b>	<b>PO- 12</b>	<b>PS O-1</b>	<b>PS O-2</b>	<b>PS O-3</b>
<b>CO-1</b>	-	-	-	-	3	3	3	3	3	3	3	3	-	-	-
<b>CO-2</b>	-	-	-	-	3	3	3	3	3	3	3	3	-	-	-
<b>CO-3</b>	-	-	-	-	-	3	3	3	3	3	3	3	-	-	-
<b>CO-4</b>	2	-	-	-	-	3	3	3	3	3	3	3	-	-	-
<b>CO-5</b>	-	-	-	-	-	3	3	3	3	3	3	3	-	-	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: Introduction (6L)</b>															
Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course, recapitulation from Universal Human Values-I Self-Exploration—what is it? - Its content and process; ‘Natural Acceptance’ and experiential Validation— as the process for self-exploration - Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels. <b>Practical component:</b>														<b>CO-1 BTL-2</b>	

<p>Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking</p> <p><b>Suggested Readings:</b></p> <p>Evolution of cyber security</p>	
<b>MODULE 2: Understanding Harmony in the Human Being (6L)</b>	
<p>Harmony in Myself! Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - happiness and physical facility Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail - Programs to ensure Sanyam and Health.</p> <p><b>Practical component:</b></p> <p>Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease</p>	<p><b>CO-2 BTL-2</b></p>
<b>MODULE 3: Understanding Harmony in the Family and Society (6L)</b>	
<p>Harmony in Human-Human Relationship- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals</p> <p><b>Practical component:</b></p> <p>Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives</p>	<p><b>CO-3 BTL-3</b></p>
<b>MODULE 4: Understanding Harmony in the Nature and Existence (6L)</b>	
<p>Whole existence as Coexistence - Understanding the harmony in the Nature -Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence.</p> <p><b>Practical component:</b></p> <p>Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.</p>	<p><b>CO-4 BTL-2</b></p>
<b>MODULE 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics (6L)</b>	
<p>Natural acceptance of human values, Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order -Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. -Case studies of typical holistic technologies, management models and production systems-Strategy for transition from the present state to Universal Human</p>	<p><b>CO-5 BTL-2</b></p>

Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.	
<b>Practical component:</b> Include practice exercises and case studies to discuss the conduct as an engineer or scientist etc.	
<b>TEXT BOOKS</b>	
1. P.R Gaur, R Asthana, G.P Bagaria, Human Values and Professional Ethics (2 <sup>nd</sup> revised edition) Excel Books, New Delhi, 2019	
2. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.	
3. A. N Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.	
Lawrence, C. (2016). <i>Cyber security for Dummies</i> , John Wiley & Sons Inc., 2 <sup>nd</sup> Edition, pp.213--432.	
<b>REFERENCE BOOKS</b>	
1.	AICTE STUDENT INDUCTION PROGRAM HANDBOOK- <a href="https://fdp-si.aicte-india.org/download/G012%20SIP%20Hand%20Book%20v2.pdf">https://fdp-si.aicte-india.org/download/G012%20SIP%20Hand%20Book%20v2.pdf</a>
<b>E BOOKS</b>	
1.	<a href="https://fdp-si.aicte-india.org/download.php#1">https://fdp-si.aicte-india.org/download.php#1</a>

COURSE TITLE	தமிழ் கலாச்சாரமும் தொழில்நுட்பமும் (TAMIL CULTURE AND TECHNOLOGY)			CREDIT	1
COURSE CODE	GLS51017	COURSE CATEGORY	FC	L-T-P-S	1-0-0-2
VERSION	1.0	APPROVAL DETAILS	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL- 4
ASSESSMENT SCHEME					
FRIST PERIODICAL ASSESSMENT	SECOND PERIODICAL ASSESSMENT	SEMINAR/ASSIGNMENTS LPROJECTS	SURPRISE TEST/QUIZ	ATTENDANCE	ESE
15%	15%	10%	5%	5%	50%
பாட விளக்கம்	தமிழர்களின் வரலாறு மற்றும் கலாச்சார மரபுகளைப் படிப்பதன் மூலம் மாணவர்களுக்கு மொழித்திறன் ஆற்றல் நன்கு வளர்ச்சி அடைகிறது. மேலும் மாணவர்களிடையே மொழிப்பற்று உருவாகி கற்றலில் ஆர்வம் அதிகரிக்கிறது. இப் பாடத்திட்டத்தில் செய்யுள், இலக்கிய வரலாறு, நாகரிகம், பண்பாடு, பண்டையத் தமிழர்களின் உணவு, உடை, உறையுள், அணிகலன், போர் முறை, பண்டையத் தமிழரின் மரபு பற்றிய செய்திகள் அடங்கியுள்ளன. களவு ஒழுக்கம், கற்பு ஒழுக்கம் ஆகியவற்றை மாணவர்கள் கற்பதன் மூலம் வாழ்க்கைக்குத் தேவையான ஒழுக்க நெறிமுறைகள் நன்கு வளர்ச்சியடையும்.				

பாடத் திட்டத்தி ன் நோக்கம்	இப் பாடத்திட்டத்தின் மூலம் சமுதாயத்தில் தங்களுக்குத் தேவையான வாய்ப்புக்களை மாணவர்கள் உருவாக்கிக்கொள்ள வழிவகைச் செய்கிறது. அத்துடன் சமய வழிபாடு, விழாக்கள், சடங்குகள், நம்பிக்கைகள், மந்திரம், விளையாட்டுகள், தொழில்கள், வாணிகம் முதலியச் செய்திகளைக் கற்பதன் மூலமாக மாணவர்களிடையே பகுத்தாயும் திறன் நன்கு வளர்ச்சியடைகிறது. இப்பாடத்திட்டதினைக் கற்பதன் மூலம் மொழித்துறையில் ஆர்வம் ஏற்பட்டுத் தமிழ் இலக்கியங்களைப் பற்றியத் தேடல் மாணவர்களிடம் அதிகரிக்கிறது.
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பாடத் திட்டத்தி ன் பயன்கள்	<p>இந்தப் பாடத்திட்டத்தில் பண்டையத்தமிழரின் கட்டிடக்கலை, இசைக்கலை, சிற்பக்கலை, ஓவியக்கலை, நாடகக்கலை, அறிவியல், மருத்துவம், வானியல், வானூர்தியியல், கனிமவியல், உயிரியல், எண்ணியல் முதலிய தொழில்நுட்பம் சார்ந்த தகவல்கள் இணைக்கப் பட்டிருப்பதால் மாணவர்களிடம் உளவியல் ரீதியான நுண்ணறிவுத் தேடலை ஏற்படுத்தி எதிர்கால வேலை வாய்ப்பிற்கு உந்து சக்தியாக அமையும்.</p> <p>பண்டையக் காலத் தொழில்நுட்பக் கருவிகள், தொழில்நுட்ப எந்திரங்கள், இன்றைய கணினித்தமிழ், இணையமும் தமிழும், தகவல் தொடர்பியல் மற்றும் ஊடகவியல் முதலியன இப்பாடத்திட்டத்தில் இணைக்கப்பட்டிருப்பது மாணவர்களிடையே தொழில்நுட்ப திறனை வளர்க்கும்.</p> <p>மாணவர்கள் மொழித்திறனை வளர்த்துக்கொண்டு தெளிவான முறையில் கவிதை, கட்டுரை, சிறுகதைப் போன்றவைகளைப் படிப்பதிலும், படைப்பதிலும் ஆர்வம் செலுத்தி சிறந்த படைப்பாளராக உருவாகி சமுதாய வளர்சிக்குத் தேவையான பல நல்ல படைப்புக்களைக் கொடுக்கும் வகையில் பாடத்திட்டம் அமைக்கப்பட்டுள்ளன.</p> <p>மாணவர்கள் ஒழுக்க நெறியோடு தங்களின் வாழ்க்கைத் தரத்தை மேம்படுத்திக் கொள்ளவும், பண்டையத் தமிழர்களின் வாழ்கை முறை, பண்பாடு, கலாச்சாரம், நாகரிக வளர்ச்சி, தொழில்நுட்பம் ஆகியவற்றைக் கற்றுக்கொண்டு மாணவர்கள் தங்களின் வாழ்க்கை தரத்தை மேம்படுத்திக் கொள்ள இந்த பாடத்திட்டம் உறுதுணையாக அமைந்துள்ளது.</p>
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Prerequisites: Plus Two Tamil-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO - 10	PO- 11	PO- 12	PSO -1	PSO -2	
CO- 1	-	-	-	-	-	-	-	-	-	3	-	-	***	***	
CO- 2	-	-	-	-	-	-	-	2	2	3	-	-	***	***	
CO- 3	-	-	-	-	-	-	-	-	-	3	-	-	***	***	
CO- 4	-	-	-	-	-	-	2	-	-	3	2	-	***	***	



<p>அருவி - ஆறு - ஏரி - அணை - குளங்கள் - கால்நடை பராமரிப்பு - மீன்வளம் - தொழில்சார் அறிவியல் சமூகம் - சொட்டுநீர் பாசனம் - தெளிப்புநீர் பாசனம்.</p> <p>வகுப்பறை செயல் முறைகள்:</p> <ol style="list-style-type: none"> <li>1.வினா எழுப்புதல்</li> <li>2. மின்னல் அட்டைகள் காண்பித்தல்</li> <li>3. வகுப்பறை குழுவிவாதம்</li> <li>4. வகுப்பறை தேர்வு</li> </ol>	<p>CO-4 BTL-1</p>
<p>அலகு -5 அறிவியல் மற்றும் கணினித்தமிழ் (3 Hours)</p>	
<p>கணினித்தமிழ் - தோற்றம் - வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்புச் செய்தல் - மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின்நூலகம் - இணையத்தமிழ் அகராதிகள் - சொற்குவை திட்டம்.</p> <p>வகுப்பறை செயல் முறைகள்:</p> <ol style="list-style-type: none"> <li>1. விளக்கவுரை அளித்தல்</li> <li>2. காட்சி விளக்கப்படங்கள்</li> <li>3. பட்டிமன்றம்</li> <li>4. கணினியில் தமிழ் செயல்முறைகள்</li> </ol>	<p>CO-5 BTL-2</p>
<p>பாடப்புத்தகம்</p>	
<ol style="list-style-type: none"> <li>1.பண்டைத் தமிழ் நாகரிகமும் பண்பாடும், ஞா.தேவநேயபாவாணர், தமிழ்மண் பதிப்பகம், சென்னை. 2000.</li> <li>2. பழந்தமிழில் அறிவியல், க.பலராமன், உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை. 2009.</li> <li>3. தமிழக வரலாறும் மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும்)</li> <li>4. கணினித்தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)</li> </ol>	
<p>பார்வை நூல்கள்</p>	
<p>மின் நூல்கள்</p>	<ol style="list-style-type: none"> <li>1. அ. , 2014, தமிழர் நாகரிகமும் பண்பாடும், யாழ் வெளியீடு, மேற்கு அண்ணா நகர், சென்னை-40,</li> <li>2. மயிலை சீனி வேங்கடசாமி, 2014, நுண்கலைகள், பூம்புகார் பதிப்பகம், சென்னை-08,.</li> <li>3. க.மங்கையர்க்கரசி , 2017,பழந்தமிழ் இலக்கியங்களில் அறிவியல் சிந்தனைகள், லாவண்யா பதிப்பகம், திருவல்லிக்கேணி, சென்னை-05,</li> <li>4. துரை.மணிகண்டன் ,இணையமும் தமிழும், நன்னிலம் பதிப்பகம், சென்னை.</li> </ol>
	<ol style="list-style-type: none"> <li>1. <a href="http://www.tamilvu.org">www.tamilvu.org</a></li> <li>2. <a href="http://www.projectmadurai.org">www.projectmadurai.org</a></li> <li>3. <a href="http://www.tamilnoolagam.in">www.tamilnoolagam.in</a></li> </ol>

**Semester-II**

COURSE TITLE	ANALYTICAL MATHEMATICS (Common to ALL B. Tech)			CREDITS	4										
COURSE CODE	EMA51002	COURSE CATEGORY	BS	L-T-P-S	3-0-2-2										
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / Lab records as approved by the Department Examination Committee “DEC”	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical )									
15%	15%	10%	5%	5%	25%	25%									
Course Description	To make the student understand the basic analytical mathematical skills that is imperative for effective understanding of engineering subject using MATLAB.														
Course Objective	1. To implement problem solving skills using vectors 2. To provide an exposure on the concepts of complex variables, conformal mapping and bilinear transformation. 3. To comprehend integrals using Cauchy’s integral and residue theorem. 4. To illustrate the applications of Laplace Transforms 5. To make the students understand the concept of Fourier series														
Course Outcome	Upon completion of this course, the students will be able to 1. Verify the standard theorems in Vector Calculus and apply them to evaluate surface area and volume. 2. Construct an analytic function when real and imaginary parts are given. 3. Evaluate finite integrals using Cauchy’s theorem. 4. Solve the system of ordinary differential equations using Laplace Transform 5. Expand the Fourier series for the given function.														
Prerequisites: Knowledge in single-variable calculus.															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	-	1	-	-	-	-	-	-	1	2	-	1
CO-2	3	2	1	-	2	-	-	-	-	-	-	1	1	-	1

[illegible]



1.	A. Chandrasekaran, G. Kavitha (2022), <i>Analytical Mathematics</i> , Dhanam Publications, 1 <sup>st</sup> Edition, Chennai.
2.	T. Veerarajan (2016), <i>Engineering Mathematics-II</i> , McGraw Hill Education (India), Private Limited, 4 <sup>th</sup> Edition, New Delhi.
3.	Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma (2016), <i>MATLAB and its Applications in Engineering</i> , Pearson Publication, 2 <sup>nd</sup> Edition, New Delhi.
4.	D. G. Duffy (2021), <i>Advanced Engineering Mathematics With MATLAB (Advances in Applied Mathematics)</i> , Chapman and Hall Publisher, 5 <sup>th</sup> Edition, CRC Press, USA.
<b>REFERENCE BOOKS</b>	
1.	P. Sivarama Krishna Das, C. Vijayakumari (2017), <i>Engineering Mathematics</i> , 1 <sup>st</sup> Edition, Pearson Publishing, Chennai.
2.	A. P. Santhakumaran, P. Titus P (2017), <i>Engineering Mathematics – II</i> , NiMeric Publications, 2 <sup>nd</sup> Edition, Nagercoil, India.
3.	Kreyszig Erwin (2016) <i>Advanced Engineering Mathematics</i> , John Wiley and Sons, 10 <sup>th</sup> Edition, New Delhi.
4.	S.S. Sastry (2015), <i>Engineering Mathematics</i> , Vol. I & II, PHI Learning Pvt. Ltd, 4 <sup>th</sup> Edition, New Delhi.
<b>E BOOKS</b>	
1.	<a href="http://ggn.dronacharya.info/APSDept/Downloads/QuestionBank/Mathematics-I/SectionD.pdf">http://ggn.dronacharya.info/APSDept/Downloads/QuestionBank/Mathematics-I/SectionD.pdf</a> .
2.	<a href="https://people.math.sc.edu/girardi/m7034/book/AshComplexVariablesWithHyperlinks.pdf">https://people.math.sc.edu/girardi/m7034/book/AshComplexVariablesWithHyperlinks.pdf</a>
3.	<a href="https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/">https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/</a>
4.	<a href="https://www.pdfdrive.com/calculus-ii-sequences-and-series-e11676778.html">https://www.pdfdrive.com/calculus-ii-sequences-and-series-e11676778.html</a>
<b>MOOC</b>	
1.	<a href="https://www.edx.org/course/introduction-engineering-mathematics-utarlingtonx-engr3-0x">https://www.edx.org/course/introduction-engineering-mathematics-utarlingtonx-engr3-0x</a>

COURSE TITLE	ENGINEERING PHYSICS (Common to ALL branches of Engineering)			CREDITS	4
COURSE CODE	EPH51001	COURSE CATEGORY	BS	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL3
ASSESSMENT SCHEME					
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	End Semester Examination
15%	15%	10%	5%	5%	Theory 25%
					Practical 25%
Course Description	This course is based on the developing areas of physics integrating both the theoretical and practical training for engineering students. Application of the concepts to solve engineering problems, to acquire practical thinking and logical reasoning.				
Course Objective	1. To evaluate various types of modulus of elasticity and impart knowledge on production and application of ultrasonic wave in SONAR and NDT. 2. To provide a strong foundation on the concepts of crystal physics and thermal conductivity. 3. To illustrate theoretically and experimentally the wave – particle duality. 4. To evaluate the material properties based on energy band gap and magnetic moment. 5. To make the students understand the production of lasers and propagation of light through an optical fiber.				

<b>Course Outcome</b>	Upon completion of this course, the students will be able to														
	1. Evaluate the elastic properties of materials and apply the properties of ultrasonic waves for industrial applications														
	2. Evaluate the characteristics of crystal structure and the thermal conductivity of good and bad conductors.														
	3. Solve the Schrodinger’s wave equations and derive energy density based on Planck’s hypothesis														
	4. Apply the fundamental concepts to classify magnetic and semiconducting materials and thereby, illustrate their applications.														
	5. Apply lasers and optical fibers as engineering tools														
<b>Prerequisites:</b> Knowledge in fundamentals of Physics at higher secondary level															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	2	-	-	2	1	2	1
CO2	3	3	2	2	3	-	-	-	3	-	-	3	2	1	1
CO3	3	3	1	1	1	-	-	-	2	-	-	2	1	2	2
CO4	3	3	1	2	1	-	-	-	3	-	-	1	1	3	1
CO5	3	3	2	1	3	-	-	-	3	-	-	3	2	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: PROPERTIES OF MATTER AND ULTRASONICS (9L + 6P)</b>															
Elasticity – Hooke’s law – Elastic Moduli – Young’s modulus of elasticity – Rigidity modulus - Bulk modulus – Twisting couple on a wire – Torsional pendulum – Determination of rigidity modulus of a wire – Depression of a cantilever – Non-uniform bending – Uniform bending – I shape girder. Introduction – Production of ultrasonic waves (Magnetostriction and Piezoelectric methods) – Properties of ultrasonic – Applications in SONAR and NDT. <b>Practical component:</b> Torsional pendulum – Determination of rigidity modulus of thin wire and moment of inertia of regular objects Non-uniform bending – Determination of Young’s modulus of wooden beam													<b>CO1 BTL3</b>		
<b>MODULE 2: CRYSTALLOGRAPHY AND THERMAL PHYSICS (9L + 6P)</b>															
Amorphous and crystalline solids – Unit cell – Lattice parameters – Crystal system and Bravais lattices (Qualitative) – Miller indices – Interplanar spacing for cubic crystal system – Crystal structures SCC, BCC, FCC, HCP (no. of atoms, coordination number, atomic packing fraction calculations) – Bragg’s law – X-ray diffractometer. Thermal conductivity – Experimental determination of thermal conductivities of good and bad conductors – Forbe’s method (Theory and experiment) – Lee’s disc method for bad conductors. <b>Practical component:</b> Lee’s disc experiment – Determination of thermal conductivity of bad conductor													<b>CO2 BTL3</b>		
<b>MODULE 3: QUANTUM PHYSICS (9L + 6P)</b>															
Black body radiation – Planck’s hypothesis – Photoelectric effect – Compton effect – Theory and experimental verification Physical significance of wave function – Schrodinger's wave equation – Time independent and time dependent equations – Particle in a 1D box – Quantum Well (no derivation)													<b>CO3 BTL3</b>		

<b>Practical component:</b> Photoelectric effect – To plot the KE as a function of frequency for different metals.		
<b>MODULE 4: MAGNETISM AND SEMICONDUCTORS (9L + 6P)</b>		
Magnetic moment – Classification of magnetic materials (Dia, para, ferro, anti-ferro) – Domain theory of ferromagnetism – Hysteresis – Hard and soft magnetic materials – Memory applications. Classification of semiconductors – Direct and in-direct bandgap – Fermi energy level – Intrinsic and extrinsic semiconductors – <i>n</i> -type and <i>p</i> -type semiconductors (Qualitative) – Hall effect – Determination of Hall voltage (Theory and experiment) – Applications of Hall effect. <b>Practical component:</b> Current – Voltage (IV) characteristics of semiconductor diode		<b>CO4 BTL3</b>
<b>MODULE 5: MODERN OPTICS (9L + 6P)</b>		
Principles of laser – Stimulated absorption – Spontaneous emission – Stimulated emission – Population inversion – Pumping action – Active medium – Laser characteristics – Nd-YAG laser – CO <sub>2</sub> laser – Dye laser – Laser in Industrial applications. Optical fiber – Principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – Types of optical fibers – Optical fiber as temperature sensors. <b>Practical component:</b> Laser – Determination of the wavelength of the laser using grating Laser – Particle size determination using lycopodium powder		<b>CO5 BTL3</b>
<b>TEXT BOOKS</b>		
1	Rajendran V. (2017), <i>Engineering Physics</i> , Tata McGraw Hill Publications, 3 <sup>rd</sup> Edition, US.	
2	Gaur R. K. and Gupta S.L. (2014). <i>Engineering Physics</i> , 8 <sup>th</sup> edition, Dhanpat Rai publications (P) Ltd., New Delhi	
3	Mani P. (2016), <i>Engineering Physics</i> , Dhanam Publications, 13 <sup>th</sup> Edition, Chennai.	
<b>REFERENCE BOOKS</b>		
1.	Arthur Beiser (2017), <i>Concepts of Modern Physics</i> , Tata McGraw Hill Publications, 7 <sup>th</sup> Edition, US.	
2.	Halliday, Resnick and Walker (2021), <i>Fundamental of Physics Extended</i> , Wiley & Sons, 12 <sup>th</sup> Edition, US.	
3	Shaikh I. A, Kulkarni H. R, Mohril, S. F. and Khairnar (2018), <i>Engineering Physics</i> , Nirali Prakashan Publishers, 5 <sup>th</sup> Edition, Pune.	
<b>E BOOKS</b>		
1.	<a href="https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/042-Fundamentals-of-Physics-II-Electromagnetism-Optics-and-Quantum-Mechanics-R.-Shankar-Edisi-1-2016.pdf">https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/042-Fundamentals-of-Physics-II-Electromagnetism-Optics-and-Quantum-Mechanics-R.-Shankar-Edisi-1-2016.pdf</a>	
2.	<a href="https://zenodo.org/record/243407#.Y0EfilxBzIU">https://zenodo.org/record/243407#.Y0EfilxBzIU</a>	
3.	<a href="https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf">https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf</a>	
<b>MOOC</b>		
1.	<a href="http://nptel.ac.in/courses/115106061">http://nptel.ac.in/courses/115106061</a>	
2.	<a href="http://nptel.ac.in/courses/117101054/12">http://nptel.ac.in/courses/117101054/12</a>	

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL B.Tech.)			CREDITS	4
COURSE CODE	ECT51001	COURSE CATEGORY	BS	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					

First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	ESE										
15%	15%	10%	5%	5%	Theory 25%										
					Practical 25%										
Course Description	To expose the students to the basics of Engineering Materials and their applications.														
Course Objective	<div>1. To make the students understand the basics of crystal structure and phase rule.</div> <div>2. To provide a knowledge on the theoretical basis of the chemical composition, properties and applications of abrasives, adhesives, lubricants and refractories.</div> <div>3. To give a strong foundation on the basic concepts of nanomaterials, the general synthetic methods with emphasis on their applications.</div> <div>4. To provide an exposure on the fundamentals and applications of polymeric materials and composites.</div> <div>5. To illustrate the applications of energy materials, liquid crystals and conducting polymers with a good exposure on their basic terminologies.</div>														
Course Outcome	<div>Upon completion of this course, the students will be able to</div> <div>1. Propose and justify suitable metals/materials for alloying.</div> <div>2. Distinguish and select a suitable material as abrasives / adhesives / lubricants / refractories based on its properties and applications.</div> <div>3. Select an appropriate technique for nanomaterial synthesis and characterization.</div> <div>4. State and select a suitable polymeric / composite material for industrial applications.</div> <div>5. Develop the suitable organic/inorganic materials that can be employed in energy storage / production and electronic devices.</div>														
Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	-	-	-	1	-	-	-	-	1	1	2	1
CO-2	3	2	1	-	-	-	2	-	-	-	-	2	2	2	2
CO-3	3	2	2	-	-	-	1	-	-	-	-	3	1	1	2
CO-4	3	2	1	-	-	-	2	-	-	-	-	2	2	2	1
CO-5	3	2	1	-	-	-	2	-	-	-	-	2	2	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: CRYSTAL STRUCTURE AND PHASE RULE (9L + 6P)															
Basic crystal systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure. Phase rule: Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system -- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule. Practical component: Construction of phenol-water phase diagram - Determination of													CO-1 BTL-3		

apparent density of porous solids.		
<b>MODULE 2: ABRASIVES, ADHESIVES, LUBRICANTS AND REFRACTORIES (9L + 6P)</b>		
Abrasives – Classification, Properties, Uses – Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications) – Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS <sub>2</sub> and Graphite - Refractories – Classification, Properties, Applications. Practical components: Preparation of urea-formaldehyde resin - Determination of porosity of a refractory		<b>CO-2 BTL-3</b>
<b>MODULE 3: NANOMATERIALS (9L + 6P)</b>		
Introduction – Scope of nanomaterials - Types of nanomaterials - Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Laser ablation, Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties – Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization – UV-Visible spectroscopy, FE-SEM and TEM (Principle and Applications only). Practical component: Preparation of ZnO nanoparticles by wet chemical method – Verification of Beer-Lambert’s law using silver nanoparticles.		<b>CO-3 BTL-3</b>
<b>MODULE 4: POLYMERS AND COMPOSITES (9L + 6P)</b>		
Introduction – Basic definitions – Classification of polymers – Structure and property relationship of polymers – Plastics – Synthesis, properties and applications of polycarbonates and phenol-formaldehyde - Biodegradable Polymers, examples and applications. Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites –Types and Applications. Practical components: Determination of molecular weight / viscosity of polymer using Ostwald Viscometer.		<b>CO-4 BTL-3</b>
<b>MODULE 5: MATERIALS FOR ENERGY AND ELECTRONIC APPLICATIONS (9L + 6P)</b>		
Energy storage materials – Metal-hydride batteries, Li-batteries - Materials for solar cells: Semi-conductors - Materials for hydrogen technology - production (electrolysis), storage (hydrides), fuel cells. Liquid Crystals - Introduction –Characteristics – Optical properties- Classification – Chemical constitution and liquid crystalline behaviour - Applications. Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications. Practical component: Preparation of polyaniline / Polypyrrole.		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Jain, P.C., Jain, M. (2018). <i>Engineering Chemistry</i> , Dhanpat Raj Publishing Company (P) Ltd, New Delhi, 17 <sup>th</sup> Edition.	
2.	Puri, B. R., Sharma, L. R., Pathania, M. S. (2020). <i>Principles of Physical Chemistry</i> , Vishal Publishing Co. Jalandhar, 47 <sup>th</sup> Edition.	
3.	Rangwala. (2017). <i>Engineering Materials</i> , Charotar Publishing House Pvt. Ltd, 43 <sup>rd</sup> Edition.	
<b>REFERENCE BOOKS</b>		
1.	Clyne, T. W., Hull, D. (2019). <i>An introduction to composite materials</i> , Cambridge University Press, 3 <sup>rd</sup> Edition.	
2.	Shah, M. A., Ahmad, T. (2021). <i>Nano Science &amp; Technology</i> , Dreamtech Press, 2021 Edition.	
3.	Palanna, O. G. (2018). <i>Engineering Chemistry</i> , Mc Graw Hill Education (India) Pvt. Ltd, 2 <sup>nd</sup> Edition.	
<b>E BOOKS</b>		



CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	1	1
CO2	-	-	-	-	-	-	-	2	2	3	-	-	0	0
CO3	-	-	-	-	-	-	-	-	-	3	-	-	1	1
CO4	-	-	-	-	-	-	2	-	-	3	2	-	0	1
CO5	-	-	-	-	-	-	-	-	2	3	2	3	1	0
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE1: Talk about different cultures</b>													<b>(9L)</b>	
<b>Grammar</b> : Modals of Obligation – Comparatives and Superlatives – Asking for and Giving Recommendations - <b>Writing</b> : Two Reviews Positive and Negative Language Adverbs. <b>Reading</b> : Article: Culture Shock, There's an app to deal with that - Blog: Hungry Adventures, - Reviews of Café. <b>Pronunciation</b> : Word Stress : compound nouns 2. Sound and Spelling: /S/ and /tS/ - Sounding Interested <b>LAB: (Listening)</b> Three monologues : Culture shock - Radio show : Vending Machines in Japan, - A Special Gift - Three Monologues : Special Occasions <b>(Speaking)</b> Describing Different Cultures - Describing a Special Meal - Asking for and giving recommendations : Expressing Surprise. - Places to go out.													<b>CO-1 BTL-2</b>	
<b>MODULE 2 : House and Home</b>													<b>(9L)</b>	
<b>Grammar</b> : Modals of deduction - Quantifiers - Making offers and requests and asking for permissions <b>Vocabulary</b> : Buildings - Verbs and Prepositions <b>Pronunciation</b> : Modal Verbs: final /t/ and /d/ sounds – Sentence stress verbs and prepositions - Sounding polite <b>Writing</b> : A note with useful information offering choices. <b>Reading</b> : Articles : Web Page : A More personal place to stay - Web page : five Reasons why small towns are better than cities. - Top five things to do in and around Miami, Florida; a note. <b>LAB (Listening)</b> : Four monologues : describing buildings – Conversation : Comparing life in a town and a city - Visiting a friend's family – Conversation: a holiday in Florida <b>(Speaking)</b> : A note with useful information offering choices.													<b>CO-2 BTL-3</b>	
<b>MODULE 3 : Information</b>													<b>(9L)</b>	
<b>Grammar</b> : Reported Speech – Verb Patterns - Generating and being Vague <b>Vocabulary</b> :Sharing information - Reporting Verbs <b>Pronunciation</b> : Sound and spelling /g/ and /k/ - sound and spelling :/h/ and /w/ <b>Writing</b> :An email about a news story summarizing information <b>Reading</b> : Articles : Thinking of making a podcast? Just give it a try! - The Restaurant that wasn't there - A news Story <b>LAB : (Listening)</b> : Podcast : Pod – on – pod - Interview : fake reviews – A job Interview - Monologue: A news story. <b>(Speaking)</b> : Giving Opinions about podcasts – Describing experiences using reporting verbs. – Generalising being vague - Air Travel.													<b>CO-3 BTL-3</b>	
<b>MODULE 4 : Entertainment</b>													<b>(9L)</b>	
<b>Grammar</b> : The passive - Defining and non-defining relative clauses - recommending and responding to recommendations <b>Vocabulary</b> : -ed / -ing adjectives – Music; Word Building(nouns) <b>Pronunciation</b> :Sound and spelling: final – ed in adjectives – relative clauses ; pausing word stress – showing contrast <b>Writing</b> : An article about a form of entertainment Contrasting ideas, the structure of an article. <b>Reading</b> : Articles on Business abroad <b>LAB : (Listening)</b> : Conversation : Film trailers - Three monologues: Musical experiences - Planning an evening out – Two monologues : live music <b>(Speaking)</b> : Recommending a film or TV programme – A musical experience - Recommending and responding; Asking someone to wait - Live vs recorded music													<b>CO-4 BTL-3</b>	
<b>MODULE 5 : Opportunities</b>													<b>(9L)</b>	
<b>Grammar</b> :Second Conditional – third conditional – Talking about possible problems and reassuring someone <b>Vocabulary</b> :Sport ; Adjectives and prepositions – Expressions with do, make and take <b>Pronunciation</b> : Sentence stress: would – Sentence stress : would and . have – sounding sure and unsure <b>Writing</b> :An email with advice advising a course of action													<b>CO-5 BTL-4</b>	

<b>Reading</b> :Article : Searching for serendipity - A web page about volunteering: Emails Giving advice. <b>LAB : (Listening)</b> : Conversation: trying new activities - Making a marriage proposal – Monologue: Volunteering. <b>(Speaking)</b> :Taking New opportunities - A past event that made life better – Talking about possible problems and reassuring someone; changing the subject – volunteering.		
<b>TEXT BOOKS</b>		
1	Doff, A., Thaine, C., Puchta, H., Stranks, J., & Lewis-Jones, P. (2023). <i>Empower Second Edition</i> . Cambridge University Press & Assessment. New Delhi.	
<b>REFERENCE BOOKS</b>		
1.	Murphy, Raymond(2019). Intermediate English Grammar. Cambridge University Press. India. (Pages 350)	
2.	Barnes, D., (2020). Exploratory talk for learning in Mercer, N. and Hodgkinson, S. (eds) Exploring Talk in School. London: Sage Publications. (Pages 208)	
3.	Dhanavel. S P ( 2018). English and Soft Skills. Orient BlackSwan. India. (Pages 136)	
4.	Goldsmith, Marshall &M.S. Rao.(2020) Soft Skills: Enhancing Employability. Dreamtech Press. India (Pages 256)	
<b>E Books</b>		
1	<a href="https://www.pdfdrive.com/basic-english-grammar-with-exercises-e12486779.html">https://www.pdfdrive.com/basic-english-grammar-with-exercises-e12486779.html</a>	
2	<a href="http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4733/1/Leadership%20The%20Power%20of%20Emotional%20Intellegence.pdf">http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4733/1/Leadership%20The%20Power%20of%20Emotional%20Intellegence.pdf</a>	
<b>MOOC Courses</b>		
1	<a href="https://www.edx.org/professional-certificate/ritx-communication-skills">https://www.edx.org/professional-certificate/ritx-communication-skills</a>	
2	<a href="https://www.coursera.org/specializations/people-and-soft-skills-for-professional-success">https://www.coursera.org/specializations/people-and-soft-skills-for-professional-success</a>	

COURSE TITLE	ELECTRIC CIRCUITS AND MACHINES			CREDITS	4
COURSE CODE	EEC51001	COURSE CATEGORY	PC	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project/Practical	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	The students shall develop an intuitive understanding of the circuit analysis, basic concepts of electrical machines and basics of electronics and be able to apply them in practical situation.				
Course Objective	1. This course aims to make the students capable of analysing any given electrical network. 2. This course make the students learn how to synthesize an electrical network from a given impedance/admittance function. 3. This course also equip the students with a basic understanding of Electrical machines for specific types of applications.				



<b>Course Outcome</b>		Upon completion of this course, the students will be able to 1. apply the knowledge of basic circuital law and simplify the circuit 2. Analyze the circuit using Network simplification theorems 3. construct and analyze two port networks and its parameters 4. identify the DC machines and transformer for specific application 5. Classify and compare different types of AC machines.													
<b>Prerequisites:</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>CO-1</b>	3	2	1	1	2	-	-	-	-	-	-	1	2	3	-
<b>CO-2</b>	3	3	1	1	2	-	-	-	-	-	-	1	2	2	-
<b>CO-3</b>	3	3	3	1	2	-	-	-	-	-	-	1	1	2	-
<b>CO-4</b>	3	3	3	0	2	-	-	-	-	-	-	1	1	2	-
<b>CO-5</b>	3	3	3	1	1	-	-	-	-	-	0	1	2	3	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE I: BASIC CIRCUITS ANALYSIS (9L+ 6P)</b>															
Ohm’s Law – Kirchhoff’s laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy Suggested Readings: three phase system, basic safety measures at home and industry <b>Lab Experiments</b> 1. Verification of Kirchhoff’s Laws 2. Verification of Mesh current and node voltage method														<b>CO-1 BTL-4</b>	
<b>MODULE II: NETWORK REDUCTION AND NETWORK THEOREMS (9L+ 6P)</b>															
Network reduction: voltage and current division, source transformation – star delta conversion. Thevenin’s and Norton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem. <b>Suggested Readings:</b> Application of network theorem in real time <b>Lab Experiments</b> 1. Verification of Thevenin’s and Norton & Theorem 2. Verification of Superposition theorem and Maximum power transfer theorem														<b>CO-2 BTL-4</b>	
<b>MODULE III: TWO PORT NETWORKS (9L+ 6P)</b>															
Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.														<b>CO-3 BTL-3</b>	

<b>Suggested Readings:</b> Find the various driving point & transfer functions of two port network <b>Lab Experiments</b> 1. To calculate and verify 'Z' parameters of two-port network 2. To calculate and verify 'H' parameters of two-port network		
<b>MODULE IV: DC MACHINES AND TRANSFORMER (9L+ 6P)</b>		
DC Machines: Principle of Operation, Classification, EMF and Torque Equations, Speed Control Methods and Applications Single Phase Transformers: Principle of Operation of a Single Phase Transformer, EMF Equation, Phasor Diagram, Equivalent Circuit of a 1-ph Transformer, Regulation & Efficiency of a Transformer (Qualitative) <b>Suggested Readings:</b> Special DC machine – BLDC motor, Three phase transformer and its applications <b>Lab Experiments</b> 1. Load test on DC series and shunt motor. 2. Load and No load test on single phase transformer		<b>CO-4 BTL-3</b>
<b>MODULE V: AC MACHINES (9L+ 6P)</b>		
Three Phase Induction Motor: Principle of Rotating Magnetic Field, Principle of Operation of 3-ph Induction Motor, Torque – Speed Characteristics of 3-ph Induction Motor, Applications of 3-ph Induction Motor. Single phase Induction: Principle of Operation, Types of single phase induction motor and application <b>Suggested Readings:</b> Alternators, Synchronous Motors application of IM in various industry <b>Lab Experiments</b> Load and No load test on single phase and three phase Induction motor		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1	Hughes revised by McKenzie Smith with John Hilcy and Keith Brown, Electrical and Electronics Technology, 8th Edition, Pearson, 2012.	
2	V.K.Metha & Rohit Metha, 'Principle of Electrical Machines', S.Chand Publishers, 2009	
3	Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007	
<b>REFERENCE BOOKS</b>		
1	Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 2015	
2	V.N Mittle, Basic Electrical Engineering, Tata McGraw Hill, 2nd edition 2017	
3	A. Chakroborty, S. Nath and C.K. Chanda, "Basic Electrical Engineering", McGraw Hill Education Pvt. Ltd., 1st Edition, 2009	
<b>E BOOKS</b>		
1	<a href="https://archive.nptel.ac.in/courses/108/102/108102042/">https://archive.nptel.ac.in/courses/108/102/108102042/</a>	
2	<a href="https://archive.nptel.ac.in/courses/108/105/108105159/">https://archive.nptel.ac.in/courses/108/105/108105159/</a>	
3	<a href="http://nptel.ac.in/courses/108106072/">http://nptel.ac.in/courses/108106072/</a>	
<b>MOOC</b>		
1	<a href="https://nptel.ac.in/courses/108102042">https://nptel.ac.in/courses/108102042</a>	
2	<a href="https://www.edx.org/course/circuits-and-electronics-1-basic-circuit-analysi-2">https://www.edx.org/course/circuits-and-electronics-1-basic-circuit-analysi-2</a>	

COURSE TITLE	PROGRAMMING FUNDAMENTALS USING C			CREDITS	3										
COURSE CODE	ECS51009	COURSE CATEGORY	ES	L-T-P-S	2- 0- 2- 2										
VERSION	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-5										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	Theory	Practical									
15%	15%	10%	5%	5%	25%	25%									
Course Description	To introduce computers and programming in C and also explore the power of computational techniques that are currently used by engineers and scientists and to develop programming skills with reasonable complexity.														
Course Objective	1. To acquire the basic knowledge in computer hardware, programming languages and Problem-solving techniques. 2. To learn the fundamentals of C programming. 3. To gain knowledge in Functions, arrays and strings in C programming. 4. To understand the pointers, Structures and Union in C programming 5. To gain knowledge on Embedded Programming and real time applications of C Programming.														
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basics of digital computer and programming languages. 2. Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem. 3. Design and Implement C program using Control Statements and Functions. 4. Design and Implement C program using Pointers and File operations. 5. Identify the need for embedded C and C Programming in real-time applications.														
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	2	2	-	-	2	-	2	-	-	1	2	2	1	1
CO-2	3	3	3	2	2	1	-	2	2	1	-	1	1	2	2
CO-3	3	3	3	2	2	2	-	1	3	3	2	1	2	1	2
CO-4	3	3	3	2	-	-	-	-	-	-	1	-	2	2	1
CO-5	1	1	1	-	1	2	-	1	-	-	-	2	2	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: PROGRAMMING LANGUAGES AND PROBLEM-SOLVING TECHNIQUES (6 L+ 6 P =12 )															

<p>Introduction – Fundamentals of digital computers - Programming languages - Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code.</p> <p><b>Practical Component</b>            Draw Flowcharts using E- Chart &amp; Write pseudo code for the following problems</p> <ol style="list-style-type: none"> <li>1. Greatest of three numbers</li> <li>2. Sum of N numbers</li> <li>3. Computation of nCr</li> </ol> <p><b>Software Required:</b> GCC</p> <p><b>Suggested Readings:</b> <a href="https://www.simplilearn.com/tutorials/programming-tutorial/problem-solving-in-programming">https://www.simplilearn.com/tutorials/programming-tutorial/problem-solving-in-programming</a></p>	<p><b>CO-1</b> <b>BTL-4</b></p>
<p><b>MODULE 2: FUNDAMENTALS OF C (6L+ 6P = 12)</b></p>	
<p>Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements.</p> <p><b>Practical Component</b></p> <ol style="list-style-type: none"> <li>1. Program to illustrate arithmetic and logical operators</li> <li>2. Program to read and print data of different types</li> <li>3. Program to calculate area and volume of various geometrical shapes</li> <li>4. Program to compute biggest of three numbers</li> <li>5. Program to print multiplication table</li> <li>6. Program to convert days to years, months and days</li> <li>7. Program to find sum of the digits of an integer</li> </ol> <p><b>Software Required:</b> GCC</p> <p><b>Suggested Readings:</b> <a href="https://www.w3schools.com/c/c_intro.php">https://www.w3schools.com/c/c_intro.php</a></p>	<p><b>CO-2</b> <b>BTL-4</b></p>
<p><b>MODULE 3: FUNCTIONS, ARRAYS, STRINGS (6L+ 6P = 12)</b></p>	
<p>Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements.</p> <p><b>Practical Component:</b></p> <ol style="list-style-type: none"> <li>1. Program to compute Factorial, Fibonacci series and sum of n numbers using recursion</li> <li>2. Program to compute sum and average of N Numbers stored in an array</li> <li>3. Program to sort the given n numbers stored in an array</li> <li>4. Program to search for the given element in an array</li> <li>5. Program to do word count</li> <li>6. Program to insert a substring in a string</li> <li>7. Program to concatenate and compare two strings</li> <li>8. Program using pre-processor statements</li> </ol> <p><b>Software Required:</b> GCC</p> <p><b>Suggested Readings:</b> <a href="https://cppguide.readthedocs.io/en/latest/cpp/array.html">https://cppguide.readthedocs.io/en/latest/cpp/array.html</a></p>	<p><b>CO-3</b> <b>BTL-4</b></p>
<p><b>MODULE 4: POINTERS, STRUCTURES AND UNION (6L+ 6P = 12)</b></p>	
<p>Pointers – Dynamic Memory allocation – Structure and Union – Files.</p> <p><b>Practical Component</b></p> <ol style="list-style-type: none"> <li>1. Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation</li> <li>2. Program to read and print records of a student/payroll database using structures</li> <li>3. Program to simulate file copy</li> <li>4. Program to illustrate sequential access file</li> </ol>	<p><b>CO-4</b> <b>BTL-4</b></p>

5.Program to illustrate random access file <b>Software Required:</b> GCC <b>Suggested Readings:</b> <a href="https://www.ibm.com/docs/en/zos/2.4.0?topic=types-structures-unions">https://www.ibm.com/docs/en/zos/2.4.0?topic=types-structures-unions</a>		
<b>MODULE 5: APPLICATIONS OF C</b>		<b>(6L+ 6P = 12)</b>
Structure of embedded C program - Data Types - Operators - Statements - Functions - Keil C Compiler. Game development using c - Analysing the environment - Snake game - Tic-Tac-Toe - flappy bird. <b>Practical component:</b> Simple programs using embedded C-Game Development using C <b>Software Required:</b> GCC <b>Suggested Readings:</b> <a href="https://www.interviewbit.com/blog/applications-of-c-programming-language/">https://www.interviewbit.com/blog/applications-of-c-programming-language/</a>		<b>CO-5</b> <b>BTL-4</b>
<b>TEXT BOOKS</b>		
1.	Ashok Kamthane, “Computer Programming”, Pearson Education, 7th Edition, Inc 2017.	
2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.	
3.	Robert Marmelstein, “Programming Games in C”	
<b>REFERENCE BOOKS</b>		
1.	Jeyapoovan T, “Fundamentals of Computing and Programming in C”, Vikas Publishing house, 2015.	
2	Yashavant Kanetkar, “Let us C”, 15th edition, BPP publication, 2016.	
3	S. Sathyalakshmi, S.Dinakar, “Computer Programming Practicals – Computer Lab Manual”, Dhanam Publication, First Edition, July 2013.	
<b>E BOOKS</b>		
1.	<a href="https://en.wikibooks.org/wiki/C_Programming">https://en.wikibooks.org/wiki/C_Programming</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc18-cs10/preview">https://onlinecourses.nptel.ac.in/noc18-cs10/preview</a>	
2.	<a href="http://nptel.ac.in/courses/106105085/2">http://nptel.ac.in/courses/106105085/2</a>	
3.	<a href="https://www.udemy.com/c-programming-for-beginners/">https://www.udemy.com/c-programming-for-beginners/</a>	
4.	<a href="https://www.coursera.org/specializations/c-programming">https://www.coursera.org/specializations/c-programming</a>	

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
COURSE CODE	EME51001	COURSE CATEGORY	ES	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment (Theory + Practical)	Second Periodical Assessment (Theory + Practical)	Weekly assignment/Observation / lab records and viva as approved by the DEC	Surprise Test/ Quiz etc., as approved by the DEC	Attendance	ESE (Theory + Practical)

15%	15%	10%	5%	5%	50%										
Course Description	This course broadly introduces the mechanical design using computer aided design tools and fundamentals of free hand sketching. It prepares the students to learn the basic concepts involved in technical drawing and computer graphics. It also emphasis on the principles of projections and visualization of part drawing.														
Course Objective	6. To demonstrate the concepts of Engineering graphics and projection of straight lines using CAD software 7. To visualize the solids in various orientations and to draw its projections 8. To comprehend the concepts of isometric projections 9. To draw the development of solid surfaces and to generate associated views of civil drawings. 10. To visualize and draw views of the object by free hand sketch and to transform 3D models to 2D drawings using CAD tools														
Course Outcome	Upon completion of this course, the students will be able to 6. Demonstrate the concepts of Engineering graphics and projection of straight lines using CAD software. 7. Apply the acquired knowledge to solve simple problems of regular solids. 8. Create solid objects in isometric view using CAD software 9. Develop the simple solids and to sketch the plan and elevation of the building drawings. 10. Visualize the objects and to draw by free hand sketching.														
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	1	-	-	1	-	-	1	1	1	-	2	2	1	1
CO-2	2	1	-	-	2	-	-	1	1	2	-	2	1	-	-
CO-3	2	2	2	-	2	-	-	2	2	2	-	2	1	2	-
CO-4	3	2	2	-	3	-	-	2	2	2	-	2	1	-	1
CO-5	3	1	2	-	-	-	-	1	2	2	-	2	-	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: BASICS OF ENGINEERING GRAPHICS (6L + 6P =12)															
Relevance of Graphics in Industry - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - Introduction to Computer Aided Drafting –Exposure to Solid Modelling software – Printer and Plotter – 3D printer. Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Projection of points and projection of Straight lines. <b>Suggested Reading:</b> Solid modelling Software commands												CO-1 BTL-2			
MODULE 2: PROJECTION OF SOLIDS (6L + 6P =12)															
Projections of solids. Solids in simple positions and axis inclined to one plane only. Section of solids. Section planes inclined to Horizontal Plane only. True shape of the section. (Manual and CAD Drawing)												CO-2 BTL-2			

<b>Suggested Reading:</b> Solids inclined to both the planes. Section of solids with sectional planes inclined to VP.		
<b>MODULE 3: ISOMETRIC PROJECTION (6L + 6P =12)</b>		
Concepts of isometric projection. Isometric scale, Isometric view of simple solids with sectional planes. (Manual and CAD Drawing) <b>Suggested Reading:</b> Isometric view of solids with multiple sectional planes.		<b>CO-3 BTL-3</b>
<b>MODULE 4: DEVELOPMENT OF SURFACES AND CIVIL DRAWING (6L + 6P =12)</b>		
Development of Surfaces of simple solids with simple sectional planes. Parallel line method and Radial line method only. (Manual and CAD Drawing) Civil Drawing: PLAN and ELEVATION of Simple residential building. (Manual and CAD Drawing) <b>Suggested Reading:</b> Development of Sphere, Sectional elevation of building drawing		<b>CO-4 BTL-2</b>
<b>MODULE 5: FREE HAND SKETCHING (6L + 6P =12)</b>		
Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three-Dimensional objects — Pictorial Projection methods - Layout of views- Conversion of pictorial views to orthographic view. <b>Suggested Reading:</b> Orthographic views to pictorial views		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Jeyapoovan, T., Engineering Graphics and Design, Vikas Publishing House Pvt Ltd., New Delhi, 8 <sup>th</sup> Edition, 2022.	
2.	P. Kannaiah, K. L. Narayana, K. Venkata Reddy, A Textbook on Engineering Drawing, BS Pub, 2016.	
<b>REFERENCE BOOKS</b>		
1.	Alf Yarwood, Introduction to AutoCAD – 2D and 3D Design, Newnes Elsevier, 2011	
2.	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2019.	
3.	Kirstie Plantenberg, Engineering Graphics Essentials, SDC Publications., fifth Edition, 2016.	
<b>E - Books</b>		
1.	<a href="https://www.amazon.in/Technical-Drawing-Engineering-Graphics-International-ebook/dp/B00IZ0FZHA">https://www.amazon.in/Technical-Drawing-Engineering-Graphics-International-ebook/dp/B00IZ0FZHA</a>	
<b>MOOC</b>		
1.	<a href="http://nptel.ac.in/courses/112103019/">http://nptel.ac.in/courses/112103019/</a>	
2.	<a href="https://nptel.ac.in/courses/112102304/">https://nptel.ac.in/courses/112102304/</a>	

COURSE TITLE	ENGINEERING PRACTICE LAB (Common to All Branches)			CREDITS	2
COURSE CODE	EGE51406	COURSE CATEGORY	BS	L-T-P-S	0-0-4-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					

CIA								ESE						
80%								20%						
Course Description	This course is specifically designed to give the students a clear understanding of the mechanical engineering design and its process.													
Course Objective	<b>The course should enable the students to</b> 1. To Relate theory and practice of basic Mechanical and Civil Engineering. 2. To Learn basic concepts in Aeronautical and Automobile Engineering. 3. To Learn basic concepts in Electrical, Electronics, mechatronics and Computer Science.													
Course Outcome	<b>Upon completion of this course, the students will be able to</b> 1. To Identify the tools, and types of joints used in welding, carpentry and plumbing. 2. To Perform basic fabrication in welding, carpentry and plumbing, to make simple joints/connections. 3. To Make simple electrical and electronic circuit connections, and may assemble the hardware of a desktop computer. 4. To observe & demonstrate the working of a mechatronics systems like CNC machine, Robot, Pneumatic circuits. 5. To observe & demonstrate the working of a 3D printer and list its applications.													
Prerequisites: NIL														
CO, PO AND PSO MAPPING														
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	-	2	-	1	-	-	-	-	-	-	2	1
CO-2	3	2	-	2	-	1	-	-	-	-	-	-	3	2
CO-3	3	2	-	2	-	1	-	-	-	-	-	-	2	1
1: Weakly related, 2: Moderately related and 3: Strongly related														
LIST OF EXPERIMENTS with expected Learning outcome														
Exp. No.	Experiment Name												CO / BTL	
1	To Perform a Fillet/Groove weld in a Welding Simulator												CO 1 & BTL 3	
2	To Fabricate a Butt joint/Lap Joint using Arc Welding												CO 1 & BTL 3	
3	To make basic pipe connections in Plumbing using valves, couplings and elbows												CO 1 & BTL 3	
4	To make a common joint using Carpentry												CO 1 & BTL 3	
5	Assembling and Dismantling of a gasoline/Diesel Engine												CO 2 & BTL 3	
6	Measurement of Force using a spring balance												CO 2 & BTL 3	
7	To make an Electrical Wiring for extension box												CO 3 & BTL 3	
8	Study of Active and Passive Components												CO 3 & BTL 3	
9	To make simple circuit using Electronic Components												CO 3 & BTL 3	
10	To Assemble a Desktop computer												CO 3 & BTL 3	
11	To study the key elements of a Mechatronics system												CO 3 & BTL 3	
12	Demo on linear actuator, using pneumatic circuit												CO 3 & BTL 3	



13	Demo on Computerized Numerical Control (CNC) machine	CO 3 & BTL 3
14	Demo on a pick and place Robot	CO 3 & BTL 3
15	Demo on a 3D Printer	CO 3 & BTL 3
<b>LIST OF EXPERIMENTS/TOOLS for 30 Students</b>		
1	Welding Rectifier – 5 Nos	
2	Welding Simulator – 1 No.	
3	Two Stroke Gasoline Engine – 1 No.	
4	Spring balance – 5 Nos	
5	PVC Pipes and its accessories – 5 sets	
6	Saw, Planner, Chisel and its accessories – 5 sets	
7	Extension box and its accessories – 5 sets	
8	Electronic boards and its accessories – 5 sets	
9	Active components – 5 sets	
10	Passive components – 5 sets	
11	Desktop Computer – 5 Nos	
12	Linear Actuators and Pneumatic Kit– 1 Nos	
13	Rotary Actuators and Pneumatic Kit– 1 Nos	
14	CNC Machine – 1 No.	
15	6 Axis Robot – 1 No.	
16	3D Printer – 1 No.	
<b>REFERENCE</b>		
1	Jeyapoovan T and Saravanapandian M., (2015),Engineering practices lab manual, Vikas publishing House, New Delhi, 4th Edition.	
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K.,(2008), “Elements of Workshop Technology”, Vol.I ,Media promoters and publishers private limited, Mumbai.	
3	Ibrahim Zeid,(2011) CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi.	

COURSE TITLE	FAB LAB FOR CIRCUIT ENGINEERING (ECE & EEE)			CREDITS	2
COURSE CODE	EGE51409	COURSE CATEGORY	ES	L-T-P-S	0-0-4-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					
Observation & Record		Practical Demonstration & Lab Test Report		VIVA	
20%		60%		20%	

<b>Course Description</b>	The Fab Lab is intended to help the students to acquire the foundational knowledge necessary to comprehend the fundamentals of diodes, transistor. The course provide a comprehensive idea to the students to design, simulate and develop a simple electronic system prototype.														
<b>Course Objective</b>	<b>The course should enable the students</b> <div>1. To introduce the concepts of identification and testing of passive and active devices.</div> <div>2. To interpret the VI characteristic of Diode and Transistor.</div> <div>3. To have hands on experience in soldering.</div> <div>4. To have hands on experience in design and prototyping of simple electronic system using perf-board.</div> <div>5. To summarize the characteristics of electrical machines.</div>														
<b>Course Outcome</b>	<b>Upon completion of this course, the students will be able to</b> <div>1. Interpret the specification and testing of active and passive devices.</div> <div>2. Comprehend the diode and transistor characteristics using Multisim software.</div> <div>3. Use soldering machines for assembly of active and passive devices in perf-board and test for the functionality.</div> <div>4. Design and demonstrate simple electronic systems using dotted board.</div> <div>5. Elucidate the basic characteristics of Electrical machines.</div>														
Prerequisites: NIL															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	1	1	-	-	-	-	-	-	1	1	1	-
CO-2	2	2	2	2	3	-	-	-	--	-	-	1	1	1	1
CO-3	2	2	2	2	1	2	-	-	-	-	-	1	1	1	1
CO-4	2	2	2	2	2	1	1	-	1	-	-	1	1	1	1
CO-5	2	2	2	2	-	1	-	-	1	-	-	1	1	-	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
LIST OF EXPERIMENTS with expected Learning outcome															
Exp. No.	Experiment Name													CO / BTL	
1	Identification: Identification, specifications, testing of R, L, C components, potentiometers, bread boards, PCBs, identification. Software/Equipment Required: Passive Components ,Breadboard,PCB													CO 1 & BTL 3	
2	Identification: Identification, Testing and specifications of active devices, diodes, BJTs, JFETs, LEDs, LCDs. Software/Equipment Required:Digital Multimeter, ohmmeter													CO 1 & BTL 3	
3	Characteristics of Fluorescent, Tungsten and Carbon filament lamps. Software/Equipment Required: Fluorescent, Tungsten and Carbon filament lamps.													CO 1 & BTL 3	
4	V-I Charecteristics of PN junction diode Software/Equipment Required: MULTISIM software													CO 1 & BTL 3	

5	<b>CB, CE and CC Configurations and their Input and Output Characteristics.</b> <b>Software/Equipment Required:</b> MULTISIM software	CO 2 & BTL 3
6	Soldering exercises through dotted boards using passive and active devices <b>Software/Equipment Required:</b> Soldering equipment, dotted boards, passive and active devices	CO 2 & BTL 3
7	Demonstrate a simple electronic system design using basic active and passive devices in dotted board.	CO 2 & BTL 3
8	Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement)	CO 2 & BTL 3
9	Demonstration of cut-out sections of machines: Transformer	CO 3 & BTL 3
10	Demonstration of cut-out sections of machines: Induction Machine (squirrel cage rotor).	CO 4 & BTL 3
<b>TEXT BOOKS</b>		
1	Satya Sai Srikant, Prakash Kumar Chaturvedi., (2020). Basic Electronics Engineering, Springer Singapore, 1st edition.	
2	John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, Al Winfield., (2018). Electrical Safety Handbook, McGraw-Hill Education, 4th Edition.	
<b>REFERENCE BOOKS</b>		
1	Jens Lienig, Hans Bruemmer., (2017). Fundamentals of Electronic Systems Design, Springer, 1st edition	

COURSE TITLE	OUTREACH (NCC) LEVEL 2 (ARMY WING)			CREDITS	1	
COURSE CODE	EGE51403	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4	
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance *	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.					

<b>Course Objective</b>	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets’ immediate environment, and thereby enabling them for a brighter and progressive future.													
<b>Course Outcome</b>	(a) To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. (b) To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. (c) To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.													
<b>CO, PO AND PSO MAPPING</b>														
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>
<b>CO-1</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-
<b>CO-2</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-
<b>CO-3</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-
<b>CO-4</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-
<b>CO-5</b>	-	-	-	-	-	3	3	3	3	3	1	1	-	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1: NCC GENERAL (9L+ 6P)</b>														
<b>NCC GENERAL:</b> NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2												<b>CO-1 BTL-3</b>		
<b>MODULE 2: NATIONAL INTEGRATION AND AWARENESS (9L+ 6P)</b>														
<b>NATIONAL INTEGRATION AND AWARENESS 4</b> NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1												<b>CO-2 BTL-3</b>		
<b>MODULE 3: PERSONALITY DEVELOPMENT. (9L+ 6P)</b>														
<b>PERSONALITY DEVELOPMENT 7</b> PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2												<b>CO-3 BTL-3</b>		
<b>MODULE 4: LEADERSHIP (9L+ 6P)</b>														
<b>LEADERSHIP 5</b> L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ‘ Code 3 L 2 Case Studies: Shivaji, Jhansi Ki Rani 2												<b>CO-4 BTL-3</b>		
<b>MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT (9L+6P)</b>														

<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8</b> SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1		<b>CO-5</b> <b>BTL-3</b>
<b><u>TEXT BOOKS</u></b>		
1.	NCC COMMON SUBJECT BOOK	
2.	RED BOOK (ARMY SPECIAL SUBJECTS)	

COURSE TITLE	OUTREACH (NCC) LEVEL 2 (AIR WING)			CREDITS	1	
COURSE CODE	EGE51403	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4	
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance *	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.					
Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets’ immediate environment, and thereby enabling them for a brighter and progressive future.					

Course Outcome	(a) To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. (b) To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. (c) To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.															
	CO, PO AND PSO MAPPING															
	CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
	CO-1	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-2	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-	
CO-3	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-	
CO-4	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-	
CO-5	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-	
1: Weakly related, 2: Moderately related and 3: Strongly related																
MODULE 1: NCC GENERAL												(9L+ 6P)				
NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC  Camps: Types & Conduct 2												CO-1 BTL-3				
MODULE 2: NATIONAL INTEGRATION AND AWARENESS												(9L+ 6P)				
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1												CO-2 BTL-3				
MODULE 3: PERSONALITY DEVELOPMENT.												(9L+ 6P)				
PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2												CO-3 BTL-3				
MODULE 4: LEADERSHIP												(9L+ 6P)				
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhansi Ki Rani 2												CO-4 BTL-3				
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT												(9L+6P)				



[illegible]



COURSE TITLE	OUTREACH (NSS) LEVEL 2			CREDITS	1
COURSE CODE	EGE51404	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	-
ASSESSMENT SCHEME					
CIA					ESE
Volunteering	Events attended	Awareness Programs attended		Attendance*	Report Submission
5	25	15		5%	50
Course Description	This course is designed to introduce students to the principles and practices of community service, social development, and active citizenship. The course aims to instill a sense of social responsibility and promote civic engagement among the participants. Through a combination of theoretical knowledge and practical experiences, students will develop essential skills and qualities required to make a positive impact on the community and society. Pre requisite: There are no specific prerequisites for enrolling in the NSS Semester 1 course. However, a genuine interest in community service, social development, and willingness to actively engage with diverse communities are essential.				
Course Objective	<ol style="list-style-type: none"><li>1. To familiarize students with the objectives, history, and importance of the National Service Scheme (NSS) in community development, emphasizing the significance of social responsibility and civic engagement.</li><li>2. To develop essential leadership skills, teamwork, and effective project management techniques, preparing students to organize and execute community service projects successfully.</li><li>3. To cultivate empathy, compassion, and cultural sensitivity, enabling students to engage respectfully and effectively with diverse communities during their community service activities.</li><li>4. To promote environmental awareness and sustainable practices, encouraging students to integrate eco-friendly approaches into their community service initiatives.</li><li>5. To enhance students' communication, problem-solving, and decision-making skills, equipping them to engage with community members, stakeholders, and address challenges effectively.</li></ol>				
Course Outcome	<ol style="list-style-type: none"><li>1. students will gain a comprehensive understanding of the objectives, history, and significance of the National Service Scheme (NSS) in promoting community development and social responsibility.</li><li>2. Participants will demonstrate the ability to identify and assess prevalent social issues and challenges in the community, laying the groundwork for effective community service initiatives.</li><li>3. Through practical experiences and workshops, students will develop essential leadership skills, teamwork, and project management techniques necessary for organizing and executing successful community service projects.</li></ol>				

	4. By engaging with diverse communities, students will cultivate empathy, compassion, and cultural sensitivity, fostering meaningful and respectful interactions during their service activities.														
	5. Upon completion of Semester 1, students will have improved their communication, problem-solving, and decision-making skills, empowering them to actively and effectively engage in community development and service projects.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-2	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-3	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-4	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
CO-5	-	-	-	-	-	3	3	3	3	3	1	1	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
TOPICS TO BE COVERED															
1. Introduction to National Service Scheme (NSS) and its Objectives 2. Understanding Social Issues and Needs Assessment in the Community 3. Project Planning and Management for Community Service 4. Leadership Development and Teamwork 5. Cultural Sensitivity and Interacting with Diverse Communities 6. Communication and Problem-Solving Skills for Community Engagement 7. Environmental Conservation and Sustainable Practices 8. Health, Hygiene, and Community Well-being 9. The Role of Arts and Culture in Community Development 10. Reflecting on Community Service Experiences and Personal Growth															
Suggest Activities															
1. <b>Community Cleanliness Drive:</b> Organize a cleanliness drive in the local community, involving students and residents in cleaning public spaces and creating awareness about cleanliness and waste management. 2. <b>Health Awareness Camp:</b> Conduct a health awareness camp where participants can provide basic health check-ups, distribute health-related information, and promote the importance of hygiene and sanitation. 3. <b>Environmental Conservation Project:</b> Initiate an environmental conservation project, such as tree planting, creating green spaces, or implementing recycling programs, to raise awareness about environmental issues. 4. <b>Teaching Assistance in Local Schools:</b> Collaborate with local schools to provide teaching assistance, conduct educational workshops, and help students with their studies. 5. <b>Empowerment Workshops:</b> Organize workshops for women, youth, or other marginalized groups to empower them with skills and knowledge relevant to their needs, such as vocational training or financial literacy.															

<ol style="list-style-type: none"> <li>6. <b>Cultural Exchange Program:</b> Arrange a cultural exchange event where NSS participants and local community members can share their traditions, dances, music, and food, fostering mutual understanding and appreciation.</li> <li>7. <b>Blood Donation Camp:</b> Partner with local healthcare institutions to organize a blood donation camp to address blood shortages and raise awareness about the importance of donating blood.</li> <li>8. <b>Community Survey and Needs Assessment:</b> Conduct a comprehensive community survey to understand the needs and priorities of the local residents, guiding the selection of future service projects.</li> <li>9. <b>Awareness Campaigns:</b> Create awareness campaigns on critical social issues like gender equality, education, or substance abuse through street plays, posters, and interactive sessions.</li> <li>10. <b>Disaster Preparedness Workshop:</b> Conduct workshops on disaster preparedness, including first aid training and emergency response, to equip the community with necessary skills.</li> <li>11. <b>Senior Citizens' Engagement:</b> Plan activities and events to engage and support senior citizens, such as organizing social gatherings or providing assistance with daily chores.</li> <li>12. <b>Digital Literacy Initiatives:</b> Set up digital literacy workshops to help community members, especially elders and underserved individuals, to learn basic computer and internet skills.</li> <li>13. <b>Community Sports Event:</b> Organize a community sports event to promote fitness, teamwork, and community bonding.</li> <li>14. <b>Skill Development Sessions:</b> Arrange skill development workshops in collaboration with local experts to teach practical skills like tailoring, painting, or handicrafts.</li> <li>15. <b>Awareness on Government Schemes:</b> Educate the community about various government schemes and programs that they may be eligible for, to ensure they can avail themselves of the benefits.</li> </ol>	
<b>REFERENCE BOOKS</b>	
1	National Service Scheme Manual, Government of India.
2	Orientation Courses for N.S.S. Programme officers, TISS.
3	Case material as Training Aid for field workers, Gurmeet Hans.
4	National Service Scheme Manual, Government of India.
5	Training Programme on National Programme scheme, TISS.
6	Social Problems in India, Ram Ahuja
7	Social service opportunities in Hospitals, Kapil K.Krishan, TISS.

COURSE TITLE			TAMIL				CREDITS			2				
COURSE CODE			GLS51008		COURSE CATEGORY		HS		L - T - P - S			2 - 0 - 0 - 2		
Version	1.0	Approval Details			37 th ACM				LEARNING LEVEL			BTL- 3		
ASSESSMENT SCHEME														
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”				Attendance		End Semester Examination ESE		
15%		15%		10%		5%				5%		50%		
Course Description		This Tamil course improves Tamil language skills of the students’ Tamil letters and Grammar are included. This course provides an opportunity not only to get interest in learning Tamil Language but also, they can learn to converse easily.												
Course Objective		1. By studying this course, students will be able to write and speak Tamil easily in any situation, daily life and daily conversations. 2. Develops language and interest in learning in students. 3. Facilitates students to create opportunities for themselves in the society. 4. Students also learn Tamil literature by developing interest in language department. 5. This lesson plan helps the students to learn about the culture by learning the Tamil language.												
Course Outcome		Upon completion of this course, the students will be able to 1. Demonstrate the Letters and basic words of Tamil Language which are in daily use 2. Develops the listening skills of Tamil language 3. Utilize the letters and common words of the language for communication 4. Develop the conversational skills 5. Demonstrate the skill of reading and writing												
Prerequisites: Plus Two -Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-
CO5	-	-	-	-	-	-	-	-	2	3	2	3	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
அலகு - 1 தமிழ் எழுத்துக்கள்												(6 L)		
தமிழ் எழுத்துகள் – ஓசைகள் – எண்கள் – வண்ணங்கள் – வடிவங்கள் - ஓர் எழுத்துச் சொற்கள் - பழங்கள் மற்றும் காய்கறிகள் – மலர்கள் – இயற்கை - மாதங்கள் சொற்கள் - பெயர்சொற்கள் – உரிச்சொற்கள் – வினைச்சொற்கள் – காலங்கள் - வாழ்த்துகள்.													CO-1 BTL-2	
வகுப்பறை செயல்முறைகள் : 1. வார்த்தைகளை வட்டமிடுதல். 2. விடுபட்ட எழுத்துகளை நிரப்புக. 3. வடிவங்களுக்கு வண்ணம் தீட்டுக.														

<b>அலகு - 2 கேட்டல் மற்றும் உச்சரித்தல் (6L)</b>	
உயிரெழுத்துகள், மெய்யெழுத்துகள் மற்றும் உயிர்மெய் எழுத்துகளை உச்சரித்தல் - சிறுகதைகள் வாசித்தல் - எதிர்ச்சொற்கள் - பொருள்தருக - வாக்கியத்தில் அமைத்து எழுதுதல் - ஒரு சொல்லில் விடையளித்தல். வகுப்பறை செயல்முறைகள் : 1. சொற்களைக் கேட்டு உச்சரிக்க செய்தல். 2. குழுவிவாதம் செய்தல். 3. கோடிட்ட இடங்களைச் சரியான சொற்களைக் கூறுதல்.	CO-2 BTL-2
<b>அலகு -3 எழுத்துப் பயிற்சி (6 L)</b>	
தமிழ் எழுத்துகளை எழுத கற்பித்தல் - உயிர் எழுத்துகள் - மெய் எழுத்துகள் - உயிர்மெய் எழுத்துகள் - ஆயுத எழுத்து - சார்பெழுத்துகள் - ஒற்றெழுத்துகள் - ஒரு சொல் - இருசொல் எழுதுதல் - ஒருவரி, இருவரி எழுதுதல். வகுப்பறை செயல்முறைகள்: 1. கோடிட்ட இடங்களை நிரப்புக. 2. சரியான எழுத்துகளை வட்டமிடுதல். 3. ஒருவரி சொற்களை எழுதுதல்.	CO-3 BTL-3
<b>அலகு - 4 உரையாடல்கள் கற்பித்தல் (6L)</b>	
சிறு உரையாடல்கள் கற்பித்தல் - வாழ்த்துக்கள் - வங்கியில் பணம் செலுத்துதல் - சந்தையில் கடைகாரரிடம் உரையாடுதல், பொது இடங்களில் உரையாடுதல். வகுப்பறை செயல்முறைகள்: 1. குறு நாடகங்கள் நடித்து உரையாடல்கள் கற்பித்தல். 2. விண்ணப்ப படிவங்கள் பூர்த்தி செய்தல். 3. மின்னல் அட்டைகள் காண்பித்தல்.	CO-4 BTL-2
<b>அலகு - 5 தமிழ் வாசிக்க மற்றும் எழுத கற்பித்தல் (6 L)</b>	
கடிதங்கள் வாசித்தல் மற்றும் எழுதுதல் - விண்ணப்ப கடிதம், வங்கிகணக்கு படிவங்கள், இரயில் முன்பதிவு விண்ணப்ப படிவம் பூர்த்திசெய்தல் - கவிதை வாசித்தல் - செய்திதாள் வாசித்தல். வகுப்பறை செயல் முறைகள்: 1. விண்ணப்ப படிவங்கள் பூர்த்திசெய்தல். 2. கவிதை வாசித்தல் போட்டிகள் 3. வகுப்பறை தேர்வுகள்	CO-5 BTL-3
<b>TEXT BOOK</b>	
1.	Saidhai. P.Sundaramurthy (2018). Learn Tamil Through english. Manimekalai Prasuram. Chennai - 17. Pages 1 to 84
2.	Pulavar Kulanthai (2020). Students Basic Tamil. Manimekalai Prasuram. Chennai -17. Pages1 to 84
<b>REFERENCE BOOKS</b>	
1.	Lena tamil vanan. (2017). Easy Tamil Grammar. Manimekalai Prasuram, Chennai -17, Pages 11 to 21
2.	Tamilnadu Board - NCERT/CBSE-Books Class – 6 <sup>th</sup> TO 9 <sup>th</sup> (2021-2022)
<b>E-REFERENCES</b>	
1	<a href="https://cbsetamil.com/cbse-tamil-book/">https://cbsetamil.com/cbse-tamil-book/</a> , <a href="https://tamil.examsdaily.in/tnpsc-tamil-ilakkanam-material-pdf-download">https://tamil.examsdaily.in/tnpsc-tamil-ilakkanam-material-pdf-download</a>

COURSE TITLE		HINDI (REGIONAL LANGUAGE)				CREDITS		2							
COURSE CODE		GLS51009	COURSE CATEGORY		HS	L - T - P - S		2 - 0 - 0 - 2							
VERSION	1.0	APPROVAL DETAILS	35 <sup>th</sup> ACM 6 <sup>th</sup> Aug. 2022				BTL LEVEL	3							
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC” etc.,			Attendan ce	End Semester Examination ESE								
15%	15%	10%	5%			5%	50%								
Course Description	This course has been designed to develop the regional language skills of the students. The course includes Hindi language, literature, vocabulary and grammar. This course teaches students how to communicate accurately, appropriately and fluently in regional language.														
Course Objective	1. To provide an environment to Speak and write in Hindi at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate. 2. To equip the students to Read, comprehend and answer questions based on literary texts. 3. To help student to become sensitive to the requirements of the society and respond to it in a constructive way. 4. To provide an environment to students to read and appreciate the literature.														
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the ability to write the grammatically correct sentences with accuracy. 2. Integrating various components of Hindi Language and determining it through reading and listening. 3. Organize and articulate ideas, concepts, and perceptions in a comprehensive manner in written correspondence, and speaking in formal and informal situations. 4. Infer details from after listening and reading and implement it in various professional situations. 5. Develop writing and speaking skills.														
Prerequisites: Plus Two -Intermediate Level															
CO, PO AND PSO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO-9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-	
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-	
CO5	-	-	-	-	-	-	-	-	2	2	-	2	-	-	
1: Weakly related, 2: Moderately related and 3: Strongly related															

मॉड्यूल 1: हिंदी पत्र और लिपि (6 L)	
<p>हिंदी स्वर और व्यंजन अक्षर - आश्रित स्वर सीखें - व्यंजन और व्यंजन समूह - अनुस्वर व्यंजन - संज्ञा - सर्वनाम - क्रिया (भविष्य) - संभावित विशेषण - काल - हिंदी के त्वरित नियम - अभिवादन - 2 अक्षर शब्द बनाना, 3 अक्षर शब्द - हर दिन शब्दावली - संख्याएं - रंग - परिवार - वस्त्र - बगीचा - घर - फल और सब्जियां - प्रकृति</p> <p><b>सुझाई गई गतिविधियां:</b></p> <p>देशी वक्ताओं द्वारा स्वर और व्यंजन का उच्चारण सुनना</p> <p>स्वर और व्यंजन के वीडियो, 2 अक्षर और 3 अक्षर के शब्द, और प्रतिदिन प्रयोगार्थ शब्दावली</p>	<p>CO-1</p> <p>BTL-2</p>
मॉड्यूल 2: सुनने का कौशल (6 L)	
<p>स्वर और व्यंजन का उच्चारण सुनना - लघु कथाएँ सुनना - साक्षात्कार - भाषण - सामाजिक मुद्दों पर पॉड वार्ता - निर्धारित पाठों को सुनना: इकाई 1 सभ्यता का रहस्य, इकाई 2 - युवाओं से - वार्तालापों को सुनना - जानकारी सुनना - सम्मेलनों के भाषण</p> <p><b>सुझाई गई गतिविधियां:</b></p> <p>सुनें और चुनें</p> <p>उम्मीदवार पाठ को सुनते हैं और तीन विकल्पों के साथ बहुविकल्पीय प्रश्न का उत्तर देते हैं।</p> <p>उम्मीदवार टीवी चैनलों में बातचीत - साक्षात्कार- अतिथि व्याख्यान, सम्मेलनों और कार्यशालाओं के दौरान विशेषज्ञों के भाषण सुनते हैं</p>	<p>CO-2</p> <p>BTL-3</p>
मॉड्यूल 3: बोलने का कौशल (6 L)	
<p>औपचारिक संवाद - अनौपचारिक संवाद - लिंग रूपों के साथ बोलना - संख्या - काल - परिवार, शहर, त्योहारों, शौक आदि जैसे सामान्य विषयों पर बोलना - पसंद और नापसंद व्यक्त करना - ज़रूरतें और संपत्ति - भूमिका निभाना।</p> <p><b>सुझाई गई गतिविधियां:</b></p> <p>प्रस्तुति – कार्यक्रमों का संचालन - भाषण देना</p>	<p>CO-3</p> <p>BTL-3</p>
मॉड्यूल- 4 : पढ़ने का कौशल (6 L)	
<p>नमूना पढ़ना - नकल पढ़ना - अक्षरों और शब्दों का सही उच्चारण करना - पढ़ने में प्रवाह - कहानियाँ पढ़ना- संपादकीय, समाचारपत्र के लेख पढ़ना।</p> <p><b>सुझाई गई गतिविधियां</b></p> <p>फ्लैशकार्ड का उपयोग - चार्ट - चित्रों की पहचान करना - शब्दों को पढ़ना</p>	<p>CO-4</p> <p>BTL-3</p>
मॉड्यूल-5 लेखन कौशल (6 L)	
<p>सामान्य पत्राचार - पत्र लेखन: छुट्टी लेने पत्र, बैंक खाता खोलना, पुस्तकें मंगवाने के लिए पत्र, शिकायत पत्र - संकेत विकास - ज्ञापन - नोटिस</p>	<p>CO-5</p> <p>BTL-3</p>

सुझाई गई गतिविधियां:		
निर्धारित पाठ्यपुस्तक के अनुसार अभ्यास पूरा करना		
पाठ्य पुस्तक		
1.	Sashtri. S.R.(2019). Hindi Shikshak, Dakshina Bharat Hindi Prachar Sabha, Chennai (Pages 137)	
संदर्भ पुस्तकें		
1.	Prathamatic Patya Pushthak. (2022), Dakshina Bharath Hindi Prachar Sabha, Chennai. (Pages 168)	
2.	Madhyama Patya Pushthak. (2022) Dakshina Bharath Hindi prachar Sabha, Chennai (Pages 184)	
ई-संदर्भ		
1.	<a href="https://www.hindipod101.com/">https://www.hindipod101.com/</a>	

COURSE TITLE			REGIONAL LANGUAGE -TELUGU						CREDITS				2	
COURSE CODE			GLS51010			COURSE CATEGORY			HS		L - T - P - S		2 – 0 – 0 – 2	
Version		1.0	Approval Details						BTL LEVEL				3	
ASSESSMENT SCHEME														
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments / Project		Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC” etc.,				Attendance		ESE		
15%		15%		10%		5%				5%		50%		
Course Description		This course has been designed to meet students' current and future language and communication needs. It attempts to develop their proficiency in the four language skills and knowledge of grammar and vocabulary. This course teaches students how to communicate accurately, appropriately and fluently in professional and social situations.												
Course Objectives		1. This course is aimed to teach the basic Telugu language speaking skills. 2.It will introduce basic skills of the Telugu Language: its alphabets, essential words and simple sentence construction methods. 3.The course intends to facilitate students in acquiring foundational skills of reading, writing and speaking Telugu along with synonyms to expand vocabulary.												
Course Outcome		Upon completion of this course, the students will be able to 1. Demonstrate the basic skills of Letters and sounds in Telugu. 2.Develop the basic vocabulary for every day’s conversation. 3.Construct simple Telugu sentences with the simple words. 4.Utilize the words that have conjunct character, and can learn functional, everyday conversation. 5.Construct Simple sentences for delivering appropriate meaning.												
Prerequisites: Plus Two Telugu-Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2





COURSE TITLE		French (Foreign Language)								CREDITS		2		
COURSE CODE		GLS51011		COURSE CATEGORY			HS		L - T - P - S		2 - 0 - 0 - 2			
Version	1.0	Approval Details		37 th ACM					LEARNING LEVEL			BTL – 3		
ASSESSMENT SCHEME														
CIA											End Semester Examination (ESE) Theory			
First Periodical Assessment	Second Periodical Assessment		Weekly assignment/ lab record and viva as approved by the Department Examination Committee “DEC”		Surprise Test / Quiz., as approved by the Department Examination Committee “DEC”		Attendance							
15 %	15 %		10 %		5 %		5 %		50%					
Course Description		Introduces students to the culture and language of the French-speaking world. Students develop an ability to communicate in real-life situations by acquiring reading, writing, listening, and speaking skills. The elementary courses prepare students to communicate successfully in some common basic social situations using the four language skills—listening, speaking, reading, and writing—within appropriate cultural contexts. The student will also acquire an understanding of cross-cultural awareness.												
Course Objective		1. To discover basic elements of the language, such as the different phonemes, the alphabet and its pronunciation 2. To discover the foundation of the language such as conjugations, auxiliaries, numbers, etc. 3. To learn how to form simple sentences about personal topics such as one's family 4.To start interacting with others by asking and answering simple questions 5. Understand your learning style and be able to check your own progress.												
Course Outcome		Upon completion of this course, the students will be able to 1. Demonstrate advanced proficiency in spoken and written French. 2. Demonstrate the ability to read critically, interpret analytically, speak persuasively, and write coherently about visual and literary texts produced in the French-speaking world. 3. Demonstrate familiarity with methodological approaches in the study of literary and cultural texts, such as close reading, socio-historical contextualization, and literary and cultural theory. 4. Demonstrate knowledge of literary and cultural traditions, such as major movements, writers, and works of the French-speaking world, focusing on at least one and ideally multiple traditions: European, African, Caribbean, Asian, North American, and other Francophone cultures. 5. Demonstrate the skills necessary for scholarly research and writing in the Humanities.												
Prerequisites: Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		

[illegible]

	11. <a href="https://lebaobabbleu.com/">https://lebaobabbleu.com/</a> 12. <a href="https://leszexpertsfle.com/">https://leszexpertsfle.com/</a> 13. <a href="https://www.ressourcesfle.fr/">https://www.ressourcesfle.fr/</a> 14. <a href="https://lecafedufle.fr/">https://lecafedufle.fr/</a>
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COURSE TITLE		German (Foreign Language)						CREDITS				2		
COURSE CODE		GLS51012		COURSE CATEGORY		HS		L - T – P - S				2 – 0 – 0 – 2		
Version	1.0	Approval Details		37 th ACM				LEARNING LEVEL				BTL – 3		
ASSESSMENT SCHEME														
CIA											End Semester Examination (ESE) Theory			
First Periodical Assessment	Second Periodical Assessment		Weekly assignment/ lab record and viva as approved by the Department Examination Committee “DEC”		Surprise Test / Quiz., as approved by the Department Examination Committee “DEC”		Attendance							
15 %	15 %		10 %		5 %		5 %		50%					
Course Description		The students shall understand the basic German Language concepts and cultural difference. They can manage to understand and communicate in German when they travel to Germany.												
Course Objective		1) This course aims to equip the students with a basic daily communication in German. 2) The students learn the spoken German required to communicate with native speakers 3) It helps them to understand the 4 different modules (Horen, Schreiben, Sprechen and Lesen ) which is required to clear the A1 first level international certificate exam. 4) The students learn the concepts which is required for pursuing their PG or Job in Germany												
Course Outcome		Upon completion of this course, the students will be able to 1. Recall and recognize the facts and use familiar, everyday expressions, create very simple sentences, which relate to the satisfying of concrete needs. 2. Understanding the texts and trying to communicate in a simple manner provided the person they are speaking to speaks slowly and clearly and is willing to help. 3. Understanding and recalling the basic German Vocabulary, Verb conjugations with pronouns, expressions and connecting the learned facts to communicate in simple German sentences 4. Applying the above learned facts and trying to create own sentences, E-mails etc. as per the basic level achieved 5. Understand the native speaker and apply the knowledge (at basic level) in writing and speaking parts.												
Prerequisites: Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	-	-	-	-	-	-	-	-	-	1	-	-	-	-

CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1 : SUPER! (3Hrs.)														
Jemanden vorstellen - Eine Hitliste internationaler Wörter schreiben - Nach dem Namen und der Herkunft fragen - Eine kursliste schreiben													CO-1 BTL-2	
<b>Grammatik:</b> regelmäßige verben – möchten, sprechen, sein - Personalpronomen – ich, du,er,sie. - Definiter Artikel im nominative der,die,das - W -Ragen, Ja/Nein														
Fragen - Präpositionen – aus, in														
MODULE 2 : Menschen (3Hrs.)														
Jemanden nach dem Befinden fragen - Sich verabschieden - <b>Interview:</b> Informationen über die Familie erfragen und darüber berichten - Über seine Freunde und die Freunde anderer schreiben und sprechen													CO-2 BTL-3	
<b>Grammatik:</b> Indefiniter Artikel – ein/eine - Negativartikel – kein/keine... Possessiveartikel – mein,dein,sein..														
MODULE 3 : Essen und Trinken (3Hrs.)														
Lebensmittel vergliechen - Lieblingsfarbe und Lebensmittel zuordnen - Umfrage: mein Lieblingsfrühstück - Eine Einkaufsliste für ein Lieblingsessen schreiben													CO-3 BTL-3	
<b>Grammatik:</b> Verb Konjugation – sein,haben - Imperative! Verbposition im Satz - W -Ragen, Ja/Nein Fragen														
MODULE 4 : Mein Leben (3Hrs.)														
Sich über Leben, Beruf, Herkunft, etc..austauschen - Eine Visitenkarte schreiben													CO-4 BTL-3	
<b>Interview:</b> sich über den Tagensablauf austauschen - Die zahlen bis 100														
<b>Grammatik:</b> Trennbaren verben_____ - “man” und “negation nicht” benutzen____ - Akkusativ(definite/indefinite/negative Artikel) - Präpositionen – um, als, für,bei														
MODULE 5 : Freizeit (3Hrs.)														
Ein kursposter mit Hobbys schreiben - Welche Hobbys habe ich,welche nicht - Notieren und sprechen – Was man selbst und die Familie am - Wochenende gerne macht- Über seinen Sonntag schreiben													CO-5 BTL-4	
<b>Grammatik:</b> Modalverben - Präpositionen – in,am														
TEXT BOOKS														
1	Rolf Bruseke , Starten Wir! (A1) ,Hueber Verlag,2018													
REFERENCE BOOKS														
1.	Stefanie Dengler, “Netzwerk neu A1.1 [Kurs und Übungsbuch]” ,Klett, 2015													
2.	Harmut Aufderstrasse,Heiko Bock, “Themen 1 aktuell kursbuch”,Hueber,2003													
E Books														
1.	<a href="https://www.learn-german-online.net/en/learning-german-resources/free-german-lessons-a1.htm">https://www.learn-german-online.net/en/learning-german-resources/free-german-lessons-a1.htm</a>													

COURSE TITLE			Spanish (Foreign Language)							CREDITS			2	
COURSE CODE			GLS51013			COURSE CATEGORY		HS		L-T-P-S			2-0-0-2	
Version	1.0	Approval Details				37 th ACM				LEARNING LEVEL			BTL- 3	
ASSESSMENT SCHEME														
CIA													ESE	
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”			Attendance					
15%		15%		10%		5%			5%		50%			
Course Description		This Spanish language course has been programmed to meet the grammatical and conversation needs of the student.  Its content is very comprehensive and will also assist in the professional and personal language requirement of the student												
Course Objective		1. To facilitate the student in reaching out to international clients across the globe. 2. To make an immediate connect by speaking to the prospective client/ company in their native language. 3. To improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. To provide survival skills to students relocating In countries where Spanish is spoken. This includes USA, all the Latin American countries and Spain.												
Course Outcome		1. Understand spoken Spanish and construction of basic sentences. 2. Creating conversations & oral understanding. 3. Enables the learners to decode a message and to give a suitable reply in the same manner. 4. Understanding the perceptions, phrases, and other vocabulary. 5. Understanding of not only the language but also culture, music, food and other aspects of the language.												
Prerequisites: Plus Two -Intermediate Level														
CO, PO AND PSO MAPPING														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		

<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>		
<b>MODULE 1: Introduction to Language &amp; Communication (Part 1) (6 Hrs.)</b>		
1. El Alfabeto – The Alphabets 2. Numeros – Numbers 3. Saludos - Salutations 4. La hora – The Time <b>Suggested Readings: USO (Basico)</b> <b>Dele Gramatica Epanola</b> <b>Author by Francisca Castro</b>		<b>CO-1</b>  <b>BTL-1</b>
<b>MODULE 2: Introduction to Language &amp; Communication (Part 2) (6Hrs.)</b>		
Los Meses, La Semana- The Month, The week and the days of the year Los Estaciones Delan'o – the Seasons of the year En el Aeropuerto, Cpger El Taxi – At the Airport, Booking tickets Hola – Salutations and Greetings Durante La Clase – During the class Art'culos – Different Articles <b>Suggested Reading: USO (Basico)</b> <b>Dele Gramatica Epanola</b> <b>Author by Francisca Castro</b>		<b>CO-2</b>  <b>BTL-2</b>
<b>MODULE 3: Understanding of Basic verb and Introduction to Grammar (6 Hrs.)</b>		
1. Verbp ser : Presente – Present tense of Verb “to be” 2. Estar / Hay – Conjugations of the verb “to be” and the verb there is / There are 3. Verbos En Presente: Regulares – Introduction to regular verbs 4. Ser / Estar / Tener – Conjugation of Irregular Verbs <b>Suggested Reading: USO (Basico)</b> <b>Dele Gramatica Epanola</b> <b>Author by Francisca Castro</b>		<b>CO-3</b>  <b>BTL-3</b>
<b>MODULE 4: Grammar and introduction to basic Concept (6 Hrs.)</b>		
1. Posesivos – Possessive Adjectives and Nouns 2. Colores – Colours and Expressions 3. La Familia – The Family and its members 4. Nombres Y Adjetivos – Nouns and Adjectives Literary Readings: <b>USO (Basico)</b> <b>Dele Gramatica Epanola</b> <b>Author by Francisca Castro</b>		<b>CO-4</b>  <b>BTL-2</b>
<b>MODULE 5 : (6 Hrs.)</b>		
1. Los nombres de la familia – Name of the Family Members 2. Relaciones – relations 3. Identificación de la tabla de familia - identification of the family table 4. Repaso del semestre entero - Full semester revision Literary Readings: <b>USO (Basico)</b> <b>Dele Gramatica Epanola</b> <b>Author by Francisca Castro</b>		<b>CO-5</b>  <b>BTL-3</b>
<b>TEXT BOOK</b>		

1.	Módulo Mind your Language Institute
<b>E-REFERENCES</b>	
1	Open.umn.edu
2	Pdftdrive.com/francisa-castro

COURSE TITLE			Korean (Foreign Language)							CREDITS			2		
COURSE CODE			GLS51014			COURSE CATEGORY			HS		L-T-P-S			2-0-0-2	
Version	1.0		Approval Details			37 th ACM				LEARNING LEVEL			BTL- 3		
ASSESSMENT SCHEME															
CIA													ESE		
First Periodical Assessment	Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”				Attendance						
15%	15%		10%		5%				5%		50%				
Course Description		One Paragraph.													
Course Objective		1. As Mandarin tops all global languages, the students get an upper hand in the prime industries of the world and direct access to the Chinese speaking community. 2. He/she will be able to create a direct connect thereby eliminating the requirement of a translator. 3. This will improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. The course will provide survival skills to students relocating to countries where Mandarin is spoken.													
Course Outcome		1. Understand spoken Mandarin and construction of advanced sentences. 2. Enhance conversations & oral understanding of few communication concepts. 3. Help in decoding a message and enable a suitable reply in the same manner. 4. Enable to construct phrases, and other vocabulary. 5. Understand of language, culture, music, food and other aspects of the language.													
Prerequisites: Plus Two -Intermediate Level															
CO, PO AND PSO MAPPING															
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	
CO1	-	-	-	-	-	-	-	-	-	3	-	-			
CO2	-	-	-	-	-	-	-	2	2	3	-	-			
CO3	-	-	-	-	-	-	-	-	-	3	-	-			
CO4	-	-	-	-	-	-	2	-	-	3	2	-			



CO5	-	-	-	-	-	-	-	-	2	3	2	3		
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1 – Introduction: Language and Culture (6 Hrs.)</b>														
<p>What kind of language is Korean?</p> <p>Korea, philosophy of the Korean language &amp; GangNam Style! In this module, students will learn Korean culture, philosophy of creating Korean scripts, and the Korean alphabet or Korean writing system called 'Hangeul'. After completing the lessons, students will be able to understand the principles how each letter was invented. Also, students will be able to understand Korean sign languages as well.</p> <p><b>Suggested Activities:</b> Memory game</p>													<p><b>CO-1</b></p> <p><b>BTL-1</b></p>	
<b>MODULE 2 – HANGEUL (6Hrs.)</b>														
<p>Greetings and Introducing phonics, the character system, Noun, Pronoun Basic Verb and Greetings &amp; Introducing. In this module, Students will learn how to greet, ask someone's nationalities / jobs and answer those questions in Korean. After completing the lessons, students will be able to introduce themselves, greet a person and talk about someone's nationalities and occupations.</p> <p><b>Suggested activities:</b> Introducing, Game with song, Flash cards game</p>													<p><b>CO-2</b></p> <p><b>BTL-2</b></p>	
<b>MODULE – 3 : Restaurant &amp; Shopping (6 Hrs.)</b>														
<p>Reading simple sentence - to be able to comprehend sign board and name, ordering at a restaurant, counting units, Interrogative sentence.</p> <p>In this module, students will learn how to order food and make requests at a restaurant in Korean. After completing the lesson, students will be able to inquire about restaurant menus, order a specific portion of food at a restaurant, and order a drink at a café. After completing the lesson, you will be able to express prices per item, purchase a product from a store, and make a specific request while shopping.</p> <p><b>Suggested Activities:</b> Playing in the condition of restaurant and Shop, Dictation</p>													<p><b>CO-3</b></p> <p><b>BTL-3</b></p>	
<b>MODULE – 4 : Daily Life &amp; Time (6 Hrs.)</b>														
<p>Talking about daily life, expressing movement, memo, simple message, object marker, expression of negation, &amp; writing.</p> <p>In this module, students will learn various Korean vocabulary regarding your daily lives. After completing the lessons, students will be able to utilize informal sentence endings, ask and answer about their everyday life.</p> <p>Students will learn about time and date in Korean. And students will also say the days of the week as well. After completing the lessons, students will be able to ask and respond time &amp; date using Korean numbers.</p> <p><b>Suggested activities:</b> Songs about numbers and family</p>													<p><b>CO-4</b></p> <p><b>BTL-2</b></p>	
<b>MODULE 5 : MODULE 5 : Speaking and interaction with Natives (6 Hrs.)</b>														
<p>Self-Introduction, conversations, finding out information about friends, talk with Korean, visit a Korean market or company. K-POP!</p> <p>Students are able to successfully handle a limited number of uncomplicated communicative tasks related to predictable topics for survival in Korea.</p> <p><b>Suggested Activities:</b> Talk with Native Korean</p>													<p><b>CO-5</b></p> <p><b>BTL-3</b></p>	
<b>TEXT BOOK</b>														
1.	세종한국어 1 The National Institute of The Korean Language													
<b>REFERENCE BOOKS</b>														
1	[ Active Korean 1 ],													

2	[ Practical Korean 1 ]	Darakwon, Korea, Korea
3	[ Korean Language for a Good Job ],	Darakwon (2007), Korea
E-REFERENCES		
1	<a href="https://www.amazon.in/Korean-Made-Simple-beginners-learning-ebook/dp/B00JHT4PCE">https://www.amazon.in/Korean-Made-Simple-beginners-learning-ebook/dp/B00JHT4PCE</a>	
2	<a href="http://www.twoponds.co.kr/en/snu">http://www.twoponds.co.kr/en/snu</a>	
3	<a href="https://www.koreantopik.com/2017/10/1-8-sejong-korean-textbook-pdfaudio69.html">https://www.koreantopik.com/2017/10/1-8-sejong-korean-textbook-pdfaudio69.html</a>	
MOOC Courses		

COURSE TITLE		MANDARIN (FOREIGN LANGUAGE)			CREDITS	2	
COURSE CODE		GLS51015	COURSE CATEGORY		HS	L-T-P-C	2-0-0-2
Version	1.0	Approval Details		37 th ACM	LEARNING LEVEL		BTL - 3
ASSESSMENT SCHEME							
First Periodical Assessment		Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE
15%		15%	10%		5%	5%	50%
Course Description		This level of Mandarin language course has been programmed to understand more symbols and grammatical concepts. It simplifies the construction of sentences, making it easy to converse basic sentences. The student will be able to translate texts and also speak relating to weather, climate and self-introduction. An introduction to ‘My family’ and description using adjectives.					
Course Objectives		1. As Mandarin tops all global languages, the students get an upper hand in the prime industries of the world and direct access to the Chinese speaking community. 2. He/she will be able to create a direct connect thereby eliminating the requirement of a translator. 3. This will improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. The course will provide survival skills to students relocating to countries where Mandarin is spoken.					

<b>Course Outcomes</b>	<p>1. Learning the rules of Hanyu pinyin, pronunciation, Mandarin Chinese tones, character-based common vocabulary, fundamental grammar, and oral and writing practices.</p> <p>2. Being able to differentiate the major tones of Chinese characters; Being able to differentiate the similar pronunciation of different vocabularies.</p> <p>3. Practicing basic communicative skills in Mandarin Chinese; through repetition practices in class, students are to learn commonly used Chinese vocabulary, sentences structure and oral communicative skills.</p> <p>4. Through in-class assignments, students are to recognize easy and basic Mandarin characters; in addition, students are to learn the regulation of expressing Mandarin Chinese in PinYin system and understand the specific adoption of borrowing from Alphabetic symbols.</p> <p>5. Through in-class assignments, students are to practice the drawing of Mandarin Chinese strokes order and characters</p>
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**Prerequisites:** Plus Two -Intermediate Level

**CO, PO AND PSO MAPPING**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		

**1: Weakly related, 2: Moderately related and 3: Strongly related**

**MODULE – 1 Mandarin Chinese Character and Tones (3 Hours)**

Basic strokes in Chinese - commonly used radicals - formation of vocabulary -pictograms - ideograms - compound ideographs - phono-semantic compounds  
- derivative cognates - phonetic loans - 4 tones introduction - consonants -single vowel - double vowels - initial, medial and vowels

**Suggested activities:**

Direct lecturing, repeated themes lecturing

**CO-1  
BTL-2**

**MODULE - 2 Listening Skills (3 Hours)**

Listening to native speaker's pronunciation of scripts, vocabularies. Tones differentiating trainings, one character with different pronunciation or tones, different characters with the same pronunciation or tones

**Suggested activities:**

Listening to native speaker's pronunciation and translate it into English.

**CO-2  
BTL-3**

**MODULE - 3 Speaking Skills (3 Hours)**

Imitating native speaker's pronunciations, tones and intonations to speak naturally

**Suggested activities:**

Reverse teaching, presentation, formal and informal conversations, singing Chinese songs, cultural activities, describing things

**CO-3  
BTL-3**

<b>MODULE - 4 Reading Skills.</b>		<b>(3 Hours)</b>
50 vocabularies - easy to difficult - important and commonly used - <b>Suggested activities:</b> Flashcards to practice, word recognition competition		<b>CO-4 BTL-3</b>
<b>MODULE 5 Writing Skills</b>		<b>(3 Hours)</b>
15 vocabularies - easy to difficult - important and commonly used - ChineseCalligraphy <b>Suggested activities:</b> Only practiced in assignments, not tested in any exams, composition practice(optional)		<b>CO-5 BTL-3</b>
<b>TEXT BOOK</b>		
1.	National Taiwan Normal University Mandarin Training Center (2015). Linking publishing company. A Course in Contemporary Chinese (Textbook) 1	
<b>REFERENCE BOOK</b>		
1.	National Taiwan Normal University Mandarin Training Center (2017). Linking publishing company. Practical Audio-Visual Chinese Vol. 1, 3rd Edition	
<b>E REFERENCE</b>		
1	<a href="http://chineseworksheetgenerator.org">http://chineseworksheetgenerator.org</a>	

COURSE TITLE			Japanese (Foreign Language)			CREDITS	2
COURSE CODE			GLS51016	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	1.0	Approval Details		37 th ACM		LEARNING LEVEL	BTL- 3
ASSESSMENT SCHEME							
CIA							ESE
First Periodical Assessment		Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”		Attendance	
15%		15%	10%	5%		5%	
15%		15%	10%	5%		5%	
Course Description		One Paragraph.					

<b>Course Objective</b>	1. By studying this course, students will be able to write and speak Tamil easily in any situation, daily life and daily conversations. 2. Develops language and interest in learning in students. 3. Facilitates students to create opportunities for themselves in the society. 4. Students also learn Tamil literature by developing interest in language department. 5. This lesson plan helps the students to learn about the culture by learning the Tamil language.													
<b>Course Outcome</b>	Upon the completion of this course, the students will be able to 1. Demonstrate the Letters and basic words of Tamil Language which are in daily use 2. Develops the listening skills of Tamil language 3. Utilize the letters and common words of the language for communication 4. Develop the conversational skills 5. Demonstrate the skill of reading and writing													
<b>Prerequisites:</b> Plus Two -Intermediate Level														
<b>CO, PO AND PSO MAPPING</b>														
<b>CO OO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO1 0</b>	<b>PO1 1</b>	<b>PO1 2</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	-	-	-	-	-	-	-	-	-	<b>3</b>	-	-		
<b>CO2</b>	-	-	-	-	-	-	-	<b>2</b>	<b>2</b>	<b>3</b>	-	-		
<b>CO3</b>	-	-	-	-	-	-	-	-	-	<b>3</b>	-	-		
<b>CO4</b>	-	-	-	-	-	-	<b>2</b>	-	-	<b>3</b>	<b>2</b>	-		
<b>CO5</b>	-	-	-	-	-	-	-	-	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>		
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1 – LANGUAGE AND CULTURE</b>										<b>(6 Hrs.)</b>				
Greetings - Self-Introduction - Numbers and Alphabets – Names of countries & Continents-Telling the time-Professions-Introduction about the language and country - Context based learning –At the Café, City orientation, Family, Daily routine ,Weather and Clothing  挨拶--自己紹介-数字とアルファベット-国と大陸の名前-時間を伝える-職業-言語と国についての紹介-コンテキストベースの学習-カフェで、都市オリエンテーション、家族、日常、天気と服装													<b>CO-1</b>  <b>BTL-1</b>	
<b>MODULE 2 : BASIC GRAMMAR</b>										<b>(6Hrs.)</b>				
Definite and indefinite articles - Simple verbs and conjugation – Pronouns-Possessive Pronoun-W Questions-Adjectives –Separable verbs  明確な冠詞と不定冠詞-単純な動詞と活用-代名詞-所有代名詞-W質問-形容詞-分離動詞													<b>CO-2</b>  <b>BTL-2</b>	
<b>MODULE 3 : READING &amp; LISTENING SKILLS</b>										<b>(6 Hrs.)</b>				
Reading simple passages - to be able to comprehend advertisements and short texts - Listening comprehension of real time situation based dialogues  簡単な文章を読む-広告や短いテキストを理解できるようにする-リアルタイムの状況に基づいた対話の理解を聞く													<b>CO-3</b>  <b>BTL-3</b>	
<b>MODULE 4 : WRITING SKILLS</b>										<b>(6 Hrs.)</b>				

Small passages – Comprehension – Composition – Letter writing		CO-4
小さな文章-理解-作文-手紙の書き方		BTL-2
MODULE 5 : SPEAKING SKILLS (6 Hrs.)		
Introducing self- describing daily routine – engaging in dialogues about family, city, orientation, ordering food at the café and weather		CO-5
自己記述的な日常生活の紹介-家族、都市、オリエンテーション、カフェでの食事の注文、天気についての対話に参加する		BTL-3
TEXT BOOK		
1.	Minna no Nihongo: main textbook and translation book. (second edition, Elementary level 1-1) Publisher: Goyal Publishers	
REFERENCE BOOKS		
E-REFERENCES		
MOOC Courses		

COURSE TITLE	UNIVERSAL HUMAN VALUES			CREDITS	2
COURSE CODE	GGE51001	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	This course is mandatory as per the AICTE for the UG students to motivate the students for focusing on the human values. The main aim is to focus on the sustainability of happiness with harmony and natural acceptance in the career. Lecture cum power points is provided as guidelines from AICTE.				
Course Objective	1. To create awareness to students on themselves and their surroundings (family, society, nature).				

	2. To create responsibility among students on life in handling problems with sustainable solutions 3. To prepare the students with human relationships and human nature in mind. 4. To Prepare the students on critical ability and sensitive to their commitment. (Human values, human relationship and human society). 5. To Apply the learning to their real life.													
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the necessity of relationship with family, society and nature. Familiarize with the challenges ahead and proposed solutions. 2. Formulate and design human cyber security policies, plans and procedures for organizations. 3. Apply standard security countermeasure tools to sustain human relationships and nature.es. 4. Recognize the necessity of human values and relationship. 5. Demonstrate the learning in their real life.													
Prerequisites: Nil														
CO, PO AND PSO MAPPING														
CO	P O -1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO -10	PO- 11	PO- 12	PSO -1	PS O-2
CO-1	-	-	-	-	3	3	3	3	3	3	3	3	-	-
CO-2	-	-	-	-	3	3	3	3	3	3	3	3	-	-
CO-3	-	-	-	-	-	3	3	3	3	3	3	3	-	-
CO-4	2	-	-	-	-	3	3	3	3	3	3	3	-	-
CO-5	-	-	-	-	-	3	3	3	3	3	3	3	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1: Introduction (6L)														
Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course, recapitulation from Universal Human Values-I Self-Exploration-what is it? - Its content and process; ‘Natural Acceptance’ and experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels. <b>Practical component:</b> Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking <b>Suggested Readings:</b> Evolution of cyber security													CO-1 BTL-2	
MODULE 2: Understanding Harmony in the Human Being (6L)														
Harmony in Myself! Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’ Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility													CO-2 BTL-2	

<p>Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail -Programs to ensure Sanyam and Health.</p> <p><b>Practical component:</b></p> <p>Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease</p>	
<b>MODULE 3: Understanding Harmony in the Family and Society (6L)</b>	
<p>Harmony in Human-Human Relationship- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals</p> <p><b>Practical component:</b></p> <p>Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives</p>	<b>CO-3 BTL-3</b>
<b>MODULE 4: Understanding Harmony in the Nature and Existence (6L)</b>	
<p>Whole existence as Coexistence - Understanding the harmony in the Nature -Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature -Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence.</p> <p><b>Practical component:</b></p> <p>Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.</p>	<b>CO-4 BTL-2</b>
<b>MODULE 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics (6L)</b>	
<p>Natural acceptance of human values, Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order -Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. -Case studies of typical holistic technologies, management models and production systems-Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.</p> <p><b>Practical component:</b></p> <p>Include practice exercises and case studies to discuss the conduct as an engineer or scientist etc.</p>	<b>CO-5 BTL-2</b>
<b>TEXT BOOKS</b>	
1. P.R Gaur, R Asthana, G.P Bagaria, Human Values and Professional Ethics (2 <sup>nd</sup> revised edition) Excel Books, New Delhi, 2019	



2. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.
  3. A. N Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
- Lawrence, C. (2016). *Cyber security for Dummies*, John Wiley & Sons Inc., 2<sup>nd</sup> Edition, pp.213--432.

#### REFERENCE BOOKS

1.	AICTE STUDENT INDUCTION PROGRAM HANDBOOK- <a href="https://fdp-si.aicte-india.org/download/Guidelines/G012%20SIP%20Hand%20Book%20v2.pdf">https://fdp-si.aicte-india.org/download/Guidelines/G012%20SIP%20Hand%20Book%20v2.pdf</a>
<b>E BOOKS</b>	
1.	<a href="https://fdp-si.aicte-india.org/download.php#1">https://fdp-si.aicte-india.org/download.php#1</a>

Semester III

COURSE TITLE	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS				CREDITS	4									
COURSE CODE	EMA51003	COURSE CATEGORY	BS	L-T-P-S	3-1-0-2										
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*	End Semester Examination										
15%	15%	10%	5%	5%	50%										
Course Description	To make the student understand the basic concepts of partial differential equations and transforms and its applications														
Course Objective	1. To present the main results in the context of partial differential equations and to study numerical methods for the approximation of their solution 2. To introduce the wave equation including time and position dependence 3. To comprehend the mechanisms of heat transfer under steady and transient conditions. 4. To enable the students to study the concept of Fourier Transform 5. To convert a discrete-time system into the difference equation using the Z Transform.														
Course Outcome	Upon completion of this course, the students will be able to 1. Formulate and solve standard types of partial differential equations. 2. Solve the Wave and Heat equations. 3. Obtain the solution of two dimensional heat equations. 4. Apply Fourier transform to find the definite integrals. 5. Compute the solution of the difference equation using Z-Transform.														
Prerequisites: Basics in Differential Equations.															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	2	2	3	1	-	1	1	-	-	1	2	1

[illegible]

2.	Datta.K.B (2013) Mathematical Methods of Science and Engineering, Cengage Learning India Pvt Ltd, Delhi.
3.	Veerarajan. T (2012) Transforms and Partial Differential Equation", Tata McGraw Hill Education Pvt. Ltd., Second reprint , New Delhi.
<b>E BOOKS</b>	
1.	<a href="https://link.springer.com/book/10.1007/978-1-4614-4809-9">https://link.springer.com/book/10.1007/978-1-4614-4809-9</a>
2.	<a href="https://s2pnd-matematika.fkip.unpatti.ac.id/wp-content/uploads/2019/03/Walter-A-Strauss-Partial-differential-equations-_an-introduction-Wiley-2009.pdf">https://s2pnd-matematika.fkip.unpatti.ac.id/wp-content/uploads/2019/03/Walter-A-Strauss-Partial-differential-equations-_an-introduction-Wiley-2009.pdf</a>
<b>MOOC</b>	
1.	<a href="https://nptel.ac.in/courses/122107037/">nptel.ac.in/courses/122107037/</a>

COURSE TITLE		PUBLIC SPEAKING AND GROUP DISCUSSION			CREDITS	1	
COURSE CODE		GLS51400	COURSE CATEGORY		HS	L - T – P – S	0-0-3-1
Version	01	Approval Details		42 <sup>nd</sup> ACM, 26 <sup>th</sup> Oct. 2024		LEARNING LEVEL	BTL -4
ASSESSMENT SCHEME							
CIA							ESE
First Periodical Assessment	Second Periodical Assessment	Practical Assessments as approved by the Department Examination Committee “DEC”		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance	Practical
15 %	15 %	10 %		5 %		5 %	50 %
Course Description		This course is an introduction to speech communication leading to group discussion that emphasizes the practical skill of public speaking, including techniques to lessen speaker anxiety and the use of visual aids to enhance speaker presentations. Civility and ethical speech-making are the foundations of this course. Its goal is to prepare students for success in typical public speaking situations and to provide them with the basic principles of organization and research needed for effective speeches. Students will learn effective self-presentation techniques, encompassing body language, attire, and verbal communication. Through practical exercises and mock sessions, students will gain hands-on experience and receive constructive feedback.					
Course Objective		By the end of this course, students will be able to: 1. Develop the ability to critically evaluate speeches by assessing both verbal and non verbal elements to effectively analyse their overall effectiveness. 2. Enhance audience analysis skills to understand the preferences, needs, and characteristics of the target audience and design speeches and discussions that align with their expectations and interests. 3. Acquire the capability to organise content in a manner that achieves specific objectives, such as providing information, persuasive arguments, or fulfilling the unique requirements of special occasions. 4. Develop skills through research and preparation of discussion topics, understanding group dynamics, building consensus and negotiation through effective verbal and non verbal responses.					

	5. Develop proficient research skills by critically analysing and interpreting diverse and relevant sources of information on a wide range of topics to bolster the credibility and depth of the speeches and group discussions.													
<b>Course Outcome</b>	Upon completion of this course, the students will be able to 1. Evaluate speeches based on a variety of verbal and non-verbal criteria. 2. Analyse the audience and design speeches to reflect the analysis. 3. Show increased confidence in their ability to handle interview and group discussion scenarios, reducing anxiety and stress. 4. Assess insightful questions that reflect their understanding and interest in the role or discussion topic. 5. Analyse meaningful research on a variety of topics.													
<b>Prerequisites:</b> Plus Two English-Intermediate Level														
<b>CO, PO AND PSO MAPPING</b>														
<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	-	-	-	-	-	-	-	-	-	3	-	2	1	0
<b>CO2</b>	-	-	-	-	-	-	-	-	-	3	-	2	1	1
<b>CO3</b>	-	-	-	-	-	-	-	-	2	3	-	2	0	1
<b>CO4</b>	-	-	-	-	-	-	-	-	2	3	-	2	1	0
<b>CO5</b>	-	-	-	-	-	-	-	-	2	3	-	2	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1 :Effectiveness of the Communication</b>														<b>(9P)</b>
Introduction to the Art of Speaking – Having simple great communication and removing the complexities —Rate of Speech to be heard-Usage of volume to add credibility & confidence-Tonality-to add emotion to your voice <b>Speaking Skills (Activities):</b> Self-Introduction-Speak for 60 seconds & Real life situations													<b>CO-1 BTL-2</b>	
<b>MODULE 2 : Designing and Enhancing Public Speaking Skills</b>														<b>(9P)</b>
Public Speaking and Audience Analysis- Acquire knowledge – Skill in real life presentation – Techniques for Conducting Audience Analysis– Adapting Speech Content- Visual aids – Organising Speeches for Information, Persuasion, and Special Occasions- Art of speech – Organisational Structures for Informative Speeches– Adapting Speech Organization to Special Occasions – Introduction and basic skills of an Emcee- -Dealing with -Nervousness-Audience-- Content-Fear- Feedback-Personality Humour-Use of Voice & Hands -To have self-confidence – Anecdotes – Personal Experiences – knowledge on current events <b>Speaking Skills (Activities):</b> Team Presentation-Role Plays - Monologues- Recitations. Group Debates - Impromptu Speaking													<b>CO-2 BTL-3</b>	
<b>MODULE 3 :Speaker’s Tool Kit</b>														<b>(9P)</b>

Brilliant ways to start any presentation -Designing- Making it Real Importance of Planning Importance of Structuring-Refining & Sketching the Draft-How to put together a great Presentation Preparation – Purpose of the Speech - Selecting the subject –Making an outline – Research Analysis Methods for Informative Speeches -Gathering materials – Critical Thinking and Research Ethics– Time Management – Rehearsing <b>Speaking Skills (Activities):</b> On the spot topic speech for 5 minutes-Mock Interviews – Panel sessions		<b>CO-3 BTL-3</b>
<b>MODULE 4 : Principles and its applications for GD</b>		<b>(9P)</b>
Group Discussion Fundamentals: Purpose and Format of Group Discussions- Techniques to Generate Ideas- Roles in a Group Discussion-Evaluating Group Performance - Effective Participation in Group Discussions: Initiating the Discussion-Building on Others' Ideas-Disagreeing Respectfully-Summarising Points. - Understanding Group Dynamics: Types of Group Members-Leadership in Group Discussions-Managing Dominant Participants- Encouraging Quiet Participants <b>Speaking Skills (Activities):</b> Fostering Active Engagement through Fishbowl Discussion		<b>CO-4 BTL-3</b>
<b>MODULE 5 : Navigating through Group Discussion</b>		<b>(9P)</b>
Mock Group Discussions: Simulated Group -Discussions-Peer Feedback Sessions-Instructor Feedback- Reflection and Improvement. Time Management in Interviews and Discussions: Structuring- Responses-Managing - Discussion Time-Prioritising Key Points-Avoiding Rambling - <b>Speaking Skills (Activities):</b> Conducting mock PI and GD sessions and providing constructive feedback.		<b>CO-5 BTL-4</b>
<b>TEXT BOOKS</b>		
1	Carnegie, Dale and Esenwein, J. Berg. (2018) <i>The Art Of Public Speaking</i> . Rupa Publications India,	
<b>REFERENCE BOOKS</b>		
1.	Peale, Norman Vincent.(2017) <i>The Power of Positive Thinking</i> , Fingerprint Publishing.	
2.	Carnegie, Dale (2015). <i>The Art of Public Speaking</i> , Mittal Books Publishing House.	
3	The Ted Talks:The official Ted Guide To Public Speaking Paperback-2018	
4.	Shankar, G. (2019). GD Guide: To Excel in Group Discussion. Independently Published.	
5.	S. Hundiwala. (2019). A Complete Kit for Group Discussion. Arihant Publications India Limited.	
<b>E Books</b>		
1.	<a href="https://www.managementhelp.org/public-speaking">https://www.managementhelp.org/public-speaking</a>	
2.	<a href="https://gtu.ge/Agro-Lib/successful-public-speaking.pdf">https://gtu.ge/Agro-Lib/successful-public-speaking.pdf</a>	
3.	(Mock Group Discussion(GD) 1   IIM Interview Questions and Answers. YouTube) Mock Group Discussion(GD) 1   IIM Interview Questions and Answers	
4.	(Group Discussion “Will Artificial Intelligence take away jobs?” YouTube) Group Discussion "Will Artificial Intelligence take away jobs?"	
<b>MOOC Courses</b>		
1	<a href="https://www.coursera.org/learn/public-speaking">https://www.coursera.org/learn/public-speaking</a>	
2	<a href="https://onlinecourses.nptel.ac.in/noc22_hs134/preview">https://onlinecourses.nptel.ac.in/noc22_hs134/preview</a>	

COURSE TITLE		ANALOG ELECTRONICS						CREDITS		4					
COURSE CODE		EEEC51002		COURSE CATEGORY			PC		L-T-P-S		3-0-2-2				
Version		1.0		Approval Details			37 th ACM		LEARNING LEVEL		BTL-3				
ASSESSMENT SCHEME															
CIA										ESE					
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY		PRACTICAL		
15%		15%		10%			5%		5%		25%		25%		
Course Description		Analog Electronics deals with electronic systems that has a continuous variable signal. In this course, the foundation of various analog electronic circuits that can be used to design amplifiers, oscillators, filters, analog converters, waveform generators and other analog circuits as required for the application is learned by the student.													
Course Objective		1. To develop the principles behind the design of an amplifier. 2. To illustrate tuned amplifier and feedback Amplifiers 3. To design an operational-amplifier 4. To select appropriate wave shaping circuits to solve problems 5. To familiarize the basic concepts of converters and ICs.													
Course Outcome		Upon completion of this course, the students will be able to  1. Apply different biasing, classify the types and solve problems on different amplifier circuits. 2. Interpret the characteristics of tuned amplifier and feedback Amplifiers 3. Examine the linear Op-Amps and its applications 4. Demonstrate appropriate wave shaping circuits to solve problems. 5. Illustrate the applications of special ICs.													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	1	1	1	0	0	0	0	2	1	3	2	1
CO-2	3	3	3	1	1	1	0	0	0	0	2	1	3	2	1
CO-3	3	3	3	1	1	1	0	0	0	0	2	1	3	2	1
CO-4	3	3	3	1	1	1	0	0	0	0	2	1	3	2	1

CO-5	2	2	3	1	1	1	0	0	0	0	2	1	3	2	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE I: BASICS OF TRANSISTOR AND SMALL SIGNAL AMPLIFIERS (9L+ 6P=15)															
<p>Basics of Transistor Operation, Biasing- Fixed, Emitter-Stabilized Bias and Voltage Divider Biasing. Basics of FET, Biasing- Fixed and Voltage Divider Biasing FET. Complete Hybrid model of transistor, H-parameter analysis of CE, CC amplifiers, Darlington connections.</p> <p><b>Suggested Readings:</b></p> <p>Transistor Biasing- DC Bias with voltage feedback, re model of transistor, Cascade amplifiers</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Characteristics of CE transistor</li> <li>2. Verification of Darlington amplifier</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Electronics Work bench</p>												<p><b>CO-1</b></p> <p><b>BTL-3</b></p>			
MODULE II: POWER AMPLIFIER, FEEDBACK AND TUNED AMPLIFIERS (9L+ 6P=15)															
<p>Transformer coupled class A, B &amp; AB amplifiers, Push-pull amplifiers. Characteristics of negative feedback amplifiers – Voltage / current, series/shunt feedback - Characteristics of tuned amplifiers – Single &amp; double tuned amplifier</p> <p><b>Suggested Readings:</b></p> <p>Stagger tuned and Synchronized tuned amplifiers and Neutralization Techniques.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Frequency response of Class A/B/AB/Push-push Amplifier</li> <li>2. Frequency response of Tuned amplifiers</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Electronics Work bench</p>												<p><b>CO-2</b></p> <p><b>BTL-3</b></p>			
MODULE III: LINEAR OP-APMPs AND ITS APPLICATIONS (9L+ 6P=15)															
<p>Linear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers, Differentiator, Integrator, Voltage to current converter, Instrumentation amplifier, Low-pass and band-pass filters, Comparator, Triangular wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator.</p> <p><b>Suggested Readings:</b></p> <p>Fabrication of ICs</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Inverting, Non-Inverting, Differentiator and Integrator using Op-amp</li> <li>2. Instrumentation amplifier using Op-amp</li> <li>3. Frequency response of Low pass &amp; High pass filters</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Electronics Work bench</p>												<p><b>CO-3</b></p> <p><b>BTL-3</b></p>			
MODULE IV: WAVE GENERATION AND WAVE SHAPING CIRCUITS (9L+ 6P=15)															



<p>Theory of sinusoidal oscillators – RC Phase shift and Wien bridge oscillators using Op-Amps – Comparators, Multivibrators: Monostable, Astable Multivibrators– Schmitt triggers, Non-linear function generator</p> <p><b>Suggested Readings:</b></p> <p>Colpitts Oscillator, Crystal oscillator and Uni-junction oscillator</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. RC phase shift &amp; Wein Bridge Oscillator using Op-amp</li> <li>2. Schmitt trigger using Op-amp</li> <li>3. Triangular wave generator using Opmap</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Electronics Work bench</p>	<p><b>CO-4</b></p> <p><b>BTL-3</b></p>
<p><b>MODULE V: D/A AND A/D CONVERTORS AND SPECIAL ICs (9L+ 6P=15)</b></p>	
<p>Introduction, Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different types of ADCs - Flash ADC, Counter type ADC, Successive approximation ADC and Dual slope ADC. PLL, VCO, Astable and Monostable Multivibrators using 555 Timer, Voltage regulators.</p> <p><b>Suggested Readings:</b></p> <p>Low-pass and band-pass filters using IC 555 Timers.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Monostable and Astable Multivibrators using IC 555 Timer</li> <li>2. Triangular wave generator using Triangular wave generator using IC 555 Timer</li> <li>3. ADC &amp; DAC</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Electronics Work bench</p>	<p><b>CO-5</b></p> <p><b>BTL-3</b></p>
<p><b>TEXT BOOKS</b></p>	
1.	Robert. L. Boylsted and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 11th edition, 2013.
2.	D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, Fourth Edition, 2018.
<p><b>REFERENCE BOOKS</b></p>	
1	Jacob Millman, Christos C Halkias and Satyabrata Jit, "Electron Devices and Circuits", Tata McGraw Hill, 3rd edition, 2010
2	Donald.A. Neamen, "Electronic Circuit Analysis and Design", 2nd Edition, Tata McGraw Hill, 2009.
3	Thomas L. Floyd, "Electronic Devices", 9th edition, Pearson education, 2011.
4	David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education Press, 5th Edition, 2010.
5	Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall of India, Fourth Edition, 2009
<p><b>E BOOKS</b></p>	
1.	<a href="https://mohamadramdhani.staff.telkomuniversity.ac.id/files/2016/08/Electronic-Devices-and-Circuit-Theory-11th-Edition-Ebook.pdf">https://mohamadramdhani.staff.telkomuniversity.ac.id/files/2016/08/Electronic-Devices-and-Circuit-Theory-11th-Edition-Ebook.pdf</a>
2.	<a href="https://maheselectronics.files.wordpress.com/2015/06/linear-integrated-circuit-2nd-edition-d-roy-choudhary.pdf">https://maheselectronics.files.wordpress.com/2015/06/linear-integrated-circuit-2nd-edition-d-roy-choudhary.pdf</a>
<p><b>MOOC</b></p>	
1.	<a href="https://nptel.ac.in/courses/108108111">https://nptel.ac.in/courses/108108111</a>
2.	<a href="https://archive.nptel.ac.in/courses/117/108/117108038/">https://archive.nptel.ac.in/courses/117/108/117108038/</a>

COURSE TITLE		DIGITAL SYSTEM DESIGN				CREDITS		3							
COURSE CODE		EEC51003		COURSE CATEGORY		PC		L-T-P-S		2-0-2-2					
Version		1.0		Approval Details		37 th ACM		LEARNING LEVEL		BTL-4					
ASSESSMENT SCHEME															
CIA									ESE						
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance *		THEORY		PRACTICAL			
15%		15%		10%		5%		5%		25%		25%			
Course Description		Introduction to logic design, with emphasis on practical design techniques and circuit implementation. Topics include Boolean algebra, switching algebra and switching functions; Theory of logic functions; mapping techniques and function minimization; hardware description language; analysis and synthesis of SR-, D-, T-, and JK-based sequential circuits.													
Course Objective		To teach the students about the fundamental principles of design for Combinational and sequential digital devices. Students will exercise their ability to apply these principles in practical application through laboratory simulation and experiments.													
Course Outcome		Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>analyze and reduce the given logical expressions using Boolean algebra also by algorithmic methods and implementations using logic gates</li><li>design the combinational logic circuits of basic and specific problem statement</li><li>design the combinational circuits using MUX and comprehend the details of sequential elements used in the digital design</li><li>analyze and design the synchronous and asynchronous sequential circuits</li><li>To implement the logic functions using Programmable devices and introductory things in HDL</li></ul>													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	-	2	-	-	1	2	-	-	2	3	1	1
CO-2	3	3	3	-	2	-	-	1	2	-	-	2	3	1	1
CO-3	3	3	3	-	2	-	-	1	2	-	-	2	3	1	1

CO-4	3	3	3	-	2	-	-	1	2	-	-	2	3	1	1
CO-5	3	3	3	-	2	-	-	1	2	-	-	2	3	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: BOOLEAN ALGEBRA, ITS SIMPLIFICATION TECHNIQUES AND BASIC COMBINATIONAL CIRCUITS (6 L+ 6 P)															
Binary arithmetic – Logic Gates – Minimization of POS and SOP Reduction of switching equations using Boolean algebra, Realization of switching function. DE Morgan’s Theorem. Karnaugh map simplification method (up to 3 variables) – Adders – Subtractors- Binary decoders and encoders -Advantages and Limitations of Karnaugh’s Map Suggested Readings: History and the usage of Alphanumeric Codes <b>Lab Experiments</b> 1. Design and implementation of Adders and Subtractors using logic gates. 2. Design and implementation of encoder and decoder using logic gates <b>Software/Equipment Used</b> Vivado 2015													CO-1 BTL-3		
MODULE 2: DESIGN OF COMBINATIONAL CIRCUITS (6 L+ 6P)															
4 Variable Karnaugh’s map simplification method-Code Converters - Binary parallel adders, Parallel subtractors – Priority encoders – Multiplexers — De-multiplexers.- Design and implementation of Magnitude Comparators using logic gates <b>Suggested Readings:</b> 5 Variable Karnaugh’s map simplification with Quine McClusky’s method tabulation Method (4 and more variables )- Design and implementation of Magnitude Comparators using IC 7485 <b>Lab Experiments</b> 1. Design and implementation of code converters using logic gates (Any one) i.BCD to excess-3 code and vice-versa (ii) Binary to gray and vice-versa 2. Design of MUX and DEMUX using Logic Gates													CO-2 BTL-3		
MODULE 3: IMPLEMENTATION USING MUX AND SEQUENTIAL CIRCUIT ELEMENTS (5 L+ 6 P)															
MUX as universal combinational modules -.Flip flops – SR, JK, D and T flip flops, Master – Slave flip flops, Characteristic and excitation table <b>Lab Experiments</b> 1. Implementation of Combinational Circuits using MUX 2. Design and Verification of truth table of Master slave JK flip flop. <b>Software/Equipment Used</b> Vivado 2015													CO-3 BTL-4		
MODULE 4: SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS (8 L+ 8 P)															
Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters, Up/Down counters – State diagram, State table, State minimization techniques- Asynchronous counters <b>Suggested Readings:</b> Additional problems in synchronous and asynchronous sequential circuits design. <b>Lab Experiments</b> 1. Construction and verification of 4 bit ripple counter and Mod-10 counters 2. Design and implementation of 3-bit synchronous up/down counter 3. Design of Asynchronous up Counter.(MOD-6)													CO-4 BTL-4		

MODULE 5:,MEMORY DEVICES AND INTRODUCTION TO HDL		(5 L+ 4 P)
Semiconductor memories- Classification of memories –Programmable Logic Devices –Logic Implementation with Programmable Logic Array (PLA), Programmable Array Logic (PAL) – concept of Field Programmable Gate Arrays (FPGA).Introduction to Hardware Description Languages-Verilog HDL Basics and Introductory Programming		CO-5 BTL-3
<b>Lab Experiments</b> 1. Circuit implementation using CPLD/FPGA		
<b>Software/Equipment Used</b> Vivado 2015		
<b>TEXT BOOKS</b>		
1	Morris Mano, “Digital design”, 5 th Edition, Prentice Hall of India, 2013	
2	Charles Roth, “ Digital System Design using VHDL” ,Tata McGraw Hill 2nd edition, 2012	
<b>REFERENCE BOOKS</b>		
1	Milos Ercegovac, Jomas Lang, “Introduction to Digital Systems”, Wiley publications, 1998.	
2	Anil K. Maini, “Digital Electronics: Principles, Devices and Applications”, Willey, 2007	
3	John M. Yarbrough, “Digital logic: Applications and Design”, Thomas – Vikas Publishing House, 2002.	
4	R.P.Jain, “Modern digital Electronics”,4th Edition, TMH, 2010.	
5	William H. Gothmann, “ Digital Electronics- An introduction to theory and practice” , PHI, 2 <sup>nd</sup> edition ,2006.	
<b>E BOOKS</b>		
1	<a href="https://www.researchgate.net/publication/264005171_Digital_Electronics">https://www.researchgate.net/publication/264005171_Digital_Electronics</a>	
2	<a href="http://free-ebook-download-links.blogspot.in/2008/08/free-books-on-digital-electronics.html">http://free-ebook-download-links.blogspot.in/2008/08/free-books-on-digital-electronics.html</a>	
<b>MOOC</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc21_ee39">https://onlinecourses.nptel.ac.in/noc21_ee39</a>	

COURSE TITLE	ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES			CREDITS	4
COURSE CODE	EEC51004	COURSE CATEGORY	PC	L-T-P-S	2-1-0-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination	Attendance	End Semester Examination (Theory)
					End Semester Examination (Practical)

								Committ ee “DEC”							
15%	15%	10%	5%	5%	25%	25%									
Course Description	The course will students shall develop an intuitive understanding of Fields and guided waves basic concepts with rectangular and circular waveguide to apply the concept on Transmission lines at radio frequencies. The students will be involved in visualizing most aspects of electromagnetics and transmission lines through MATLAB software .														
Course Objective	<div>1. <b>To introduce the fundamental theory and concepts of</b> To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.</div> <div>2. To impart knowledge on the concepts of Guided waves between parallel wavesTo expose the students to give ideas of electromagnetic waves and structure of transmission lines.</div> <div>3. To learn the concept and characteristics of Rectangular and Circular waveguidetransmission line theory to solve problems</div> <div>4. To impart the Transmission Line theory for application.</div> <div>5. To apply Smith chart use for solution of transmission line problems and impedance matching.</div>														
Course Outcome	<b>Upon completion of this course, the students will be able to</b> <div>1. Apply the knowledge of time varying fields and waves.</div> <div>2. Apply the concept of guided waves between parallel waves.</div> <div>3. Analyse the characteristics of Rectangular and Circular waveguide.</div> <div>4. Examine to synthesize the Transmission Line theory for application.</div> <div>5. Analyse the application of the Transmission line at Radio frequency.</div>														
Prerequisites:															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	1	2	1	-	-	-	-	-	-	3	-	3
CO-2	3	2	2	2	1	-	-	-	-	-	-	-	3	-	3
CO-3	3	1	2	1	2	1	-	-	-	-	-	-	3	-	3
CO-4	3	3	3	1	-	-	-	-	-	-	-	1	3	1	3
CO-5	3	3	3	0	1	1	-	-	-	-	-	1	3	1	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULEI: TIME VARYING FIELDS AND WAVES												(6L+ 3T=9)			

<p>Faraday's law, displacement current, ampere's circuital law for time varying fields, Maxwell's equations in phasor form, differential and integral form, wave propagation in free space, Helmholtz equation, uniform plane wave, pointing vector and the flow of power. Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, skin effect, Wave polarization: linear, elliptical and circular polarization, Reflection of uniform plane wave: normal and oblique incidence.</p> <p><b>Suggested Reading:</b> VECTOR ANALYSIS- Coordinate Systems: Cartesian, cylindrical and spherical co-ordinate systems, Vector Calculus: differential lengths, surfaces and volumes in Cartesian, cylindrical and spherical coordinate systems, del operator, gradient, divergence and curl.</p>	<p><b>CO-1</b> <b>BTL-4</b></p>
<p><b>MODULE II: GUIDED WAVES (6L+ 3T=9)</b></p>	
<p>Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – characteristics of TE and TM Waves – Transverse Electromagnetic waves –Velocities of propagation – component uniform plane waves between parallel planes – Attenuation of TE and TM waves in parallel plane guides – Wave impedances.</p> <p><b>Suggested Reading:</b> Propagation, attenuation and impedance in parallel planes guides. Transformer and Motional emf, retarded potentials. MATLAB® programs for computations and animations of EM principles.</p>	<p><b>CO-2</b> <b>BTL-4</b></p>
<p><b>MODULE III: – RECTANGULAR AND CIRCULAR WAVEGUIDES (6L+ 3T=9)</b></p>	
<p>Transverse Magnetic Waves and Transverse Electric Waves in Rectangular Waveguides – characteristic of TE and TM Waves – Cut off wavelength and phase velocity – Impossibility of TEM waves in waveguides– characteristic impedance – Excitation of modes. Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide – excitation of modes.</p> <p><b>Suggested Reading:</b> Propagation, attenuation, excitation and impedances. Snell's law, critical and Brewster's angle, standing waves.</p>	<p><b>CO-3</b> <b>BTL-4</b></p>
<p><b>MODULE IV: TRANSMISSION LINE THEORY (6L+ 3T=9)</b></p>	
<p>The Lumped-Element Circuit Model for a Transmission Line, Transmission line equations and their solutions, Transmission line parameters, Characteristic impedance, Propagation constant, Attenuation constant, Phase constant, Waveform distortion, Distortion less transmission lines, Input impedance of lossless lines – reflection on a line not terminated by <math>Z_0</math> - Transfer impedance– reflection factor and reflection loss – T and <math>\Pi</math> Section equivalent to lines.</p> <p><b>Suggested Reading:</b> Symmetrical networks, characteristic impedance and propagation constant. Asymmetrical networks, Image and Iterative impedances. Image transfer constant and iterative transfer constant. Properties of L, T and <math>\Pi</math> section types</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<p><b>MODULE V: – TRANSMISSION LINES AT RADIO FREQUENCIES (6L+ 3T=9)</b></p>	
<p>Loading of transmission lines, Reflection coefficient and VSWR. Equivalent circuits of transmission lines, Transmission lines at radio frequency. Open circuited and Short circuited lines, Smith Chart, Application of the Smith Chart– Conversion from impedance to reflection coefficient and vice-versa. Impedance to Admittance conversion and vice versa – Input impedance of a lossless line terminated by an impedance – Stub matching: single stub matching and double stub matching</p> <p><b>Suggested Reading:</b> Classification of filters, filter networks, equation of filter networks, classification of pass band and stop band, characteristics impedance in pass band and stop band,</p>	<p><b>CO-5</b> <b>BTL-3</b></p>

Attenuators and equalizers Attenuators-type, $\pi$ -type, Lattice, Bridge, L-Type attenuators; series, shunt, delay, attenuation equalizer	
<b>TEXT BOOKS</b>	
1	Matthew N.O. Sadiku, "Elements of Electromagnetics", Oxford Univ. Press E.C.Jordan and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, 1968, Reprint 2005
2	G.S.N.Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education (Singapore) Pvt., Ltd.J.D. Ryder, "Networks, Lines and Fields", 2nd edition, Pearson Education India, 2015.
3	Mathew. N. O. Sadiku " Principles of Electromagnetics", 6th edition, Oxford university Press, 2015.
4	William H. Hayt, Jr., John A. Buck, "Engineering Electromagnetics", 8th edition, Tata McGraw Hill, 2011.
5	Jorden, Ballman, "Electromagnetic Fields & Radiating Systems", 2nd edition, Pearson, 2015.
<b>REFERENCE BOOKS</b>	
1	E.C.Jordan and Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 1968, Reprint 2015G.S.N. Raju, "Electromagnetic field theory and transmission lines", 1st edition (3rd reprint), Pearson Education India, 2009
2	Engineering Electromagnetics, W. H. Hayt and J. A. Buck, 7th edition, Tata McGraw HillJohn D.Kraus and Ronalatory Marhefka, "Antennas", Tata McGraw-Hill Book Company, 2002.
3	Electromagnetics with applications, J. D. Kraus and Fleisch, Tata McGraw-HillR.E.Collins, 'Antennas and Radio Propagation ", McGraw-Hill, 1987
4	Fields and Waves in Communication Electronics, S. Ramo, J. R. Whinnery, and T. Van Duzer, WileyBallany , "Antenna Theory " , John Wiley & Sons, second edition , 2003
5	David. K. Cheng, "Fields and Wave electromagnetics, 2nd edition, Pearson Education, 2002.Prasad, K.D./ Antennas and Wave Propagation/ Khanna Publications, 2001.
6	John Kraus, Daniel Fleisch, "Electromagnetics with applications", 5th edition, McGraw Hill Education, 2017..
7	David. K. Cheng, "Fields and Wave electromagnetics, 2nd edition, Pearson Education, 2002..
8	A. Chakroborty, S. Nath and C.K. Chanda., (2019). <i>Basic Electrical Engineering</i> , McGraw Hill Education Pvt. Ltd., 4th Edition.
<b>E BOOKS</b>	
1	<a href="https://pdfcoffee.com/gsn-raju-electromagnetic-field-theory-amp-transmission-lines-pearson-education-2013pdf-pdf-free.html">https://pdfcoffee.com/gsn-raju-electromagnetic-field-theory-amp-transmission-lines-pearson-education-2013pdf-pdf-free.html</a> <a href="http://engineeronadisk.com/book_modeling/">http://engineeronadisk.com/book_modeling/</a>
2	<a href="https://www.academia.edu/36273757/Elements_Of_Electromagnetics_Sadiku_3rd_ed">https://www.academia.edu/36273757/Elements_Of_Electromagnetics_Sadiku_3rd_ed</a> Text book companion <a href="http://www.scilab.in/Completed_Books#2">http://www.scilab.in/Completed_Books#2</a>
3	<a href="https://archive.org/details/ewand-rs-2nd/page/20/mode/2up">https://archive.org/details/ewand-rs-2nd/page/20/mode/2up</a> Mathew. N. O. Sadiku, Principles of Electromagnetics.
4	<a href="http://www.scilab.in/Completed_Books#2">http://www.scilab.in/Completed_Books#2</a>
<b>MOOC</b>	

1	<a href="https://onlinecourses.nptel.ac.in/noc23_ee97/previewhttps://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-630-electromagnetics-fall-2006/index.htm">https://onlinecourses.nptel.ac.in/noc23_ee97/previewhttps://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-630-electromagnetics-fall-2006/index.htm</a>
2	<a href="https://onlinecourses.swayam2.ac.in/aic22_ts62/previewhttp://nptel.ac.in/syllabus/117101056/">https://onlinecourses.swayam2.ac.in/aic22_ts62/previewhttp://nptel.ac.in/syllabus/117101056/</a>
3	<a href="https://onlinecourses.nptel.ac.in/noc22_ee43/preview">https://onlinecourses.nptel.ac.in/noc22_ee43/preview</a> Antenna and wave propagation(web), <a href="http://nptel.ac.in/downloads/117101057/">http://nptel.ac.in/downloads/117101057/</a>
4	<a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-661-receivers-antennas-and-signals-spring-2003/lecture-notes/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-661-receivers-antennas-and-signals-spring-2003/lecture-notes/</a>
5	<a href="http://www.creativeworld9.com/2011/02/learn-antennas-and-wave-propagation.html">http://www.creativeworld9.com/2011/02/learn-antennas-and-wave-propagation.html</a>
6	<a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-630-electromagnetics-fall-2006/index.htm">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-630-electromagnetics-fall-2006/index.htm</a>

COURSE TITLE	ENVIRONMENTAL SCIENCE AND SUSTAINABLE DEVELOPMENT			CREDITS	2
COURSE CODE	GGE51003	COURSE CATEGORY	ES	L-T-P-S	2-0-0-2
Version	1.0	Approval Details	37 th ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	To expose the students to the basics of environmental science and sustainable development.				
Course Objective	<ol style="list-style-type: none"> <li>1. To make the students aware of the natural resources and to educate them to understand the need for preserving the resources.</li> <li>2. To provide knowledge on the various aspects of environmental pollution and issues.</li> <li>3. To provide basic knowledge and concepts of sustainability.</li> <li>4. To educate the students about the concepts of sustainable habitat.</li> <li>5. To give a broad knowledge on environmental management system.</li> </ol>				



<b>Course Outcome</b>	Upon completion of this course, the students will be able to													
	1. Recognize the effects of over exploitation of natural resources and their impact on day-to-day life on earth.													
	2. Apply the sustainable solutions for environmental pollution and issues.													
	3. Implement the concepts of sustainability in the product development.													
	4. Use appropriate methods for designing green house and maintaining sustainable cities, transport system, industries, etc.													
5. Manage the environment for sustainable product development.														
<b>Prerequisites: Basic knowledge of science and environment.</b>														
<b>CO, PO AND PSO MAPPING</b>														
<b>CO</b>	<b>P O -1</b>	<b>PO- 2</b>	<b>PO- 3</b>	<b>PO- 4</b>	<b>PO- 5</b>	<b>PO- 6</b>	<b>PO- 7</b>	<b>PO- 8</b>	<b>PO- 9</b>	<b>PO - 10</b>	<b>PO- 11</b>	<b>PO- 12</b>	<b>PSO- 1</b>	<b>PSO- 2</b>
CO-1	2	2	2	-	-	1	3	-	-	-	-	2	1	1
CO-2	2	2	2	-	-	1	3	-	-	-	-	2	2	2
CO-3	2	2	2	-	-	1	3	-	-	-	-	2	1	1
CO-4	2	2	2	-	-	1	3	-	-	-	-	2	1	1
CO-5	2	2	2	-	-	1	3	-	-	-	-	2	2	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1: NATURAL RESOURCES (6L)</b>														
Introduction - Forest resources: Use and over-exploitation – Water resources: Use and over-utilization – Mineral resources: Use and exploitation – Food resources: World food problems, effects of modern agriculture – Energy resources: conventional and nonconventional, solar energy, fuel cells, wind energy, hydro plants, bio-fuels, Energy derived from oceans, geothermal energy – Land resources: Use and over-exploitation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.													<b>CO-1</b> <b>BTL-3</b>	
Field study – Documentation of nearby environmental assets – river / forest / grassland / hill / mountain.														
<b>MODULE 2: ENVIRONMENTAL POLLUTION AND ISSUES (6L)</b>														
Air pollution, effects of air pollutions; Water pollution – sources, sustainable waste water treatment; Solid waste – sources, impacts, zero waste concept, 3R concept, Global environmental issues – Resource degradation, climate change, global warming, ozone layer depletion – Regional and local environmental issues – Carbon credits and carbon trading, carbon foot print.													<b>CO-2</b> <b>BTL-3</b>	
Field Study - Observe a pond nearby and analyze the different measures that can be adopted for its conservation.														

<b>MODULE 3: SUSTAINABILITY (6L)</b>	
<p>Introduction, need of sustainability – Social, environmental and economic sustainability concepts – sustainable development, Nexus between technology and sustainable development, challenges for sustainable development – multilateral environmental agreements and protocols – clean development mechanism (CDM) – Environmental legislations in India – water act, air act.</p> <p>Field Study - Assessment of sustainability in your neighborhood in education / housing / water resources / energy resources / food supplies/ land use / environmental protection, etc.</p>	<p><b>CO-3</b></p> <p><b>BTL-3</b></p>
<b>MODULE 4: CONCEPTS OF SUSTAINABLE HABITAT (6L)</b>	
<p>Green buildings: material for sustainable design, green building certification, methods for increasing energy efficiency of buildings – sustainable urbanization - sustainable transport – Industrialization and poverty reduction – Industrial processes: material selection, pollution prevention, industrial ecology, industrial symbiosis.</p> <p>Assignment – Explore the different methods that can be adopted for maintaining a sustainable transport system in your city.</p>	<p><b>CO-4</b></p> <p><b>BTL-3</b></p>
<b>MODULE 5: ENVIRONMENTAL MANAGEMENT (6L)</b>	
<p>Environmental management: Principles and strategies, Indicators of environmental quality – economic valuation - environmental cost-benefit analysis – Fiscal incentives in pollution control and management – Environmental management system: ISO 14000, Life Cycle Analysis (LCA) – scope and goal, bio-mimicking – Environmental Impact Assessment (EIA) – Procedures of EIA in India.</p> <p>Assignment – Conducting an EIA study of a small project (example, construction of house, road, bridge, etc.) in your local area.</p>	<p><b>CO-5</b></p> <p><b>BTL-3</b></p>
<b>TEXT BOOKS</b>	
1.	Basu, M., Savarimuthu, X. (2017). <i>Fundamentals of Environmental Studies</i> , Cambridge University Press, 1 <sup>st</sup> Edition.
2.	Bhavik R. Bakshi (2019). <i>Sustainable Engineering: Principles and Practice</i> , Cambridge University Press, 1 <sup>st</sup> Edition.
3.	Mulligan, C. (2020). <i>Sustainable Engineering: Principles and Implementation</i> , CRC Press, 1 <sup>st</sup> Edition.
<b>REFERENCE BOOKS</b>	
1.	Wasewar, K. L., Rao, S. N. (2022). <i>Sustainable Engineering, Energy, and the Environment Challenges and Opportunities</i> , CRC Press, 1 <sup>st</sup> Edition.
2.	Singh, J.S., Singh, S.P., Gupta, S. R. (2017). <i>Ecology, Environmental Science and Conservation</i> . S. Chand Publishing Company, New Delhi,
<b>E BOOKS</b>	

1.	<a href="https://www.hzu.edu.in/bed/E%20V%20S.pdf">https://www.hzu.edu.in/bed/E%20V%20S.pdf</a>
2.	<a href="https://library.oapen.org/handle/20.500.12657/33379">https://library.oapen.org/handle/20.500.12657/33379</a>
<b>MOOC</b>	
1.	<a href="https://www.my-mooc.com/en/categorie/environmental-science">https://www.my-mooc.com/en/categorie/environmental-science</a>
2.	<a href="https://www.coursera.org/specializations/sustainable-cities">https://www.coursera.org/specializations/sustainable-cities</a>

COURSE TITLE	DESIGN PROJECT-I				CREDITS	1									
COURSE CODE	EEC51800	COURSE CATEGORY	EEC		L-T-P-S	0-0-2-6									
Version	1.0	Approval Details	37 th ACM dated 20.01.2023		LEARNING LEVEL	BTL-3									
ASSESSMENT SCHEME															
First Review	Second Review	Third Review		Project Report & Viva Voce											
20%	20%	10%		50%											
Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the basic real time problem statement. This course provides an exposure to teamwork to emulate a typical professional design environment. Simulations are to be used both in the execution of the design methodology and the management of the design project.														
Course Objective	The course will enable the students to understand: 1. To develop literature survey and report preparation skills 2. To identify a project and execution of preliminary solution to address the problem statement 3. To enrich the communication and team management skills														
Course Outcome	Upon completion of this course, the students will be able to 1. Identify a real time problem by intensive literature survey 2. Selection of appropriate methodology with the required modern tools 3. Design & Analyse the solution through appropriate Measurement and scientific calculations														
Prerequisites: Basic knowledge in Measurements, Data Analysis, Interpretation.															
CO, PO AND PSO MAPPING															
	PO-1	PO-2	PO -3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	1	3	2	1	3	3	3	3	2	2	2	2
CO-2	3	3	2	1	3	2	1	3	3	3	3	2	2	1	1
CO-3	3	3	2	1	3	2	1	3	3	3	3	2	2	2	2

**Weightage of Assessment:**

Review / Examination Scheme	Weightage
First Review	20%

Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee will be constituted by the HoD for Review process

### **Assessment Rubrics**

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

\* - Attributes for individual contribution.

COURSE TITLE	INTERNSHIP – 1 (To be carried out in summer after 2 <sup>nd</sup> semester and evaluated in 3 <sup>rd</sup> semester)				CREDITS	1									
COURSE CODE	EEC51801	COURSE CATEGORY	EEC	L-T-P-S	#-#-#2										
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-4										
ASSESSMENT SCHEME															
Visit Report, Feedback of the employer, Presentation & Viva Voce, MCQ Assessment															
100%															
Course Description	This course aims to inculcate the application of knowledge & skill learned through classroom practices. It demands the academic component consisting of research, reflection, written and oral skills of the learner.														
Course Objective	The course will enable the students to 1. Explore career alternatives prior to graduation. 2. Integrate theory and practice. 3. Assess interests and abilities in their field of study. 4. Build a record of work experience.														
Course Outcome	Upon completion of this course, the students will be able to 1. Choose appropriate modern tools used in the field of Electronics and Communication engineering to manage the resources effectively by applying innovative ideas 2. Demonstrate ethical conduct and professional accountability while working in a team for the benefit of society. 3. Communicate effectively and to write the scientific report of the learnings														
Prerequisites: Basic knowledge in Measurements, Data Analysis, Interpretation.															
CO, PO AND PSO MAPPING															
CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O-1	PS O-2	PS O-3
CO-1	3	3	-	-	3	2	-	-	-	-	2	-	-	3	-
CO-2	-	-	-	-	3	-	-	3	2	2	-	-	2	-	2
CO-3	-	-	-	-	-	-	-		3	3	3	2	--	-	-

**Weightage of Assessment:**

Assessment Scheme	Weightage
Presentation & Viva voce	50 %
Report	20 %
Feedback of the Employer	30%

A committee will be constituted by the HoD with Internship coordinator as head for learning assessment process

**Assessment Rubrics**

Performance Indicators	Excellent(5)	Good(4)	Fair(3)	Poor(2)
<b>Requirement analysis and clarity on problem statement(5)</b>	Requirement well understood and problem statement well defined	Requirement well understood but problem statement not well defined	Understood the requirement and not defined properly	Not properly understood the requirements and problem statement not defined properly
<b>Relevance with Industry /Societal problem(5)</b>	Relevant	Relevant to industry with small modifications	Partially relevant	Irrelevant
<b>Project timeline scheduled(5)</b>	Scheduled and followed strictly	Scheduled and but not followed strictly	Scheduled but not followed	Not Scheduled and not followed
<b>Usage of latest application and software(5)</b>	latest applications and software's are used	Moderate usage of new technology	Slightly outdated	No latest applications and software's used
<b>Design and code efficiency(5)</b>	Excellent design of experiment and all possible outcomes are handled	Effective design but all possible outcomes are not handled	Satisfactory Design	Irrelevant design
<b>Report Preparation(10)</b>	Excellent documentation	Good documentation	Average documentation	Poor documentation
<b>Presentation skills ,Fluency and comprehensibility(5)</b>	Excellent communication skills and good comprehensibility	Good confidence , lack of communication skills and average comprehensibility	Less confidence, vocabulary need to be improved and poor comprehensibility	Poor skills
<b>Slide organization and contents time conscious(5)</b>	Content is organized properly and effective time management	Content is organized properly but not effective time management	Content is not organized properly	Poor organization and least time management
<b>Feedback from Industry mentor(5)</b>	Regular /novel idea/Excellent execution of project	Regular /Novel idea/Good execution of project	Regular /existing idea/Good execution of project	Irregular /existing idea/Poor execution of project

COURSE TITLE		INDUSTRIAL SAFETY (MANDATORY COURSE-II)						CREDITS				Non Credit Course			
COURSE CODE		EGE5102		COURSE CATEGORY				MC		L-T-P-S				3-0-0-2	
Version		1.0		Approval Details				36 <sup>TH</sup> ACM		LEARNING LEVEL				BTL-3	
ASSESSMENT SCHEME															
CIA														ESE	
First Periodical Assessment		Second Periodical Assessment		Seminar/Assignments/Project				Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”		Attendance*					
15%		15%		10%				5%		5%		50%			
Course Description		Upon completion of the Industrial Safety course, participants will be equipped with the knowledge and skills necessary to foster a safer and healthier workplace, thereby safeguarding workers, assets, and the environment. Whether the students are an industry professional seeking to enhance their safety expertise or a manager responsible for the well-being of their team, this course will empower them to make informed decisions and contribute to a culture of safety excellence within their organization.													
Course Objective		The objective of this course is to equip students with the knowledge, skills, and mindset necessary to promote a safe and healthy work environment, protect workers and assets, and contribute to the overall success and sustainability of industrial operations. It provides / covers <ul style="list-style-type: none"><li>comprehensive understanding of safety protocols, standards, and practices within industrial settings.</li><li>course covers a wide range of safety terminologies used in the industry, enabling students to effectively communicate and engage with safety professionals and colleagues.</li><li>delve into the fundamental principles of safety regulations, ensuring compliance with the highest safety standards</li></ul>													
Course Outcome		Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Realize the importance and basic Terminologies of safety.</li><li>Enable the students to learn about the Important Statutory Regulations and standards.</li><li>Enable students to Conduct and participate the various Safety activities in the industry.</li><li>Appreciate about Workplace Exposures and Hazards.</li><li>Assess the various Hazards and consequences through various Risk Assessment Techniques.</li></ul>													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	-	-	2	2	-	-	1	1	2			



CO-2	3	3	2	-	-	2	2	-	-	1	1	2			
CO-3	3	3	2	-	-	2	2	-	-	1	1	2			
CO-4	3	3	2	-	-	2	2	-	-	1	1	2			
CO-5	3	3	2	-	-	2	2	-	-	1	1	2			
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION (9L)															
Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government, and voluntary agencies in safety. Safety policy - Safety Officer-responsibilities, authority. Safety committee-need, types, advantages. <b>Suggested Reading:</b> <ul style="list-style-type: none"><li>Importance of Safety, Health and Environment policies at Workplace</li></ul>													CO-1 BTL-2		
MODULE 2: STANDARDS AND REGULATIONS (9L)															
Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006 <b>Suggested Readings:</b> <ul style="list-style-type: none"><li>Industrial Safety Signs: Types of Signs, Regulations, Standards and Best Practices to Promote Safety in the Workplace</li></ul>													CO-2 BTL-3		
MODULE 3: SAFETY ACTIVITIES (9L)															
Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. <b>Suggested Readings:</b> <ul style="list-style-type: none"><li>Roles and Responsibilities of Safety Officers and Safety Representatives</li></ul>													CO-3 BTL-3		
MODULE 4: HAZARDS AND RISKS (9L)															
Hazard and risk, Types of hazards- Mechanical Hazard, Electrical Hazard, Noise hazard and Fire Hazard - Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition. Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants <b>Suggested Readings / Activities:</b> <ul style="list-style-type: none"><li>Personal Protective Equipment (PPE), Types of PPE and their appropriate use, PPE selection, maintenance, and training, Assessing PPE effectiveness in hazard control</li></ul>													CO-4 BTL-3		
MODULE 5: HAZARD IDENTIFICATION TECHNIQUES (9L)															
Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment <b>Suggested Readings:</b>													CO-5 BTL-3		

<ul style="list-style-type: none"><li>Guidelines for safe handling, storage, and disposal of hazardous materials in various industries</li></ul>		
TEXTBOOKS		
1.	R.K. Jain and Prof. Sunil S. Rao, Industrial Safety, Health and Environment management systems, Khanna Publications, 2000.	
2.	L. M. Deshmukh, Industrial Safety Management: Hazard Identification and Risk Control, McGraw-Hill Education, 2005.	
REFERENCE BOOKS		
1	Frank Lees, ‘Lees’ Loss Prevention in Process Industries, Butterworth-Heinemann publications, UK, 4th Edition, 2012.	
2	John Ridley, John Channing, Safety at Work, 7 <sup>th</sup> edition, Routeledge, 2007.	
3	Das Akhil Kumar, Principles of Industrial Safety Management Understanding the Ws of Safety at Work, PHI Learning Pvt Ltd, 2020.	
E Resources for Reference		
1.	<a href="https://hsseworld.com/wp-content/uploads/2020/08/Industrial-Safety-Management.pdf">https://hsseworld.com/wp-content/uploads/2020/08/Industrial-Safety-Management.pdf</a>	
MOOC		
1.	<a href="https://onlinecourses.nptel.ac.in/noc20_mg43/preview">https://onlinecourses.nptel.ac.in/noc20_mg43/preview</a>	

#### Semester-IV

COURSE TITLE	RANDOM PROCESS			CREDITS	4
COURSE CODE	EMA51008	COURSE CATEGORY	BS	L-T-P-S	3-1-0-1

Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance *	End Semester Examination										
15%	15%	10%	5%	5%	50%										
Course Description	To make the student understand the basic concepts and techniques of numerical solution of algebraic equation, numerical solution of differentiation, integration and their application to engineering and science.														
Course Objective	1. To predict the outcome of an using the concept of probability 2. To compare the concept of discrete and continuous case 3. To categorize random variables in two dimensions 4. To classify the random process 5. To find the correlation and spectral density														
Course Outcome	Upon completion of this course, the students will be able to 1. Formulate theorems about the concept of probability and Calculate probabilities using Conditional probability. 2. Identify the standard distributions and apply them appropriately in real time problems 3. Compute the covariance and correlation 4. Classify the different types of random process 5. Compute the power spectral density and cross spectral density of a random process.														
Prerequisites: Basics of Statistics															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	2	3	2	-	-	-	-	-	-	-	-	-
CO-2	3	3	2	2	2	-	-	-	-	-	2	-	-	-	-
CO-3	3	3	2	2	3	2	-	-	-	-	-	-	-	-	-
CO-4	3	3	2	2	3	-	-	-	-	-	-	-	-	-	-
CO-5	3	3	2	2	3	-	-	-	-	-	-	-	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1:PROBABILITY AND RANDOM VARIABLES (9L+3T=12)															

Axioms of Probability– Bayes’ Theorem -Random variables – Moments – Moment generating functions. <b>Suggested Reading:</b> Basic Probability		CO-1 BTL-3
MODULE 2: STANDARD DISTRIBUTIONS (9L+3T=12)		
Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions <b>Suggested Reading:</b> Discrete and Continuous Functions		CO-2 BTL-3
MODULE3: TWO-DIMENSIONAL RANDOM VARIABLES (9L+3T=12)		
Joint distribution – Marginal and conditional distribution – Co-variance – Correlation and Regression <b>Suggested Reading:</b> Random Variables		CO-3 BTL-3
MODULE 4: CLASSIFICATION OF RANDOM PROCESS (9L+3T=12)		
Definition and examples– first order, second order, strictly, wide sense stationary and Ergodic processes– Markov process –Binomial, Poisson processes. <b>Suggested Reading:</b> Random Variable		CO-4 BTL-3
MODULE 5: CORRELATION AND SPECTRAL DENSITIES (9L+3T=12)		
Auto-correlation – Cross-correlation – Properties (Statement only) – Power spectral density – Cross spectral density–Properties (Statement only) –Wiener-Khinchinrelation (Statement only) –Relationship between power spectrum and cross correlation function. <b>Suggested Reading:</b> Correlation		CO-5 BTL-3
TEXT BOOKS		
1.	S.L. Miller and D.G Childers (2004), Probability and Random Processes with Applications to Signal Processing and Communication, Academic Press.	
2.	A. Chandrasekaran and G. Kavitha (2014) Probability, Statistics, Random Processes and Queuing Theory, Dhanam Publications, Chennai.	
3.	Raj Kumar Bansal, Ashok Kumar Goel,and Manoj Kumar Sharma(2016) MATLAB and its Applications in Engineering, Second Edition, Pearson Publication, New Delhi, India.	
REFERENCE BOOKS		
1.	O.C. Ibe. (2007) Fundamentals of Applied Probability and Random Processes, Elsevier, 1st Indian Reprint.	
2.	G. R. Cooper and C.D. Mc Gillem (2012) Probabilistic Methods of Signal and System Analysis, 3rd Indian Edition, Oxford University Press, New Delhi.	
3.	D. G. Duffy (2013) Advanced Engineering Mathematics with MATLAB, CRC Press, Third Edition, USA.	
E BOOKS		
1.	<a href="http://wiki.stat.ucla.edu/socr/index.php/Probability_and_statistics_EBook">http://wiki.stat.ucla.edu/socr/index.php/Probability_and_statistics_EBook</a>	
2.	<a href="https://www.khanacademy.org">https://www.khanacademy.org</a>	
MOOC		
1.	<a href="https://archive.nptel.ac.in/courses/111/105/111105090/">https://archive.nptel.ac.in/courses/111/105/111105090/</a>	

COURSE TITLE	PROFESSIONAL EDITING AND PROJECT WRITING			CREDITS	1
COURSE CODE	GLS51004	COURSE CATEGORY	HS	L - T - P - S	1 - 0 - 1 - 1

Version	1.0	Approval Details		36 <sup>TH</sup> ACM					LEARNING LEVEL				BTL – 4	
ASSESSMENT SCHEME														
CIA												End Semester Examination (ESE) Theory		
First Periodical Assessment	Second Periodical Assessment	Weekly assignment/ lab record and viva as approved by the Department Examination Committee “DEC”		Surprise Test / Quiz., as approved by the Department Examination Committee “DEC”		Attendance								
15 %	15 %	10 %		5 %		5 %								
50%														
Course Description		Professional Editing and Project Writing is a course to help students develop their editing and writing skills for professional purposes. Topics include document structure, editing for clarity and accuracy, content types and project management. Students will edit documents, prepare presentations and develop writing projects. The course aims to help students understand the writing process and become more proficient in editing and writing for professional purposes.												
Course Objectives		1. To Copyedit written texts professionally and appropriately 2. To understand and respect the role of the author in the editing process 3. To carry out a constructive and appropriate structural edit of written texts 4. To understand the editorial and production processes for producing books and other texts 5. To identify the market and readership of a text												
Course Outcomes		Upon completion of this course, the students will be able to 1.Develop a comprehensive understanding of professional editing and project writing. 2.Effectively edit and revise documents for clarity, accuracy and consistency. 3.Demonstrate an understanding of the different types of content used in professional writing. 4. Construct coherent and well-structured documents for various audiences. 5.Gain experience in developing and delivering effective presentations.												
Prerequisites: Intermediate Level														
CO, PO AND PSO MAPPING														
CO	P O1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	-	-	-	2	-	-	-	-	1	3	-	2		
CO2	-	-	-	2	-	-	-	-	1	3	-	2		
CO3	-	-	-	2	-	-	-	-	1	3	-	2		
CO4	-	-	-	2	-	-	-	-	1	3	-	2		
CO5	-	-	-	2	-	-	-	-	1	3	-	2		
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1– INTRODUCTION TO PROFESSIONAL EDITING AND PROJECT WRITING													(3Hrs.)	
Writing: Academic writing and kinds, Non-academic writing and kinds, Ways to an Effective Writing, Review/Research/Project Writing. Editing: Basics of Editing and Steps Involved in Editing. Traits of an Editor and Copy Editor. Basics of Proof-reading													CO-1 BTL-2	
MODULE 2 – MECHANICS OF WRITING- GRAMMAR, PUNCTUATION AND STYLE													(3Hrs.)	
Reviewing the fundamentals of grammar, understanding common grammatical errors, Spelling, Punctuation, Capitalization, Italics, Names of Persons, Number, Vocabulary, Appropriate use of Abbreviations, Established Symbols. Dos & Don'ts of writing, Common Errors/Words often Confused.													CO-2 BTL-3	

Exploring different writing styles, their appropriate usage and applying consistent style throughout a document		
<b>MODULE 3 – RESEARCH AND WRITING</b>		<b>(3Hrs.)</b>
Elements of Writing: Selecting a Topic, Conducting Research, Using Sources, Evaluating and Incorporating Sources, Developing Ideas, Gather data, Incorporate it into a project, Writing Clear and Effective Sentences and Paragraphs, Developing Unity, Coherence, Revisions; Format of Manuscripts, Academic Honesty and Plagiarism.		<b>CO-3 BTL-3</b>
<b>MODULE 4 – DOCUMENTATION</b>		<b>(3Hrs.)</b>
Documenting Sources, APA Style, Parenthetical documentation, List of works Cited, Figures, Charts and Tables, Endnotes, Footnotes, Citations components, Bibliography, and Appendices.		<b>CO-4 BTL-3</b>
<b>MODULE 5 – EDITING</b>		<b>(3Hrs.)</b>
Types and Stages, Roles, Duty and Responsibility of an Editor, Principles and Components of Editing, Functions of Editing, Copy Editing, Editing and Review, Developing Editorial Skills and Editorial Functions		<b>CO-5 BTL-4</b>
<b>TEXT BOOKS</b>		
1	Dade, P. (2020). The Oxford Guide to Effective Writing and Speaking. Reference Reviews, OUP. London.	
2.	Montagnes, I. (2018). Editing and publication: A training manual. Int. Rice Res. Inst..	
<b>REFERENCE BOOKS</b>		
1.	Strunk Jr, W., & White, E. B. (2007). The Elements of Style Illustrated. Penguin.	
2.	Blumenstock, N. A. (1984). The Chicago Manual of Style. By the University of Chicago Press. Chicago: University of Chicago Press, 1982. ix, 740 pp.	
3.	Lester, J. D., & Lester, J. D. (2005). Writing research papers: A complete guide. New York: Pearson/Longman.	
4	Saller, C. F. (2016). The subversive copy editor. In The Subversive Copy Editor, Second Edition. University of Chicago Press.	
<b>E Books</b>		
1.	<a href="https://edisciplinas.usp.br/pluginfile.php/3928474/mod_resource/content/1/Introduction%20to%20Academic%20Writing.pdf">https://edisciplinas.usp.br/pluginfile.php/3928474/mod_resource/content/1/Introduction%20to%20Academic%20Writing.pdf</a>	
2.	<a href="https://www.routledge.com/rsc/downloads/A_Practical_Guide_to_Academic_Writing_for_International_Students-A_Routledge_FreeBook-_FINAL_VERSION_.pdf">https://www.routledge.com/rsc/downloads/A_Practical_Guide_to_Academic_Writing_for_International_Students-A_Routledge_FreeBook-_FINAL_VERSION_.pdf</a>	
<b>MOOC Courses</b>		
1	<a href="https://www.coursera.org/specializations/academic-english">https://www.coursera.org/specializations/academic-english</a>	
2	<a href="https://www.coursera.org/learn/introduction-to-academic-writing">https://www.coursera.org/learn/introduction-to-academic-writing</a>	

COURSE TITLE	SIGNALS AND SYSTEMS			CREDITS	4
COURSE CODE	EECS1005	COURSE CATEGORY	PC	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as	Attendance	End Semester Examination (Practical)

				approved by the Department Examination Committee "DEC"		tion (Theory)									
15%	15%	10%	5%	5%	25%	25%									
Course Description	This module provides the basic of signals and systems its representations and response. It also describes the different response using Laplace Transform, Z-transform and Fourier Transform too.														
Course Objective	1. To know about types of signals and systems and its representations. 2. To understand the LTI systems and its properties. 3. To identify the response of signal using Laplace transform. 4. To visualize the effect of z Transform on the signals. 5. To interpret the effects of FS, FT on the signals.														
Course Outcome	Upon completion of this course, the students will be able to 1. Classify the continuous time & discrete time signals and systems 2. Apply the properties of LTI systems and perform time domain analysis of continuous and discrete time signals and systems. 3. Analyse and determine the impulse and step response of LTI systems using Laplace transforms and its properties 4. Examine and determine the impulse and step response of LTI systems by applying Z-transform, its properties 5. Outline the properties of Fourier transform and its variant for the given system.														
Prerequisites: Basic understanding of differential and integral calculus, limits and adequate knowledge of mathematics.															
CO, PO AND PSO MAPPING															
CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	3	1	-	-	-	-	-	-	2	2	3	3
CO-2	3	2	2	3	1	-	-	-	-	-	-	2	2	3	3
CO-3	3	3	2	2	1	-	-	-	-	-	-	2	2	3	3
CO-4	3	2	2	3	1	-	-	-	-	-	-	2	2	3	3
CO-5	3	3	2	3	1	-	-	-	-	-	-	2	2	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Continuous and Discrete Time Signals and Systems												(9L+ 6P=15)			

<p>Mathematical representation, classification of Continuous Time and Discrete Time signals, arithmetic operations on the signals, Mathematical representation, classification of CT and DT systems, Sampling and reconstruction, aliasing effect</p> <p><b>Suggested Readings:</b> Basic of Continuous and Discrete signals</p> <p><b>Lab Experiments ( Using MATLAB)</b></p> <ol style="list-style-type: none"> <li>1. Generate the following signals (i) Sine (ii) Saw tooth (iii) Sinc (iv) signum Function</li> <li>2. Plot the graph for Impulse, Unit Step and Ramp sequence</li> </ol>	<p><b>CO-1</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 2: Time Domain Analysis of Continuous and Discrete Time Signals And Systems (9L+ 6P=15)</b></p>	
<p>Properties of LTI systems, impulse and step response, Use of convolution integral and convolution sum for analysis of LTI systems, Properties of convolution integral/sum.</p> <p><b>Suggested Readings:</b> LTI systems and convolution.</p> <p><b>Lab Experiments( Using MATLAB)</b></p> <ol style="list-style-type: none"> <li>1. Write a program for amplitude scaling, time scaling and time shifting of given signal, <math>x=[1 \ -1 \ 2 \ -5 \ 1 \ 1 \ 3 \ -2 \ -1 \ 0 \ 1 \ -1 \ 2]</math></li> <li>2. Obtain the convolution of two given sequence x and h , where <math>x=[1,2,1,2,1,3,2]</math> and <math>h=[1,-1,2,-2,1,1]</math></li> </ol>	<p><b>CO-2</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 3: Frequency Domain Analysis of Continuous Time System Using Laplace Transform (9L+ 6P=15)</b></p>	
<p>Need of Laplace transform, review of Laplace transform, properties, inverse of Laplace transform, concept of ROC, poles and zeros, Unilateral Laplace transform, Analysis and characterization of LTI system using Laplace transform: impulse and step response, causality, stability, stability of causal system, Block diagram representation of Continuous Time systems.</p> <p><b>Suggested Readings:</b> Laplace transform</p> <p><b>Lab Experiments( Using MATLAB)</b></p> <ol style="list-style-type: none"> <li>1. Obtain the system impulse response and plot for the given transfer function of linear system –  <math display="block">H(s) = (s+1) / (s^2+5s+6)</math></li> <li>2. Write program to find system zero-state response due to the input signal <math>f(t) = \sin(2t)u(t)</math> for the given transfer function <math>H(s) = (s+1) / (s^2+5s+6)</math></li> </ol>	<p><b>CO-3</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 4: Frequency Domain Analysis of Discrete Time System Using Z- Transform (9L+ 6P=15)</b></p>	
<p>Need of Z transform, definition, properties of unilateral and bilateral Z Transform, mapping with s plane, relationship with Laplace transform, Z transform of standard signals, ROC, poles and zeros of transfer function, inverse Z transform, Analysis and characterization of LTI system using Z transform: impulse and step response, causality, stability of causal system, Block diagram representation and system realization.</p> <p><b>Suggested Readings:</b> Z- transform</p> <p><b>Lab Experiments ( Using MATLAB)</b></p> <ol style="list-style-type: none"> <li>1. Write the program to determine <math>H(z)</math> and sketch its pole-zero plot for a given a causal system, <math>y(n) = 0.9y(n-1) + x(n)</math>..</li> <li>2. Write program to find inverse Z-transform using partial fraction expansion for the given Z- transfer function. <math>H(z) = z / (3z^2 - 4z + 1)</math></li> </ol>	<p><b>CO-4</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 5: Frequency Domain Analysis of Continuous and Discrete Signals using Fourier (9L+ 6P=15)</b></p>	
<p>Review of Fourier transform, properties of Fourier transform, relationship with Laplace and Z transform, Discrete time Fourier transform, Properties, Frequency sampling, Discrete Fourier transform, Properties.</p>	<p><b>CO-5</b></p> <p><b>BTL-4</b></p>



<b>Suggested Readings:</b> DTFT,FT		
<b>Lab Experiments( Using MATLAB)</b>		
1. Write a Program to find n-point DFT of a given Sequence $x=[1\ 1\ 1\ 1\ 0\ 0\ 0\ 0]$		
2. Write the program to verify Perceval's theorem.		
<b>TEXT BOOKS</b>		
1.	Allan V.Oppenheim, S.Wilsky and S.H. Nawab, "Signals and Systems", Pearsons,2007	
2	Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007.	
<b>REFERENCE BOOKS</b>		
1	John G.Proakis and DimitrisG.Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, 4th Edition, PHI, 2006.	
2	B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.	
3	R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.	
4	John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007	
5	M.J.Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", Tata McGraw Hill, 2007.	
<b>E BOOKS</b>		
1	<a href="http://bookboon.com/en/introduction-to-digital-signal-and-system-analysis-ebook">http://bookboon.com/en/introduction-to-digital-signal-and-system-analysis-ebook</a>	
2	<a href="https://www.ece.uvic.ca/~frodo/sigsysbook/downloads/signals_and_systems-3.0.pdf">https://www.ece.uvic.ca/~frodo/sigsysbook/downloads/signals_and_systems-3.0.pdf</a>	
<b>MOOC</b>		
1	Signals and Systems (web), <a href="http://nptel.ac.in/courses/117104074/">http://nptel.ac.in/courses/117104074/</a>	
2	Signals and Systems (web), <a href="http://nptel.ac.in/courses/117101055/">http://nptel.ac.in/courses/117101055/</a>	

COURSE TITLE	VLSI Design			CREDITS	3
COURSE CODE	EECS1006	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA				ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination	Attendance *	THEORY PRACTICAL

			Committee “DEC”												
15%	15%	10%	5%	5%	25%	25%									
Course Description	The aim of this course is to provide an introduction to the design and layout of Very Large Scale Integrated (VLSI) circuits for complex digital systems. It covers custom design, cellbased hierarchical design, and algorithmic aspects of VLSI CAD tools. With a focus on CMOS technology, students generate layouts of CMOS chips on engineering workstations in an associated laboratory. By the end of the course, students will have designed, laid out, and testing all digital circuits.														
Course Objective	1. To comprehend the fabrication concepts and CMOS circuits 2. To study MOS transistor theoretical concepts 3. To familiarise the VLSI concepts in combinational and sequential circuits 4. To discuss ASIC and FPGA architecture. 5. To design Arithmetic Blocks and Perform Testing for digital circuits														
Course Outcome	Upon completion of this course, the students will be able to 1. Illustrate the techniques used for VLSI fabrication, design of CMOS logic circuits, Layout and Stick Diagram. 2. Analyze the behaviour of a DC characteristics of MOS Transistor 3. Analyze and design combinational and sequential circuits using CMOS gates. 4. Interpret the techniques of chip design using programmable devices. 5. Demonstrate the knowledge of arithmetic Building blocks and Execute Testing.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	0	0	0	0	0	0	0	1	2	1
CO-2	3	2	2	1	1	0	0	0	0	0	0	0	1	1	1
CO-3	3	2	2	1	1	0	0	0	0	0	1	1	2	2	2
CO-4	3	2	1	1	1	0	0	0	0	0	0	0	1	1	2
CO-5	3	2	1	1	1	0	0	0	0	0	1	1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: CMOS TECHNOLOGY (6 L+ 6 P)															
MOS transistor, CMOS logic- Inverter, NAND gate, NOR gate, logic gates, compound gates, Pass transistors and Transmission gates, multiplexers, NMOS Fabrication, CMOS Fabrication process, Twin tub Process, Latch up Concepts, NMOS,CMOS Layout design rules, Gate layouts and Stick diagram. Suggested Readings: MOS transistor, IC fabrication, logic gates Lab Experiments: 1. Schematic design of transistor level Inverter using CMOS logic 2. Schematic design of transistor level NAND and NOR gates using CMOS logic 3. Schematic design of 4:1 Multiplexer using Pass Transistor													CO-1 BTL-3		
MODULE 2: MOS TRANSISTOR THEORY (6 L+ 6P)															

MOS transistor introduction, Long channel I-V characteristics, Non ideal I-V characteristics, DC transfer characteristics, CV characteristics, second order effects, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Scaling. <b>Suggested Readings:</b> VI characteristics ,power dissipation <b>Lab Experiments:</b> 1. Design an Adder ; Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA 2. Design and implement Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software		CO-2 BTL-3
MODULE 3: COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS (6 L+ 6 P)		
Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Domino logic Power dissipation : Dynamic Power, Static Power Static and dynamic latches and registers, Timing issues, Pipelines, Clock strategies <b>Suggested Readings:</b> Latches, flipflops, registers, memory <b>Lab Experiments:</b> 1. HDL based Design entry and Simulation using Combinational Logic Circuits 2. Synthesis, Area, Power and Timing report generation using Sequential Circuits		CO-3 BTL-3
MODULE 4: ASIC AND FPGA ARCHITECTURE (6 L+ 6 P)		
CMOS chip design options-Full custom ASICs, Standard. Cell based ASICs, Gate Array based ASICs Channeled, Channel less and structured GA, FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Fine-, medium- & coarse-grained architectures. <b>Suggested Readings:</b> Memory, SRAM, DRAM <b>Lab Experiments:</b> 1. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA 2. Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA		CO-4 BTL-3
MODULE 5: DESIGN OF ARITHMETIC BUILDING BLOCKS AND TESTING (6 L+ 6 P)		
Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Boundary Scan. <b>Suggested Readings:</b> Digital circuits, gates, combinational circuits and sequential circuits <b>Lab Experiments:</b> 1. Design and Simulate a CMOS Inverting Amplifier. 2. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers. 3. Design and simulate simple 5 transistor differential amplifier.		CO-5 BTL-3
TEXT BOOKS		
1	CMOS VLSI Design A Circuits and Systems Perspective, Fourth Edition by Neil H.E. Weste, David Money Harris, 2011	
2	M.J. Smith, —Application specific integrated circuits  , Addison Wesley, 2002.	
3	A.Pucknell, Kamran Eshraghian, “BASIC VLSI Design”, Third Edition, Prentice Hall of India, 2007.	
REFERENCE BOOKS		
1	Jan Rabaey, AnanthaChandrakasan, B.Nikolic, “Digital Integrated Circuits: A Design Perspective”, Second Edition, Prentice Hall of India, 2003.	
2	Debaprasad Das, “ VLSI Design”, Second Edition, Oxford University Press, 2016.	
3	Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India 2005	

E BOOKS	
1	<a href="https://www.pinterest.com/pin/348677196134415137/">https://www.pinterest.com/pin/348677196134415137/</a>
2	<a href="http://www.freebookcentre.net/electronics-ebooks-download/">http://www.freebookcentre.net/electronics-ebooks-download/</a>
MOOC	
1	<a href="https://nptel.ac.in/courses/108107129">https://nptel.ac.in/courses/108107129</a>
2	<a href="http://nptel.ac.in/courses/117106092">http://nptel.ac.in/courses/117106092</a>

COURSE TITLE		Microcontroller for Embedded System design (Industry Collaborated Course)			CREDITS	3									
COURSE CODE	EEEC51007	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2										
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-6										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment (Theory)	Second Periodical Assessment t (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRAC TICAL									
15%	15%	10%	5%	5%	25%	25%									
Course Description	The students shall get an systemic introductions to all components and materials related to the ARM microcontroller system, including hardware and software as well as practical applications with real examples.														
Course Objective	<ul style="list-style-type: none"><li>• This course aims the students to Interpret embedded system and the concept of microcontroller</li><li>• This course also equips students to build microcontroller based embedded system</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>• Summarize the various concepts of embedded system and microcontroller</li><li>• Elaborate embedded system architecture and apply basics microcontroller interfacing</li><li>• Develop simple programming for microcontroller</li><li>• Utilize the microcontroller to interface with external peripherals</li><li>• Build a microcontroller based embedded system</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

[illegible]

Low Power Modes in Microcontroller. Introduction to Microcontroller Timer Module and it's Modes of Operation. Generating Pulse Width Modulation (PWM) using Timer Capture Mode. Interfacing DC MOTOR with Microcontroller. ADC operation in Microcontroller. Interfacing analog inputs. <b>Suggested Readings:</b> PWM and ADC Applications <b>Lab Experiments</b> 1. Interfacing Seven Segment Displays and Liquid Crystal Displays 2. Generating random numbers 3. Waveform generation using Microcontroller. <b>Software/Equipment Used</b> Software - Keil /Code Composer Studio/Energia Microcontroller -- TIVA C Series		CO-4 BTL-3
<b>MODULE 5: ADVANNCED INTERFACING WITH MICROCONTROLLER (6L+ 6P)</b>		
Serial Communication Protocols: UART, SPI, I2C. Interfacing Universal Serial Communication Interface (USCI) Module of the Microcontroller for UART and I2C Communication. <b>Suggested Readings:</b> Circuit Prototyping techniques. Microcontroller Based Project Design and Implementation. <b>Lab Experiments</b> 1. Coding Exercises based on Interrupt driven Programming. 2. Building an Electronics Project. <b>Software/Equipment Used</b> Software - Keil /Code Composer Studio/Energia Microcontroller -- TIVA C Series		CO-5 BTL-6
<b>TEXT BOOKS</b>		
1.	Sarmad Naimi , Sepehr Naimi , Muhammad Ali Mazidi , Shujen Chen "TI TIVA ARM programming for Embedded system" Microdigitaled, 2017	
2.	Muhammad Ali Mazidi, "TI Tiva ARM Programming For Embedded Systems: Programming ARM Cortex-M4 TM4C123G with C", Microdigitaled, 2017	
<b>REFERENCE BOOKS</b>		
1	Dhananjay V. Gadre, Sarthak Guptha, "Getting Started with Tiva ARM Cortex M4 microcontrollers : A Lab Manual for Tiva LaunchPad Evaluation Kit" Springer, 2017	
2	Dr, Yifeny Zhu, "Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C", E-Man Press LLC, 4th edition, 2023	
<b>E BOOKS</b>		
1.	<a href="https://www.ti.com/seclit/ml/ssqu017/ssqu017.pdf">https://www.ti.com/seclit/ml/ssqu017/ssqu017.pdf</a>	
2.	<a href="http://users.ece.utexas.edu/~valvano/">http://users.ece.utexas.edu/~valvano/</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc20_ee98/preview">https://onlinecourses.nptel.ac.in/noc20_ee98/preview</a>	
2.	<a href="https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-i">https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-i</a>	

COURSE TITLE	DESIGN PROJECT-2			CREDITS	1
COURSE CODE	EEEC51802	COURSE CATEGORY	EEC	L-T-P-S	0-0-2-6
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Review	Second Review	Third Review	Project Report & Viva Voce		

20%	20%	10%	50%												
Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the real time problem statement. This course provides an exposure to emulate a typical professional development of solution as a team. Appropriate Simulation tools to be used in the execution of the design methodology. The resources and team management skills are utilised to develop an innovative, economic solution to the selected problem														
Course Objective	The course will enable the students to: 1. Explore the literature study and report preparation skills 2. Demonstrate project identification and execution of feasible solution to address the problem statement 3. Elucidate the communication and team management skills														
Course Outcome	Upon completion of this course, the students will be able to 1. Identify a real-time problem by intensive literature survey 2. Selection of appropriate methodology by using modern tools 3. Design & analyse the solution through appropriate Measurements and calculations														
Prerequisites: Design Project-1															
CO, PO AND PSO MAPPING															
COs	PO-1	PO-2	PO -3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	2	3	2	2	3	3	3	3	1	3	3	1
CO-2	3	3	3	2	3	2	2	3	3	3	3	1	3	3	2
CO-3	3	3	3	2	3	2	2	3	3	3	3	1	3	3	2

**Weightage of Assessment:**

Review / Examination Scheme	Weightage
First Review	20%
Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee shall be constituted by the HoD for the Review.

**Assessment Rubrics**

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0

Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

\* - Attributes for individual contribution.

#### EVALUATION PARAMETERS FOR ASSESSMENT

To be followed same as approved for Design project 1

COURSE TITLE		Personality Development and Soft Skill Techniques			CREDITS	2
COURSE CODE		ETP51853	COURSE CATEGORY	EEC	L - T – P – S	0- 0 -3- 2
Version	1.0	Approval Details	41 ACM Dt. 13 Jul 24		LEARNING LEVEL	BTL -4
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Practical Assessments as approved by the Department Examination Committee “DEC”	Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance	Practical
15%	15%	10 %	5%		5 %	50%
Course Description	This course aims to enhance students' understanding and application of essential skills for personal and professional growth. It delves into the intricacies of personality development and soft skills, providing students with the knowledge and tools necessary to excel in various aspects of life.					



<b>Course Objective</b>	1.To understand the concept of self-awareness and its importance in personal and professional development. 2.To recognize the significance of setting clear, specific, and achievable goals inpersonal and professional contexts. 3.To explore a variety of time management techniques, such as prioritization, goalsetting, and task scheduling. 4.To learn strategies for managing and regulating emotions effectively in varioussituations. 5.To acquire skills in critical thinking, problem-solving, and decision-making tonavigate complex challenges and opportunities.													
<b>Course Outcome</b>	Upon completion of this course, the students will be able to 1. Identify their strengths and areas for growth, leading to improved self-confidence and self-efficacy. 2. Demonstrate the ability to prioritize goals based on importance, urgency, and alignment with their values and long-term aspirations. 3. Analyze the ability to manage their time effectively, resulting in increased productivity and efficiency in academic, professional, and personal tasks. 4. Develop stronger interpersonal relationships characterized by empathy, understanding, and effective communication, leading to enhanced collaboration and teamwork. 5. Apply effective networking skills, building and nurturing relationships with stakeholders, mentors, and peers to support personal and organizational growth.													
<b>Prerequisites:</b> Plus Two English-Intermediate Level														
<b>CO, PO AND PSO MAPPING</b>														
<b>CO/ PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	-	-	-	-	-	-	-	2	1	2	-	3	1	1
<b>CO2</b>	-	-	-	-	-	-	-	2	2	2	-	3	1	1
<b>CO3</b>	-	-	-	-	-	-	-	2	2	2	-	3	0	1
<b>CO4</b>	-	-	-	-	-	-	-	-	1	2	2	3	1	2
<b>CO5</b>	-	-	-	-	-	-	-	-	2	2	2	3	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1 : SELF AWARENESS AND ATTITUDE</b>													<b>(9P)</b>	
<b>Understanding Yourself:</b> Personality Assessment Test – Understanding of the Self- Self Analysis through SWOT Method- Self-Grooming-Personal Branding – Attitude Building: The power of positive thinking – Positive self-talk –self-esteem and positive attitude - Attitude at the workplace-Etiquette and manners in the class, public and professional places–Self-analysis through Johari Window. <b>Practicum:</b> 1. Students will be asked to enact a role play of a situation to build a positive attitude. 2.Prepare a case study on the personality traits of the students in collegeby SWOT Analysis Method.													<b>CO-1BTL-2</b>	
<b>MODULE 2: GOAL SETTING</b>													<b>(9P)</b>	

<b>GOAL SETTING:</b> What is goal? - What are SMART goals? - How does SMART goal setting work? - Goals as commitment – Useful Guideline for goal setting – Trying personal and professional goals – Goals at the workplace – Cascading goals – Types of goals <b>Practicum:</b> 1. Identify three goals you need to set to take you towards your dream job. Then list the steps you would take to reach that ultimate goal. 2.Students will be asked to set SMART goal of each type for the current academic year.		<b>CO-2BTL-3</b>
<b>MODULE 3: TIME AND STRESS MANAGEMENT</b> (9P)		
<b>Time Management:</b> What is time management? Prioritization – Time stressors – Time stealers – Coming out of Procrastination-Eisenhower Matrix– Strategies for effective time management – productivity pyramid – The four Ds of time management. <b>Stress Management–</b> Understanding stress-Identifying Stressors- Effects and Symptoms of Stress, Techniques of Stress Management <b>Practicum:</b> 1. Read Stephen Covey’s demonstration of the concept of time and prepare the schedule based on your daily activity. 2.Prepare a case study based on Time management during chess game.		<b>CO-3BTL-3</b>
<b>MODULE 4: EMOTIONAL INTELLIGENCE</b> (9P)		
<b>EMOTIONAL INTELLIGENCE:</b> What is Emotional Intelligence? Enhancing your emotional self-awareness, - Emotional intelligence and change management –Rewiring the Brain: unfreezing the old, re-freezing the new– emotional intelligence – Emotional Intelligence Test -Crisis management. <b>Practicum:</b> Prepare a case study of why concept of emotional intelligence is important on organizational setting.		<b>CO-4BTL-3</b>
<b>MODULE 5: LEADERSHIP AND CHANGE MANAGEMENT</b> (9P)		
<b>LEADERSHIP:</b> Qualities of a leader – Leadership and assertiveness – problem –solving and decision-making – Creative Thinking-Approaches to problem – solving and decision-making – Brainstorming –Cause-and-effect analysis- Building Self Confidence – Overcoming fear and anxiety- Understanding Change Management <b>Practicum:</b> 1. Identify any one individual from around you who you think is a good leader. How many of the above qualities does he/she possesses? Give evidence for each quality. 2.Visualization Relaxation exercises.		<b>CO-5BTL-4</b>
<b>TEXT BOOKS</b>		
1	Pillai, Sabina., & Fernandez, Agna. (2018). <i>Soft Skills &amp; Employability Skills</i> . Cambridge University Press. India.	
<b>REFERENCE BOOKS</b>		
1.	Mitra K Barun. (2011). <i>Personality Development and Soft Skills</i> . Oxford University Press. New Delhi.	
1.	Dhanavel. S P ( 2018). <i>English and Soft Skills</i> . Orient Black Swan. India.	
2.	Goldsmith, Marshall & M.S. Rao.(2020) <i>Soft Skills: Enhancing Employability</i> . Dream tech Press. India.	
<b>E Books</b>		
1.	<a href="http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4733/1/Leadership%20The%20Power%20of%20Emotional%20Intelligence.pdf">http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4733/1/Leadership%20The%20Power%20of%20Emotional%20Intelligence.pdf</a>	
<b>MOOC Courses</b>		
1.	<a href="https://www.coursera.org/specializations/people-and-soft-skills-for-professional-success">https://www.coursera.org/specializations/people-and-soft-skills-for-professional-success</a>	

**SEMESTER V**

COURSE TITLE		LOGICAL REASONING AND VERBAL ABILITY						CREDITS		1					
COURSE CODE		ETP51852		COURSE		EEC				L-T-P-S		1- 0 -2- 1			
Version		1.0		Approval Details		41ACM Dt. 13 Jul 24				LEARNIN G LEVEL		BTL 3			
CIA										ESE					
First Periodical Assessment	Second Periodical Assessment		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”				Attendance		Theory		Practical		
15%	15%		10%		5%				5%		25%		25%		
Course Description	This course is an in-depth exploration of reasoning and verbal aptitude, essential skills for placement. Students will engage with a variety of verbal reasoning problems, logical puzzles, and language comprehension exercises designed to enhance their analytical capabilities and linguistic proficiency.														
Course Objective	<div>1. Develop the ability to analyze, evaluate, and synthesize information.</div> <div>2. Practice solving verbal reasoning puzzles and problems.</div> <div>3. Strengthen abilities in reading comprehension and textual analysis.</div> <div>4. Engage with various forms of logical reasoning, including deductive and inductive reasoning.</div>														
Course Outcome	<div>At the end of the course the students will be able to:</div> <div>1. Apply arithmetic operations to solve complex problems.</div> <div>2. Simplify and solve equations and inequalities.</div> <div>3. Analyze and interpret data presented in various formats, including charts, graphs, and tables.</div> <div>4. Solve geometric problems involving shapes, volumes, and areas.</div> <div>5. Decipher quantitative problems with effective strategies and logical reasoning.</div>														
Prerequisites: Plus Two English-Intermediate Level															
CO, PO AND PSO MAPPING															
CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	-	-	-	-	-	-	-	2	1	2	-	3	1	2	

CO2	-	-	-	-	-	-	-	2	2	2	-	3	1	1	
CO3	-	-	-	-	-	-	-	2	2	2	-	3	1	2	
CO4	-	-	-	-	-	-	-	-	1	2	2	3	1	1	
CO5	-	-	-	-	-	-	-	-	2	2	2	3	1	2	
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1 : General Mental Ability-I (3L + 6P)															
Analogy- Classification-Series Completion-Coding, Decoding- Blood Relations-Puzzle test- Sequential Output Tracing-Direction Sense-Logical Venn Diagram-Alphabet Test- Number, Ranking and Time Sequence Test														CO-1	
BTL-2															
MODULE 2 : General Mental Ability-II (3L + 6P)															
Mathematical Operations-Logic Sequence of Words-Arithmetical Reasoning-Inserting the missing Character-Data Sufficiency – Decision Making- Assertion and Reason, Situation Reaction Test- Verification of the truth of the Statement														CO-2	
BTL-3															
MODULE 3 : Logical Reasoning -I (3L + 6P)															
Logic- Statement: Arguments- Statement: Assumptions-Statement: Course of Actions-Statement: Conclusions- Deriving Conclusion from the Passage- Theme Detection- Question: Statements-Series-Analogy-Classification														CO-3	
BTL-3															
MODULE 4 : Logical Reasoning -II (3L + 6P)															
Analytical Reasoning-Mirror & Water Images-Embedded figures-Completion of Incomplete patterns- Figure Matrix- Paper folding and Paper cutting-Grouping of Identical figures- Cubes and Dice-Construction of Triangles and Squares-Figure formation and Analysis														CO-4	
BTL-3															
MODULE 5 : Verbal Ability (3L + 6P)															
Reading Comprehension-Sentence Completion-Sentence correction-spotting errors-Synonyms and Antonyms-Filling the blanks-One word substitution-Idioms and Phrases-Filling with correct parts of speech-Identifying spelling errors-Arranging the sentences in a logical way														CO-5	
BTL-3															
TEXT BOOK															
1	Sharma, Arun & Upadhyay, Meenakshi (2020). How to Prepare For Verbal Ability And Reading Comprehension. New Delhi: McGraw Hill.														
REFERENCE BOOK															
1.	Aggarwal, RS (2018). A Modern Approach to Verbal & Non-Verbal Reasoning. New Delhi: S. Chand.														

COURSE TITLE	PROBLEM SOLVING USING QUANTITATIVE TECHNIQUES			CREDITS	1
COURSE CODE	ETP51855	COURSE	HS	L-T-P-S	1 - 0 - 2 - 2
Version	1.0	Approval Details	41ACM Dt. 13 Jul 24	LEARNING LEVEL	BTL - 3
CIA				ESE	

First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	Theory	Practical								
15%	15%	10%	5%	5%	25%	25%								
Course Description	This course is designed to develop and enhance students' quantitative aptitude and verbal reasoning skills, essential for competitive exams, academic pursuits, and professional success. The quantitative aptitude section covers fundamental mathematical concepts, problem-solving techniques, and data interpretation. The verbal reasoning section focuses on critical thinking, comprehension, and effective communication. Through a combination of theoretical knowledge and practical exercises, students will gain the confidence and proficiency required to tackle various aptitude tests.													
Course Objective	<ol style="list-style-type: none"><li>1. To provide a thorough grounding in basic mathematical concepts and principles essential for quantitative aptitude.</li><li>2. To enhance students' ability to solve a variety of quantitative problems efficiently and accurately.</li><li>3. To develop skills in interpreting and analyzing data presented in various formats such as charts, graphs, and tables.</li><li>4. To cultivate critical thinking and logical reasoning abilities necessary for verbal reasoning tasks.</li><li>5. To develop proficiency in solving various types of puzzles and logical reasoning problems.</li></ol>													
Course Outcome	<p>At the end of the course the students will be able to:</p> <ol style="list-style-type: none"><li>1. Demonstrate a solid understanding of fundamental mathematical concepts and their applications.</li><li>2. Solve quantitative problems with accuracy and speed.</li><li>3. Interpret data from various sources and making informed decisions based on that data.</li><li>4. Exhibit strong critical thinking and logical reasoning skills required for verbal reasoning tasks.</li><li>5. Solve puzzles and logical reasoning problems.</li></ol>													
Prerequisites: Plus Two -Intermediate Level														
CO AND PO MAPPING														
CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2
CO-1	-	-	-	-	-	-	-	-	-		3		-	-
CO-2	-	-	-	-	-	-	-	2	2		3		-	-
CO-3	-	-	-	-	-	-	-	-	-		3		-	-
CO-4	-	-	-	-	-	-	2	-	-		3		2	-
CO-5	-	-	-	-	-	-	-	-	2		3		2	3
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1: Number System							(3L + 6P)							
Number System, Problems with HCF and LCM - Divisibility Rules – Progression: AP, GP & HP – Mean & Averages- Allegations & Mixtures – Percentages - Maths using BODMAS Rule													CO-1	
													BTL-2	

<b>MODULE 2: Profit &amp; Loss</b>		<b>(3L + 6P)</b>
Profit & Loss - Interest: Simple Interest & Compound Interest – Ratio, Proportion & Variation - Time & Work – Time, Speed & Distance - Problems on Trains- Trigonometry		<b>CO-2</b>  <b>BTL-3</b>
<b>MODULE 3 : Logarithms</b>		<b>(3L + 6P)</b>
Logarithms - Permutations & Combinations– Probability - Surds & Indices - Decimal Fractions - Spatial Ability - Functions – Graphs - Data Interpretation on Multiple Charts		<b>CO-3</b>  <b>BTL-3</b>
<b>MODULE 4 : Quadratic Equations</b>		<b>(3L + 6P)</b>
Quadratic Equations- Set Theory- Conditional Syllogisms - Statements and Conclusions - Statements and Assumptions- Geometry-Mensuration – Pipes & Cisterns - Sequence – Series		<b>CO-4</b>  <b>BTL-3</b>
<b>MODULE 5 : Inequalities</b>		<b>(3L + 6P)</b>
Inequalities- Image Based Problems- Clocks & Calendars - Problems on Ages - Factor Theorem - Power Theorem - Remainder Theorem -Coordinate Geometry		<b>CO-5</b> <b>BTL-3</b>
<b>TEXT-BOOK</b>		
1	Sharma, Arun (2022). <i>Quantitative Aptitude for Competitive Examinations (11<sup>th</sup> Ed)</i> . New Delhi: McGraw Hill.	
<b>REFERENCE BOOK</b>		
1.	Agarwal, RS (2022). <i>How to Prepare for Quantitative Aptitude</i> . New Delhi: S Chand.	

COURSE TITLE	DIGITAL SIGNAL PROCESSING			CREDITS	4	
COURSE CODE	EEEC51008	COURSE CATEGORY	PC	L-T- P-S	3-0-2-2	
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	This course covers theory and methods of digital signal processing including basic principles, the analysis and design of discrete-time systems. Aim to provide working knowledge of design, implementation and analysis of various DSP systems.					

Course Objective	<ul style="list-style-type: none"><li>• To compute Discrete Fourier Transform effectively by utilising its properties</li><li>• To analyze the frequency response characteristics of discrete-time composite signals</li><li>• To design FIR and IIR digital filters for the given specifications</li><li>• To convert (up or down) the original sampling rate of the signal as per application</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ol style="list-style-type: none"><li>1. Compute DFT efficiently using decimated FFT algorithms</li><li>2. Design &amp; compare the IIR filter characteristics as per the user specifications</li><li>3. Design &amp; Implement practical FIR Filters for the given specifications</li><li>4. Analyze the effects of quantization errors and the need of Multi-rate sampling conversion for real time applications.</li><li>5. Illustrate the architectural resources of TMS320C6713 &amp; 6748 DSP Processor for signal processing application development</li></ol>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	-	2	2	-	2	2	-	1	1	1	2	2
CO-2	2	2	1	2	2	2	-	2	2	-	1	2	2	3	2
CO-3	3	3	2	1	2	2	-	2	2	-	1	2	2	3	-
CO-4	3	2	1	1	2	1	-	2	2	-	1	2	2	1	2
CO-5	3	3	1	1	3	2	-	2	2	-	1	2	1	-	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: EXISTENCE OF FOURIER TRANSFORM IN (9L+ 6P)															
The Discrete Fourier Transform –Frequency Domain Sampling, Properties of DFT. Computation of DFT - FFT Algorithms (Radix 2 only), Linear Filtering and Correlation using DFT. Suggested reading- Application of FFT in real time examples <b>Lab Experiments</b> <ol style="list-style-type: none"><li>1. DFT computation and verification using MATLAB &amp; Simulink</li><li>2. FFT computation and Verification using MATLAB &amp; Simulink</li></ol> <b>Software/Equipment Used</b> MATLAB & Simulink												CO-1 BTL-3			
MODULE 2: FIR FILTER DESIGN TECHNIQUES (9L+ 6P)															
Design of FIR Filters- FIR Filters using Windowing method and Frequency Sampling Method- Design of Linear-Phase FIR Filters. <b>Suggested reading-</b> Kaiser window technique and its importance <b>Lab Experiments</b> Design and verification of FIR filter performance over the input signal using MATLAB & Simulink tool <b>Software/Equipment Used</b> MATLAB & Simulink												CO-2 BTL-3			

MODULE 3: IIR FILTER DESIGN CONCEPTS (9L+ 6P)	
<p>Design of IIR Digital Filters from Analog Filters- Digital IIR Filter Design using: ImpulseInvariance method - Bilinear Transformation method.</p> <p>Implementation of efficient Filter structures:</p> <p><b>Suggested reading-</b> Performance comparison of Butterworth and Chebyshev filterdesign concepts</p> <p><b>Lab Experiments</b></p> <p>Design and performance verification of digital bilinear/ Impulse invariant IIR filter using MATLAB &amp; Simulink tool</p> <p><b>Software/Equipment Used</b></p> <p>MATLAB &amp; Simulink</p>	CO-3 BTL-3
MODULE 4: FINITE WORD LENGTH EFFECTS IN DSP (10L+ 6P)	
<p>Analysis of finite word length effects- Quantization noise, round off errors, input andoutput quantization error, limit cycles in IIR filters. Multi-rate Digital Signal Processing- Decimation and Interpolation concepts -</p> <p><b>Suggested reading-</b> Sampling Rate Conversion for real time applications</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Verify the performance of Up-sampling &amp; Down-sampling using MATLAB &amp;Simulink tool</li> <li>2. Analyze the effect of limit cycle operation using MATLAB &amp; Simulink tool</li> </ol> <p><b>Software/Equipment Used</b></p> <p>MATLAB &amp; Simulink</p>	CO-4 BTL-4
MODULE 5: ARCHITECTURAL DESCRIPTIONS OF DSP PROCESSORS (8L+ 6P)	
<p>Computer architecture for signal processing applications- Architecture of TMS320C6713 and 6748 processors and its functional characteristics. Assembly language / C programming for basic signal processing applications with TMS320C 6713 and 6748processors</p> <p><b>Suggested reading-</b> Advanced DSP processor for real time applications</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Develop the code for simple DSP applications using CCS and TMS 6748 DSPprocessor device</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Code Composer Studio and TMS 320 floating point processor</p>	CO-5 BTL-3
TEXT BOOKS	
1.	John G Proakis, Dimitris G Monolakis, "Digital Signal Processing" 4 <sup>th</sup> Edition, PHI. 2007
2.	B.Venkataramani & M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application", 2 <sup>nd</sup> edition, TMH 2002
REFERENCE BOOKS	
1	Sanjith K Mitra, "Digital Signal Processing", 4 <sup>th</sup> edition, Tata Mc Graw Hill, 2010
2	Sen M. kuo, Woon-seng S. Gan, "Digital signal processors : architectures , implementations & applications" Pearson, 2015
3	Emmanuel C Ifeachor, Barrie W Jervis, "Digital Signal Processing", 2 <sup>nd</sup> Edition, Pearson Education /PHI, 2007.
4	Avtar singh, S. Srinivasan, "DSP Implementation using DSP microprocessor with Examples from TMS32C54XX" -Thamson / Brooks cole Publishers, 2003
E BOOKS	
1.	<a href="http://electronicsforu.com/resources/cool-stuff-misc/8-free-ebooks-digital-signal-processing">http://electronicsforu.com/resources/cool-stuff-misc/8-free-ebooks-digital-signal-processing</a>
2.	<a href="http://www.freebookcentre.net/Electronics/DSP-Books-Download.html">http://www.freebookcentre.net/Electronics/DSP-Books-Download.html</a>



MOOC	
1.	<a href="http://nptel.ac.in/courses/117104070/">http://nptel.ac.in/courses/117104070/</a>
2.	<a href="https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/readings/">https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/readings/</a>

COURSE TITLE	COMMUNICATION SYSTEMS			CREDITS	3
COURSE CODE	EECS1009	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3

#### ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	This course focuses on analysis and design of communication systems with an emphasis on digital communications based on time and frequency domain analysis. Fourier transform techniques, linear systems, Analog techniques such as Amplitude Modulation (AM) and Frequency Modulation (FM) radio will be reviewed for conceptual and comparative purposes.					
Course Objective	<ul style="list-style-type: none"> <li>To Compute the Fourier transform and the energy and power spectral densities of communications signals.</li> <li>To calculate the bandwidth and signal-to-noise ratio of a signal at the output of a linear system or filter.</li> <li>To explain the operation of basic digital communication systems (both baseband and bandpass) in both the time and frequency domains.</li> <li>To evaluate the performance, in terms of bit error rate, of a digital communication link.</li> <li>To explain the concepts of link budget and multiple access as it applies to wireless communication.</li> </ul>					

Course Outcome	<div>1. To Compute the Fourier transform and the energy and power spectral densities of communications signals.</div> <div>2. To calculate the bandwidth and signal-to-noise ratio of a signal at the output of a linear system or filter.</div> <div>3. To explain the operation of basic digital communication systems (both baseband and bandpass) in both the time and frequency domains.</div> <div>4. To evaluate the performance, in terms of bit error rate, of a digital communication link.</div> <div>5. To explain the concepts of link budget and multiple access as it applies to wirelesscommunication.</div>															
	CO, PO AND PSO MAPPING															
	CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
	CO-1	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1
	CO-2	2	2	1	2	-	-	-	-	-	-	-	-	1	1	1
CO-3	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2	
CO-4	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2	
CO-5	2	2	2	1	1	-	-	-	1	-	-	1	1	2	2	
1: Weakly related, 2: Moderately related and 3: Strongly related																
MODULE 1: BASICS OF ANALOG COMMUNICATIONS																
Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation-Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation-AM Signals and Spectra, DSB Signals and Spectra, Suppressed Side Band Amplitude Modulation - Illustrative Problems.  AM Modulator and De Modulator													CO-1  BTL-2			
MODULE 2: ANALOG MODULATION TECHNIQUES																
Pulse amplitude modulation – Flat top sampling and Pulse amplitude modulation (PAM), PulseTime Modulation – Pulse Duration and Pulse Position modulations, PPM spectral analysis, Illustrative Problems  Sampling and Reconstruction													CO-2  BTL-3			
MODULE 3: DIGITAL MODULATION TECHNIQUES																
Pulse Code Modulation (PCM) - Generation and Reconstruction, Quantization Noise, NonUniform Quantization and Companding, PCM with Noise, Delta modulation, Adaptive Delta Modulation, Differential PCM systems (DPCM), Digital Multiplexing-Multiplexers and Hierarchies  Delta Modulation and Demodulation Observation (simulation)													CO-3  BTL-3			

<b>MODULE 4: – BAND PASS DIGITAL TRANSMISSION</b>	
Quadrature Carrier and M-ary Systems- Quadrature Carrier Systems, M-ary PSK Systems, M-ary QAM Systems, M-ary FSK Systems, BPSK and FSK, Timing and Synchronization, Interference, NonCoherent Binary Systems, Non-Coherent FSK, Differentially Coherent PSK, Optimum Binary Detection, Coherent ASK (OOK (on-off keying)).  FSK, PSK and DPSK schemes (Simulation)	<b>CO-4</b>  <b>BTL-3</b>
<b>MODULE 5: CHANNEL CODING</b>	
Error Detection & Correction - Repetition & Parity Check Codes, Interleaving, Code Vectors and Hamming Distance, Forward Error Correction (FEC) Systems, Automatic Retransmission Query (ARQ) Systems, Linear Block Codes – Matrix Representation of Block Codes, Convolutional Codes – Convolutional Encoding, Decoding Methods  Line coding	<b>CO-5</b>  <b>BTL-3</b>
<b>TEXT BOOKS</b>	
1	Simon Haykin, —Communication Systems  , Wiley-India edition, 3rd edition, 2010
<b>REFERENCE BOOKS</b>	
1	Sam Shanmugam, "Digital and Analog Communication Systems" ,John Wiley, 2005
2	A. Bruce Carlson, & Paul B. Crilly, —Communication Systems – An Introduction to Signals & Noise in Electrical Communication  , McGraw-Hill International Edition, 5th Edition, 2010
<b>E BOOKS</b>	
1	<a href="http://www.eem.anadolu.edu.tr/tansufilik/EEM%20409/icerik/Communication%20Systems%20-%204ed%20-%20Haykin.pdf">http://www.eem.anadolu.edu.tr/tansufilik/EEM%20409/icerik/Communication%20Systems%20-%204ed%20-%20Haykin.pdf</a>
<b>MOOC</b>	
1	<a href="https://nptel.ac.in/courses/108/104/108104091/">https://nptel.ac.in/courses/108/104/108104091/</a>

COURSE TITLE	Control systems			CREDITS	4
COURSE CODE	EEC51010	COURSE CATEGORY	PC	L-T-P-S	2 -1- 0 - 2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY  PRACTICAL

15%	15%	10%	5%	5%	25%	25%									
Course Description	This course gives a strong theoretical foundation for understanding open loop and closed loop control system analysis and is suitable for general engineering students. It covers standard analytical tools such as Bode plot, Polar plot, root-loci and Nyquist plots. Later part of the course focus on the design of compensators using analysis tools.														
Course Objective	1. Analyze representation of systems and to derive transfer function models, 2. Provide adequate knowledge in the time response of systems and steady state error analysis 3. Give basic knowledge to analyze the stability of the system using frequency response plots 4. Provide the concept of stability of control system and methods of stability analysis 5. Acquire knowledge to design Lead, Lag Compensators to achieve desired Performance														
Course Outcome	1. Analyze electromechanical systems with mathematical modeling concepts 2. Determine Transient and Steady State behavior of systems using standard test signals 3. Analyze the stability of the system using frequency response plots 4. Analyze the stability of the system by applying various stability criteria 5 Design Lead, Lag Compensators to achieve desired Performance														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	1	3	1	1	-	-	-	1	2	3	2	-
CO-2	3	3	3	1	3	-	-	-	-	-	1	2	3	2	-
CO-3	3	3	3	1	3	-	-	-	-	-	1	2	3	2	-
CO-4	3	3	3	1	3	-	-	-	-	-	1	2	3	2	-
CO-5	3	3	3	3	3	1	1	-	-	-	1	2	3	2	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
Module 1:- SYSTEM REPRESENTATION (9L+ 6P)															
Basic elements in control systems -Open and closed loop control system Feedback control systems- Transfer function of a system and basis of Laplace transforms - Need for mathematical modeling-Representation of mechanical translational systems using differential equation and determination of transfer function-Representation of mechanical rotational systems and determination of transfer function-Conversions of Mechanical system to Electrical system-Block diagram reduction rules and methodology-Evaluation of transfer function using block diagram reduction-Signal flow graphs and evaluation of transfer function- Mason’s gain formula- Block diagram to signal flow conversion Suggested Readings:												CO-1 BTL-3			

Differential Equations, Laplace Transforms, <b>Lab Experiments</b> 1.To simulate basic open and closed loop system. $\omega$ 2. To plot torque-speed characteristics of A.C servo motor. <b>Software/Equipment Used</b> MATLAB	
<b>MODULE 2: TIME RESPONSE (9L+ 6P)</b>	
Time response – Time domain specifications and their significance – Numerical solution-Standard test signals and their expression— First and second order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control. <b>Suggested Readings:</b> Error analysis, Time series, Binomial Series, Controller Design, Continuous time systems analysis. <b>Lab Experiments</b> To Generate and plot characteristics of Test Inputs (Pulse, Step, Ramp, Parabola). 2.To plot the Time domain response and analyze the parameters of the System (First & Second order Systems) <b>Software/Equipment Used</b> MATLAB	<b>CO-2</b> <b>BTL-3</b>
<b>MODULE 3: FREQUENCY RESPONSE (9L+ 6P)</b>	
Frequency response – Bode plot – Polar plot – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications <b>Suggested Readings:</b> Frequency Domain characteristics and Analysis. <b>Lab Experiments</b> 1.To plot the Frequency domain response and parameters of with Bode plot (First & Second order Systems). 2.To study the system characteristics using Polar plot <b>Software/Equipment Used</b> MATLAB	<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: STABILITY OF CONTROL SYSTEM (9L+ 6P)</b>	
Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criteria <b>Suggested Readings:</b> Stability analysis of Systems. <b>Lab Experiments</b> 1.To plot the poles and zeros in complex S plane. 2. To find the stability of the system using Routh Hurwitz criterion. 3.To find the stability of the system using Root locus method. 4.To analyze the effect of pole & zero addition in system. 5.To analyze the system and design a Compensator for a given Mathematical Model <b>Software/Equipment Used</b> MATLAB	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: (9L+ 6P)</b>	
Performance criteria – Lag, lead networks –The general state – Space representation – Applying the state-space representation – Converting a transfer function to state space – Converting from state-space to a transfer function. <b>Suggested Readings:</b> Compensator Design	<b>CO-5</b> <b>BTL-3</b>

<b>Lab Experiments</b> 1. LAG-LEAD COMPENSATORS 2. STATE SPACE MODEL OF TRANSFER FUNCTION USING MATLAB <b>Software/Equipment Used</b> MATLAB		
<b>BOOKS</b>		
1.	Ogata.K, “Modern Control System Engineering “Fifth Edition –Pearsons, 2010.	
2.	I.J. Nagrath & M. Gopal,” Control Systems Engineering, “New Age International Publishers, Sixth Edition 2017	
3	B.C. Kuo,”Automatic Control Systems” Tenth Edition, 2017, McGraw-Hill Education.	
<b>REFERENCE BOOKS</b>		
1	M. Gopal, “Control Systems, Principles & Design”, Fourth edition, Tata McGraw Hill, New Delhi, 2012.	
2	M.N. Bandyopadhyay, “Control Engineering Theory and Practice” , Prentice Hall of India, 2009	
<b>E BOOKS</b>		
1.	<a href="http://engineeronadisk.com/book_modeling/">http://engineeronadisk.com/book_modeling/</a>	
2.	Text book companion <a href="http://www.scilab.in/Completed_Books#2">http://www.scilab.in/Completed_Books#2</a>	
<b>MOOC</b>		
1.	Control Engineering(web), <a href="http://nptel.ac.in/courses/108102044/">http://nptel.ac.in/courses/108102044/</a>	
2.	Control Engineering(video), <a href="http://nptel.ac.in/courses/108102043/">http://nptel.ac.in/courses/108102043/</a>	

COURSE TITLE	DESIGN PROJECT-3			CREDITS	1
COURSE CODE	EEC51803	COURSE CATEGORY	EEC	L-T-P-S	0-0-2-6
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Review	Second Review	Third Review	Project Report & Viva Voce		
20%	20%	10%	50%		
Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the real time problem statement and gives a strong Engineering and Practical foundation for understanding the different types of social problems and its solution based on engineering knowledge. This course is suitable for general engineering students to understand the importance of engineering concepts and its relevant applications. Different Simulation tools to be used in the execution of the design methodology. The resources and team management skills are utilized to develop an innovative, economic solution to the selected problem.				

<b>Course Objective</b>	The course will enable the students to: <ul style="list-style-type: none"><li>• Explore the literature study and report preparation skills</li><li>• Demonstrate project identification and execution of feasible solution to address the problem statement</li><li>• Elucidate the communication and team management skills</li></ul>														
<b>Course Outcome</b>	Upon completion of this course, the students will be able to <ol style="list-style-type: none"><li>1. Identify a real-time problem by intensive literature survey</li><li>2. Selection of appropriate methodology by using modern tools</li><li>3. Design &amp; analyse the solution through appropriate Measurements and calculations</li></ol>														
<b>Prerequisites: Design Project -2</b>															
<b>CO, PO AND PSO MAPPING</b>															
	<b>PO - 1</b>	<b>PO - 2</b>	<b>PO - 3</b>	<b>PO - 4</b>	<b>PO - 5</b>	<b>PO - 6</b>	<b>PO - 7</b>	<b>PO - 8</b>	<b>PO - 9</b>	<b>PO - 10</b>	<b>PO - 11</b>	<b>PO - 12</b>	<b>PSO - 1</b>	<b>PSO - 2</b>	<b>PSO - 3</b>
<b>CO- 1</b>	3	3	2	2	3	2	2	3	3	3	3	1	3	3	3
<b>CO- 2</b>	3	3	3	2	3	2	2	3	3	3	3	1	3	3	3
<b>CO- 3</b>	3	3	3	2	3	2	2	3	3	3	3	1	3	3	3

**Weightage of Assessment:**

<b>Review / Examination Scheme</b>	<b>Weightage</b>
First Review	20%
Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee shall be constituted by the HoD for the Review.

**Assessment Rubrics**

<b>Parameter</b>	<b>Weightage (%)</b>
Title & Objectives	5.0
Review of Literature (RL)	10.0

Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

\* - Attributes for individual contribution.

#### EVALUATION PARAMETERS FOR ASSESSMENT

To be followed same as approved for Design project 1

COURSE TITLE	ENTREPRENEURSHIP			CREDITS	2
COURSE CODE	EGE51004	COURSE CATEGORY	ES	L-T-P-S	2-0-0-6
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance *	
15%	15%	10%	5%	5%	
Course Description	The students shall develop a detailed insight about various aspects of Entrepreneurship. Knowledge and Skill levels of Entrepreneur will be discussed in the Module I, whereas stakeholders policies were briefed in the Module II. Detailed procedure of preparing a business plan will be taught in the Module III, mobilization of various resources will be discussed in the Module IV. Finally, Module V will provide insights about monitoring and evaluation of business.				



[illegible]

1.	Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2.	S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001
<b>REFERENCE BOOKS</b>	
1	Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition ,2005
2	Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3	P. Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai -1997.
4	Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning.2012
<b>E Resources for Reference</b>	
1.	<a href="https://epgp.inflibnet.ac.in/ahl.php?csrno=23">https://epgp.inflibnet.ac.in/ahl.php?csrno=23</a> (Management P-01, M-02)
2.	<a href="https://epgp.inflibnet.ac.in/ahl.php?csrno=23">https://epgp.inflibnet.ac.in/ahl.php?csrno=23</a> (Management P-01, M-13)
3.	<a href="https://epgp.inflibnet.ac.in/ahl.php?csrno=23">https://epgp.inflibnet.ac.in/ahl.php?csrno=23</a> (Management P-01, M-14)
4	<a href="https://epgp.inflibnet.ac.in/ahl.php?csrno=23">https://epgp.inflibnet.ac.in/ahl.php?csrno=23</a> (Management P-01, M-21)
5	<a href="https://epgp.inflibnet.ac.in/ahl.php?csrno=23">https://epgp.inflibnet.ac.in/ahl.php?csrno=23</a> (Management P-01, M-30)
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_mg70/preview">https://onlinecourses.nptel.ac.in/noc21_mg70/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc22_ge03/preview">https://onlinecourses.nptel.ac.in/noc22_ge03/preview</a>

COURSE TITLE	INTERNSHIP – 2 ( (to be evaluated in 5 <sup>th</sup> semester. To be carried out in summer after 4 <sup>th</sup> semester)			CREDITS	1
COURSE CODE	EEC51804	COURSE CATEGORY	EEC	L-T-P-S	0-0-0-0
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
Visit Report, Feedback of the employer , Presentation & Viva Voce, MCQ Assessment					
100%					
Course Description	This course aims to inculcate the application of knowledge & skill learned through classroom practices. It demands the academic component consisting of research, reflection, written and oral skills of the learner.				
Course Objective	The course will enable the students to <ol style="list-style-type: none"><li>1. Explore career alternatives prior to graduation.</li><li>2. Integrate theory and practice.</li><li>3. Assess interests and abilities in their field of study.</li><li>4. Build a record of work experience.</li></ol>				
Course Outcome	Upon completion of this course, the students will be able to <ol style="list-style-type: none"><li>1. Choose appropriate modern tools used in the field of Electronics and Communication engineering to manage the resources effectively by applying innovative ideas</li><li>2. Demonstrate ethical conduct and professional accountability while working in a team for the benefit of society.</li><li>3. Communicate effectively and to write the scientific report of the learnings</li></ol>				
Prerequisites: Basic knowledge in Measurements, Data Analysis, Interpretation.					
CO, PO AND PSO MAPPING					

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	-	-	3	2	-	-	-	-	2	-	-	3	-
CO-2	-	-	-	-	3	-	-	3	2	2	-	-	2	-	2
CO-3	-	-	-	-	-	-	-		3	3	3	2	--	-	-

#### Weightage of Assessment:

Assessment Scheme	Weightage
Presentation & Viva voce	50 %
Report	20 %
Feedback of the Employer	30%

A committee will be constituted by the HoD with Internship coordinator as head for learning assessment process

#### Assessment Rubrics

Performance Indicators	Excellent(5)	Good(4)	Fair(3)	Poor(2)
<b>Requirement analysis and clarity on problem statement(5)</b>	Requirement well understood and problem statement well defined	Requirement well understood but problem statement not well defined	Understood the requirement and not defined properly	Not properly understood the requirements and problem statement not defined properly
<b>Relevance with Industry /Societal problem(5)</b>	Relevant	Relevant to industry with small modifications	Partially relevant	Irrelevant
<b>Project timeline scheduled(5)</b>	Scheduled and followed strictly	Scheduled and but not followed strictly	Scheduled but not followed	Not Scheduled and not followed
<b>Usage of latest and application software(5)</b>	latest applications and software's are used	Moderate usage of new technology	Slightly outdated	No latest applications and software's used
<b>Design and code efficiency(5)</b>	Excellent design of experiment and all possible outcomes are handled	Effective design but all possible outcomes are not handled	Satisfactory Design	Irrelevant design

<b>Report Preparation(10)</b>	Excellent documentation	Good documentation	Average documentation	Poor documentation
<b>Presentation skills ,Fluency and comprehensibility(5)</b>	Excellent communication skills and good comprehensibility	Good confidence , lack of communication skills and average comprehensibility	Less confidence, vocabulary need to be improved and poor comprehensibility	Poor skills
<b>Slide organization and contents time conscious(5)</b>	Content is organized properly and effective time management	Content is organized properly but not effective time management	Content is not organized properly	Poor organization and least time management
<b>Feedback from Industry mentor(5)</b>	Regular /novel idea/Excellent execution of project	Regular /Novel idea/Good execution of project	Regular /existing idea/Good execution of project	Irregular /existing idea/Poor execution of project

#### SEMESTER – VI

COURSE	PROFESSIONAL SKILL AND ETHICS				CREDITS	Non Credit
COURSE CODE	ETP51854	COURSE CATEGORY	MC	L - T – P – S	0-0-3-2	
Version	1.0	Approval Details	41ACM Dt. 13 Jul 24	LEARNING LEVEL	BTL – 3	
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	Theory	Practical
15%	15%	10%	5%	5%	25%	25%

<b>Course Description</b>	The Grooming and Mock Interview Training course is a focused 10-hour program designed to prepare the students for successful campus placements and professional careers. This course covers essential aspects of personal grooming, professional etiquette, effective communication, resume building, and interview preparation. Through practical exercises, interactive sessions, and real-world scenarios, students will gain the skills and confidence needed to excel in job interviews and professional environments.														
<b>Course Objective</b>	<ol style="list-style-type: none"><li>1. To enhance personal grooming and professional etiquette.</li><li>2. To improve verbal and non-verbal communication skills.</li><li>3. To create customised resumes and cover letters as per job role.</li><li>4. To prepare students for various types of interviews.</li><li>5. To provide practical experience through mock interviews and group discussions.</li></ol>														
<b>Course Outcome</b>	Upon completion of this course, the students will be able to <ol style="list-style-type: none"><li>6. Exhibit appropriate personal grooming and professional attire suitable for various business environments.</li><li>7. Communicate effectively and confidently in verbal and non-verbal interactions, ensuring clarity, articulation, and appropriate tone.</li><li>8. Formulate well-structured, targeted resumes and cover letter that highlight relevant skills, achievements, and experiences.</li><li>9. Prepare for different types of interviews (HR and Technical), knowing what each assesses.</li><li>10. Engage confidently in mock interviews, receiving and incorporating feedback to improve performance.</li></ol>														
<b>Prerequisites:</b> Plus Two English-Intermediate Level															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO/PO</b>	<b>PO<sub>1</sub></b>	<b>PO<sub>2</sub></b>	<b>PO<sub>3</sub></b>	<b>PO<sub>4</sub></b>	<b>PO<sub>5</sub></b>	<b>PO<sub>6</sub></b>	<b>PO<sub>7</sub></b>	<b>PO<sub>8</sub></b>	<b>PO<sub>9</sub></b>	<b>PO<sub>10</sub></b>	<b>PO<sub>11</sub></b>	<b>PO<sub>12</sub></b>	<b>PSO<sub>1</sub></b>	<b>PSO<sub>2</sub></b>	
<b>CO1</b>	-	-	-	-	-	-	-	2	1	2	-	3	1	1	
<b>CO2</b>	-	-	-	-	-	-	-	2	2	2	-	3	0	1	
<b>CO3</b>	-	-	-	-	-	-	-	2	2	2	-	3	1	1	
<b>CO4</b>	-	-	-	-	-	-	-	-	1	2	2	3	1	1	
<b>CO5</b>	-	-	-	-	-	-	-	-	2	2	2	3	1	1	
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>Module 1 : BUSINESS ETHICS AND ETIQUETTE</b>															<b>(9P)</b>
Importance of personal grooming-Dressing for success: Business formal and business casual attire- Personal hygiene and grooming tips- Makeup and accessories for a professional look- Introduction to professional behavior-Business etiquettes: Do's and don'ts-Practice for professional dressing, Dining Etiquettes															<b>CO-1 BTL-2</b>
<b>Module 2 : TAILORING AND CUSTOMIZING RESUME TO MEET JOB ROLE INCLUDING COVER LETTER (9P)</b>															
Key components of a professional resume- Tailoring your resume for different job profiles- Use of Action verbs in Resume-Resume do's and don'ts- Reviewing and refining student resumes as per job description- Customizing cover letters for specific roles, Preparation of Checklist and Portfolio, Researching for the company and gaining details of the job description															<b>CO-2 BTL-3</b>
<b>Module 3: VERBAL AND NON-VERBAL PRESENTATION IN THE INTERVIEW</b>															<b>(9P)</b>
Effective speaking skills-Articulation and clarity-Tone and pitch control- Introducing oneself in a professional setting- Making first impression- Non-Verbal Communication: Importance of body															<b>CO-3 BTL-3</b>

language-Eye contact, facial expressions, and gestures- Posture and handshake- Magics of smile in interview-Role-playing exercises to enhance non-verbal cues- Time management in interviews		
<b>Module 4: INTERVIEW PREPARATION TECHNIQUES</b>		<b>(9P)</b>
Overview of different types of interviews: HR and Technical-Understanding what each type of interview assesses- Discussing frequently asked interview questions- STAR method for answering behavioural questions (Situation, Task, Action, Result)- Practice for answering common questions in pairs, Removing Fear, nervousness and anxiety using relaxation method and breathing techniques		<b>CO-4 BTL-3</b>
<b>Module 5 : MOCK INTERVIEWS AS PER JOB ROLE AND FEEDBACK</b>		<b>(9P)</b>
Simulated one-on-one interviews as per job description with feedback-Role-playing in different interview scenarios (HR, Technical)- Time management in responses-Feedback to Each Student regarding merits and scopes for improvement, Advanced strategies for handling difficult interview questions, Negotiation skills and salary discussions, Interaction with Alumni Ambassadors-Full length Panel Interview Follow-Up Emails and Letters- Maintaining Professional Connections and networking		<b>CO-5 BTL-3</b>
<b>TEXT BOOK</b>		
1	Collins, Allan (2016). HR Interview Secrets: How to Ace Your Next Human Resources Interview, Dazzle Your Interviewers & LAND THE JOB YOU WANT! USA: Success in hr.	

COU RSE TITLE	ANTENNA AND WAVE PROPAGATION			CREDITS	4
COURSE CODE	EEC51011	COURSE CATEGORY	PC	L-T-P-S	2-1-2-2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-6
<b>ASSESSMENT SCHEME</b>					
CIA					ESE
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance *	THEORY  PRACTICAL
15%	15%	10%	5%	5%	25% 25%
Course Description	This course covers in depth knowledge of Basic antenna principles, concepts of antenna wave propagation, antenna theory, design, and measurements.				
Course Objective	<ul style="list-style-type: none"> <li>To explain the antenna fundamentals and the radiation fields of antennas</li> <li>To discuss the array of point sources and uniform linear arrays and know about the loop antennas</li> <li>To summarize the radiation mechanism of travelling wave and wideband antennas</li> <li>To analyse the radiation of rectangular aperture, slot, parabolic reflector and lens antennas</li> <li>To learn the basic propagation and its types.</li> </ul>				

Course Outcome	Upon completion of this course, the students will be able to														
	<div>1. Interpret the radiation mechanism of various antennas and measurement of antenna parameters</div> <div>2. Develop the performance characteristics of antennas arrays, its operating principles, methods, and concepts to design</div> <div>3. Design and analyze wide band antennas</div> <div>4. Design and analyze aperture antennas and smart antennas</div> <div>5. Illustrate the behaviour of nature on EM wave propagation and identify the type of radio-wave propagation for different communication</div>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	2	2	1	1	-	-	2	1	3	3	-	1
CO-2	3	3	3	1	2	2	1	-	-	1	1	2	3	-	-
CO-3	3	2	3	1	2	1	1	-	-	1	1	1	3	-	2
CO-4	3	2	2	1	2	1	1	-	-	1	1	1	3	1	1
CO-5	3	3	3	1	2	2	1	-	-	1	1	2	3	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1 – ANTENNA FUNDAMENTALS AND RADIATION FIELDS OF WIRE ANTENNAS (9L+3T=12)															
<div>Radiation intensity. Directive gain. Directivity. Power gain. Beam Width. Band Width. Gain and radiation resistance of current element. Half-wave dipole and folded dipole. Reciprocity principle. Effective length and Effective area. Relation between gain effective length and radiation resistance. Concept of vector potential. Modification for time varying, retarded case.</div> <div>Fields associated with Hertzian dipole. Power radiated and radiation resistance of current element. Radiation resistance of elementary dipole with linear current distribution. Radiation from half-wave dipole and quarter-wave monopole.</div> <div>Lab Experiments :</div> <div>Practice: Design of Half wave Dipole Antenna</div> <div>Practice: Design of Monopole Antenna</div>													CO-1 BTL-2		
MODULE 2: ANTENNA ARRAYS AND LOOP ANTENNAS (9L+3T=12)															
<div>Antenna Arrays: Expression for electric field from two and three element arrays. Uniform linear array. Method of pattern multiplication. Binomial array. Use of method of images for antennas above ground.</div> <div>Loop Antennas: Radiation from small loop and its radiation resistance. Helical antenna. Normal mode and axial mode operation.</div> <div>Lab Experiments :</div> <div>Practice: Design of Arrays</div> <div>Practice: Design of Small loop Antenna</div>													CO-2 BTL-3		
MODULE 3: BROADBAND ANTENNAS (9L+3T=12)															
<div>Radiation mechanisms of travelling wave on a wire. Analysis and design of Rhombic antenna. Coupled Antennas-Self and mutual impedance of antennas. Yagi antennas. Log periodic antenna.</div> <div>Lab Experiments :</div>													CO-3 BTL-4		

Practice: Design of Rhombic Antenna		
Practice: Design of Log Periodic Dipole Antenna		
<b>MODULE 4: APERTURE ANTENNAS</b>		<b>(9L+3T=12)</b>
<p>Huygens’ principle, radiation from rectangular and circular apertures, design considerations, Babinet’s principle, Radiation from sectoral and pyramidal horns, design concepts of Microstrip antennas</p> <p><b>Basic Concepts of Smart Antennas:</b></p> <p>Concept and benefits of smart antennas, Fixed weight beamforming basics, Adaptive beamforming</p> <p>Lab Experiments :</p> <p>Practice: Design of Horn Antennas</p> <p>Practice: Design of Microstrip Antenna Simulation</p> <p>Practice: Design of Microstrip Antenna Array Simulation</p>		<b>CO-4 BTL-4</b>
<b>MODULE 5: WAVE PROPAGATION</b>		<b>(9L+3T=12)</b>
<p>The three basic types of propagation; ground wave, space wave and sky wave propagation.</p> <p><b>Sky wave propagation:</b> Structure of the ionosphere. Effective dielectric constant of ionized region. Mechanism of refraction. Refractive index. Critical frequency. Skip distance. Effect of earth’s magnetic field. Energy loss in the ionosphere due to collisions. Maximum usable frequency. Fading and Diversity reception.</p> <p><b>Space wave propagation:</b> Reflection from ground for vertically and horizontally polarized waves. Reflection characteristics of earth. Resultant of direct and reflected ray at the receiver. Duct propagation.</p> <p><b>Ground wave propagation:</b> Attenuation characteristics for ground wave propagation. Calculation of field strength at a distance</p>		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1	Constantine Balanis.A, “Antenna Theory: Analysis and Design”, Third Edition, John Wiley and Sons, 2012.	
2	E.C.Jordan and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, 2nd Edition 2015	
<b>REFERENCE BOOKS</b>		
1	John D kraus , Ronald J Marhefka, Ahmed S Khan “Antenna and wave propagation” 4 th Edition 2010	
2	Raju.G.S.N, “Antennas and wave propagation”, 1st Edition Pearson Education, 2012.	
3	Ballany , "Antenna Theory and Applications " , John Wiley & Sons, 4th edition , 2021	
4	Prasad, K.D./ Antennas and Wave Propagation/ Khanna Publications, 2021.	
<b>E BOOKS</b>		
1.	<a href="https://in.pinterest.com/pin/677862181420757766/">https://in.pinterest.com/pin/677862181420757766/</a>	
2.	<a href="https://ia600102.us.archive.org/15/items/CollinAntennasRadiowavePropagation1985/CollinAntennasRadiowavePropagation1985.pdf">https://ia600102.us.archive.org/15/items/CollinAntennasRadiowavePropagation1985/CollinAntennasRadiowavePropagation1985.pdf</a>	
<b>MOOC</b>		
1.	Antenna and wave propagation(web), <a href="http://nptel.ac.in/downloads/117101057/">http://nptel.ac.in/downloads/117101057/</a>	
2.	<a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-661-receivers-antennas-and-signals-spring-2003/lecture-notes/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-661-receivers-antennas-and-signals-spring-2003/lecture-notes/</a>	
3.	<a href="http://www.creativeworld9.com/2011/02/learn-antennas-and-wave-propagation.html">http://www.creativeworld9.com/2011/02/learn-antennas-and-wave-propagation.html</a>	

COURSE TITLE	AUOMATED TEST ENGINEERING FOR ELECTRONICS			CREDITS	3
COURSE CODE	EECS1012	COURSE CATEGORY	PC	L-T-P-S	2- 0- 2- 2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					



CIA													ESE		
First Periodical Assessment (Theory)			Second Periodical Assessment (Theory)			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”			Attendance *		THEORY	PRACTICAL
15%			15%			10%			5%			5%		25%	25%
Course Description			This course has been designed to make students' industry ready. It attempts to develop their proficiency in the field of testing the equipment’s. The course instructs students on the accurate and appropriate testing of PCBs, as well as the effective troubleshooting and rectification of faulty boards.												
Course Objective			<ul style="list-style-type: none"><li>To introduce the students to the field of testing the equipment’s</li><li>Understand the basics of printed circuit boards and its tests.</li><li>To equip the students on how to find faulty equipment’s and troubleshoot in a system</li></ul>												
Course Outcome			<p>Upon completion of this course, the students will be able to</p> <ul style="list-style-type: none"><li>Proficiently identify various components and easily detect faulty ones within a PCB.</li><li>Analyze available faulty boards to determine the appropriate tests for accurate diagnosis.</li><li>Develop skills to effectively organize and troubleshoot PCB boards, ensuring optimal functionality.</li></ul>												
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	1	2	1	0	0	1	0	0	1	1	1	1
CO-2	3	3	2	1	2	1	0	0	1	0	0	1	1	1	1
CO-3	3	3	2	1	2	1	0	0	1	0	0	1	1	1	1
CO-4	3	3	2	1	2	1	0	0	1	0	0	1	1	1	1
CO-5	3	3	2	1	2	1	0	0	1	0	0	1	1	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: SEMICONDUCTOR COMPONENTS AND TEST													(9L+ 6P)		
Discrete Component test overview, passive component tests, resistor test, capacitor test, Diode test, LED testing Active component test, DC continuity test, Gross functional test, IDD Gross current test, Mixed Signal test, Measuring DNL and INL, Jitter Measurement Techniques, Test Handler, Manipulators, Test Time and its Impact.													CO-1 BTL-3		

<p><b>Suggested Readings:</b> Components in electronics and various test Measurement</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>3. Check the given components for its serviceability using suitable Lab Equipment with Report - R-47KOhm (One Axial Resistor), C-10uF (Electrolytic Cap), Zener Diode (5V or 9V Zener)</li> <li>4. Given PS the DC output is 5V and measure its Jitter at peak voltage using Scope measuring Equipment</li> </ol> <p><b>Software/Equipment Used</b> Test Equipment, Scope, DMM</p>	
<b>MODULE 2: PCB PRODUCTION (9L+ 6P)</b>	
<p>How is a Printed circuit board made? PCB Manufacturing process, Bare PCB, Bare board Test, Visual Inspection, manual inspection, automated Optical Inspection, Defective PCB patterns, PCB defects, Electrical tests, Cross Talk test, Populated Board test, Reliability test, burn in test, diagnosis, Combinational Fault diagnosis methods.</p> <p><b>Suggested Readings:</b> PCB manufacturing and Electrical tests</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>3. Given Bare PCB having a track short. Find out the track short using suitable equipment. Chart the values of impedance values from the Ref point and make a relevant graph to illustrate</li> <li>4. Given board is having a PS short in the supply line. Detect the location using a short Locator.</li> <li>5. Cross Talk Test Explain. Find out the erroneous voltage in the cross-talk line in the given PCB using suitable equipment and record the values.</li> </ol> <p><b>Software/Equipment Used</b> Bare Board sample (with Short), Short Locator, Measuring Equipment, DMM, Scope</p>	<p><b>CO-2 BTL-3</b></p>
<b>MODULE 3: PCB TROUBLE SHOOTING (9L+ 6P)</b>	
<p>Symptom recognition, symptom elaboration Listing of probable faulty functions, Localizing the faulty function, bracketing technique, Localizing the trouble in a circuit, Component failure analysis, types of circuit trouble, failures and faults, breaks in circuit connections, testing devices using test jigs.</p> <p><b>Suggested Readings:</b> Localizing the faulty function</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Localize the fault in a given circuit. Calculate the Error, Defect and Fault.State the correct output of this circuit in the given input conditions.With suitable Equipment, demonstrate the output for the given NAND Gate IC.</li> <li>2. Given a Bare Board, find out the following defects made.  Breakout, PinHole, Open Circuit, Under Etch, Missing Bite, Missing Conductor, Spur, Short, Wrong Hole size, Conductor Too Close, Spurious Copper and Excessive Short. (Any Four Can be grouped and asked to identify and locate in the board. (Sample Bare Board with These defects can be issued to the student)</li> <li>3. Given a Board, inspect and find out the possible Manufacturing Defects like, Soldering Issue (1) , Poor Quality Components (2), Damaged components(2) . Describe the nature of fault identified.</li> </ol> <p><b>Software/Equipment Used</b></p>	<p><b>CO-3 BTL-3</b></p>

Sample Board with NAND Circuit to test, Test Equipment, Bare Board with Defects as listed above, Board with Damaged (2)- Poor Quality Components( 2) and Soldering Bridge or Excess (1) can be issued to the students.	
<b>MODULE 4 ATE SYSTEM TEST PROGRAM GENERATION (9L+ 6P)</b>	
<p>ATE System systems for board test, ATE system, ATE system components, Test languages, test Vector generation, text method creation, Fault simulation, creating attest program, Functional test timing, test program tester diagnostics, verifying the test setup.</p> <p><b>Suggested Readings:</b></p> <p><b>ATE systems and Test diagnostics</b></p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Test the given IC 7432 using a suitable Test Equipment. Show the report for Pass/Fail conditions. Enumerate the pass/fail conditions while carried the testing.</li> <li>2. Test The given EXOR gate IC using suitable Test Equipment. State the output from IC is correct or not. Simulate the condition for input shorted and describe the output in the Test Equipment. Set up the circuit and demonstrate.</li> <li>3. Explain the given Integrated Chip (7447) architecture and write the Boolean expression for its output. Test the IC with the given Automated Test Equipment (ATE) and illustrate the possible specifications testing using various parameters. Also demonstrate how to Lamp test provision provided in the IC to use it in a circuit having a 7-segment display.</li> </ol> <p><b>Software/Equipment Used</b> IC 7432, IC 7447, IC 7486, Test Equipment, Scope, DMM</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<b>MODULE 5: – DESIGN FOR TESTABILITY (9L+ 6P)</b>	
<p>Design for testability, PCB in the past, Test methodologies, Mock up test, In circuit test, in circuit test of populated PCBs, When to use thermal test, testing flow, the stuck at fault model, logic simulation, fault simulations, sequential ATPG, built in self-test, types of test patterns, Emulation techniques, Boundary scan test</p> <p><b>Suggested Readings:</b> PCB testing and emulations used</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>3. What is a Unity Gain amplifier circuit? Explain with a simple circuit diagram. Test the given Op Amp to check whether it is working for the application as an i) Inverting Amplifier ii) Non-Inverting Amplifier iii) Voltage follower</li> <li>4. Explain various types of programmable ICs . What is the difference between OTP and EEPROM ICs in its functionality. Test 2764 Programmable IC using an TESTER. Check whether the IC is blank or having data in it. If the data is found save the data file.</li> </ol> <p><b>Software/Equipment Used</b> IC LM124, IC 2764 (Sample Programmed), Test Equipment, DMM, Scope, Data sheets of IC can be seen from the equipment and referred for connectivity's.</p>	<p><b>CO-5</b> <b>BTL-3</b></p>
<b>TEXT BOOKS</b>	
1.	S.R Sabapathi, "Test Engineering for Electronics Hardware", Qmax test Technologies Pvt Ltd, First edition, 2017.
2.	Floyd," The fundamentals of Digital semiconductor Testing, Pearson Education , India, Sep-2005
<b>REFERENCE BOOKS</b>	

1	Practical Electronic Fault Finding and Troubleshooting by Robin Pain Newnes, Reed Educational and professional publishing Ltd., 1996
2	Building a successful Board Test strategy, Stephen F. Scheiber, 2011
<b>E BOOKS</b>	
1.	<a href="https://bookboon.com/en/introduction-to-electronic-engineering-ebook">https://bookboon.com/en/introduction-to-electronic-engineering-ebook</a>
2.	<a href="https://bookboon.com/en/advanced-topics-in-electrodynamics-ebook">https://bookboon.com/en/advanced-topics-in-electrodynamics-ebook</a>
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_ee55/preview">https://onlinecourses.nptel.ac.in/noc21_ee55/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc22_ee25/preview">https://onlinecourses.nptel.ac.in/noc22_ee25/preview</a>

COURSE TITLE		COMPUTER NETWORKS				CREDITS		3						
COURSE CODE		EEC51013		COURSE CATEGORY		PC		L-T-P-S		2-0-2-2				
Version		1.0		Approval Details		36 <sup>TH</sup> ACM		LEARNING LEVEL		BTL-3				
ASSESSMENT SCHEME														
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz		Attendance		ESE				
15%		15%		10%		5%		5%		50%				
Course Description		This module introduces computer networks, with a special focus on the Internet architecture and protocols. Data communication and Networks have changed the way business and other daily affair works. Through this module Graduates are focused on Performances of computer Networks: Transit time, Response time, Number of users, Reliability, Security.												
Course Objective		<div>1. To Describe how computer networks are organized with the concept of layered approach</div> <div>2. To obtain a theoretical understanding of data communication and computer networks</div> <div>3. To implement a simple LAN with hubs, bridges and switches.</div>												
Course Outcome		<div>Upon completion of this course, the students will be able to</div> <div>1. Categorize different computer networking concepts based on their performance.</div> <div>2. Identify the appropriate switching /routing technology for the given Source and destination pair.</div> <div>3. Classify the characteristics of connection-oriented and connectionless communication protocols</div> <div>4. Identify the proper IP addressing scheme for effective data forwarding mechanism of the given scenario</div> <div>5. Validate the error-free received information using the appropriate security protocols</div>												
Prerequisites: Knowledge in basics of computers and computer programming.														
CO, PO AND PSO MAPPING														
CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2

CO-1	3	-	-	-	2	1	-	-	-	-	-	-	3	1
CO-2	3	-	3	-	2	1	-	-	-	-	-	2	3	1
CO-3	3	-	3	2	1	1	-	-	-	-	-	-	3	1
CO-4	2	-	2	3	1	1	-	-	-	-	-	2	3	1
CO-5	3	-	2	2	1	1	1	-	-	-	-	2	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1 :INTRODUCTION TO COMPUTER NETWORKS (9L)														
Introduction to computer networks, protocols and standards, line configuration, topology, categories of networks, transmission media, OSI model and function of layers, TCP/IP protocol, line coding, Modems, RS 232 interface													CO-1 BTL-2	
MODULE 2 : DATA LINK LAYER (9L)														
Introduction, Link-Layer Addressing, DLC Services, Data-Link Layer Protocols, HDLC, PPP, Media Access Control, Wired LANs: Ethernet, Wireless LANs, Introduction- IEEE 802.3, IEEE 802.4, IEEE 802.5, IEEE 802.11 IEEE 802.11, FDDI,SONET.													CO-2 BTL-3	
MODULE 3 : NETWORK LAYER (9L)														
Internetworking – Circuit Switching, Packet switching,subnetting, IPv4, IPv6 - address mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP, - Routing, Distance vector routing. Link state routing- Unicast, Multicast routing protocols.													CO-3 BTL-3	
MODULE 4: TRANSPORT LAYER (9L)														
Duties of transport layer, Connectionless transport, Multiplexing, Demultiplexing, socket, User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call,Congestion control, Quality of Service, Integrated services.													CO-4 BTL-3	
MODULE 5: APPLICATION LAYER (9L)														
Domain Name System (DNS), SMTP,FTP, SNMP, WWW,HTTP, Multimedia Network Security: Cryptography, Symmetric key and Public Key algorithms, DES and AES algorithms, Digital signature, Management of Public keys, Communication Security, Authentication Protocols.													CO-5 BTL-3	
TEXT BOOKS														
1.		Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw-Hill, Fourth edition, July 2017.												
2.		William Stallings, “High Speed Networks and Internet”, Pearson Education, Second Edition,2014.												
REFERENCE BOOKS														
1.		Andrew S. Tannenbaum, “Computer Networks”, Pearson Education, Fifth Edition,2010.												
E BOOKS														
1.		<a href="http://intronetworks.cs.luc.edu/">http://intronetworks.cs.luc.edu/</a>												
2.		<a href="https://www.topfreebooks.org/free-books-on-computer-networking/">https://www.topfreebooks.org/free-books-on-computer-networking/</a>												
3.		<a href="https://www.kobo.com/us/en/ebook/basics-of-computer-networking">https://www.kobo.com/us/en/ebook/basics-of-computer-networking</a>												
MOOC														

1.	<a href="http://nptel.ac.in/courses/106105082/30">http://nptel.ac.in/courses/106105082/30</a>
2.	<a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communication-networks-fall-2002/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communication-networks-fall-2002/</a>
3.	<a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-976-high-speed-communication-circuits-and-systems-spring-2003/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-976-high-speed-communication-circuits-and-systems-spring-2003/</a>

COURSE TITLE	DESIGN PROJECT-4				CREDITS	1									
COURSE CODE	EEC51805	COURSE CATEGORY	EEC	L-T-P-S	0-0-2-6										
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-5										
ASSESSMENT SCHEME															
First Review	Second Review	Third Review	Project Report & Viva Voce												
20%	20%	10%	50%												
Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the real time problem statement and gives a strong Engineering and Practical foundation for understanding the different types of social problems and its solution based on engineering knowledge. This course suitable for general engineering students to understand the importance of engineering concepts and its relevant applications. Different Simulation tools to be used in the execution of the design methodology. The resources and team management skills are utilised to develop an innovative, economic solution to the selected problem.														
Course Objective	The course will enable the students to: 1. Demonstrate a wide range of the skills learned during their course of study by delivering a product that has passed through the design, analysis, testing and evaluation. 2. Encourage multidisciplinary research by integrating the concepts learned in a various courses. 3.Develop problem solving, analysis, synthesis and evaluation skills and communication skills by emphasizing them to prepare project report, poster and oral presentation.														
Course Outcome	Upon completion of this course, the students will be able to 1. Identify and work for the real life needs of the society 2. Implement practical solutions to the societal problem 3. Demonstrate the importance of Engineering concepts and its relevant application														
Prerequisites: Design Project-3															
CO, PO AND PSO MAPPING															
	PO-1	PO-2	PO -3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	2	3	2	2	3	3	3	3	1	3	3	3
CO-2	3	3	3	2	3	2	2	3	3	3	3	1	3	3	3
CO-3	3	3	3	2	3	2	2	3	3	3	3	1	3	3	3

**Weightage of Assessment:**

Review / Examination Scheme	Weightage
First Review	20%
Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee shall be constituted by the HoD for the Review.

**Assessment Rubrics**

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

\* - Attributes for individual contribution.

**RUBRICS FOR ASSESSMENT**

To be followed same as approved for Design project 1

**Semester VII**

COURSE TITLE		ENGLISH FOR COMPETITIVE EXAMINATIONS								CREDITS		1		
COURSE CODE		GLS51006		COURSE CATEGORY				HS		L-T-P-S		0-0-2-1		
VERSION	1	APPROVAL DETAILS			35 <sup>th</sup> ACM				LEARNING LEVEL		BTL-4			
ASSESSMENT SCHEME														
CIA										ESE				
First Periodical Assessment		Second Periodical Assessment		Practical Assessment		Surprise Test / Quiz., as approved by the Department Examination Committee “DEC”			Attendance		Practical		Theory	
15 %		15 %		10 %		5 %			5 %		25 %		25 %	
Course Description		This course provides students with the skills and strategies needed to succeed in competitive exams, such as English grammar, vocabulary, reading and writing skills, listening comprehension, and critical thinking. It also helps them to understand the English language and exam structure better.												
Course Objective		<div>1. To provide an environment where people may compete on both a formal and casual level and employ those abilities in regular conversation, presentations, group discussions, and debates.</div> <div>2. To prepare the students to read literary materials, comprehend them, and respond to questions based on them.</div> <div>3. Assisting students in developing social awareness and positive responses to societal demands.</div> <div>4. To give students a setting in which to take competitive exams.</div>												
Course Outcome		<div>Upon completion of this course, the students will be able to;</div> <div>1. Acquire knowledge of the structure and format of competitive examinations.</div> <div>2. Improve vocabulary and grammar to increase success in competitive examinations.</div> <div>3. Develop critical thinking and problem-solving skills to answer complex questions.</div> <div>4. Analyse their vocabulary and communication ability to build the knowledge of idioms, phrasal verbs and commonly used expressions for better productivity, job performance and to develop self-confidence.</div> <div>5. Learn how to approach and solve comprehension and essay questions with confidence.</div>												
Prerequisites:-Intermediate Level														
CO,PO AND PSO MAPPING														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-			-
CO2	-	-	-	-	-	-	-	2	2	3	-			-
CO3	-	-	-	-	-	-	-	-	-	3	-			-
CO4	-	-	-	-	-	-	2	-	-	3	2			-
CO5	-	-	-	-	-	-	-	-	2	3	2			3



1:Weaklyrelated,2:Moderatelyrelatedand3:Stronglyrelated	
<b>MODULE 1</b>	<b>(6P)</b>
Introduction to Competitive Exams - IELTS, TOEFL etc., Precis writing – Types of Letter writing – Business Letters – Letters for employability	<b>CO-1</b> <b>BTL-2</b>
<b>MODULE 2</b>	<b>(6P)</b>
Reading Comprehension- Cloze Test- Passage Completion-Practice Test – Listening Comprehension Exercise (Lab)	<b>CO-2</b> <b>BTL-3</b>
<b>MODULE 3</b>	<b>(6P)</b>
Spotting Errors- Sentence Improvement-Practice Test	<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4</b>	<b>(6P)</b>
Para Jumbles- Tracing Odd Sentences- Synonyms and Antonyms-Practice Test	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5</b>	<b>(6P)</b>
Idioms and Phrases, One Word Substitution, Active and Passive Voice, Direct-Indirect Speech-Practice Tests	<b>CO-5</b> <b>BTL-3</b>
<b>TEXT-BOOK</b>	
1. General English for Competitive Exams, by Dr. Rashmi Singh, 2 <sup>nd</sup> Edition	
<b>REFERENCEBOOKS</b>	
1. TOEFL	
<b>E-REFERENCES</b>	
1 <a href="https://www.careers360.com/all-ebooks">https://www.careers360.com/all-ebooks</a>	
2 <a href="https://www.dishapublication.com/ebooks">https://www.dishapublication.com/ebooks</a>	
3 <a href="https://www.visionias.net/p/free-e-books-for-all-competitive.html">https://www.visionias.net/p/free-e-books-for-all-competitive.html</a>	
4 <a href="https://www.fdaytalk.com/ebooks/">https://www.fdaytalk.com/ebooks/</a>	
<b>MOOC</b>	
1 <a href="https://www.mooc-list.com/tags/english">https://www.mooc-list.com/tags/english</a>	

COURSE TITLE	OPTICAL AND MICROWAVE ENGINEERING			CREDITS	4	
COURSE CODE	EEC51015	COURSE CATEGORY	PC	L-T-P-S	2-1-2-2	
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	This course gives an introduction about optical communication, optical fiber modes configuration and various signal degradation factors associated with optical fibers. It covers optical sources and receivers. Microwave engineering pertains to the study and					

	design of microwave circuits, components and systems. Fundamental principles are applied to analysis, design and measurement techniques in this field.														
Course Objective	<ol style="list-style-type: none"><li>1. To interpret the basics of Optical Fiber Communication System.</li><li>2. To lay a strong foundations in the basics techniques of RF components and measurement techniques</li><li>3. To impart the knowledge of Scattering Matrix and establish the S-Matrix for various types of microwave junctions</li><li>4. To provide in-depth knowledge of semiconductor devices relevant for high frequency microwave operation, design broadband and power amplifiers</li></ol>														
Course Outcome	<p><b>Upon completion of this course, the students will be able to</b></p> <ol style="list-style-type: none"><li>1. Analyze the mode theory of light propagation through fibers and Identifying the different loss mechanism in fibers</li><li>2. Identify the performance of different and calculate error performance of optical systems. Illustrate the design aspects of digital optical transmission system</li><li>3. Relate microwave measurement parameters and identify, design and solve elements in impedance matching</li><li>4. Apply the concepts of reciprocity, scattering matrix in Microwave Components, determine resonance frequencies and Q-value for open or short-circuited transmission line resonators.</li><li>5. Choose analysis methods to determine circuit properties of passive or active microwave devices, design microwave high frequency, broadband and power amplifier</li></ol>														
Prerequisites:															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	1	1	0	0	0	0	0	0	1	3	1	3
CO-2	3	3	3	1	1	0	0	0	0	0	0	1	3	1	3
CO-3	3	1	2	1	2	0	0	0	0	0	0	1	3	1	3
CO-4	3	1	2	1	1	0	0	0	0	0	0	1	3	1	3
CO-5	3	1	2	1	2	0	0	0	0	0	0	1	3	1	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE I: MODULE 1 – INTRODUCTION TO OPTICAL FIBER STRUCTURE, WAVEGUIDE AND AND SIGNAL DEGRATION (9L+ 6P=15)															
Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –Fiber types, Rays and modes, Step-Index Fiber Structure, Ray Optics Representation, Wave Representation, --Single Mode Fibers-Graded Index fiber structure,  Signal Degradation On Optical Fibers-Attenuation – Absorption losses, scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-													CO-1  BTL-2		

<p>Information Capacity determination –Group Delay- Material Dispersion, Waveguide Dispersion, Signal distortion in SM Fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI Fibers-Mode Coupling.</p> <p>Suggested Readings:</p> <ul style="list-style-type: none"> <li>• Photonic Crystal Fibers (PCF) and characteristics</li> <li>• PCF and its working principle</li> <li>• Pulse Broadening in GI fibers-Mode Coupling.</li> </ul> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Study of Propagation loss and bending loss in Optical fiber.</li> <li>2. Study of Numerical Aperture and attenuation losses of optical fiber</li> </ol>	
<b>MODULE II: OPTICAL SOURCE DETECTORS AND RECEIVER OPERATION (9L+ 6P=15)</b>	
<p>Optical Source – LED, LED Structure, Light Source Material, Quantum Efficiency, Power Bandwidth Product, Laser Diode-Laser Diode Mode and Threshold Condition, Resonant Frequency, Single Mode Laser, Modulation of Laser Diode, Physical Principle of Photodiode-The pin Photo detector-Avalanche Photodiode, Optical Receiver Operation-Digital Signal Transmission, Error Source, Receiver Configuration–Receiver performance calculation – Probability of Error, Quantum Limit, Receiver Noise, sensitivity calculation</p> <p><b>Suggested Readings:</b></p> <ul style="list-style-type: none"> <li>• Coherent Optical Fiber Communication</li> <li>• Optical Receiver Operation</li> <li>• Photonics Switches</li> </ul> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Study of V-I characteristics of LED and Photodiode using optical transceiver kit.</li> <li>2. Study of V-I characteristics of Photo Detectors using optical transceiver kit.</li> </ol>	<p><b>CO-2</b></p> <p><b>BTL-2</b></p>
<b>MODULE III: – RF COMPONENTS AND MICROWAVE MEASUREMENTS (9L+ 6P=15)</b>	
<p>Baluns, Wilkinson Power Dividers/Combiners, Couplers; Microwave applications, relation between dB, dBm, dBw. Description of microwave bench, Noise at microwave frequency and measurement of noise figure, Power measurement, attenuation, frequency, impedance, VSWR, EIRP and Gain Over Noise Temperature (G/T)</p> <p>Suggested Reading Basic microwave components</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Design and simulation of directional couplers using HFSS.</li> <li>2. Design and simulation of power divider using HFSS</li> <li>3. To determine the standing wave ratio</li> </ol>	<p><b>CO-3</b></p> <p><b>BTL-2</b></p>
<b>MODULE IV: MICROWAVE NETWORK ANALYSIS AND WAVEGUIDE COMPONENTS (9L+ 6P=15)</b>	
<p>Impedance and Admittance Matrices, The Scattering Matrix, Power Waves and Generalized Scattering Parameters, Three-Port Networks (T-Junctions), Basic Properties of Dividers and Couplers, Ferrites— Composition and Characteristics, Faraday Rotation, Ferrite Components — Gyrator, Isolator, Circulator.</p> <p>Suggested Reading Dividers and couplers</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. To determine the frequency and wavelength in a rectangular waveguide working on TE<sub>10</sub> mode.</li> <li>2. To measure input and output power for H-plane, E-plane and Magic tee.</li> </ol>	<p><b>CO-4</b></p> <p><b>BTL-3</b></p>
<b>MODULE V: – MICROWAVE DEVICES &amp; MICROWAVE HIGH EFFICIENCY BROADBAND AND POWER AMPLIFIER (9L+ 6P=15)</b>	

Microwave Tubes: Klystron, TWT, Magnetron; Schottky Diodes and Detectors, PIN Diodes , Varactor Diodes, Heterojunction Bipolar Transistor, Transfer Electron Devices – GUNN Diode. Overdriven Class B, Class-F Circuit Design, Inverse Class F, Bode-Fano Criterion, Matching Networks with Lumped Elements Suggested Reading 1.Semiconductor Physics <b>Lab Experiments</b>  1. Design a GaAs FET amplifier for maximum gain at 4.0 GHZ. 2. Design a GaAs FET amplifier having a 2.0 dB noise figure with the maximum gain that is compatible with noise figure. 3. To study V-I characteristics of Gunn Diode.		<b>CO-5</b>  <b>BTL-3</b>
<b>TEXT BOOKS</b>		
1	Gerd Keiser, “Optical Fiber Communication” McGraw –Hill International, 4th ed., 2010	
2	J.Senior, “Optical Communication, Principles and Practice”, Third Edition, Prentice Hall of India, 2010.	
3	D.M.Pozar, “ Microwave engineering” ,Wiley, 4th edition, 2011.	
4	Matthew M. Radmanesh, “Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design”, AuthorHouse, 2009.	
5	R.Ludwig and P.Bretchko, “R. F. Circuit Design”, Pearson Education Inc, 2009.	
<b>REFERENCE BOOKS</b>		
1	Keiser, “Optical Communication essentials”, McGraw-Hill Companies (28 July 2003)	
2	G.P Agrawal, “Fiber-Optic Communication Systems”, Wiley; Third edition, 2007	
3	David M Pozar Microwave Engineering” Wiley Publications, 4th Ed , 2012 2	
4	R.E. Collin “Foundations for Microwave Engineering” IEEE Press, John Wiley, 2nd Edition, 2002	
5	Matthew M Radmanesh “Advanced RF and Microwave Circuit Design: The Ultimate Guide to Superior Design”, Author House, 2009	
<b>E BOOKS</b>		
1	<a href="http://www.scilab.in/Completed_Books#2">http://www.scilab.in/Completed_Books#2</a>	
2	<a href="https://www.intechopen.com/books/optical-communication">https://www.intechopen.com/books/optical-communication</a>	
3	<a href="http://www.ibook4u.com/2014/03/microwave-engineering-by-david-m-pozar.html">http://www.ibook4u.com/2014/03/microwave-engineering-by-david-m-pozar.html</a> 2.	
4	<a href="https://www.accessengineeringlibrary.com/browse/rf-and-microwave-power-amplifierdesign-second-edition#fullDetails">https://www.accessengineeringlibrary.com/browse/rf-and-microwave-power-amplifierdesign-second-edition#fullDetails</a>	
<b>MOOC</b>		
1	<a href="https://nptel.ac.in/courses/117/101/117101002/">https://nptel.ac.in/courses/117/101/117101002/</a>	
2	<a href="https://www.conted.ox.ac.uk/courses/practical-rf-microwave-design">https://www.conted.ox.ac.uk/courses/practical-rf-microwave-design</a>	

COURSE TITLE	Machine Learning and Artificial Intelligence			CREDITS	3
COURSE CODE	EECS1016	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA				ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved	Attendance*	THEORY PRACTICAL

			by the Departme nt Examinati on Committe e “DEC”												
15%	15%	10%	5%	5%	25%	25%									
Course Descripti on	Machine learning is a branch of artificial intelligence wherein concepts/hypothesis/patterns are learnt from data by using heuristic algorithms. This course provides a broad perspective of the Machine learning framework and introduces the core concepts of supervised, unsupervised and artificial intelligence. Moreover, this course will give an insight to artificial neural network, deep learning techniques and its application.														
Course Objective	<ul style="list-style-type: none"><li>To introduce the fundamental concepts of machine learning</li><li>To explain the core concepts of learning methods such as supervised and unsupervised learning techniques</li><li>To understand the concepts of artificial neural networks and deep learning.</li><li>To provide exposure to the students to artificial problem-solving approaches.</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ol style="list-style-type: none"><li>Summarize the fundamental framework of machine learning.</li><li>Explain the core concepts of Supervised learning techniques.</li><li>Apply dimensionality reduction techniques for machine learning problems.</li><li>Elucidate the artificial neural network and Deep learning for machine learning applications.</li><li>Explore the problem-solving approaches in artificial intelligence</li></ol>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	P O-3	P O-4	PO -5	P O-6	P O-7	P O-8	PO-9	PO -10	PO-11	PO -12	PSO-1	PSO-2	PSO-3
CO -1	3	2	3	2	3	-	-	-	-	1	-	2	1	1	3
CO -2	3	3	3	3	2	1	2	1	1	2	-	1	1	2	3
CO -3	3	3	2	3	2	1	2	1	1	2	-	1	1	2	3
CO -4	3	3	2	3	2	1	2	1	1	2	-	2	1	1	3
CO -5	3	3	2	3	2	-	-	-	-	2	-	2	1	1	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: FUNDAMENTALS OF MACHINE LEARNING (5L+ 4P)															
Introduction to machine learning - Types of machine learning: supervised, unsupervised and reinforcement learning - The machine learning process – Basic terminologies in machine learning – datasets, weight space, the curse of dimensionality, overfitting, accuracy metrics - Perspectives and issues in machine learning. Lab Experiments <ol style="list-style-type: none"><li>Introduction to NumPy, SciPy, and Matplotlib, Pandas</li><li>Reading, Preprocessing and cleaning the data</li></ol>													CO-1 BTL-2		

MODULE 2: SUPERVISED LEARNING		(5L+ 4P)
Bayes decision theory - Minimum-error-rate classification – Linear Regression - Logistic Regression – K-Nearest Neighbor - Support Vector Machines (SVM) - Learning with decision Trees – Constructing decision trees – Classification and Regression Trees (CART) - Ensemble learning: boosting, bagging and random forest. <b>Lab Experiments</b> 1. Demonstration of Simple Linear Regression using an available dataset 2. Demonstration of Logistic using an available dataset		<b>CO-2 BTL-3</b>
MODULE 3: UNSUPERVISED LEARNING		(5L+ 4P)
Clustering: K-means – Adaptive K-means - K Nearest Neighbours - Vector Quantization. Dimensionality reduction: Linear Discriminant Analysis (LDA) - Principal Component Analysis (PCA) <b>Lab Experiments</b> 1. Demonstration of K-Means Clustering Algorithm on Handwritten Dataset 2. Demonstration of PCA and LDA on Iris dataset		<b>CO-3 BTL-3</b>
MODULE 4: ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING		(5L+ 4P)
Learning - The brain and the neuron - Models of a neuron - Feed-Forward neural networks - Perceptron learning - Multi-layer feed-forward neural network - Gradient descent - Back propagation algorithm. Introduction to Deep Neural Network (DNN) – Convolutional Neural Network – Auto Encoders – Applications of Deep Learning Networks. <b>Lab Experiments</b> 1. Case Study to predict customer churn rate based on Artificial Neural Network (ANN) 2. An Artificial Neural Network based Traffic Light Controller		<b>CO-4 BTL-3</b>
MODULE 5: FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE		(5L+ 4P)
AI and Problem Solving by Search - Problem Solving by Search – Depth First Search (DFS) and Breadth First Search (BFS) - Knowledge Representation and Reasoning - Reasoning under Uncertainty - Planning and Decision Making <b>Lab Experiments</b> 1. Implementation of DFS and BFS algorithms with a case study		<b>CO-5 BTL-3</b>
TEXT BOOKS		
1.	Stephen Marsland, (2014), “Machine learning – an algorithmic perspective”, Chapman & Hall/CRC, Second Edition, pp. 1- 457.	
2.	Elaine Rich, Kevin Knight, Shivashankar B Nair, (2017), “Artificial Intelligence”, McGraw Hill Education, Third edition, pp. 1-588.	
REFERENCE BOOKS		
1	Tom. M. Mitchell, (2013), “Machine learning”, McGraw Hill education, First Edition, pp.1-414	
2	Staurt Russel, Peter Norvig, (2021) “Artificial Intelligence: A Modern Approach”, Pearson New International Edition, 4 <sup>th</sup> edition, pp. 1-1030	
3	Luis Pedro Coelho, Willi Richert, (2015), “Building Machine Learning Systems with Python”, Packt Publishing Ltd, Second Edition., pp.1-326.	
E BOOKS		
1.	<a href="https://dai.fmph.uniba.sk/courses/NN/haykin.neural-networks.3ed.2009.pdf">https://dai.fmph.uniba.sk/courses/NN/haykin.neural-networks.3ed.2009.pdf</a>	
2.	<a href="http://www.cs.cmu.edu/~tom/files/MachineLearningTomMitchell.pdf">http://www.cs.cmu.edu/~tom/files/MachineLearningTomMitchell.pdf</a>	
MOOC		
1.	<a href="https://www.coursera.org/collections/machine-learning">https://www.coursera.org/collections/machine-learning</a>	
2.	<a href="https://www.coursera.org/specializations/machine-learning-introduction">https://www.coursera.org/specializations/machine-learning-introduction</a>	

<b>COURSE TITLE</b>	<b>NEXT GENERATION WIRELESS NETWORKS</b>	<b>CREDITS</b>	<b>3</b>
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COURSE CODE	EECS1017	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2										
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*											
15%	15%	10%	5%	5%											
50%															
Course Description	The course on Next Generation Wireless Networks provides an insight to the emerging wireless networks and the next generation wireless networks. The course also focuses on the basic concepts of 5G and millimeter wave communications. Security and privacy issues associated with the upcoming technology are also dealt with.														
Course Objective	<ul style="list-style-type: none"><li>• This course aims to equip the students with a basic understanding emerging technologies and its applications.</li><li>• This course aims to equip students with understanding of the Next generation wireless networks</li><li>• This course aims to equip students with understanding of 5G Concepts, architecture and its deployment.</li><li>• This course aims to equip students with understanding of concepts of millimeter communication.</li><li>• This course aims to equip students with understanding of security issues and privacy in networks</li></ul>														
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ul style="list-style-type: none"><li>• Analyze the trends and challenges of emerging wireless networks</li><li>• Examine the architectural features of Next generation wireless networks</li><li>• Predict the requirements for the deployment of 5G</li><li>• Illustrate the technologies involved in millimeter wave propagation</li><li>• Identify the privacy and security issues in 5G deployed networks</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	2	2	1	1	0	0	0	0	1	1	3	1	1

[illegible]



4	Singhal, Chetna, and De Swades, “Resource Allocation in Next Generation Broad Band Wireless Access Networks”, Advances in Wireless Technologies and Telecommunication-IGI Global, 2017
<b>E BOOKS</b>	
1.	<a href="https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad">https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad</a>
<b>MOOC</b>	
1.	<a href="https://archive.nptel.ac.in/courses/117/102/117102062/">https://archive.nptel.ac.in/courses/117/102/117102062/</a>
2.	<a href="https://www.digimat.in/nptel/courses/video/117104099/L01.html">https://www.digimat.in/nptel/courses/video/117104099/L01.html</a>

COURSE TITLE		Research Methodology & IPR								CREDITS		2		
COURSE CODE		EGE51005		COURSE CATEGORY				ES		L-T-P-S		2-0-0-2		
Version		1.0		Approval Details				36 <sup>TH</sup> ACM		LEARNING LEVEL		BTL-3		
ASSESSMENT SCHEME														
CIA												ESE		
First Periodical Assessment		Second Periodical Assessment		Seminar/Assignments/Project			Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”			Attendance *				
15%		15%		10%			5%			5%		50%		
Course Description		The students shall develop a detailed insight about various aspects of Research Methodology and IPR. Research Process and its type will be discussed in the Module I, whereas research variables were briefed in the Module II. Detailed procedure of data preparation and analysis will be taught in the Module III, report writing will be discussed in the Module IV. Finally, Module V will provide insights about IPR												
Course Objective		<div><div>1. The course aims to identify and appreciate scientific inquiry</div><div>2. The course also equips the students to develop the skill of writing research proposals</div><div>3. The course aims to plan a systematic outlook towards business Situations for the purpose of objective decision making, and the method of conducting scientific inquiry to solve organizational problems</div><div>4. The course also trains the students to analyze data and find solutions to the research problems</div><div>5. The course aims the students to Prepare research reports</div></div>												
Course Outcome		<div>Upon completion of this course, the students will be able to</div> <div><div>1. Identify and appreciate scientific inquiry</div><div>2. Develop the skill of writing research proposals</div><div>3. Plan a systematic outlook towards business Situations for the purpose of objective decision making, and the method of conducting scientific inquiry to solve organizational problems</div><div>4. Consolidate data and write technical reports</div><div>5. Summarize the salient features of Intellectual Property Rights</div></div>												
CO, PO AND PSO MAPPING														
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	3	3	2	2	2	2	2	3	2	2
CO-2	2	3	1	1	3	3	2	3	2	3	2	3	1	1
CO-3	3	2	1	1	3	2	1	2	1	2	2	3	2	2
CO-4	2	3	1	1	3	2	1	1	3	3	2	3	2	2
CO-5	2	3	1	1	3	2	3	2	3	3	2	3	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related														

<b>MODULE 1: INTRODUCTION (6L)</b>	
Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research–Theoretical and empirical Research – Cross – Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research. <b>Suggested Readings:</b> 1. Research Hypotheses	<b>CO-1 BTL-3</b>
<b>MODULE 2: RESEARCH DESIGN AND MEASUREMENT (6L)</b>	
Research design – Definition – types of research design –Variables in Research – Measurement and Scaling – Different scales – Construction of instrument –Validity and Reliability of instrument. Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of Questionnaire and instrument – Types of Validity –Sampling plan–Sample size– determinants optimal sample size – sampling techniques – Sampling methods. <b>Suggested Readings:</b> 1. Sampling Techniques	<b>CO-2 BTL-3</b>
<b>MODULE 3: DATA PREPARATION AND ANALYSIS (6L)</b>	
Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Applications of Bivariate and Multivariate statistical techniques, Factor analysis, Discriminant analysis, Cluster analysis, Multiple regression and Correlation, Multidimensional scaling. <b>Suggested Readings:</b> 1. Cluster Analysis	<b>CO-3 BTL-3</b>
<b>MODULE 4: REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH (6L)</b>	
Research report –Types – Contents of report – need for executive summary – Chaptalization– contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report <b>Suggested Readings:</b> 1. Report Writing	<b>CO-4 BTL-3</b>
<b>MODULE 5: INTRODUCTION TO IPRS (INTELLECTUAL PROPERTY RIGHTS) (6L)</b>	
Meaning, importance – Various Types of Intellectual Property Rights – Patent, Copyrights, Geographical Indication, trade Secretes, Industrial Design – Registration, rights – World Intellectual Property Organization (WIPO)- Intellectual Property Rights in India <b>Suggested Readings:</b> 1. Patent and Copyrights	<b>CO-5 BTL-3</b>
<b>BOOKS</b>	
1.	UmaSekaran, ResearchMethodsforBusiness,WileyPublications,2011.
2.	DonaldR.CooperandPamela S.Schindler-BusinessResearchMethods-TataMcGrawHill,2010
<b>REFERENCE BOOKS</b>	
1	Naresh K Malhotra –Marketing Research: An Applied Orientation, Pearson Education,4thEdition,2010.
2	T.N.Srivastava&ShailajaRego - BusinessResearchMethodology,TataMcGrawHill,2013,Edition.2012
3	Uma Sekaran and Roger Bougie, Research methods for Business, 5th Edition, Wiley India, NewDelhi,2012.
4	Karuppasamy & H.C.Bindusha, A Practical Approach to Intellectual Property Rights, Himalaya Publications, Mumbai, 2014.
<b>E Resources for Reference</b>	
1	<a href="http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkededucation(P05-M29))">http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkededucation(P05-M29))</a>
2.	<a href="http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkeducation(P05-M01))">http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkeducation(P05-M01))</a>
3.	<a href="http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkeducation(P05-M09))">http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkeducation(P05-M09))</a>
4	<a href="http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkeducation(P05-M12))">http://epgp.inflibnet.ac.in/ahl.php?csrno=33(Socialworkeducation(P05-M12))</a>
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc23_ge36/preview">https://onlinecourses.nptel.ac.in/noc23_ge36/preview</a>

2.	<a href="https://nptel.ac.in/courses/127106227">https://nptel.ac.in/courses/127106227</a>
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COURSE TITLE	PROJECT PHASE-1			CREDITS	3
COURSE CODE	EEC51806	COURSE CATEGORY	EEC	L-T-P-S	0-0-6-6
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3

#### ASSESSMENT SCHEME

FIRST REVIEW	SECOND REVIEW	THIRD REVIEW	PROJECT REPORT & VIVAVOCE
20%	20%	10%	50%

<b>Course Description</b>	This course is designed to offer a diverse range of objectives, spanning from design and practical implementation to computational work and research-based projects. Every proposed project presents a pathway to accomplish the desired learning outcomes. The core purpose of this module is to serve as a platform for students to not only develop and integrate their existing knowledge and skills but also to explore and, in certain cases, contribute to new knowledge through literature review, experimentation, or modelling and analysis, as applicable. Moreover, the module places a strong emphasis on recognizing and nurturing students' curiosity and motivation. It strives to provide a gratifying learning experience through close interaction and guidance from an academic supervisor.
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<b>Course Objective</b>	<p>The course will enable the students to:</p> <ol style="list-style-type: none"> <li>1. Undertake theoretical studies, computer simulations and hardware construction based on the literature review performed.</li> <li>2. Produce progress reports on the work completed and maintain to schedule the time frame of the project</li> <li>3. Finally deliver a seminar and prepare a report/paper to present in a forum involving paper presentations and demonstration of the operational hardware and software</li> </ol>
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<b>Course Outcome</b>	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>1. Categorize the topic of interest and identify the project domain based on the societal / industry requirements</li> <li>2. Reproducing the existing system and feasibility of the proposed project</li> <li>3. Articulate the methodology of the project based on comprehensive Literature survey and break down to point out the methods and strategies for implementation.</li> </ol>
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#### CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	0	0	2	1	1	2	1	1	2	3	3	3
CO-2	3	1	2	0	0	2	1	1	2	1	1	2	3	3	3
CO-3	3	1	2	0	0	2	1	1	2	1	1	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

The Project Work shall be carried out in the field of Electronics & Communication Engineering. Students shall work in convenient groups of not more than four members in a group. Every Project Work shall have a Supervisor. During this period the supervisor shall guide the students to implement the project. The students shall give periodical presentations of the progress made in the Project Work.

Each group shall finally produce a report covering background information, literature survey, problem statement, project work details and conclusions. This final report shall be typewritten form as specified in the guidelines. Assessment Review / Exam.

Assessment	
Review / Exam	Weightage
First Review	20%
Second review	20%
Third review & DEMO	10%
Project Report & viva Voce	50%
<b>TOTAL</b>	<b>100%</b>

A committee shall be constituted by the HoD for the Review

#### Assessment Rubrics

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	5.0

Report / Thesis	5.0
Publication, Patent, Funding, Competitions	5.0
Peer Assessment*	5.0

\* - Attributes for individual contribution

#### Semester VIII

COURSE TITLE	PROJECT PHASE-II			CREDITS	13
COURSE CODE	EEC51807	COURSE CATEGORY	EEC	L-T-P-S	0-0-26-10
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
FIRST REVIEW	SECOND REVIEW		THIRD REVIEW		PROJECT REPORT & VIVAVOCE
20%	20%		10%		50%

<b>Course Description</b>		This course encompasses a diverse range of objectives, catering to both design and manufacturing, computational work, and research-oriented projects. Regardless of the chosen project, all participants will have ample opportunities to attain the intended learning outcomes. The primary goal of this module is to furnish students with a platform to foster and consolidate their knowledge and skills, encouraging them to explore and potentially contribute to new knowledge through various means such as literature review, experimentation, or modelling and analysis when relevant. Furthermore, the course places significant emphasis on nurturing curiosity and self-motivation, promoting a fulfilling and engaging experience for students as they engage in close collaboration with their academic supervisor.													
<b>Course Objective</b>		The course will enable the students to: <ol style="list-style-type: none"> <li>1. Undertake theoretical studies, computer simulations and hardware construction based on the literature review performed.</li> <li>2. Produce progress reports on the work completed and maintain to schedule the time frame of the project</li> <li>3. Finally deliver a seminar and prepare a report/paper to present in a forum involving paper presentations and demonstration of the operational hardware and software</li> </ol>													
<b>Course Outcome</b>		Upon completion of this course, the students will be able to <ol style="list-style-type: none"> <li>1. Build and demonstrate the prototype based on the technical knowledge gained in the phase 1</li> <li>2. Design Engineering solutions to real time problems utilizing system approach</li> <li>3. Illustrate and interpret the graphical results obtained</li> <li>4. Analyze, Evaluate and compare the performance of the results.</li> <li>5. Communicate with Engineers, peer team members and professionals</li> </ol>													
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
CO-1	3	3	2	2	3	1	1	1	3	1	3	1	3	3	3
CO-2	3	3	2	2	3	1	1	1	3	1	3	1	3	3	3
CO-3	3	3	2	2	3	1	1	1	3	1	3	1	3	3	3
CO-4	3	3	2	2	3	1	1	1	3	1	3	1	3	3	3
CO-5	3	3	2	2	3	1	1	1	3	1	3	1	3	3	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															

The Project Work shall be carried out in the field of Electronics & Communication Engineering. Students shall work in convenient groups of not more than four members in a group. Every Project Work shall have a Supervisor. During this period the supervisor shall guide the students to implement the project. The students shall give periodical presentations of the progress made in the Project Work.

Each group shall finally produce a report covering background information, literature survey, problem statement, project work details and conclusions. This final report shall be typewritten form as specified in the guidelines. Assessment Review / Exam.

Assessment	
Review / Exam	Weightage
First Review	20%
Second review	20%
Third review & DEMO	10%
Project Report & viva Voce	50%
<b>TOTAL</b>	<b>100%</b>

#### Assessment Rubrics

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	5.0

Report / Thesis	5.0
Publication, Patent, Funding, Competitions	5.0
Peer Assessment*	5.0

\* - Attributes for individual contribution

#### **EVALUATION PARAMETERS FOR ASSESSMENT**

To be followed same as approved for Project Phase I

#### **Department Electives (DE)**

	Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5	Vertical 6
<b>SEM</b>	<b>Embedded System</b>	<b>Communication System and Signal Processing</b>	<b>VLSI Technology</b>	<b>Software and System Modelling</b>	<b>Underwater Communication And Sensors</b>	<b>Electronics Manufacturing Technology</b>
<b>III</b>	IDE Based Programming and its applications	Linear and Electronic Switching Circuits	Verilog HDL	Data Structures and Algorithms with C	Introduction to Ocean engineering	Tools, Components, equipment for Electronics Manufacturing
	OR	OR	OR	OR		OR
	Interfacing Techniques for General Purpose Processors	Electronic Instrumentation	DSP Processor and Architecture	Circuit Simulation Using Pspice		Consumer and Industrial Electronics
<b>IV</b>	Embedded System Software	Fundamentals of Nanoscience	Digital System Design Using FPGA Board	Object Oriented Programming Languages with C++	Ocean Acoustics	PCB Design, Layout and Placement
	OR	OR	OR	OR		OR
	Robotics and Control	Opto Electronic Devices	Semiconductor or Modelling	PCB Design – Idea to Product		1D Simulation
<b>V</b>	System Design Using Raspberry Pi Processor	Neural Networks	Analog VLSI	Advanced Python Programming	Nano Electronic Devices and Sensors	Design for Manufacturability
	OR	OR	OR	OR		OR
	Embedded Automotive Systems	Virtual and Augmented Reality	ASIC Design	Optimization Techniques		Electronic Product Design – Industrial case study



VI	Wearable Sensors and Devices	Wireless Adhoc Sensor Networks	Low Power VLSI	RF Components and System Design	Underwater Robotics	PCB Design Verification
	OR	OR	OR	OR		OR
	IOT and its applications	Satellite and RADAR Communication	VLSI Signal Processing	Embedded C Programming		Electronic Packaging
VII	Electronic Standards, Codes and Specifications	Smart Antennas	System on Chip Design	Foundation of Quantum Computing	Marine Navigational Systems	Reliability on Electronic Systems
	OR	OR	OR	OR		
	Security Issues in IOT	High Speed Communication Networks	CAD for VLSI	Speech and Image Processing		Future trends in Electronics Manufacturing

**Syllabus for Department Electives**

**DEPARTMENT ELECTIVES  
VERTICAL-1: EMBEDDED SYSTEM**

<b>COURSE TITLE</b>	IDE BASED PROGRAMMING AND ITS APPLICATIONS			<b>CREDITS</b>	3
<b>COURSE CODE</b>	EEEC51500	<b>COURSE CATEGORY</b>	DE	<b>L-T-P-S</b>	2-0-2-2

Version	1.0	Approval Details				37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL		BTL-4					
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Practical Assessmen ts	Observation / lab records as approved by the Department Examination Committee “DEC			Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)					
15%	15%	10%	5%			5%		25%		25%					
Course Description	The students are given the opportunity to create and use actual word applications in this subject. Arduino can modify lights, motors, and other actuators to change the environment around it after receiving input from sensors. The interface between digital and analogue input/output devices and Arduino is covered in this module. Additionally, it introduces using an Arduino programming using software libraries.														
Course Objective	1. To provide knowledge of different Smart system applications 2. To familiarize students with Arduino as IDE, Programming language and platform 3. To provide knowledge of Arduino boards and basic components. 4. To develop skills to design and implement various smart system application.														
Course Outcome	Upon completion of this course, the students will be able to  1. Summarize the embedded system characteristics and illustrate some embedded system applications. 2. Classify and compare different types of 8-bit Microcontroller 3. Demonstrate the Arduino development board and its functions. 4. Analyze the interfacing of Digital and Analog I/O devices with Arduino 5. Develop different control and automation systems with Arduino														
Prerequisites: Basics of C and C++, Microcontroller and Electronic basics															
CO, PO AND PSO MAPPING															
CO	PO -1	PO- 2	PO-3	PO-4	PO- 5	PO- 6	PO-7	PO-8	PO-9	PO -10	PO- 11	PO- 12	PSO- 1	PSO- 2	PSO-3
CO-1	2	1	2	1	1	-	1	-	-	-	-	-	2	-	-
CO-2	3	1	2	1	1	-	1	-	-	-	-	-	2	-	-
CO-3	3	2	3	2	3	-	3	-	-	3	-	-	2	1	1
CO-4	3	2	3	2	3	-	3	-	-	3	3	3	3	1	1
CO-5	3	2	3	2	3	-	3	-	-	3	3	3	3	1	
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: OVERVIEW OF EMBEDDED SYSTEMS												(6L+6P)			
Embedded System Characteristics, Examples: Washing Machine, Chocolate Vending Machine, Room Temperature Controller, Embedded Product Development Life Cycle (EDLC), Characteristics of Real Time Operating System.												CO-1  BTL-2			

<b>Case study: Biometric system architecture.</b>  <b>Lab experiments:</b>  <b>1. Interfacing LEDs with Arduino</b>	
<b>MODULE 2: 8-BIT MICROCONTROLLERS ARCHITECTURE (6L+6P)</b>	
Microcontroller Types: PIC, AVR, ARM: features and applications, AVR microcontroller: Types, Architecture, Internal Architectural, Block diagram of controller (At mega 8), Functions of each pins of AT mega, Bootloader Circuit.  <b>Case study: 6-channel ADC Working</b>  <b>Lab experiments:</b>  <b>1. Interfacing 16x2 LCD with Arduino</b>	<b>CO-2</b>  <b>BTL-2</b>
<b>MODULE 3: ARDUINO IDE AND ITS FUNCTIONS (6L+6P)</b>	
Basic features of an IDE, Arduino PLC IDE, Arduino: architecture, libraries, Arrays, Operators, I/O Functions, Looping Techniques, Decision Making Techniques, Programming of an Arduino (Arduino ISP).  <b>Case study: Arduino in cloud</b>  <b>Lab experiments:</b>  <b>1. Interfacing switches and 7 segment LED with Arduino boards.</b>	<b>CO-3</b>  <b>BTL-3</b>
<b>MODULE 4: ARDUINO INTERFACING (6L+6P)</b>	
Basic Interfacing and I/O Concept, Arduino pinouts, Interfacing LED, Switch, 7seg LED its and Code, Interfacing POT, LM35, Accelerometer (ADXL3C5C) and its Code, Interfacing DC motor and its Code, Interfacing 16x2 LCD and its code.  <b>Case study: Arduino based-Self-balancing Robot</b>  <b>Lab experiments:</b>  <b>1. Interfacing Servomotor with Arduino</b> <b>2. Interfacing Accelerometer with Arduino</b>	<b>CO-4</b>  <b>BTL-4</b>
<b>MODULE 5: REAL-TIME APPLICATIONS USING ARDUINO) (6L+6P)</b>	
Motor Driver L293D, IR Sensor, Code for Line Follower Robot, Interfacing Accelerometer with Arduino, Record Gestures, Code for Accelerometer based Robot, Interfacing of RF Tx/RF Rx with Arduino, Interfacing of Relay Driver ULN2803 with Arduino, Code for Home automation and its Control, Interfacing of USB-UART.  <b>Case study: Smart home automation using development boards.</b>  <b>Lab experiments:</b>  <b>1. Smart home automation using Arduino boards and microcontrollers</b> <b>2. Line follower robot with Arduino</b>	<b>CO-5</b>  <b>BTL-4</b>
<b>TEXT BOOKS</b>	

1.	Simon Monk, "30 Arduino Projects for Evil Genius "McGraw-Hill Professional.
2.	Michael McRoberts, Beginning Arduino, "Technology in Action ,2010
<b>REFERENCE BOOKS</b>	
1.	Dale Wheat, "Arduino Internas", Technology in Action, 2012
2.	John-david, Warren Josh Adams, Harald Molle, "Arduino Robotics, Technology in Action, 2008
<b>E BOOKS</b>	
1.	<a href="http://www.introtoarduino.com/downloads/IntroArduinoBook.pdf">http://www.introtoarduino.com/downloads/IntroArduinoBook.pdf</a>
2.	<a href="http://phylab.fudan.edu.cn/lib/exe/fetch.php?media=yuandi:arduino: getting_started_with_arduino_v2.pdf">http://phylab.fudan.edu.cn/lib/exe/fetch.php?media=yuandi:arduino: getting_started_with_arduino_v2.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/learn/arduino">https://www.coursera.org/learn/arduino</a>
2.	<a href="https://www.coursera.org/learn/arduino-platform">https://www.coursera.org/learn/arduino-platform</a>

COURSE TITLE	Interfacing Techniques for General Purpose processor			CREDITS	3	
COURSE CODE	EEC51501	COURSE CATEGORY		DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details		37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	A course about the interfacing techniques with the general-purpose processors.					
Course Objective	1. Learn concepts and features in different forms of data transfer such as Programmed IO, Interrupt driven IO and direct-memory transfer in microprocessor-based systems. 2. Study and understand methods of interfacing peripheral devices to a microprocessor to realize different forms of Input/output function.					
Course Outcome	Upon completion of this course, the students will be able to  1. Recall the basics of processor, its ways of addressing data for operation by instruction set and executing basic programs in emulator. 2. Execute basic and advanced assembly language programs in Simulator and exploiting the usage of 8251 and 8253 3. Learn the ways to interface using 8255, ADC/DAC and Keyboard interfacing and practicing the implementation.					

	4. Able to design systems using the interfaces 8259, DMA and I2C and understanding the basics of USB and practical with case study and programming 5. understand to the interfacing of the Digital Signal Processors.														
Prerequisites: Microcontroller and Electronic basics															
CO, PO AND PSO MAPPING															
CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	-	-	-	-	-	-	-	1	2	3	1	-
CO-2	3	3	3	-	-	-	-	-	-	-	1	2	3	1	-
CO-3	3	3	3	1	-	-	-	-	-	-	1	2	3	1	-
CO-4	3	3	3	-	-	-	-	-	-	-	1	2	3	1	-
CO-5	3	3	3	1	-	-	-	-	-	-	1	2	3	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: OVERVIEW OF EMBEDDED SYSTEMS														(7L+6P)	
General Purpose Processor Architecture Models- 16 bit Processor Architecture- Addressing Modes and Instruction Set- Simple Programs - Emulator for the 16-bit processor <b>Suggested Readings:</b> Evolution of General Purpose of Processors -4 bit to Core Processors <b>Practical :</b> 1.Case Study on Instruction Sets 8086 Processors 2. Addition, Subtraction, Multiplication and Division Equipments/ Software Required														CO-1  BTL-3	
MODULE 2: Simulator of 16 bit processor AND Introduction to Peripheral Interfacing-I (6L+8P)															
IDE for 16 bit processors-Simulations Using MASM - programming Examples -IC 8251 USART, Timer 8253- LED and seven segment display-Stepper Motor interfacing <b>Suggested Readings:</b> Case Study on Memory Segmentations and Programming <b>Practical:</b> 1.Ascending and Descending 2. LED and Seven Segment Display 3.Stepper motor Interfacing														CO-2  BTL-3	
MODULE 3: Peripheral Interfacing-II														(6 L+6P)	

8255 PPI, Data converters (A/D and D/A Converter), and key- board interfacing		CO-3  BTL-4
<b>Suggested Reading</b>  Implementation of Keyboard matrix Interfacing		
<b>Practical:</b>  1. Waveform generation Traffic Light Controller with 2 lanes		
<b>MODULE 4: Peripheral Interfacing- III (6 L+ 6 P)</b>		
Interrupt controller-8259 , DMA and I <sup>2</sup> C interfacing- RS232 and USB <b>Suggested Readings:</b> High Speed Communication Protocols <b>Practical :</b> 1.Case Study on Interfacing DMA and I <sup>2</sup> C 2.Programming Example on 8259		CO-4 BTL-4
<b>MODULE 5: Digital Signal Processors Interface (5 L+ 4 P)</b>		
Digital Signal Processors and interface -UART-SPI-I2S-USB- GPIO-I2C-Network Interfaces-External Memory Interfaces-Other Interfaces <b>Suggested Readings:</b> Other Interfaces in DSPr like PCI Express (PCIe), HyperLink, McBSP (Multichannel Buffered Serial Port), SRIO (Serial RapidIO) <b>Case Studies</b> 1. 4 way traffic with different sets of constraints on timing at different point of time. 2. Application building around DC motor , Servo motor and other machines.		CO-5 BTL-3
<b>TEXT BOOKS</b>		
1	A.K. Ray and K.M. Bhurchandi Advanced Microprocessors and Peripherals, third Edition, Tata McGraw Hill, 2012.	
2	Barry B Bray, The Intel Microprocessor 8086/8088, 80186,80286, 80386 and 80486 Architecture, programming and interfacing, PHI, 8th Edition, 2009.	
3	Soumitra K Mandal, “Microprocessors and Microcontroller Architecture, Programming and Interfacing using 8085,8086,8051”, Tata McGraw Hill 2nd edition, 2011.	
4	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C ,PHI,2 <sup>nd</sup> Edition , 2013	
<b>REFERENCE BOOKS</b>		
1	Douglas V. Hall, SSSP Rao Microprocessors and Interfacing Programming and Hardware. Tata McGraw Hill, Third edition, 2012.	
2	Mohamed Rafiquazzaman, Microprocessor and Microcomputer based system design, Universal Book stall, New Delhi, Second edition, 1995	
3	K Uday Kumar, B S Umashankar, Advanced Micro processors IBM-PC Assembly Language Programming, Tata McGraw Hill, 2002.	
4	Kennath Ayyala, 8051 Microcontroller: Architecture, Programming and Applications ,Penram Publications , 2 <sup>nd</sup> Edition ,1996.	
<b>E BOOKS</b>		

1.	<a href="https://www.pdfdrive.com/the-8051-microcontroller-and-embedded-e952238.html">https://www.pdfdrive.com/the-8051-microcontroller-and-embedded-e952238.html</a>
2.	<a href="https://www.pdfdrive.com/the-intel-microprocessors-80868088-8018680188-80286-80386-80486-pentium-pentium-pro-e89806753.html">https://www.pdfdrive.com/the-intel-microprocessors-80868088-8018680188-80286-80386-80486-pentium-pentium-pro-e89806753.html</a>
<b>MOOC</b>	
1.	<a href="https://nptel.ac.in/courses/108103157">https://nptel.ac.in/courses/108103157</a>
2.	<a href="https://nptel.ac.in/courses/117104072">https://nptel.ac.in/courses/117104072</a>

COURSE TITLE		Embedded System Software								CREDITS		3			
COURSE CODE		EECS1511		COURSE CATEGORY				DE		L-T-P-S		2-0-2-2			
Version		1.0		Approval Details				37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL		BTL-3			
ASSESSMENT SCHEME															
First Periodical Assessment		Second Periodical Assessment		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC		Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)			
15%		15%		10%		5%		5%		25%		25%			
Course Description		The main objective of this course is to provide an understanding of the technology essential to the design and implementation of an embedded system software, Identify the need for embedded C in real-time applications & To gain Knowledge on Embedded Programming.													
Course Objective		1. This course aims to provide knowledge on the basics, building blocks of Embedded System. 2. This course also equips students with an ability to understand the fundamentals of embedded Programming. 3. This course aims to study the basic concepts of embedded C & 8051 Programming.													
Course Outcome		Upon completion of this course, the students will be able to  1. Demonstrate the functionalities of processor internal blocks, with their requirement. 2. Deliver insight into embedded C programming and its salient features for embedded systems. 3. Illustrate the software and hardware architecture for distributed computing in embedded systems. 4. Develop a solution for problems by using the concept learned in programming using the embedded controllers 5. Develop simple applications with 8051 by using its various features and interfacing with various external hardware.													
Prerequisites: Embedded systems, Programming in C															
CO, PO AND PSO MAPPING															
CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	-	1	0	0	1	-	-	-	-	1	2	-	-

[illegible]



<b>Lab Experiments</b> <ol style="list-style-type: none"> <li>1. Programming for timer configuration</li> <li>2. Program for Interrupts using 8051</li> </ol> <b>Software/Equipment Used</b> programs using 8051 mc	
<b>TEXT BOOKS</b>	
1.	Paul Deitel and Harvey Deitel, "C How to Program", 9th Edition, Pearson Education Limited, 2022, 1st edition.
2.	Michael J Pont, "Embedded C", Addison-Wesley, An imprint of Pearson Education, 2002.
<b>REFERENCE BOOKS</b>	
1.	<b>Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.</b>
2.	Peckol, "Embedded system Design", JohnWiley&Sons,2010
3.	Noel Kalicharan, "Learn to Program with C", Apress Inc., 2015, 1st edition.
4.	Steve Oualline, "Practical C programming", O'Reilly Media, 1997, 3rd edition.
5.	Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, 'The 8051 Microcontroller and Embedded Systems' Prentice Hall, 2nd Edition 2007.
<b>E BOOKS</b>	
1.	<a href="https://www.cprogramming.com/">https://www.cprogramming.com/</a>
2.	<a href="https://en.wikibooks.org/wiki/C_Programming">https://en.wikibooks.org/wiki/C_Programming</a>
<b>MOOC</b>	
1.	<a href="https://www.udemy.com/course/embedded-systems-programming-for-beginners/">https://www.udemy.com/course/embedded-systems-programming-for-beginners/</a>
2.	<a href="https://nptel.ac.in/courses/117106112">https://nptel.ac.in/courses/117106112</a>

[illegible]

1: Weakly related, 2: Moderately related and 3: Strongly related	
<b>MODULE 1: INTRODUCTION (6L+6P)</b>	
Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system. Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.  <b>Lab Experiments:</b>  Simulation of Robotic arm using MATLAB  Model and Control Manipulator Arm with Robotics and Simscape	<b>CO-1</b>  <b>BTL-2</b>
<b>MODULE 2: MOTION ANALYSIS I (6L+6P)</b>	
Homogeneous transformations as applicable to rotation and translation – problems Manipulator Kinematics Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems. <b>Lab Experiment</b> Build Manipulator Robot Using Kinematic DH Parameters	<b>CO-2</b>  <b>BTL-4</b>
<b>MODULE 3: MOTION ANALYSIS II (6L+6P)</b>	
Differential transformation and manipulators, Jacobians problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages <b>Lab Experiment</b> Compute Geometric Jacobian for Manipulators in Simulink	<b>CO-3</b>  <b>BTL-4</b>
<b>MODULE 4: ARDUINO INTERFACING (6L+6P)</b>	
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity Sensors. <b>Case study</b> 1. Selection of sensors based on robotics application 2. Selection of actuators based on robotics application	<b>CO-2</b>  <b>BTL-3</b>
<b>MODULE 5: ROBOT APPLICATION IN MANUFACTURING (6L+6P)</b>	
Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection. <b>Case study</b> Robot application in medicine	<b>CO-5</b>  <b>BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Mathew. N. O. Sadiku “Principles of Electromagnetics”, 6 <sup>th</sup> edition, Oxford University Press, 2015.
2.	William H. Hayt, Jr., John A. Buck, “Engineering Electromagnetics”, 8 <sup>th</sup> edition, Tata McGraw Hill, 2011.
3.	Jorden, Ballman, “Electromagnetic Fields & Radiating Systems”, 2 <sup>nd</sup> edition, Pearson, 2015.
<b>REFERENCE BOOKS</b>	
1.	John Kraus, Daniel Fleisch, “Electromagnetics with applications”, 5 <sup>th</sup> edition, McGraw Hill Education, 2017.

2.	David. K. Cheng, "Fields and Wave electromagnetics, 2 <sup>nd</sup> edition, Pearson Education, 2002.
<b>E BOOKS</b>	
1.	Constantine Balanis, "Advanced Engineering Electromagnetics", 2 <sup>nd</sup> edition, John Wiley & Sons, Inc., 2012.
2.	Sophocles J. Orfanidis, "Electromagnetic Waves and Antennas", 2016. Web page: <a href="http://www.ece.rutgers.edu/~orfanidi/ewa">www.ece.rutgers.edu/~orfanidi/ewa</a>
3.	Robert E. Collin, "Field Theory of Guided Waves", 2 <sup>nd</sup> edition, Wiley-IEEE Press, 1990.
<b>MOOC</b>	
1.	<a href="http://nptel.ac.in/courses/108106073/">http://nptel.ac.in/courses/108106073/</a> : Dr.Harishankar Ramachandran, IIT Madras.
2.	<a href="http://nptel.ac.in/courses/117101057/40">http://nptel.ac.in/courses/117101057/40</a>

COURSE TITLE	System Design Using Raspberry Pi Processor			CREDITS	3	
COURSE CODE	EECS1522	COURSE CATEGORY		NE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details		37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	The students get the necessary knowledge of the Raspberry Pi to design and develop for practical applications					
Course Objective	This course aims the student to provide introduction to Raspberry Pi being used today. This course also equips the students to learn programming skills and developing hardware projects, use them in industrial application.					
Course Outcome	Upon completion of this course, the students will be able to  1. Explains about basic knowledge on Raspberry pi and setup and operate the Raspberry Pi  2. Understand the basics of the Linux OS used on the Pi;  3. Evaluate the program Pi using the programming language Python  4. Develop skills in the design of practical solutions related to projects.  5. Create applications that make use of electrical and electronic devices					
Prerequisites: Nil						

CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	-	1	-	1	-	2	-	-	-	-	2	2	1	
CO-2	1	2	-	-	2	-	3	-	-	2	-	2	2	2	
CO-3	2	3	1	1	2	-	-	-	-	1	-	1	3	2	
CO-4	2	2	2	1	2	-	3	-	-	1	-	2	3	3	
CO-5	2	3	2	-	2	-	2	-	-	2	-	2	3	3	
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Raspberry Pi (6L+6P)															
Tour to Board- Model A/B- Raspberry Pi I- Raspberry II- Raspberry III- Raspberry Zero- ARM versus x86- Windows versus Linux  Exp 1: To study the architecture of ARM application board of Raspberry Pi  Hardware Requirement: Raspberry Pi board  Exp 2: To illustrate the OS for Raspberry Pi in a SD card and configuration of Raspberry Pi during first booting  Software Requirement: Linux image file. Win32.  Hardware requirement: Raspberry Pi board. SD card, Basic I/O Devices													CO-1  BTL-3		
MODULE 2: Linux on the Raspberry Pi (6L+6P)															
An overview to Linux- Raspbian Introduction- Using External Storage Devices- Creating User account- Software Installation  Exp 3: To display the basic linux commands on Raspberry pi  Software : Linux image file.  Hardware : Raspberry Pi board, SD card, Basic I/O Devices													CO-2  BTL-3		
MODULE 3: Python on the Raspberry Pi (6L+6P)															
Python- Objects and Modules- Troubleshooting- Basic Inputs and Outputs- Programming Inputs and Outputs with Python  Exp 4: To create a database & Store the value in Raspberry Pi.  Software: Python  Hardware: Analog to Digital Converters, Connecting Wires, Potentiometer													CO-3  BTL-3		
MODULE 4: Raspberry Pi Configuration Tool (6L+6P)															
Network Configuration-Running the tool- System tab- Interfaces- Performance- Overclock- GPU Memory- Localisation- Keyboard  Exp 5: To make a set up Raspberry Pi without I/O devices  Hardware: Raspberry Pi board, SDHC Card with Linux, Personal Computer/Laptop													CO-4  BTL-3		

MODULE 5: Building a Productivity Machine		(6L+6P)
Pi as Home theatre PC- HTPC with OSMC- Internet media-Local Network media- OSMC configuration  Exp 6: To set up OSMC on Raspberry Pi  Software : Linux image file.  Hardware: Raspberry Pi board, SD Card		<b>CO-5</b>  <b>BTL-3</b>
TEXT BOOKS		
1.	Eben Upton, Gareth Halfacree , “Raspberry Pi User Guide”, 2016	
2.	Matt Richardson, Shawn Wallace, “Getting Started with Raspberry Pi”,2012	
REFERENCE BOOKS		
1	Eben Upton, Jeffrey Duntemann, Ralph Roberts, Tim Mamtara, Ben Everard , “Learning Computer Architecture with Raspberry Pi”, 2016	
E BOOKS		
1.	<a href="https://www.amazon.com/Raspberry-Pi-Complete-Beginners-Programming-ebook/dp/B079WGWJ6L?tag=uuid10-20">https://www.amazon.com/Raspberry-Pi-Complete-Beginners-Programming-ebook/dp/B079WGWJ6L?tag=uuid10-20</a>	
2.	<a href="https://freecomputerbooks.com/compscRaspberryPiBooks.html">https://freecomputerbooks.com/compscRaspberryPiBooks.html</a>	
MOOC		
1.	<a href="https://www.mooc-list.com/tags/raspberry-pi">https://www.mooc-list.com/tags/raspberry-pi</a>	
2.	<a href="https://www.my-mooc.com/en/mooc/the-raspberry-pi-platform-and-python-programming-for-the-raspberry-pi/">https://www.my-mooc.com/en/mooc/the-raspberry-pi-platform-and-python-programming-for-the-raspberry-pi/</a>	

COURSE TITLE	EMBEDDED AUTOMOTIVE SYSTEMS			CREDITS	3		
COURSE CODE	EEEC51523	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2		
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3		
ASSESSMENT SCHEME							
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)	First Periodical Assessment
15%	15%	10%	5%	5%	25%	25%	15%
Course Description	The main objective of this course is to brief the undergraduate students to all the multidisciplinary area of Electronic Engine, Management systems and assembly of Electric vehicles						

<b>Course Objective</b>	1. To expose the students to the fundamentals and building of Electronic Engine Control systems. 2. To teach on functional components and circuits for vehicles. 3. To discuss on programmable controllers for vehicles management systems. 4. To teach logics of automation & commercial techniques for vehicle communication 5. To introduce the embedded systems concepts for E-vehicle system development														
<b>Course Outcome</b>	Upon completion of this course, the students will be able to  1. learn the significance of the role of embedded system for automotive applications. 2. Illustrate the need, selection of sensors and actuators and interfacing with ECU 3. Develop the Embedded concepts for vehicle management and control systems. 4. Demonstrate the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs 5. Understand recent trends in embedded systems design and its application in automotive systems.														
<b>Prerequisites: Nil</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>CO-1</b>	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1
<b>CO-2</b>	2	2	1	2	-	-	-	-	-	-	-	-	1	1	1
<b>CO-3</b>	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2
<b>CO-4</b>	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2
<b>CO-5</b>	2	2	2	1	1	-	-	-	1	-	-	1	1	2	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: BASIC OF ELECTRONIC ENGINE CONTROL SYSTEMS (6 L+ 6 P)</b>															
Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits and vehicle performance; Automotive microcontrollers- Electronic control Unit- Hardware & software selection and requirements for Automotive applications  Simulation and modeling of automotive system components. <b>Suggested Readings:</b> ECU-Hardware & Software <b>Case Study:</b> 5. Modelling of automotive systems													<b>CO-1 BTL-2</b>		
<b>MODULE 2: SENSORS AND ACTUATORS FOR AUTOMOTIVES (6 L+ 6P)</b>															
Review of sensors- sensors interface to the ECU, conventional sensors and actuators, Modern sensor and actuators - LIDAR sensor- smart sensors- MEMS/NEMS sensors and actuators for automotive applications <b>Suggested Readings:</b> Sensors and actuators <b>Case Studies:</b> NEMS sensors													<b>CO-2 BTL-3</b>		
<b>MODULE 3: VEHICLE MANAGEMENT SYSTEMS (6 L+ 6 P)</b>															

Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition- Adaptive cruise control - speed control-anti-locking braking system-electronic suspension - electronic steering, Automatic wiper control- body control system ; Vehicle system schematic for interfacing with EMS, ECU. Energy Management system for electric vehicles- Battery management system, power management system-electrically assisted power steering system- Adaptive lighting system- Safety and Collision Avoidance		CO-3 BTL-3
<b>Suggested Readings: Steering system</b>		
<b>Case Studies:</b> Battery Management systems		
<b>MODULE 4: ONBOARD DIAGNOSTICS AND TELEMATICS</b> (6 L+ 6 P)		
On board diagnosis of vehicles -System diagnostic standards and regulation requirements Vehicle communication protocols Bluetooth, CAN, LIN, FLEXRAY, MOST, KWP2000 and recent trends in vehicle communications- Navigation- Connected Cars technology – Tracking- Security for data communication- dashboard display and Virtual Instrumentation, multimedia electronics- Role of IOT in Automotive systems		CO-4 BTL-3
<b>Suggested Readings:</b> CAN (Hardware & software)		
<b>Case Studies:</b> IOT Automotive systems		
<b>MODULE 5: ELECTRIC VEHICLES</b> (6 L+ 6 P)		
Electric vehicles –Components- Plug in Electrical vehicle- Charging station – Aggregators- Fuelcells/Solar powered vehicles- Autonomous vehicles.		CO-5 BTL-3
<b>Suggested Readings:</b> Solar vehicles		
<b>Case Studies:</b> Electric vehicle assembly		
<b>TEXT BOOKS</b>		
1	William B. Riddens, “Understanding Automotive Electronics”, 5th Edition, Butterworth 1998.	Hennimann Woburn,
<b>REFERENCE BOOKS</b>		
1	William B. Ribbens ,”Understanding Automotive Electronics”, Elseiver,2012	
2	Automotive Electricals / Electronics System and Components, Tom Denton, 3 <sup>rd</sup> Edition, 2004.	
3	Automotive Hand Book, Robert Bosch, Bently Publishers, 1997.	
4	Jurgen, R., Automotive Electronics Hand Book.	
<b>E BOOKS</b>		
1	<a href="https://link.springer.com/book/10.1007/978-3-030-59897-6">https://link.springer.com/book/10.1007/978-3-030-59897-6</a>	
<b>MOOC</b>		
1	<a href="https://www.udemy.com/course/automotive-embedded-systems-applications/">https://www.udemy.com/course/automotive-embedded-systems-applications/</a>	

COURSE TITLE	Wearable Sensors and Devices			CREDITS	3
COURSE CODE	EEC51527	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					



First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)									
15%	15%	10%	5%	5%	25%	25%									
Course Description	The students shall develop an intuitive understanding of the need for wearable sensors and its impact in various fields such as biomedical safety etc and its applications in practical situation.														
Course Objective	1. Identify the need for development of wearable devices and its implications on various sectors. 2. Comprehend the design and development of various wearable inertial sensors and wearable bioelectrode and physiological activity monitoring devices for use in healthcare applications. 3. To familiarize the characteristics, working principle and application of special purpose transducers. 4. To impart the importance of smart sensors, sensor interface standards for wearable device applications and to provide a brief overview of wearable technology and its impact on social life.														
Course Outcome	Upon completion of this course, the students will be able to 1. Identify and understand the need for development of wearable devices and its influence on various sectors. 2. Discuss the applications of various wearable inertial sensors for biomedical applications. 3. Realize the concept of reactive sensors employed for real life applications 4. Understand the working principle of special purpose sensors and the need for developing smart sensors. 5. Design and perform experiments on the sensors and develop the projects based on the customer needs.														
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	2	2	2	1	1	-	1	1	1	2	2	2	2
CO-2	1	1	2	2	2	1	1	-	1	1	1	2	2	2	2
CO-3	1	1	2	2	2	1	1	-	1	1	1	2	2	2	2
CO-4	1	1	2	2	2	1	1	-	1	1	1	2	2	2	2
CO-5	1	1	2	2	2	1	1	-	1	1	1	2	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Wearable Devices (6L+ 6P)															

Motivation for development of Wearable Devices, The emergence of wearable computing and wearable electronics, Types of wearable sensors: Invasive, Non-invasive; Intelligent clothing, Industry sectors' overview – sports, healthcare, Fashion and entertainment, military, environment monitoring, mining industry, public sector and safety.		CO-1 BTL-3
Case Study: Health monitoring Wearables: Challenges and Opportunities		
MODULE 2: Wearable Inertial Sensors (6L+ 6P)		
Wearable Inertial Sensors - Accelerometers, Gyroscopic sensors and Magnetic sensors; Modality of Measurement- Wearable Sensors, Invisible Sensors, In-Shoe Force and Pressure Measurement; Applications: Fall Risk Assessment, Fall Detection , Gait Analysis. Physical Activity monitoring: Human Kinetics, Cardiac Activity, Energy Expenditure measurement: Pedometers, Actigraphy.		CO-2 BTL-3
Case Study: Fall detection Analysis: For stampede victim rescue		
MODULE 3: Reactive Sensors (6L+ 6P)		
Inductive sensors - variable reluctance sensors, Hall effect, Eddy current sensors, Linear variable differential transformers (LVDT), variable transformers, magneto-elastic, magneto-resistive, and magnetostrictive sensors. Capacitive sensors- variable capacitor, differential capacitor.		CO-3 BTL-3
Case Study: Wearable applications: Body/textile antennas for wireless data transmission		
MODULE 4: Self generating Sensors & Mechanical transducers (6L+ 6P)		
Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors, Wearable applications: temperature sensitive fabric, electrochemical sensors Accelerometers: Characteristics and working principle, Types- Capacitive, Piezoresistive, piezoelectric; Gyroscopes: Characteristics and working principle, Rotor Gyroscope; Diaphragm Pressure Sensor – resistive & capacitive type (micro press sensor). Wearable applications: Motion sensors for fall detection, hemiplegic and PD (Parkinson's disease) patients.		CO-4 BTL-3
Case Study: Wearable sensors : Future and Research Roadmap		
MODULE 5: Smart Sensors and Scope of Wearable Devices (6L+ 6P)		
Integrated and Smart sensors, IEEE 1451 standard & Transducer Electronic Datasheets (TEDs), Overview of various smart sensors: Digital temperature sensor (DS1621, TMP36GZ), Humidity sensor (DHT11, DHT22, FC28), IR sensor (FC51), Gas sensor (MQ2,MQ8), Pressure sensors (BMP180), Accelerometers (ADXL335), etc		CO-5 BTL-3
Case Study: Google Glass :Challenges and Opportunities		
BOOKS		
1.	Edward Sazonov, "Wearable Sensors: Fundamentals, Implementation and Applications", Elsevier,Second edition, 2021.	
2.	Jacob Fraden, "HandBook of Modern Sensors: physics, Designs and Applications", 3rd ed., Springer, 2010.	
REFERENCE BOOKS		
1	A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", DhanpatRai & Co.,2015.	
2	Seamless Healthcare Monitoring, Toshiyo Tamura and Wenxi Chen, Springer, 2018	
3	Aimé Lay-Ekuakille and Subhas Chandra Mukhopadhyay, "Wearable and Autonomous Biomedical Devices and Systems for Smart Environment", Springer 2010 .	
E BOOKS		

1.	Nilanjan Dey, Amira S. Ashour, Wearable and Implantable Medical Devices: Applications and Challenges (ISSN Book 7) 1st Edition, Kindle Edition
2.	Edward Sazonov, Wearable Sensors: Fundamentals, Implementation and Applications 2nd Edition, Kindle Edition
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc23_ee66/preview">https://onlinecourses.nptel.ac.in/noc23_ee66/preview</a>

COURSE TITLE		IOT and its Applications			CREDITS	3									
COURSE CODE	EEEC51528	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0										
Version	1.0	Approval Details	37 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL									
15%	15%	10%	5%	5%	25%	25%									
Course Description	The students shall develop an intuitive understanding of the subject that covers the fundamentals of IoT with its architecture, protocols and Applications. It also covers the overview and programming of two widely used IoT platforms Arduino and Raspberry Pi.														
Course Objective	<ul style="list-style-type: none"><li>To Determine the Market Perspective of IoT</li><li>To Understand the vision of IoT from a global context</li><li>To make student able to design smart home appliances</li></ul>														
Course Outcome	Upon completion of this course the student will be able to <ul style="list-style-type: none"><li>Illustrate the Characteristics of IoT, Things in IoT and Enabling technologies in IoT.</li><li>Demonstrate the use of Devices, Gateways and Data Management in IoT and M2M to IoT.</li><li>Design IoT Architecture in different domain and be able to analyze their performance</li><li>Implement basic IoT applications on embedded platform</li><li>Analyze the privacy, security and governance related to IoT platforms</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO-1	1	2	3	-	2	2	-	1	1	1	1	1	3	1	3
CO-2	1	1	2	2	2	2	-	1	1	1	1	1	3	1	3
CO-3	1	2	3	1	1	2	-	1	1	1	1	1	3	1	3
CO-4	1	1	3	2	2	2	-	1	1	1	1	1	3	1	3
CO-5	1	1	2	-	1	1	-	1	2	1	1	1	3	1	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: Introduction to Internet of Things (6L+ 6P)</b>															
Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling technologies, IoT challenges, IoT levels, IoT and cyber physical system, IoT and WSN, Time for Convergence, Towards the IoT Universe, Internet of Things Vision.													<b>CO-1 BTL-3</b>		
Lab Experiments: <ul style="list-style-type: none"><li>1. Familiarization with Arduino/Raspberry Pi/CC3200 LaunchPad</li><li>2. To interface LED/Buzzer with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to turn ON LED for 1 sec after every 2 sec.</li></ul>															
<b>MODULE 2: M2M to IoT (6L+ 6P)</b>															
M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.													<b>CO-2 BTL-3</b>		
Lab Experiments: <ul style="list-style-type: none"><li>1. To interface Push Button/ Digital sensor(IR/LDR) with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to turn ON LED when Push button is pressed or at sensor detection</li><li>2. To interface the DHT11 sensor with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to print temperature and humidity readings.</li></ul>															
<b>MODULE 3: IoT Architecture (6L+ 6P)</b>															
IoT Architecture -Introduction, State of the art, Architecture. Reference Model - Introduction, Reference Model and architecture, IoT reference Model. IoT Reference Architecture -Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.													<b>CO-3 BTL-3</b>		
Lab Experiments: <ul style="list-style-type: none"><li>1. To interface motor using relay with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to turn ON motor when push button is pressed</li><li>2. To interface OLED with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to print temperature and humidity readings.</li></ul>															
<b>MODULE 4: IoT Applications for Value Creations (6L+ 6P)</b>															
IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, e-Health.													<b>CO-4 BTL-3</b>		
Lab Experiments: <ul style="list-style-type: none"><li>1. To interface Bluetooth with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to send sensor data to a smartphone using Bluetooth.</li><li>2. To interface Bluetooth with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to turn LED ON/OFF when ‘1’/ ‘0’ is received from a smartphone using Bluetooth .</li><li>3. To interface OLED with Arduino/Raspberry Pi/CC3200 LaunchPad and write a program to print temperature and humidity readings.</li></ul>															
<b>MODULE 5: Internet of Things Privacy, Security and Governance (6L+ 6P)</b>															

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.		CO-5 BTL-3
<b>Lab Experiments:</b> 1. write a program to create TCP server on Arduino/Raspberry Pi/CC3200 LaunchPad and respond with humidity data to TCP client when requested 2. write a program to create a UDP server on Arduino/Raspberry Pi/CC3200 LaunchPad and respond with humidity data to UDP client when requested.		
<b>TEXT BOOKS</b>		
1.	Vijay Madiseti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited ,1st Edition,2014.	
2.	Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications,1st Edition, 2013.	
<b>REFERENCE BOOKS</b>		
1	Vasudevan, Nagarajan and Sundaram, "Internet of Things", Wiley India,2019	
2	Jeeva Jose, "Internet of Things", Khanna Book Publishing,first edition,2018.	
3	CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011.	
<b>E BOOKS</b>		
1.	<a href="https://www.pdfdrive.com/internet-of-things-books.html">https://www.pdfdrive.com/internet-of-things-books.html</a>	
2.	<a href="https://github.com/connectIoT/iottoolkit">https://github.com/connectIoT/iottoolkit</a> ~ <a href="https://www.arduino.cc/">https://www.arduino.cc/</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc22_cs53">https://onlinecourses.nptel.ac.in/noc22_cs53</a>	

COURSE TITLE	Electronic standards, codes , and specifications			CREDITS	3
COURSE CODE	EECS1536	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					
<b>CIA</b>					<b>ESE</b>
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY PRACTICAL
15%	15%	10%	5%	5%	25% 25%
Course Description	The students shall develop an intuitive understanding of the electronic standards, codes and specifications of electrical and electronics equipment, machines and basics of electronics standards and be able to apply them in practical situation.				



Quality control standards (e.g., ISO 9000 series)-Reliability standards and methods (e.g., MIL-STD-810, IEC 62380)-Statistical techniques for reliability assessment-Design for reliability and maintainability. <b>Case study :</b> 1. Study on Quality control standards 2. Study on defense applications		<b>CO-4 BTL-3</b>
<b>MODULE 5: Emerging Technologies and Future Trends (6L+6P+ 6P)</b>		
Standards for emerging technologies (e.g., IoT, renewable energy systems)-Green and sustainable standards (e.g., ISO 14000 series)-Industry-specific standards (e.g., automotive, aerospace, healthcare)-Future trends in electrical and electronic standards development. <b>Case study :</b> 1. Study on IOT standards 2. Study on Telecommunication applications -		<b>CO-5 BTL-3-</b>
<b>BOOKS</b>		
1.	Principles of Electrical and Electronic Measurements" by A. S. Sawhney by A.K. Sawhney ,2015, Danpai Rai &co.	
2.	Electrical Safety Handbook (ELECTRONICS) Hardcover – Import, 21 July 2019 by Dennis K. Neitzel (Author), Mary Capelli-Schellpfeffer (Author), Al Winfield (Author)	
<b>REFERENCE BOOKS</b>		
1	Reliability Engineering and Risk Analysis: A Practical Guide, Third Edition Hardcover –2016 by Mohammad Modarres (Author), Mark P. Kaminskiy (Author), Vasiliy Krivtsov (Author)	
2	Reliability, Maintainability and Risk: Practical Methods for Engineers Paperback – 21 2017 by David J Smith (Auteur)	
<b>E BOOKS</b>		
1.	<a href="http://www.academia.edu/8140873/A_K_Sawhney_A_course_in_Electrical_and_Electronic_Measurements_and_Instrumentation">http://www.academia.edu/8140873/A_K_Sawhney_A_course_in_Electrical and Electronic Measurements and Instrumentation</a>	
<b>MOOC</b>		
1.	<a href="https://www.my-mooc.com/en/mooc/introduction-national-electrical-safety-ieee-nesc01-x/">https://www.my-mooc.com/en/mooc/introduction-national-electrical-safety-ieee-nesc01-x/</a>	
2.	<a href="https://bestaccreditedcolleges.org/articles/online-classes-and-courses-on-electrical-codes.html">https://bestaccreditedcolleges.org/articles/online-classes-and-courses-on-electrical-codes.html</a>	

COURSE TITLE	Security Issues in IOT			CREDITS	3
COURSE CODE	EEC51537	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination	Attendance	End Semester Examination (Theory)  End Semester Examination (Practical)

				Committee “DEC											
15%	15%	10%	5%	5%	25%	25%									
Course Description	The course will elucidate the complex subjects of IoT security and privacy issues. As IoT is implemented in more applications, security, and privacy concerns about IoT grow more important. In response to this request, the course will methodically examine IoT security from the standpoints of systems, hardware, and communication.														
Course Objective	This course is designed to have students become acquainted with IoT security. Students will be able to understand IoT security related to hardware, system and networking. The recited topics include introduction to IoT, IoT Application - smart home, attacks against IoT, IoT communication protocol and Cloud computing and challenges,														
Course Outcome	Upon completion of this course, the students will be able to 1. Identify and demonstrate the variety of IoT systems architectures, essential components and challenges 2. Interpret various communication protocol used in IoT 3. Apply process involved in creating a cloud-based application 4. Reflect on the impact of current and future IoT technologies on security and privacy. 5. Discuss appropriate security and privacy solutions for real-world applications														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	3	1	3	2	2	1	1		1	1	3	2	3
CO-2	3	1	3	1	3	2	2	1	1		1	1	3	1	3
CO-3	3	1	3	1	3	2	2	1	1		1	1	2	1	3
CO-4	3	1	3	1	3	2	2	1	1		1	1	2	1	3
CO-5	3	1	3	1	3	2	2	1	1		1	1	2	1	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE I: INTRODUCTION TO IoT													(6L+6P)		
Understand different visions of the Internet of Things (IoT), enabling technologies, their advantages and disadvantages, different aspects of IoT security and privacy Suggested Reading: IoT in industry Lab Experiments: <ul style="list-style-type: none"><li>Write an arduino program to demonstrate analog I/O functions</li><li>Write an arduino program for interfacing with temperature sensor</li></ul>													CO-1 BTL-3		
MODULE II: IoT COMMUNICATION PROTOCOL													(6L+6P)		
IEEE 802.15.4 , 6LoWPAN , Message Queuing Telemetry Transport (MQTT), HART, RFID, CoAP Suggested Reading: Secure MQTT, XMPP, AMQP Lab Experiments: <ul style="list-style-type: none"><li>MQTT implementation – Mosquitto</li><li>RFID interfacing and data handling</li></ul>													CO-2 BTL-3		
MODULE 3: CLOUD COMPUTING AND ITS CHALLENGES													(6L+6P)		



Cloud Computing Fundamental: Cloud computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. <b>Suggested Reading:</b> Benefits and challenges of cloud computing <b>Lab Experiments:</b> Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim. Find a procedure to transfer the files from one virtual machine to another virtual machine.		<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: ATTACK AGAINST IoT (6L+6P)</b>		
Attacks against IoT system (hardware + software) , IoT network protocols, industry IoT <b>Suggested Reading:</b> <b>Lab Experiments:</b>		<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: IoT SECURITY (6L+6P)</b>		
Vulnerabilities, Attacks and Countermeasures. Information Assurance. Attack types. New security threats and vulnerabilities. Fault Trees and CPS. Threat Modeling. Attack, Defense, and Network Robustness of Internet of Things <b>Suggested Reading:</b> A Solution-Based Analysis of Attack Vectors on Smart Home Systems. <b>Lab Experiments/Case Studies:</b> <ul style="list-style-type: none"><li>IoT enabled Smart traffic control system</li><li>IoT enabled Agriculture</li></ul>		<b>CO-5</b> <b>BTL-3</b>
<b>BOOKS</b>		
1.	Brian Russell, Drew Van Duren, “Practical Internet of Things Security: Design a security framework for an Internet connected ecosystem”, 2nd Edition, 2018.	
2.	Drew Van Duren, Brian Russell, “Practical Internet of Things Security”, Packt, 1st Edition, 2016	
3.	N. Ida, Sensors, Actuators and Their Interfaces: A Multidisciplinary Introduction, 2nd EditionScitech Publishers, 2020	
<b>REFERENCE BOOKS</b>		
1	Sean Smith, “The Internet of Risky Things”, O'Reilly Media, 1st Edition, 2017.	
2	MayurRamgir, Internet of Things- Architecture, Implementation, and Security, New Delhi:Pearson Education, 2019	
3	Cornel Amariei, Arduino Development Cook Book,Birmingham: Packt Publishing Ltd., 2015.	
<b>E BOOKS</b>		
1.	<a href="https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf">https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf</a>	
2.	<a href="https://sectrio.com/complete-guide-to-iot-security/">https://sectrio.com/complete-guide-to-iot-security/</a>	
3.	<a href="https://link.springer.com/book/10.1007/978-981-16-1372-2">https://link.springer.com/book/10.1007/978-981-16-1372-2</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc22_cs53">https://onlinecourses.nptel.ac.in/noc22_cs53</a>	
2.	<a href="https://onlinecourses.nptel.ac.in/noc21_ee85">https://onlinecourses.nptel.ac.in/noc21_ee85</a>	

#### VERTICAL-2: COMMUNICATION SYSTEM AND SIGNAL PROCESSING

COURSE TITLE	LINEAR AND ELECTRONIC SWITCHING CIRCUITS			CREDITS	3	
COURSE CODE	EEEC51502	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the	Attendance*	THEORY	PRACTICAL

[illegible]

<p>Diode as a Switch, Piecewise Linear Diode Characteristics, Diode Switching times, Transistor as a Switch, Break down voltages, Transistor in Saturation, Temperature variation of Saturation Parameters, Transistor-switching times, Silicon-controlled-switch circuits.</p> <p><b>Suggested Readings:</b></p> <p>Transistors, SCR</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Switching characteristics of Transistor</li> <li>2. SCR Characteristics</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Workbench / Multisim</p>	<p><b>CO-2</b> <b>BTL-3</b></p>
<b>MODULE III: MULTIVIBRATORS (6L+ 6P=12)</b>	
<p>Multivibrators, Schmitt trigger, Analysis and Design of Bistable, Monostable, Astable Multivibrators using Transistors.</p> <p><b>Suggested Readings:</b></p> <p>Waveform generators</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Waveform generators using Transistors</li> <li>2. Multivibrators using Transistors</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Workbench / Multisim</p>	<p><b>CO-3</b> <b>BTL-3</b></p>
<b>MODULE IV: TIME BASE GENERATORS (6L+ 6P=12)</b>	
<p>Methods of Generating Time Base Waveform, Miller and Bootstrap Time base Generators-Basic Principles, Transistor Miller Time Base generator, Transistor Bootstrap Time Base Generator, Transistor Current Time Base Generators.</p> <p><b>Suggested Readings:</b></p> <p>General features of a Time base Signal, Methods of Linearity improvement</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Miller Time base Generators</li> <li>2. Bootstrap Time base Generators</li> </ol> <p><b>Software/Equipment Used</b></p> <p>Workbench / Multisim</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<b>MODULE V: SYNCHRONIZATION AND FREQUENCY DIVISION (6L+ 6P=12)</b>	
<p>Frequency division in Sweep Circuit, Astable Relaxation Circuits, Monostable Relaxation Circuits, Synchronization of a Sweep Circuit with Symmetrical Signals, Sine wave frequency division with a Sweep Circuit.</p> <p><b>Suggested Readings:</b></p> <p>Pulse Synchronization of Relaxation Devices, Stability of Relaxation Devices.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. UJT Relaxation oscillator</li> </ol>	<p><b>CO-5</b> <b>BTL-3</b></p>

2. Bootstrap sweep circuit		
Software/Equipment Used		
Workbench / Multisim		
TEXT BOOKS		
1.	Nashelsky, Louis, Boylestad and Robert L., “Electronic Devices and Circuit Theory”, Pearson New International Edition. Taiwan, Pearson Education, 2013.	
2.	Bell David A, “Solid State Pulse Circuits”, United Kingdom, Oxford University Press, 2019.	
REFERENCE BOOKS		
1	Jacob Millman, Christos C Halkias and Satyabrata Jit, "Electron Devices and Circuits", Tata McGraw Hill, 3rd edition 2010	
2	Donald .A. Neamen, “Electronic Circuit Analysis and Design”, 2nd Edition, Tata McGraw Hill, 2009.	
3	Thomas L. Floyd, "Electronic Devices", 9th edition, Pearson education, 2011.	
4	David A. Bell, “Electronic Devices and Circuits”, Oxford Higher Education Press, 5th Edition, 2010.	
5	Millman and H. Taub, “Pulse, Digital And Switching Waveforms”, India, McGraw-Hill Education (India) Pvt Limited, 2011.	
6	Strauss Leonard, “Wave Generation and Shaping”, United States, Literary Licensing, LLC, 2012.	
E BOOKS		
1.	<a href="https://mohamadramdhani.staff.telkomuniversity.ac.id/files/2016/08/Electronic-Devices-and-Circuit-Theory-11th-Edition-Ebook.pdf">https://mohamadramdhani.staff.telkomuniversity.ac.id/files/2016/08/Electronic-Devices-and-Circuit-Theory-11th-Edition-Ebook.pdf</a>	
MOOC		
1.	<a href="https://archive.nptel.ac.in/courses/108/102/108102097/">https://archive.nptel.ac.in/courses/108/102/108102097/</a>	
2.	<a href="https://nptel.ac.in/courses/106105185">https://nptel.ac.in/courses/106105185</a>	

COURSE TITLE		ELECTRONIC INSTRUMENTATION											CREDITS		3		
COURSE CODE		EEC51503			COURSE CATEGORY			DE						L-T-P-S		2-0-2-2	
Version		1.0			Approval Details			37 <sup>th</sup> ACM, 20.01.2023						LEARNING LEVEL		BTL-4	
ASSESSMENT SCHEME																	
First Periodical Assessment		Second Periodical Assessment			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC			Attendance			End Semester Examination (Theory)		End Semester Examination (Practical)	
15%		15%			10%			5%			5%			25%		25%	
Course Description		To equip the students with the required knowledge and practical training of the principle and operation of measuring instruments, which are used in the design of an instrument for high detectivity .															
Course Objective		1. Explain the basic electronics instruments for measuring basic parameters . 2. Elaborate Ac and DC measuring instruments .. 3. Describe the principle of Digital instruments.. 4. Explain the working principle of digital storage oscilloscope 5. Elaborate display devices and oscilloscopes.															
Course Outcome		Upon completion of this course, the students will be able to  1. Recognize the evolution and history of units and standards in Measurements 2. Identify the various measuring meters that are used in electronic instrumentation. 3. Demonstrate about analog and digital measuring instruments 4. Describe the operation of DSO. 5. To have a deep understanding about oscilloscope and display devices used in measuring instruments															
Prerequisites: Nil																	
CO, PO AND PSO MAPPING																	
CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO -8	PO- 9	PO- 10	PO- 11	PO- 12	PSO- 1	PSO-2	PSO-3		
CO-1	2	-	-	3	2	-	-	-	1	1	2	2	-	-	1		
CO-2	-	-	-	3	2	1	1	-	-	-	1	-	3	3	-		
CO-3	-	-	1	2	1	1	-	-	1	1	-	-	3	2	-		
CO-4	-	1	2	2	3	1	-	-	-	1	-	-	3	2	-		
CO-5	-	1	2	2	3	1	-	-	-	1	-	-	2	1	-		
1: Weakly related, 2: Moderately related and 3: Strongly related																	
MODULE 1: ELECTRONIC MEASUREMENTS (6L+6P)																	

<p>Introduction- units of measurements –system of units –Standards of measurements-Methods of measurements –Generalised Measurement systems –Measurement characteristics –Errors in measurements –statistical analysis .</p> <p><b>Experiments</b></p> <p>1.Measurement of Resistance by Kelvin’s Bridge Method</p> <p>2. Measurement of Self Inductance and Capacitance using Bridges.</p> <p><b>Software Required :Electronic Test Bench</b></p>	<p><b>CO-1</b></p> <p><b>BTL 3</b></p>
<p><b>MODULE 2: Ac and Dc measuring instruments (6L+6P)</b></p>	
<p>Moving iron type instruments-Thermo couple instruments –Dynamo meter instruments – Electromechanical instruments –Galvanometer –DC ammeter- DC voltmeter –ohm meter</p> <p><b>Experiments</b></p> <p>1.Measurement of Temperature using Thermocouple</p> <p>2. Measurement of Temperature using Thermister</p> <p><b>Software Required :Electronic Test Bench</b></p>	<p><b>CO-2</b></p> <p><b>BTL-3</b></p>
<p><b>MODULE 3: Digital Instruments (6L+6P)</b></p>	
<p>Introduction-Advantage of digital instruments –Comparison of analog and digital instruments – Digital voltmeter –Characteristics of digital voltmeter-Digital multimeter- Digital frequency meter system-LVDT</p> <p><b>Experiments</b></p> <p>1.Measuement of strain using Strain gauge and multimeter</p> <p>2.To determine the output characteristics of LVDT and measure displacement using LVDT</p> <p><b>Software Required :Electronic Test Bench</b></p>	<p><b>CO-3</b></p> <p><b>BTL-4</b></p>
<p><b>MODULE 4 :Digital Storage Oscilloscope (6L+6P)</b></p>	
<p>Digital Storage Oscilloscope –Digital oscilloscope technology-Digital Data acquisition- Advantages and disadvantages of digital storage oscilloscope –Application of DSO</p> <p><b>Experiments</b></p> <p>1. To study the pulse response of an RC circuit using DSO</p> <p>2. To study the diode based clipper circuit using DSO.</p> <p><b>Software Required :Electronic Test Bench</b></p>	<p><b>CO-4</b></p> <p><b>BTL-3</b></p>
<p><b>MODULE 5: Display devices and recorders (6L+6P)</b></p>	

Introduction- Analog displays and Recorders –CRT display- Data plotter- Types of plotters - Electroluminescent Displays- Light emitting displays –Magnetic and optical recording –Liquid crystal displays		CO-5 / BTL-2
<b>Experiments</b>  1.Measure the amplitude ,time period and frequency of time varying signals 2. Measurement of phase difference & frequency using CRO		
<b>Software Required :Electronic Test Bench</b>		
<b>TEXT BOOKS</b>		
1.	Khurana Rohit ,”Electronic Instrumentation and Measurement”, Vikas Publishing house, 2015	
2.	John G. Webster, Halit Eren ,”Measurement, Instrumentation, and Sensors Handbook”, CRC press, 2017.	
<b>REFERENCE BOOKS</b>		
1.	Robert B. Northrop ,”Introduction to Instrumentation and Measurements”,Third Edition 2018,CRC Press , Tailor and Francies group	
2.	Davide Bucci,”Analog Electronics for Measuring Systems”,2017, WILEY ISTE ,Focus Electronics Engineering Series	
3	Syed Akhtar Imam, Vibhav Kumar Sachan ,”Electronic Measurement and Instrumentation” I K International Publishing House; 0 edition 30 October 2018	
<b>E Book links</b>		
1	<a href="https://books.google.co.in/books?id=dLKIDAAQBAJ&amp;printsec=frontcover&amp;source=gbs_ge_summary_r&amp;cad=0#v=onepage&amp;q&amp;f=false">https://books.google.co.in/books?id=dLKIDAAQBAJ&amp;printsec=frontcover&amp;source=gbs_ge_summary_r&amp;cad=0#v=onepage&amp;q&amp;f=false</a>	
2	<a href="https://books.google.co.in/books?id=sDRIDwAAQBAJ&amp;printsec=frontcover&amp;source=gbs_ge_summary_r&amp;cad=0#v=onepage&amp;q&amp;f=false">https://books.google.co.in/books?id=sDRIDwAAQBAJ&amp;printsec=frontcover&amp;source=gbs_ge_summary_r&amp;cad=0#v=onepage&amp;q&amp;f=false</a>	
3	<a href="https://books.google.co.in/books?id=4dM-bX0X2HAC&amp;printsec=frontcover&amp;source=gbs_ge_summary_r&amp;cad=0#v=onepage&amp;q&amp;f=false">https://books.google.co.in/books?id=4dM-bX0X2HAC&amp;printsec=frontcover&amp;source=gbs_ge_summary_r&amp;cad=0#v=onepage&amp;q&amp;f=false</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc22_ee112/preview">https://onlinecourses.nptel.ac.in/noc22_ee112/preview</a>	
2	<a href="https://www.iare.ac.in/?q=courses/elective/electronic-measurements-and-instrumentation">https://www.iare.ac.in/?q=courses/elective/electronic-measurements-and-instrumentation</a>	

COURSE TITLE		FUNDAMENTALS OF NANOSCIENCE						CREDITS		3					
COURSE CODE	EEC51511	COURSE CATEGORY				DE		L-T-P-S		2-0-2-2					
Version	1.0	Approval Details				37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL		BTL3					
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC		Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)					
15%	15%	10%		5%		5%		25%		25%					
Course Description	This course presents introductory concepts of Nanoscience to students to develop emerging device applications to perform advanced smart applications such as energy conversion, sensing, and display technologies. The course will equip the students to understand essential theory required to develop next generation technologies in terms of emerging materials, and Physics. Structural, optical, electrical and mechanical properties of nanomaterials and their influence on device applications will be a major component of the course. Students can expect correlating basic Physics into the design of functional materials and fabrication methodologies of Nanodevices influenced by size-effects. This course will definitely have plenty of room at the bottom.														
Course Objectives	6. To learn Physics of Nano and why Nano is significant in various device technologies. 7. To understand size-effects on physical properties functional materials. 8. To study size-effects of functional materials on device applications. 9. To demonstrate the effects of material and device dimensions on various applications. 10. To project how the future device technologies will be. 11. To be conscious on the effects of Nanomaterials to the environment.														
Course Outcomes	Upon completion of this course, the students <i>will be able to</i> 6. Connect the concepts of Nanoscience into various materials and devices 7. Apply the knowledge of Nanomaterials to design devices for energy conversion, sensing and display. 8. Understand the concepts of Nanoscience with a major focus on Physics and Materials. 9. Interpret the effects of material dimensions in terms of device applications. 10. Work with emerging nano-functional materials to fabricate devices.														
Prerequisites: Knowledge in Physics and Mathematics at higher secondary level															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO1	3	3	-	-	-	-	-	1	3	-	-	3	-	-	-
CO2	3	3	-	2	3	-	-	1	3	-	-	3	-	-	-
CO3	3	3	-	-	1	-	-	1	3	-	-	3	-	-	-
CO4	3	3	-	2	-	-	-	1	3	-	-	3	-	-	-
CO5	3	3	-	-	3	-	-	1	3	-	-	3	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															



MODULE 1: Physics of NANO (6L+6L)	
Why Nano-What is Nano-The Physics of Nano-Quantum Postulates-Dimensions in Nano-0D-1D-2D-3D- Effects of Size and Dimensionality-Quantum Confinement-Density of states-Light-Matter Interaction- Charge Transport-Issues in scalability <b>Practical Component:</b> Assess the size variation in nanomaterial using optical absorption spectroscopy	CO1 BTL3
MODULE 2: Nanomaterials: Synthesis and Studies (6L+6L)	
Introduction to Physical and Chemical vapor deposition methods- Wet chemical processing-Introduction to the concepts of Top down and Bottom up approaches- Nano characterization: Nanomorphology-Scanning and Transmission Electron Microscopy Techniques, Optical-UV visible and IR spectroscopy. Surface-X-ray photoelectron spectroscopy-Atomic Force Microscopy, X-ray diffraction and particle size effects. Practical: Wet-chemical processing of Au Nanoparticles-Absorption, transmittance and reflection using optical UV-Visible spectroscopy-demonstrate the size effects-CVD and PVD based thin film coating-structural, optical and electrical characterization. <b>Practical Component:</b> Coating of nanofilms and measure electrical conductivity using two and four probe methods.	CO2 BTL3
MODULE 3: Introduction to Nanodevices (6L+6L)	
Comparison of Classical and Nanodevices-Moore's law-Concepts in Nanodevices-charge transport and band structures, Effects of density of states-Scaling Effects-Concepts of nano-physics needed for the design and analysis. <b>Practical Component:</b> Fabrication of PN junction and study charge transport, mobility and photo-responsivity.	CO3 BTL3
MODULE 4: Nanofabrication (6L+6L)	
Clean room environment- Processes of wafer cleaning and gettering-Photoresist- Photolithography- Etching-Metallization for electrodes-Top down and Bottom up approaches-epitaxy-thin film devices- electron beam lithography, focused ion beam lithography <b>Practical Component:</b> Fabrication of Schottky barrier diode and study I-V characteristics.	CO4 BTL3
MODULE 5: Nano and the environment (6L+6L)	
Effects of physical and chemical material processing on the environment-invisibility and contamination- air, water and soil resources- toxicity and nanomaterials-remediation-solid/liquid waste management- health issues, future scope <b>Practical Component:</b> Examination of Nanoparticle contamination in environment and human health-Case studies.	CO5 BTL3
TEXT BOOKS	
1	Gabor L. Hornyak, Joydeep Dutta, H.F. Tibbals, Introduction to Nanoscience, CRC Press, (2008).
2	Nanostructures and Nanomaterials - Synthesis, Properties and Applications - Cao, Guozhong, Ying Wang, World Scientific, (2011).
REFERENCE BOOKS	
1.	V. V. Mitin, V. A. Kochelap, M. A. Satrosco, Introduction to Nanoelectronics: Science, Technology, Engineering & Applications, Cambridge University Press, (2008).
2.	Supriyo Datta, Quantum Transport: Atom to Transistor; Cambridge University Press (2005).
3.	Jamie R. Lead, Emma Smith, Environmental and Human Health Impacts of Nanotechnology, Wiley, (2009).

COURSE TITLE	OPTO ELECTRONICS DEVICES			CREDITS	3
COURSE CODE	EEEC51514	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME															
First Periodical Assessment		Second Periodical Assessment			Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC		Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)		
15%		15%			10%		5%		5%		25%		25%		
Course Description		Optoelectronics is a field of study and application of physics of light with electricity. It encompasses the study, design and manufacture of hardware device and convert electrical signal into photon signal and vice versa. Course is based on the quantum mechanical effects of light on electronic materials, especially semiconductors, sometimes in the presence of electric fields. This is a relatively new and technologically very advance sector.													
Course Objective		1. To understand the basics of solid-state physics 2. To understand the basics of display devices 3. To understand the optical detection devices. 4. To understand about optical modulators. 5. To understand the design of optoelectronic integrated circuits													
Course Outcome		Upon completion of this course, the students will be able to 1. Describe the wave nature of light and the quantum mechanical treatment of light. 2. Distinguish between Electro Luminescence, photo Luminescence, Cathode Luminescence, and Injection Luminescence and recognize various features of optical laser. 3. Analyze mechanism of operation of photo detector, Thermal Detector, Photo device, Photo Conductors, Photo Diodes by studying their performance characteristics. 4. Categorize Analog and Digital Modulation, Electro-optic modulators and solve problem related to optical Switching and Logic devices. 5. Appraise the development of Optical Integrated Circuit (OIC) and Integrated Transmitter and Receiver.													
Prerequisites: Electronic Devices Circuits															
CO, PO AND PSO MAPPING															
CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	0	0	0	0	0	0	0	0	2	2	2	3
CO-2	3	2	3	0	0	0	0	0	0	0	0	2	2	2	3
CO-3	3	2	3	0	0	0	0	0	0	0	0	2	2	2	3
CO-4	3	2	3	0	0	0	0	0	0	0	0	2	2	2	3
CO-5	3	2	3	0	0	0	0	0	0	0	0	2	2	2	3
1: Weakly related, 2: Moderately related and 3: Strongly related															

<b>MODULE 1: ELEMENTS OF LIGHT AND SOLID STATE PHYSICS</b>		<b>(6L+6P)</b>
Wave nature of light, Polarization, Interference, Diffraction, Light Source, Review of Solid-State Physics, Review of Semiconductor Physics and Semiconductor Junction Device		<b>CO-1</b> <b>BTL-3</b>
<p><b>Suggested Reading:</b></p> <ol style="list-style-type: none"> <li>1. Review of Solid-State Physics</li> <li>2. Light Source-Black body Radiation</li> <li>3. Energy bands in solids</li> </ol> <p><b>Case study</b></p> <ul style="list-style-type: none"> <li>• Wave nature of light, Polarization, Interference, Diffraction</li> <li>• Polarization, Interference and Diffraction of Light</li> </ul>		
<b>MODULE II: DISPLAY DEVICES AND LASERS</b>		<b>(6L+6P)</b>
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications		<b>CO-2</b> <b>BTL-3</b>
<p><b>Suggested Reading:</b></p> <ol style="list-style-type: none"> <li>1. Radiative recombination Process</li> <li>2. Plasma Display</li> <li>3. Numeric Displays, Laser</li> </ol> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Study of V-I characteristics of LED using optical transceiver kit.</li> <li>2. Study of V-I characteristics of Photodiode using optical transceiver kit.</li> </ol>		
<b>MODULE III: – OPTICAL DETECTION DEVICES</b>		<b>(6L+6P)</b>
Thermal detector-The bolometer, Pneumatic detector, Pyro electric detector, Photon Devices-Vacuum Photodiode, Photo emissive devices, Photo multipliers, Photoconductive detector, Photo Counting Technique, Solar cells		<b>CO-3</b> <b>BTL-3</b>
<p><b>Suggested Reading:</b></p> <ol style="list-style-type: none"> <li>1. Detector Performance Parameter</li> <li>2. Photo devices-Image intensifiers and Detectors arrays</li> </ol> <p><b>Small Design Project</b></p> <p>Small project using solar cell</p>		
<b>MODULE IV: OPTOELECTRONIC MODULATOR</b>		<b>(6L+6P)</b>
Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acousto-Optic devices, Optical, Switching and Logic Devices		<b>CO-4</b> <b>BTL-3</b>
<p><b>Suggested Reading:</b></p> <ul style="list-style-type: none"> <li>• Properties of Optoelectronics Modulators</li> <li>• Types of Electro optics Molators</li> <li>• Application of Optoelectronics Modulators</li> </ul> <p><b>Case study</b></p> <ul style="list-style-type: none"> <li>• Properties of Optoelectronics Modulators</li> <li>• Electro-optic modulators, Magneto Optic Devices, Acousto-Optic devices</li> </ul>		
<b>MODULE V: – OPTOELECTRONIC INTEGRATED CIRCUITS</b>		<b>(6L+6P)</b>
Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices		<b>CO-5</b> <b>BTL-3</b>

<b>Suggested Reading:</b> <ol style="list-style-type: none"><li>1. Optical Amplifiers</li><li>2. Optical Logic Gates</li><li>3. Application Logic gates application</li></ol> <b>Case study</b> <ul style="list-style-type: none"><li>• Application of Opto Electronic Integrated Circuits Polarization,</li><li>• Integrated transmitters and Receivers</li></ul>		
<b>TEXT BOOKS</b>		
1	J Wilson and JFB Hawkes, Optoelectronics – an Intro duction, PHI, 3/e, 2010	
2	Pallab Bhattacharya, Semiconductor Optoelectronic Devices, PHI, 2/e, 2009	
<b>REFERENCE BOOKS</b>		
1	John M Senior, Optical Fiber Communication – principle and practices, PHI, 3/e, 2010.	
2	Djafar K Manbaev, Fiber-Optic Communication technology, Pearson Education, 6 <sup>th</sup> Reprint, 2012	
<b>E BOOKS</b>		
1	<a href="https://www.free-ebooks.net/internet-technology/All-Optical-Signal-Processing-with-Semiconductor-Optical-Amplifiers-and-Tunable-Filters">https://www.free-ebooks.net/internet-technology/All-Optical-Signal-Processing-with Semiconductor-Optical-Amplifiers-and-Tunable-Filters</a>	
2	<a href="https://www.free-ebooks.net/internet-technology/Optoelectronic-Devices-and-Properties">https://www.free-ebooks.net/internet-technology/Optoelectronic-Devices-and- Properties</a>	
3	<a href="https://onlinelibrary.wiley.com/doi/book/10.1002/9781118688977">https://onlinelibrary.wiley.com/doi/book/10.1002/9781118688977</a>	
<b>MOOC</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc16_mm01/announcements">https://onlinecourses.nptel.ac.in/noc16_mm01/announcements</a>	
2	<a href="https://nptel.ac.in/courses/117/108/117108142/">https://nptel.ac.in/courses/117/108/117108142/</a>	
3	<a href="https://nptel.ac.in/courses/115/102/115102026/">https://nptel.ac.in/courses/115/102/115102026/</a>	
4	<a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-974-fundamentals-of-photonics-quantum-electronics-spring-2006/download-course-materials/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-974- fundamentals-of-photonics- quantum-electronics-spring-2006/download-course- materials/</a>	

COURSE TITLE	Neural Networks			CREDITS	3
COURSE CODE	EECS1520	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)
15%	15%	10%	5%	5%	25%
					25%

<b>Course Description</b>	The objective of this course is to present sufficient background in neural network so that students in future can pursue advanced soft computing methodologies. This course combines knowledge, techniques, and methodologies from various sources, using techniques from neural networks.
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. Develop the skills to gain a basic understanding of neural network theory .</li> <li>2. To introduce the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks.</li> <li>3. Discuss neural networks architectures, algorithms and applications.</li> <li>4. Introduce the theory and applications of artificial neural network to engineering applications with emphasis on image processing and control.</li> <li>5. Reveal different applications of these models to solve engineering and other problems.</li> </ol>
<b>Course Outcome</b>	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>1. Identify and recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem.</li> <li>2. Comprehend the concepts of feed forward neural networks</li> <li>3. Analyze the various feedback networks.</li> <li>4. Analyze basic Fuzzy Systems.</li> </ol>

#### CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	0	0	2	0	0	0	0	0	0	0	2	2	2
CO-2	2	2	1	2	2	0	0	0	0	0	0	0	2	2	2
CO-3	2	2	2	2	2	0	0	0	0	0	0	0	3	3	3
CO-4	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3
CO-5	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

#### MODULE 1: ARCHITECTURE OF NEURAL NETWORKS

(6 L+ 6P)

Introduction –Biological neuron-Artificial neuron-Neuron modeling Learning rules-Single layer-Multi layer feed forward network-Back propagation-Learning factors.  
Case Study : Comparative Study on Biological and Artificial neuron

**CO-1  
BTL-3**

#### MODULE 2: BACKPROPAGATION NETWORKS

(6 L+ 6P)

Architecture of a Backpropagation network, backpropagation Learning, Illustration, Applications, Effect of tuning parameters of the backpropagation neural network.  
Lab Experiments : Design for Facial Recognition using BPN in Deep Learning.

**CO-2  
BTL-3**

#### MODULE II FEED FORWARD NETWORKS

(6 L+ 6P)

Feedback networks – Discrete time hop field networks – Transient response of continuous time networks – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

Lab Experiments: Design a model for Signature Verification and Handwriting Analysis using Artificial Neural Networks.

**CO-3  
BTL-3**

#### MODULE 4: ASSOCIATIVE MEMORIES

(6 L+ 6 P)

Paradigms of Associative Memory, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function.		CO-4 BTL-3
Lab Experiments : Design a model to analyze stress in Education using BAM .		
MODULE 5: FUZZY SYSTEMS		(6 L+ 6)
Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules. Lab Experiments: Lab Experiments: Design an Optimal Fuzzy Logic Controller of a DC Motor		CO-5 BTL-3
TEXT BOOKS		
1	A Text book on Neural Networks and Deep learning by Charu.C. Agarwal 2023. ( <a href="https://www.deeplearningbook.org/">https://www.deeplearningbook.org/</a> )	
2	A Textbook on Neural Networks for Pattern Recognition by Christopher M.Bishop ,2022	
REFERENCE BOOKS		
1	Neural Networks and Deep Learning by Michael Nielson 2015	
2	Artificial Neural Networks by Francois Duval 2018.	
E BOOKS		
1	<a href="https://drive.google.com/file/d/0B2iRDvP8jUuAUnpfaDBnQTBWLUU/edit">https://drive.google.com/file/d/0B2iRDvP8jUuAUnpfaDBnQTBWLUU/edit</a>	
MOOC		
1	<a href="https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge07/">https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge07/</a>	

COURSE TITLE	VIRTUAL AND AUGMENTED REALITY			CREDITS	3
COURSE CODE	EECS1521	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY PRACTICAL
15%	15%	10%	5%	5%	25% 25%
<b>Course Description</b>	This course makes the students know the concepts and framework of virtual reality. The course will cover VR and AR hardware and different modeling techniques. This course provides students with an opportunity to explore the applications and issues in Virtual Reality and Augmented Reality (VR & AR).				

<b>Course Objective</b>	1. To learn the basics of VR and its components 2. To explore the various input output devices available with its advantages and limitations 3. To study about the different modelling techniques available for VR design 4. To learn about human factors research in VR 5. To explore other similar technologies like Augmented reality and Mixed reality with its applications.														
<b>Course Outcome</b>	Upon completion of this course, the students will be able to 1. Describe the basics of VR and the components that are the building blocks of VR system 2. Demonstrate the operating principles of various input output devices and summarize its advantages and limitations 3. Explore different modelling techniques available for VR design with their limitations and advantage 4. Examine the different areas of human factors research in VR and to evaluate the benefits and drawbacks of specific VR techniques on the human body 5. Classify the characteristics and components of other similar technologies like Augmented reality and Mixed reality in the area of market potential and applications														
<b>Prerequisites: Nil</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>CO-1</b>	3	2	2	1	-	-	-	-	-	-	-	2	-	-	-
<b>CO-2</b>	3	2	2	1	-	-	-	-	-	-	-	2	-	-	-
<b>CO-3</b>	3	3	3	1	-	-	-	-	-	-	-	2	-	-	-
<b>CO-4</b>	3	3	2	1	-	2	2	-	-	-	-	2	-	-	-
<b>CO-5</b>	3	2	2	1	-	-	-	-	-	-	-	2	-	-	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>													<b>(6L+ 6P)</b>		
The three I’s of virtual reality, commercial VR technology and the five classic components of a VR system three phase system, basic safety measures at home and industry <b>Suggested Readings:</b> Evolution of Virtual Reality <b>Lab Experiments</b> 1. An experiment on the effects of different lighting conditions on immersion in a virtual environment 2. An experiment on the effects of different types of input devices on user performance in a virtual environment. <b>Software/Equipment Used</b> UNITY /OPENVR/UNREAL Engine													<b>CO-1 BTL-3</b>		
<b>MODULE 2: INPUT DEVICES AND OUTPUT DEVICES</b>													<b>(6L+ 6P)</b>		

Trackers, Navigation, and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces, Output Devices: Graphics displays, sound displays & haptic <b>Suggested Readings:</b> Advances in Tracking devices and Display devices <b>Lab Experiments</b> 1. Virtual Reality Drawing Experiment 2. Haptic Feedback Experiment <b>Software/Equipment Used</b> UNITY /OPENVR/UNREAL Engine		CO-2 BTL-3
MODULE 3: MODELING (6L+ 6P)		
Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management <b>Suggested Readings:</b> Best practices in Modeling <b>Lab Experiments</b> 1. 3D Printing Experiment 2. Robotics Simulation Experiment 3. Vehicle Dynamics Experiment <b>Software/Equipment Used</b> UNITY /OPENVR/UNREAL Engine		CO-3 BTL-3
MODULE 4: HUMAN FACTORS (6L+ 6P)		
Methodology and terminology, user performance studies, VR health and safety issues, Applications: Medical applications, military applications, robotics applications. <b>Suggested Readings:</b> VR effect in human – Case study <b>Lab Experiments</b> 1. Medical VR Training Experiment: 2. Military VR Training Experiment: <b>Software/Equipment Used</b> UNITY /OPENVR/UNREAL Engine		CO-4 BTL-3
MODULE 5: INTRODUCTION TO MIXED AND AUGMENTED REALITY (6L+ 6P)		
Key concepts and techniques at work in Mixed and Augmented Reality. business aspects of augmented reality: AR market, the potential applications and the value chain. characteristics of AR systems, components of an AR architecture. <b>Suggested Readings:</b> Latest applications in AR and MR <b>Lab Experiments</b> 1. Tracking 2. Rendering <b>Software/Equipment Used</b> UNITY /OPENVR/UNREAL Engine		CO-5 BTL-3
BOOKS		
1.	Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc., 2003.	
2.	Virtual Reality Systems, John Vince, Pearson Education, 1995	
3	Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan Craig, Elsevier (Morgan Kaufmann), 2018.	
REFERENCE BOOKS		
1	3D Modeling and surfacing, Bill Fleming, Elsevier (Morgan Kauffman), 1999	
2	3D Game Engine Design, David H.Eberly, Elsevier, 2006	





[illegible]

REFERENCE BOOKS	
1	Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, —Ad Hoc Mobile Wireless Networks  , Auerbach Publications, 2008.
2	Carlos De Morais Cordeiro, Dharma Prakash Agrawal, —Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)  , World Scientific Publishing, 2011.
3	Waltenegus Dargie, Christian Poellabauer, —Fundamentals of Wireless Sensor Networks Theory and Practice  , John Wiley and Sons, 2010
E BOOKS	
1	<a href="https://www.taylorfrancis.com/books/mono/10.4324/9781420040401/handbook-ad-hoc-wireless-networks">https://www.taylorfrancis.com/books/mono/10.4324/9781420040401/handbook-ad-hoc-wireless-networks</a>
MOOC	
1	<a href="https://nptel.ac.in/courses/106105160">https://nptel.ac.in/courses/106105160</a>

COURSE TITLE	SATELLITE AND RADAR COMMUNICATION			CREDITS	3	
COURSE CODE	EEC51530	COURSE CATEGORY	DE		L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project/Practical	Surprise Test / Quiz	Attendance	ESE (Theory)	ESE (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	In this course, fundamental principles of different types of radar systems and basic characteristics and services of satellite systems will be introduced. In addition to these fundamental discussions, this course introduces other crucial and significant applications of these two systems, such as weather monitoring and surveillance systems.					
Course Objective	<b>The course should enable the students to</b> 1. Analyze Kepler’s laws of Planetary motion and its application to Earth satellite systems and it’s control Know radar fundamentals and analysis of the radar signals. 2. Understand the various the types of orbits and launching satellite into their orbits and the maintenance of the satellite systems 3. To impart the knowledge of radar fundamentals and analysis of the radar signals. 4. Learn the types of radars and its comparison 5. Know the measurements and application RADAR and satellite services					
Course Outcome	Upon completion of this course, the students will be able to  1. Describe the Kepler’s laws of Planetary motion and its application to Earth satellite systems, orbital elements and controlling of them. 2. Discuss the types of orbits and launching satellite into their orbits and maintaining them throughout their life. 3. Explain the radar fundamentals and analysis of the radar signals. 4. Discuss various radars like MTI, Doppler and tracking radars and their comparison. 5. Relate the measurement parameters and applications of RADARS and also explain the satellite services and application					
Prerequisites: Nil						
CO, PO AND PSO MAPPING						

[illegible]

1.	Radar Handbook- MERILL I SKOLNIK- Tata McGraw Hill -3 <sup>rd</sup> edition 2003.
2.	Timothy Pratt – Charles Bostian& Jeremy Allmuti, Satellite Communications, John Willy & Sons (Asia) Pvt. Ltd. 2004
<b>EBOOK</b>	
1.	<a href="http://www.radartutorial.eu/druck/Book1.pdf">http://www.radartutorial.eu/druck/Book1.pdf</a>
2.	<a href="https://ocw.mit.edu/resources/res-ll-001-introduction-to-radar-systems-spring-2007/">https://ocw.mit.edu/resources/res-ll-001-introduction-to-radar-systems-spring-2007/</a>
3.	<a href="http://www.radartutorial.eu/druck/Book1.pdf">http://www.radartutorial.eu/druck/Book1.pdf</a>
<b>MOOC</b>	
1.	<a href="https://nptel.ac.in/courses/117105131">https://nptel.ac.in/courses/117105131</a>
2.	<a href="https://www.coursera.org/lecture/remote-sensing/module-3-lecture-11-fundamentals-of-radar-imaging-mRPiS">https://www.coursera.org/lecture/remote-sensing/module-3-lecture-11-fundamentals-of-radar-imaging-mRPiS</a>
3.	<a href="https://isat.iirs.gov.in/mooc.php">https://isat.iirs.gov.in/mooc.php</a>

COURSE TITLE	Smart Antennas			CREDITS	3	
COURSE CODE	EEEC51546	COURSE CATEGORY	TP	L-T-P-S	2-0-2-2	
Version	XX	Approval Details	XX	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance *	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	Smart antennas, also known as adaptive antennas, are advanced antenna systems equipped with digital signal processing capabilities that can adapt their radiation pattern to optimize the transmission and reception of wireless signals. They use techniques like beamforming and spatial filtering to focus signals in specific directions, enhancing signal quality and reducing interference in wireless communication systems. Smart antennas are crucial in improving the performance and efficiency of technologies such as 5G, Wi-Fi, and radar systems.					
Course Objective	● To optimize wireless communication by improving signal quality, increasing network capacity, and reducing interference.					
Course Outcome	1. Analyze the environmental factors influencing signal processing in smart antenna systems 2. Evaluate the requirements for the design and implementation of smart antenna systems 3. Explain the fundamental structure, characteristics, and advantages of smart antennas. 4. Demonstrate the capability to incorporate smart antenna technology into the overall design, principles, and performance of communication systems. 5. Analyze the beam forming techniques and adaptive array techniques.					

CO, PO AND PSO MAPPING															
CO	PO -1	PO- 2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO- 11	PO- 12	PSO-1	PSO-2	PSO-3
CO -1	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO -2	2	2	1	2	-	-	-	-	-	-	-	-	1	1	1
CO -3	1	2	2	-	-	-	-	-	1	-	-	1	2	1	1
CO -4	1	2	2	-	-	-	-	-	1	-	-	1	2	1	1
CO -5	2	2	2	1	1	-	-	-	1	-	-	1	2	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
Module 1:Smart Antennas															
Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.  To plot 2-D and 3-D radiation pattern of directional antenna .													CO-1 BTL-2		
MODULE 2: DOA Estimation Fundamentals															
Introduction, Array Response Vector, Received Signal Model, Conventional DOA Estimation Methods, Conventional Beamforming Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm.  2. To design and simulate the linear array using antenna designing software.													CO-2 BTL-3		
MODULE 3: Beam Forming Fundamentals															
Classical Beam former, Statistically Optimum Beamforming Weight Vectors, Maximum SNR Beam former, Multiple Sidelobe Canceller and Maximum, SINR Beam former, Adaptive Algorithms for Beamforming  3. To design and simulate the microstrip antenna using antenna designing software.													CO-3 BTL-3		
MODULE 4- Integration and Simulation of Smart Antennas															
overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, DOA, Adaptive Beam forming  4.To design and simulate the MIMO antenna using antenna designing software													CO-4 BTL-3		
MODULE 5: Space–Time Processing															
Introduction, Discrete Space–Time Channel and Signal Models, Space– Time Beamforming, Inter symbol and Co-Channel Suppression, Space–Time Processing for DSCDMA, Capacity, and Data Rates in MIMO Systems													CO-5 BTL-3		

5.To design and simulate the adaptive beam steering antenna using antenna designing software	
<b>TEXT BOOKS</b>	
1.Constantine A. Balanis & Panayiotis I. Ioannides, “Introduction to Smart Antennas”, Morgan & Claypool Publishers’ series-2007 2.Joseph C. Liberti Jr., Theodore S Rappaport, “Smart Antennas for Wireless CommunicationsIS-95 and Third Generation CDMA Applications”, PTR – PH publishers 3018	
<b>REFERENCE BOOKS</b>	
1	T.S Rappaport, “Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location”, IEEE press 1998, PTR – PH publishers 1999.
2	Lal Chand Godara, “Smart Antennas”, CRC Press, LLC-20
<b>E BOOKS</b>	
1	<b>Robert C. C. Hansen” Smart Antennas: Microwave and Optical Engineering”</b>
<b>MOOC</b>	
1	<a href="#">NPTEL :: Electronics &amp; Communication Engineering - Advanced Antenna Theory</a>

COU Low Power VLSI RSE TITLE	High Speed Communication Networks			CREDITS	3	
COURSE CODE	EEEC51547	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	Overview of probability and stochastic process, Queuing analysis, single server and multi-server queues, queues with priorities, networks of queues, Self-similar Data traffic Congestion control in data networks and internets, Link level flow and error control, TCP traffic control, Traffic and congestion control in ATM networks					
Course Objective	To impart the students a thorough exposure to the various high speed networking technologies and to analyse the methods adopted for performance modeling, traffic management and routing					

Course Outcome	1.Compare and analyse the fundamental principles of various high speed communication networks and their protocol architectures 2. Analyse the methods adopted for performance modeling of traffic flow and estimation 3. Examine the congestion control issues and traffic management in TCP/IP and ATM networks 4. Compare, analyse and implement the various routing protocols in simulation software tools 5. Examine the various services.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO-2	2	2	1	2	-	-	-	-	-	-	-	-	1	1	1
CO-3	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2
CO-4	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2
CO-5	2	2	2	1	1	-	-	-	1	-	-	1	1	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: HIGH SPEED NETWORKS (6L+6P)															
Introduction-frame relay networks –ATM protocol architecture-ATM logical connection –ATM cells-ATM service categories -AAL- high speed LANS: the emergence of high speed LANS-Ethernets-fiber channel-wireless LANS  Lab Experiments:  Study of basic network command and Network configuration commands. Performing an Initial Switch Configuration													CO-1 BTL-2		
MODULE 2: CONGESTION AND TRAFFIC MANAGEMENT (6L+6P)															
Congestion control in data networks and internets-link level flow and error control- TCP traffic -congestion control in ATM networks.- Interior routing protocols.  Lab Experiments:  Configuring WEP on a Wireless Router Configuring and Troubleshooting a Switched Network													CO-2 BTL-3		
MODULE 3: QOS IN IP NETWORKS (6L+6P)															
Integrated service architecture-queuing discipline -random early detection differentiated services protocol for QOS support- RSVP- multiportal Label switching - real time transport protocol- IP version six.  Lab Experiments:  Implementing an IP Addressing Scheme													CO-3 BTL-3		



Configuring Ethernet and Serial Interfaces		
MODULE 4-PRINCIPLES OF WIRELESS NETWORK OPERATION (6L+6P)		
Local broad band and Ad hoc networks. Introduction to wireless LANS-IEEE 802.11 WLAN-WATM-HIPERLAN-Ad hoc networking and WPAN. <b>Lab Experiments:</b> Examining Network Address Translation (NAT) Observing Static and Dynamic Routing		CO-4 BTL-3
MODULE 5: NETWORK MANAGEMENT AND APPLICATION		(6L+6P)
Network management- choosing a configuration method-MIB-SNMP-XMLCORBA- COPS-VPNS-mobile IP-voice over IP. <b>Lab Experiments:</b>  Configuring Ethernet and Serial Interfaces Planning Network-based Firewalls		CO-5 BTL-3
TEXT BOOKS		
1	W. Stallings," High Speed networks and Internets", second edition, Pearson Education,2002	
2	A.Pattavina,"Switching Theory",Wiley,1998.	
3	J.F.Kurose and K.W.Ross",Computer networking" 3rd edition,Pearson education,2005	
REFERENCE BOOKS		
1	M. Schwartz, "Telecommunication networks, protocols, modeling and analysis", Pearson education,2004	
2	Giroux,N. and Ganti,S. "Quality of service in ATM networks", Prentice Hall ,1999	
E BOOKS		
1	<a href="https://link.springer.com/book/10.1007/978-1-4615-3450-1">https://link.springer.com/book/10.1007/978-1-4615-3450-1</a>	
MOOC		
2	<a href="https://onlinecourses.nptel.ac.in/noc22_ee61/preview">https://onlinecourses.nptel.ac.in/noc22_ee61/preview</a>	

### VERTICAL-3: VLSI TECHNOLOGY

COURSE TITLE	VERILOG HDL			CREDITS	3
COURSE CODE	EEEC51504	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	End Semester Examination (Theory) End Semester Examination (Practical)

15%	15%	10%	5%	5%	25%	25%									
Course Description	Designing digital circuits, behavioural and RTL modeling of digital circuits using Verilog HDL, verifying these Models and synthesizing RTL models to standard cell libraries and FPGAs. Students gain practical experience by designing, modeling, implementing and verifying several digital circuits.														
Course Objective	The objective of the course is to enable the students to <ul style="list-style-type: none"><li>understand the different technologies related to HDLs.</li><li>construct, compile and execute Verilog HDL programs using provided software tools.</li><li>Design digital components and circuits that are testable, reusable, and synthesizable.</li></ul>														
Course Outcome	Upon completion of this course, the students will be able <ol style="list-style-type: none"><li>to describe Verilog HDL Language</li><li>to apply register Transfer Level (RTL) models of Digital Circuits.</li><li>to explain various behavioral models of digital circuits.</li><li>to explain the process of CMOS switches using switch level.</li><li>to design sequential circuits.</li></ol>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	-	1	1	-	-	-	-	-	-	-	-	-	3	1
CO-2	1	1	1	1	-	-	-	-	-	-	-	-	1	3	1
CO-3	1	-	1	2	-	-	-	-	-	1	-	1	1	3	1
CO-4	1	1	1	1	-	-	-	-	-	-	-	1	-	3	2
CO-5	1	-	1	1	-	-	-	-	-	-	-	-	-	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO VERILOG													(6L+6P)		
Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module. Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. <b>Suggested Reading:</b> truth table models of combinational and sequential logic with Verilog modules <b>Lab Experiments:</b> Write a Verilog HDL code to verify the functionality of all the logic gates.													CO-1 BTL-1		
MODULE 2: GATE LEVEL AND DATA FLOW MODELING													(6L+6P)		
Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit, Continuous Assignment Structure, Delays and Continuous Assignments,, Operators. <b>Suggested Reading:</b> Continuous Assignments and design of combinational circuits using dataflow modelling <b>Lab Experiments:</b> Write a Verilog HDL code using Dataflow modeling for the following combinational circuit and verify the design using simulation.													CO-2 BTL-2		

a) 8 to 3 Encoder		b) 3 to 8 Decoder		Write a Verilog HDL code for the following combinational circuit using structural modeling and verify the functionality using simulation. a) Half adder b) Full adder c) Half subtractor d) Full subtractor
MODULE 3: BEHAVIOURAL MODELING				(6L+6P)
Introduction, Operations and Assignments, Functional Bifurcation, 'Initial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Designs at Behavioural Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop. <b>Suggested Reading:</b> RTL assignments and Looping statements Lab Experiments: Write a Verilog HDL code using behavioral modeling to realize Multiplexer (4:1) and Demultiplexer and verify the design using simulation and synthesis.				CO-3 BTL-2
MODULE 4: SWITCH LEVEL MODELING				(6L+6P)
Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with 'Strengths' and 'Delays' Strength Contention with Trireg Nets. <b>Suggested Reading:</b> MOS switches <b>Lab Experiments:</b> Write a Verilog code for Moore FSM Sequence Detector and verify the design using simulation. Write a Verilog HDL code using switch level modeling for CMOS inverter and verify the design using simulation.				CO-4 BTL-3
MODULE 5: SEQUENTIAL CIRCUIT				(6L+6P)
Sequential Models - Feedback Model, Implicit Model, Static Machine Coding. Test Bench - Combinational Circuits Testing, Sequential Circuit Testing. <b>Suggested Reading:</b> Verilog code for flip-flops (D, T and JK) <b>Lab Experiments:</b> Write a Verilog HDL code for 4-bit binary to gray converter and download the program using FPGA Board such as Basys3 or equivalent boards to verify the functionality of the circuit.				CO-5 BTL-1
BOOKS				
1.	Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.			
2.	Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI, 2009.			
REFERENCE BOOKS				
1	T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009.			
2	Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012			
E BOOKS				
1.	<a href="http://www.brookscole.com/engineering/roth.html">http://www.brookscole.com/engineering/roth.html</a>			
2.	<a href="https://www.pinterest.com/pin/348677196134415137/">https://www.pinterest.com/pin/348677196134415137/</a>			
MOOC				
1.	<a href="http://nptel.ac.in/courses/117101058/">http://nptel.ac.in/courses/117101058/</a>			
2.	<a href="http://nptel.ac.in/courses/117106092/2">http://nptel.ac.in/courses/117106092/2</a>			

COURSE TITLE	DSP Processor and Architecture			CREDITS	3
COURSE CODE	EECS1505	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	XX	Approval Details	XX	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					

CIA													ESE		
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)				Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”			Attendance*	THEORY	PRACTICAL		
15%	15%				10%			5%			5%	25%	25%		
Course Description	The aim of this course is to provide an introduction of DSP and its Processor design and its different types of architectures too. It covers custom design, cell based hierarchical design, and algorithmic aspects of micro level architecture design..														
Course Objective	Course Objectives 1. To introduce the DSP processing and different types of filtering. 2. To recall digital transform techniques and architectural features of DSP Processors. 3. To give practical examples of DSP Processor architectures for better understanding. 4. To develop the programming knowledge using Instruction set of DSP Processors. 5. To understand interfacing techniques to memory and I/O devices.														
Course Outcome	Upon completion of this course, the students will be able to  1. Able to understand the Digital Signal Processing system and its different types of Transforms 2.To distinguish between the architectural features of general purpose processors and DSP processors 3. Understand the architectures of TMS 320C54XX and ADSP2100 DSP devices 4. Able to write assembly language programs using instruction set of TMS320C54XX 5. Can interface various devices to DSP Processors														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	0	0	0	0	0	0	0	1	2	1
CO-2	3	2	2	1	1	0	0	0	0	0	0	0	1	1	1
CO-3	3	2	2	1	1	0	0	0	0	0	1	1	2	2	2
CO-4	3	2	1	1	1	0	0	0	0	0	0	0	1	1	2
CO-5	3	2	1	1	1	0	0	0	0	0	1	1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE I: Introduction to Digital Signal Processing:													(6L+ 6P)		

<p>Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time- invariant systems, Digital filters, Decimation and interpolation.</p> <p>Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.</p> <p><b>Lab Experiment :</b></p> <ol style="list-style-type: none"> <li>1. To find the DFT and IDFT for the given input sequence.</li> <li>2. Sampling of analog signal and study of aliasing.</li> </ol> <p><b>Software/Equipment Used</b></p>	<p><b>CO-1</b> <b>BTL-3</b></p>
<p><b>MODULE II: Architectures for Programmable DSP Devices: (6L+ 6P)</b></p>	
<p>Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.</p> <p><b>Lab Experiment:</b></p> <ol style="list-style-type: none"> <li>1. Implementation of adaptive filter using Least Mean Squares (LMS) algorithm in MATLAB.</li> <li>2. Implementations of Finite Impulse Response (FIR) filter in MATLAB</li> </ol> <p><b>Software/Equipment Used</b></p>	<p><b>CO-2</b> <b>BTL-3</b></p>
<p><b>MODULE 3: Programmable Digital Signal Processors: (6L+ 6P)</b></p>	
<p>Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors.</p> <p><b>Lab Experiment:</b></p> <ol style="list-style-type: none"> <li>1. Convolution of 2 sequences using TMS**** DSK.</li> <li>2. Computation of Radix-2 and Radix-4 FFT using TMS**** DSK.</li> </ol> <p><b>Software/Equipment Used</b></p>	<p><b>CO-3</b> <b>BTL-3</b></p>
<p><b>MODULE 4: Analog Devices Family of DSP Devices: (6L+ 6P)</b></p>	
<p>Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.</p> <p>Introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. To study about DSP Processors and architecture of ADSP2100.</li> <li>2. To Implement Floating point Arithmetic.</li> </ol> <p><b>Software/Equipment Used</b></p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<p><b>MODULE 5: Interfacing Memory and I/O Peripherals to Programmable DSP Devices: (6L+ 6P)</b></p>	
<p>Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Implementation of simple algorithms in I/O processing. (detection, de-noising, filtering etc.)</li> <li>2. Filtering of noisy signals</li> </ol> <p><b>Software/Equipment Used</b></p>	<p><b>CO-5</b> <b>BTL-3</b></p>
<p><b>BOOKS</b></p>	
<p>1.</p>	<p>Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.</p>

2.	A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3.	Embedded Signal Processing with the Micro Signal Architecture Publisher: Woon-Seng Gan, Sen M. Kuo, Wiley-IEEE Press, 2007
<b>REFERENCE BOOKS</b>	
1	Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2	DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
3	Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI
<b>E BOOKS</b>	
1.	<a href="https://www.google.co.in/books/edition/Digital_Signal_Processors/HBpHPgAACAAJ?hl=en">https://www.google.co.in/books/edition/Digital_Signal_Processors/HBpHPgAACAAJ?hl=en</a>
2.	<a href="https://www.freebookcentre.net/Electronics/DSP-Books-Download.html">https://www.freebookcentre.net/Electronics/DSP-Books-Download.html</a>
3.	<a href="https://www.scribd.com/doc/217906199/Digital-signal-processors-A-Venkatramani">https://www.scribd.com/doc/217906199/Digital-signal-processors-A-Venkatramani</a>
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc19_ee70/preview">https://onlinecourses.nptel.ac.in/noc19_ee70/preview</a>
2.	<a href="https://archive.nptel.ac.in/courses/108/108/108108185/">https://archive.nptel.ac.in/courses/108/108/108108185/</a>

COURSE TITLE	DIGITAL SYSTEM DESIGN USING FPGA BOARDS			CREDITS	3	
COURSE CODE	EECS1513	COURSE CATEGORY		DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details		37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	This course covers the systematic design of advanced digital systems using field-programmable gate arrays (FPGAs). The emphasis is on top-down design starting with a software application, and translating it to high-level models using a hardware description language (such as VHDL or Verilog). The course will focus on design for high-performance computing applications using streaming architectures. We will first review in detail the basic building blocks of FPGA programming. Second, we focus on architecture, design methodologies, best design practices, and optimization techniques for performance (frequency, latency, area, power, etc). Finally, we will cover testbench development, simulation for bit-true design verification, and synthesis of complete digital systems.					
Course Objective	This course covers the advanced design and analysis of digital circuits with HDL. The primary goal is to provide in depth understanding of system design. The course enables students to apply knowledge for the design of advanced digital hardware systems with help of FPGA tools.					

<b>Course Outcome</b>	Upon completion of this course, the students will be able to														
	6. Design and optimize complex combinational and sequential digital circuits 7. Understand the different architectures of FPGAs 8. Design and model digital circuits with Verilog HDL at behavioural, structural, and RTL Levels 9. Develop test benches to simulate combinational and sequential circuits. 10. Understand the different types of FPGA SoCs and their families with applications														
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
CO-1	1	-	1	1	-	-	-	-	-	-	-	-	-	3	1
CO-2	1	1	1	1	-	-	-	-	-	-	-	-	1	3	1
CO-3	1	-	1	2	-	-	-	-	-	1	-	1	1	3	1
CO-4	1	1	1	1	-	-	-	-	-	-	-	1	-	3	2
CO-5	1	-	1	1	-	-	-	-	-	-	-	-	-	3	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: Digital System Design</b>													<b>(6L+6P)</b>		
Introduction to Digital design; Hierarchical design, controller (FSM), case study, FSM issues, timing issues, pipelining, resource sharing, metastability, synchronization, MTBF Analysis, setup/hold time of various types of flip-flops, synchronization between multiple clock domains, reset recovery, proper resets. <b>Practical: Finite state machine using Verilog</b>													<b>CO-1 BTL-1</b>		
<b>MODULE 2: Overview of FPGA Architectures and Technologies</b>													<b>(6L+6P)</b>		
FPGA Architectural options, coarse vs fine grained, vendor specific issues (emphasis on Xilinx FPGA), Antifuse, SRAM and EPROM based FPGAs, FPGA logic cells, interconnection network and I/O Pad, <b>AMD Xilinx and Altera devices.</b> <b>Practical: Create IP cores using Vivado Design Suite and HLS</b>													<b>CO-2 BTL-2</b>		
<b>MODULE 3: VERILOG MODELLING</b>													<b>(6L+6P)</b>		
Verilog Modelling of Combinational and Sequential Circuits: Behavioral, Data Flow and Structural Realization – Adders – Multipliers- Comparators - Flip Flops - Realization of Shift Register - Realization of a Counter- Synchronous and Asynchronous FIFO –Single port and Dual port RAM – Pseudo Random LFSR – Cyclic Redundancy Check. <b>Practical: Design combinational circuits using Verilog</b>													<b>CO-3 BTL-2</b>		
<b>MODULE 4: SIMULATION AND SYSTHESIS</b>													<b>(6L+6P)</b>		
Synchronous Sequential Circuit: State diagram-state table –state assignment-choice of flipflops – Timing diagram –One hot encoding Mealy and Moore state machines – Design of serial adder using Mealy and Moore state machines - State minimization – Sequence detection, design examples of Sequence detector, Serial adder, Vending machine using One Hot Controller. <b>Practical: Design sequential circuits using Verilog</b>													<b>CO-4 BTL-3</b>		
<b>MODULE 5: FPGA-BASED SYSTEMS-ON-CHIP AND APPLICATIONS</b>													<b>(6L+6P)</b>		
AMD Xilinx Spartan-6, Zynq SoCs, Altera and Actel FPGAs, Embedded system design using FPGAs, DSP using FPGAs, Dynamic architecture using FPGAs, reconfigurable systems, application case studies. <b>Practical: Create a design using SoCs for image processing applications</b>													<b>CO-5 BTL-1</b>		
<b>BOOKS</b>															

1.	Andina, J. J. R., De la Torre Arnanz, E., & Valdes, M. D. (2017). FPGAs: fundamentals, advanced features, and applications in industrial electronics. CRC Press.
2.	Ian Grout, "Digital Systems Design with FPGAs and CPLDs" Newnes, Elsevier, 2008
<b>REFERENCE BOOKS</b>	
1	Peter Ashenden, Digital Design using VHDL, Elsevier, 2007
2	Kilts, S. (2007). Advanced FPGA design: architecture, implementation, and optimization. John Wiley & Sons.
3	Monk, S. (2016). Programming FPGAs: Getting Started with Verilog. McGraw Hill Professional.
<b>E BOOKS</b>	
1.	<a href="https://www.pdfdrive.com/digital-system-design-with-fpga-implementation-using-verilog-and-vhdl-e195130048.html">https://www.pdfdrive.com/digital-system-design-with-fpga-implementation-using-verilog-and-vhdl-e195130048.html</a>
2	<a href="http://ebook.pldworld.com/_eBook/FPGA%EF%BC%8FHDL/-Eng-/Digital%20Systems%20Design%20with%20FPGAs%20and%20CPLDs%20(Ian%20Grout).pdf">http://ebook.pldworld.com/_eBook/FPGA%EF%BC%8FHDL/-Eng-/Digital%20Systems%20Design%20with%20FPGAs%20and%20CPLDs%20(Ian%20Grout).pdf</a>
3	<a href="https://www.pdfdrive.com/fpga-based-implementation-of-signal-processing-systems-d167261452.html">https://www.pdfdrive.com/fpga-based-implementation-of-signal-processing-systems-d167261452.html</a>
<b>MOOC</b>	
1.	<a href="https://www.tce.edu/tce-mooc/21tocee01">https://www.tce.edu/tce-mooc/21tocee01</a>
2.	<a href="https://archive.nptel.ac.in/courses/117/108/117108040/">https://archive.nptel.ac.in/courses/117/108/117108040/</a>

COURSE TITLE	SEMICONDUCTOR MODELING			CREDITS	3	
COURSE CODE	EEEC51516	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	This course provides an in-depth understanding of semiconductor modelling techniques and their applications in the design and analysis of electronic circuits. Students will learn theoretical concepts and practical skills required to develop mathematical and computational models for semiconductor devices. The course will cover various modelling approaches, including analytical, empirical, circuit-level, and physics-based models.					
Course Objective	This course aims 11. To introduce students to the fundamentals of semiconductor physics and device characteristics. 12. To develop students' ability to create and analyze mathematical models for semiconductor devices. 13. To familiarize students with different modelling techniques used in semiconductor device design and simulation. 14. To enhance students' problem-solving skills through practical applications of semiconductor modelling. 15. To prepare students for advanced studies and research in semiconductor device technology.					



Course Outcome	Upon completion of this course, the students will be able to														
	16. Gain a solid understanding of the fundamental principles and concepts related to semiconductor physics														
	17. Acquire proficiency in mathematical modeling techniques commonly used in semiconductor device modeling														
	18. Develop skills to analyze and interpret simulation results to gain insights into the performance and characteristics of semiconductor devices.														
	19. Develop the ability to optimize semiconductor device designs based on performance requirements, using modeling and simulation tools.														
20. Cultivate research skills and problem-solving abilities related to semiconductor modeling.															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	0	1	1	0	1	0	0	2	1	2	2	1	0	0
CO-2	1	3	2	2	1	1	0	0	0	2	1	2	0	0	1
CO-3	1	1	3	2	3	0	0	0	1	0	0	2	0	1	1
CO-4	0	1	2	1	3	0	0	0	0	1	1	2	1	1	0
CO-5	1	1	2	0	2	0	0	0	2	1	1	2	1	1	0
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Semiconductors & Semiconductor Device Fundamentals													(6L+ 6P)		
Basics of semiconductor materials, Intrinsic and extrinsic semiconductors, Band theory and energy bands in semiconductors, Carrier statistics and transport phenomena, PN junction diodes and their characteristics, Bipolar junction transistors (BJTs), Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs), Other semiconductor devices (e.g., Schottky diodes, JFETs)													CO-1 BTL-3		
MODULE 2: Analytical Modelling & Empirical Modelling													(6L+ 6P)		
Development of analytical models for diodes and transistors, Small-signal and large-signal analysis techniques, Model parameter extraction methods, Data-driven modelling techniques, Curve fitting and interpolation methods, Extraction of device parameters from experimental data													CO-2 BTL-3		
MODULE 3: Circuit-Level Modelling & Physics-Based Modelling													(6L+ 6P)		
Introduction to SPICE simulation, SPICE model libraries for diodes and transistors, Modeling of integrated circuits and system-level simulations, Quantum mechanical principles in semiconductor modelling, Density of states and carrier transport models, Simulation techniques for advanced physics-based models													CO-3 BTL-3		
MODULE 4: Advanced Topics in Semiconductor Modelling													(6L+ 6P)		
Device reliability modelling, High-frequency and RF modelling, Power device modelling, Semiconductor device simulation software tools													CO-4 BTL-3		
MODULE 5: Applications of Semiconductor Modelling													(6L+ 6P)		
Design and optimization of electronic circuits, Analysis of device performance and characteristics, Device parameter variation and yield analysis													CO-5 BTL-3		
BOOKS															
1.		"Semiconductor Device Fundamentals" by Robert F. Pierret - 2017													
2.		"Solid-State Electronic Devices" by Ben G. Streetman and Sanjay Kumar Banerjee - Latest Edition, 2020													
3.		"Device Modeling for Analog and RF CMOS Circuit Design" by Trond Ytterdal, Yuhua Cheng, and Tor A. Fjeldly - 2018													
REFERENCE BOOKS															

1	"Semiconductor Physics and Devices: Basic Principles" by Donald A. Neamen - Latest Edition, 2017
2	"Introduction to Semiconductor Devices: For Computing and Telecommunications Applications" by Kevin F. Brennan and April S. Brown -2019
3	"Advanced Semiconductor Fundamentals" by Robert F. Pierret - 2020
4	"Modeling Semiconductor Devices" by Shunri Oda - 2017
	"Semiconductor Device Modeling with SPICE" by Paolo Antognetti and Giuseppe Massobrio - 2018
<b>MOOC Courses</b>	
1.	"Semiconductor Devices" by The Hong Kong University of Science and Technology (edX)
2.	"Introduction to Semiconductor Devices" by Purdue University (edX)
3.	"Introduction to Transistors and Digital Circuits" by Massachusetts Institute of Technology (MIT OpenCourseWare)

COURSE TITLE	ANALOG VLSI			CREDITS	3	
COURSE CODE	EECS1526	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description						
Course Objective	<ul style="list-style-type: none"><li>To introduce the students about the analog circuits from the perspective of designing amplifiers in an integrated circuit using MOS transistors</li><li>To learn about the operational modes and examples of Differential amplifiers</li><li>To comprehend the frequency response of the amplifiers</li><li>To learn about the working feedback amplifiers</li><li>To learn about Switched Capacitor Filter, Oscillators and PLL.</li></ul>					
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ul style="list-style-type: none"><li>Comprehend the importance of Analog IC design and also the VLSI analog process flow.</li><li>interpret about the MOS device physics and MOS models.</li><li>analyze and design current mirrors, voltage and current reference circuits.</li><li>design principles of different kinds of amplifiers like the single stage MOS amplifiers, MOS differential amplifier, CMOS OPAMP and switched capacitor amplifiers.</li><li>design circuits like the oscillators and PLL.</li></ul>					

CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	-	-	-	-	-	-	-	-	-	1	1	1
CO-2	3	3	3	2	2	-	1	-	-	-	-	1	1	1	1
CO-3	3	3	3	2	2	-	1	-	-	-	-	1	1	1	2
CO-4	3	3	3	2	2	-	1	-	-	-	-	1	1	1	2
CO-5	3	3	3	2	2	-	1	-	-	-	-	1	1	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Analog VLSI (6 L+ 6 P)															
Introduction to Analog VLSI Circuits Design, Design Flow of Analog VLSI Circuits. Basic MOS Device Physics – General Considerations, MOS I/V Characteristics, Second Order effects, MOS Device models. Short Channel Effects and Device Models. Single Stage Amplifiers – Basic Concepts, Common Source Stage, Source Follower, Common Gate Stage, Cascode Stage.													CO-1 BTL-2		
<b>Practicals :</b> 1. Introduction to EDA tools and basic Examples															
MODULE 2: Differential Amplifiers (6 L+ 6P)															
Differential Amplifiers – Single Ended and Differential Operation, Basic Differential Pair, Common Mode Response, Differential Pair with MOS loads, Gilbert Cell. Passive and Active Current .													CO-2 BTL-3		
<b>Suggested Readings:</b> Mirrors Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors.															
<b>Practicals :</b> 2. Design of Differential Amplifier															
MODULE 3: Frequency response of Amplifiers (6 L+ 6 P)															
Frequency Response of Amplifiers – General Considerations, Common Source Stage, Source Followers, Common Gate Stage, Cascode Stage, Differential Pair. Noise – Types of Noise, Representation of Noise in circuits, Noise in single stage amplifier.													CO-3 BTL-3		
<b>Suggested Readings:</b> Noise in Differential Pairs.															
<b>Practicals :</b> 3. Design of Single stage Amplifiers															
MODULE 4: Feedback Amplifiers (6 L+ 6 P)															
Feedback Amplifiers – General Considerations, Feedback Topologies, Effect of Loading. Operational Amplifiers – General Considerations, One Stage Op Amps, Two Stage Op Amps, Gain Boosting, Common – Mode Feedback, Input Range limitations, Slew Rate, Power Supply Rejection, Noise in Op Amps.													CO-4 BTL-3		
<b>Suggested Readings:</b> Stability and Frequency Compensation.															
<b>Practicals :</b> 4. Design of Single stage and two stage op amps															
MODULE 5: Switched capacitor Filters , Oscillators and PLL (6 L+ 6 P)															

Introduction to switched capacitor circuits, switched capacitor amplifiers, noise analysis, Distortion, current and voltage references, Oscillators and PLL.		CO-5 BTL-3
<b>Suggested Readings:</b> Band gap references, Constant		
<b>Practicals :</b> 5. Design of Oscillators		
TEXT BOOKS		
1	Behzad Razavi, Design of Analog CMOS Integrated Circuits McGraw-Hill International Edition 2016.	
REFERENCE BOOKS		
1	Sedra and Smith, Microelectronics Circuits, Oxford University Press, 2004	
2	P.R.Gray, P.J.Hurst, S.H.Lewis and R.G.Meye; Analysis and Design of Analog Integrated Circuits, John Wiley & Sons, Fourth Edition, 2003.	
3	R. Jacob Baker, CMOS CMOS Circuit Design, Layout , and Simulation, IEEE Press, 1997	
E BOOKS`		
1	Behzad Razavi, Analog vlsi: Circuits AND Principles The MIT Press DOI: <a href="https://doi.org/10.7551/mitpress/1250.001.0001">https://doi.org/10.7551/mitpress/1250.001.0001</a> ISBN electronic: 780262256568 , 2002	
MOOC		
1	<a href="https://onlinecourses.nptel.ac.in/noc23_ee142/">https://onlinecourses.nptel.ac.in/noc23_ee142/</a>	
2	<a href="https://onlinecourses.nptel.ac.in/noc21_ee51">https://onlinecourses.nptel.ac.in/noc21_ee51</a>	

COURSE TITLE		ASIC DESIGN			CREDITS	3
COURSE CODE	EECS1527	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description		An application-specific integrated circuit (ASIC) is an integrated circuit customized for a particular use, rather than intended for general-purpose use. In this course, the reader is introduced to various ASIC architectures, ASIC design flow, issues in ASIC design and testing of ASICs and also about SOC Design.				
Course Objective		1. To prepare the student to be an entry-level industrial standard ASIC or FPGA designer. 2. To give the student an understanding of issues and tools related to ASIC/FPGA design and implementation. 3. To give the student an understanding of basics of System on Chip and Platform based design.				
Course Outcome		Upon completion of this course, the students will be able to  1. Demonstrate VLSI tool-flow and appreciate FPGA architecture.				

	2. Understand the basic of ASIC and FPGA based system design. 3. Understand the design principle and operation of FPGA board and their design techniques. 4. Understand the basics of System on Chip, On chip communication architectures like AMBA, AXI and utilizing Platform based design. 5. Appreciate high performance algorithms available for ASICs.													
Prerequisites: Knowledge in basics of ASICs and FPGAs.														
CO, PO AND PSO MAPPING														
CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO- 11	PO-12	PSO-1	PSO-2
CO-1	3	-	-	-	2	1	-	-	-	-	-	-	3	1
CO-2	3	-	3	-	2	1	-	-	-	-	-	2	3	1
CO-3	3	-	3	2	1	1	-	-	-	-	-	-	3	1
CO-4	2	-	2	3	1	1	-	-	-	-	-	2	3	1
CO-5	3	-	2	2	1	1	1	-	-	-	-	2	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1 :INTRODUCTION TO ASIC (6L+6P)														
Types of ASICs, VLSI Design flow, Programmable ASICs - Antifuse, SRAM, EPROM, EEPROM based ASICs. Programmable ASIC logic cells and I/O cells. Programmable interconnects. Latest Version - FPGAs and CPLDs and Soft-core processors.  Lab Experiments :  Practice: Design of SRAM  Practice: Code Coverage													CO-1  BTL-2	
MODULE 2 : PROGRAMMABLE ASIC -1 (6L+6P)														
Programmable ASIC Logic Cells, Actel, Xilinx LCA., XC3000 CLB, XC4000 Logic Block, XC5200 Logic Block, Xilinx CLB Analysis, Logic 8 9 Expanders, Programmable ASIC I/O Cells, Totem-Pole Output, Mixed Voltage Systems, Metastability, Xilinx I/O Block, Boundary Scan  Lab Experiments :  Practice: Gate Array using anyone EDA Tools - Cadence, Synopsis, Xilinx, Mentor Graphics  Practice: Full custom design													CO-2  BTL-3	
MODULE 3 : PROGRAMMABLE ASIC -2 (6L+6P)														
Programmable ASIC Interconnect and Programmable ASIC Design Software, Actel ACT, RC Delay in Antifuse Connections, Xilinx EPLD Logic Synthesis, FPGA Synthesis, Third-party Software, low level design entry, logic synthesis, simulation.  Lab Experiments :  Practice: FPGA Synthesis													CO-3  BTL-3	

MODULE 4: SOC DESIGN		(6L+6P)
System-On-Chip Design - SoC Design Flow, Platform-based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures, On-Chip Communication Architecture Standards, Low-Power SoC Design		CO-4  BTL-3
Lab Experiments :		
Practice: Logic Equivalence Checking		
Practice:Power Analysis (Dynamic power)		
MODULE 5: HIGH PERFORMANCE ASIC		(6L+6P)
High performance algorithms for ASICS/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC, USB controllers, OMAP		CO-5  BTL-3
Lab Experiments :		
Practice: Static Timing Analysis		
Practice: study of USB controllers		
TEXT BOOKS		
1.	M.J.S. Smith, “Application Specific Integrated Circuits”, Pearson, 2003	
2.	H.Gerez, “Algorithms for VLSI Design Automation”, John Wiley, 1999	
3.	Himanshu Bhatnagar, Advanced ASIC Chip Synthesis: Using Synopsys Design Compiler, 2nd Edition, Kluwer Academic Press,2001.	
REFERENCE BOOKS		
1.	J..M.Rabaey, A. Chandrakasan, and B.Nikolic, ”Digital Integrated Circuit Design Perspective (2/e)”, PHI 2003	
2.	Hoi-Jun Yoo, Kangmin Leeand Jun Kyong Kim, “Low-Power NoC for High-Performance SoC Design”, CRC Press, 2008	
3.	S.Pasricha and N.Dutt, ” On-Chip Communication Architectures System on Chip Interconnect, Elsevier”, 2008	
E BOOKS		
1.	<a href="http://www.csit-sun.pub.ro/resources/asic/CH01.pdf">http://www.csit-sun.pub.ro/resources/asic/CH01.pdf</a>	
3.	<a href="https://www.cs.ccu.edu.tw/~pahsiung/courses/soc/notes/soc01.pdf">https://www.cs.ccu.edu.tw/~pahsiung/courses/soc/notes/soc01.pdf</a>	
MOOC		
1.	<a href="https://nptel.ac.in/courses/117106092">https://nptel.ac.in/courses/117106092</a>	
3.	<a href="http://nitttrc.edu.in/nptel/courses/video/117106092/L55.html">http://nitttrc.edu.in/nptel/courses/video/117106092/L55.html</a>	

COURSE TITLE	LOW POWER VLSI			CREDITS	3
COURSE CODE	EEEC51537	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME															
CIA													ESE		
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”			Attendance*			THEORY	PRACTICAL	
15%	15%			10%			5%			5%			25%	25%	
Course Description	The objective of this course is to brief the undergraduate students the issues involved in design and analysis of low power VLSI circuits														
Course Objective	<ul style="list-style-type: none"><li>• To teach students the limitations in low power circuits</li><li>• Students will exercise their ability to apply these principles in design and analysis of low power devices</li></ul>														
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"><li>1. Identify the need for low power VLSI circuits</li><li>2. Analyze the impact of CMOS process technology on low power devices</li><li>3. To design low power circuit level in adders and multipliers</li><li>4. To interpret the probabilistic power analysis for low power devices</li><li>5. To design and analyze software design for low power</li></ol>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO-2	3	2	2	1	1	-	-	-	-	-	-	-	1	1	1
CO-3	3	2	2	1	1	-	-	-	-	-	1	1	2	2	2
CO-4	3	2	1	1	1	-	-	-	-	-	-	-	1	1	2
CO-5	3	2	1	1	1	-	-	-	-	-	1	1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO LOW POWER ICs													(6 L+ 6 P)		
Need for low power VLSI chips, - Sources of power dissipation - Design for low power - - Power dissipation in CMOS -Low power design limits. <b>Suggested Readings:</b> Low Power Figure of Merits <b>Case Study:</b> 6. Emerging Low power approaches													CO-1 BTL-3		
MODULE 2: CMOS PROCESS TECHNOLOGY IMPACT ON LOW POWER DEVICES													(6 L+ 6P)		

Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Constraints on reduction, Impact of technology Scaling, Technology & Device innovation.		CO-2 BTL-3
<b>Suggested Readings:</b> Voltage scaling using high-level transformations		
<b>Case Studies:</b> 1. Power Management		
MODULE 3: LOW POWER CIRCUIT LEVEL DESIGN (6 L+ 6 P)		
Ripple Carry Adders, Carry Look-Ahead Adders, Carry-Select Adder, Conditional Sum Adders, Braun Multiplier, Baugh-Wooley Multiplier, Modified Booth Multiplier, Wallace Tree, Arithmetic Logic Unit, Comparator, Shifter.		CO-3 BTL-3
<b>Suggested Readings:</b> Programmable Logic Array		
<b>Case Studies:</b> 1. Phase Locked Loops		
MODULE 4: PROBABILISTIC POWER ANALYSIS (6 L+ 6 P)		
Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.		CO-4 BTL-3
<b>Suggested Readings:</b> Logic power estimation		
<b>Case Studies:</b> 1. Simulation power analysis		
MODULE 5: SOFTWARE DESIGN FOR LOW POWER (6 L+ 6 P)		
Software design for low power - Software power estimation - Software power optimization - Gate-Level Techniques- Architecture-Level Power Estimation- Behavioral-Level Power Estimation		CO-5 BTL-3
<b>Suggested Readings:</b> Automated low power code generation		
<b>Case Studies:</b> 1. Co design for low power		
BOOKS		
1	Gary Yeap, “Practical low power digital VLSI design”, Kluwer, 1998.	
2	AbdelatifBelaouar, Mohamed.I.Elmasry, “Low power digital VLSI design”, Kluwer, 1995	
REFERENCE BOOKS		
1	A.P.Chandrasekaran and R.W.Brodersen, “Low power digital CMOS design”, Kluwer,1995.	
2	DimitriosSoudris, C.Pignet, Costas Goutis,“Designing CMOS Circuits for Low Power”Kluwer, 2002.	
3	James B.Kulo, Shih-Chia Lin, “Low voltage SOI CMOS VLSI devices and Circuits”, John Wiley and sons, inc. 2001.	
4	Kaushik Roy and S.C.Prasad, “Low power CMOS VLSI circuit design”, Wiley, 2000	
E BOOKS		
1	<a href="https://studylib.net/doc/25663544/practical-low-power-digital-vlsi-design-by-gary-yeap">https://studylib.net/doc/25663544/practical-low-power-digital-vlsi-design-by-gary-yeap</a>	
MOOC		
1	<a href="https://archive.nptel.ac.in/content/syllabus_pdf/106105034.pdf">https://archive.nptel.ac.in/content/syllabus_pdf/106105034.pdf</a>	

<b>COURSE TITLE</b>	<b>VLSI SIGNAL PROCESSING</b>	<b>CREDITS</b>	<b>3</b>
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COURSE CODE	EECS1538	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2										
Version	XX	Approval Details	XX	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL									
15%	15%	10%	5%	5%	25%	25%									
Course Description	The objective of this course is design and implementation of signal processing algorithms using application-specific VLSI architecture, including programmable digital signal processors and dedicated signal processors implemented with VLSI technology.														
Course Objective	<ul style="list-style-type: none"><li>Introduce students to the fundamentals of VLSI signal processing and expose them to examples of applications.</li><li>Design and optimize VLSI architectures for basic DSP algorithms.</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to  1.Understand VLSI design methodology for signal processing systems.  2. Comprehend the pipelining and parallel processing for DSP.  3. construct systolic architectures in building signal processing  4. implement basic bit level arithmetic architectures for DSP.  5. perform low power design and implement the Convolution algorithms														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO-2	3	2	2	1	1	-	-	-	-	-	-	-	1	1	1
CO-3	3	2	2	1	1	-	-	-	-	-	1	1	2	2	2
CO-4	3	2	1	1	1	-	-	-	-	-	-	-	1	1	2
CO-5	3	2	1	1	1	-	-	-	-	-	1	1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO SIGNAL PROCESSING ALGORITHMS (6 L+ 6 P)															

<b>MODULE-I</b> Introduction to DSP systems: Representation of DSP algorithms; Iteration Bound: Definition, Examples, Algorithms for computing Iteration bound; <b>Suggested Readings:</b> <b>Case Study:</b> 7. Sample DSP algorithms		<b>CO-1</b> <b>BTL-3</b>
<b>MODULE 2:PIPELINIG AND PARALLEL PROCESSING (6 L+ 6P)</b>		
Pipelining and Parallel Processing: Definitions, Pipelining and parallel processing of FIR filters. Retiming: Definitions and Properties, Solving system of Inequalities, Retiming techniques; Unfolding: Definition, An algorithm for unfolding,; Folding: Definition, Folding transformations, Register minimization techniques <b>Suggested Readings:</b> Applications of unfolding , , Register minimization in folded architectures; <b>Case Studies:</b> 1. FIR Filters		<b>CO-2</b> <b>BTL-3</b>
<b>MODULE 3: SYSTOLIC ARCHITECTURES</b>		<b>(6 L+ 6 P)</b>
Systolic Architecture Design: Introduction, Systolic Array Design Methodology, FIR Systolic Arrays, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design, <b>Suggested Readings:</b> Systolic Design for Space Representations Containing Delays. <b>Case Studies:</b> 1. Multiplication and Systolic Array design		<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: BIT LEVEL ARITHMETICS</b>		<b>(6 L+ 6 P)</b>
Bit-Level arithmetic architectures: Parallel multipliers, Bit-serial multipliers, Bit-Serial FIR filter design and Implementation; Redundant arithmetic: Redundant number representation, Carry-free radix-2 addition and subtraction, <b>Suggested Readings:</b> radix-2 hybrid redundant multiplication architectures; <b>Case Studies:</b> 2. Parallel Multipliers		<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: LOW POWER DESIGN AND FAST CONVOLUTION ALGORITHMS</b>		<b>(6 L+ 6 P)</b>
Low-power design: Low-power design: Theoretical background, Scaling versus power consumption, Power analysis, Power reduction techniques, Power estimation approaches. Fast Convolution: Introduction, Cook, Toom Algorithm, Winogard Algorithm, <b>Suggested Readings:</b> Iterated Convolution, Cyclic Convolution, Design of Fast Convolution Algorithm by Inspection. <b>Case Studies:</b> 1. Fast Convolution Algorithms		<b>CO-5</b> <b>BTL-3</b>
<b>BOOKS</b>		
<b>1</b>	Keshab K. Parhi. "VLSI Digital Signal Processing Systems" , Wiley-Inter Sciences, 1999	
<b>2</b>	U. Meyer-Baese, "Digital Signal processing with Field Programmable Arrays", Springer, 3rd edition 2007.	
<b>REFERENCE BOOKS</b>		
<b>1</b>	Mohammed Ismail, Terri, Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1994.	
<b>2</b>	Kung. S.Y., H.J. While house T.Kailath, VLSI and Modern singal processing, Prentice Hall, 1985.	

3	Jose E. France, YannisTsividis, Design of Analog Digital VLSI Circuits for Telecommunications and Signal Processing' Prentice Hall, 1994.
4	S. Ramachandran, Digital VLSI systems design. Springer, 2007.
<b>E BOOKS</b>	
1	<a href="https://www.ebooks.com/en-in/book/708311/vlsi-digital-signal-processing-systems/keshab-k-parhi/?_c=1">https://www.ebooks.com/en-in/book/708311/vlsi-digital-signal-processing-systems/keshab-k-parhi/?_c=1</a>
<b>MOOC</b>	
1	<a href="https://onlinecourses.nptel.ac.in/noc20_ee44/preview">https://onlinecourses.nptel.ac.in/noc20_ee44/preview</a>

COURSE TITLE	System on Chip Design			CREDITS	3	
COURSE CODE	EECS1548	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The aim of this course is to provide an introduction to the design and layout of the chip design process and the macro design process . It covers custom design, cell based hierarchical design, and algorithmic aspects of micro level chip design..					
Course Objective	1. To learn about the system on chip design process and macro design process. 2. To learn the concepts of system on chip verification technology options. 3. To have a basic exposure to the concepts of multi-processor system on chips and the techniques for designing MPSoCs.					
Course Outcome	Upon completion of this course, the students will be able to 1. Analyze the behavior of SoC design and modelling techniques with emphasis on architectural exploration. 2. Analyze and design chip verification technology options. 3. Analyze the behavior of a System On Chip demonstrator with CPU and bus models, device models and device drivers. 4. Interpret the techniques of chip design using multiprocessor systems-on-chip (MPSoC). 5. Demonstrate the knowledge of arithmetic Building blocks and Execute Testing.					

<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>CO-1</b>	3	2	2	1	1	0	0	0	0	0	0	0	1	2	1
<b>CO-2</b>	3	2	2	1	1	0	0	0	0	0	0	0	1	1	1
<b>CO-3</b>	3	2	2	1	1	0	0	0	0	0	1	1	2	2	2
<b>CO-4</b>	3	2	1	1	1	0	0	0	0	0	0	0	1	1	2
<b>CO-5</b>	3	2	1	1	1	0	0	0	0	0	1	1	2	2	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE I: INTRODUCTION TO Chip Design Process (6L+6P)</b>															
Basic of system On Chip Design Process: A canonical SoC Design, SoC Design flow - waterfall vs spiral, Top-down vs Bottom up, Specification requirement and its types. System Design process and issues, - Soft IP vs Hard IP, Design for timing closure, Logic design issues- Verification strategy, On-chip buses and interfaces, Low Power, Manufacturing test strategies.													<b>CO-1 BTL-3</b>		
<b>MODULE II: Macro Design Process (6L+6P)</b>															
Top level Macro Design and its process, Macro Integration, Soft Macro productization. Developing hard macros, Design issues for hard macros, Design process, System Integration with reusable macros.													<b>CO-2 BTL-3</b>		
<b>MODULE 3: SoC Verification (6L+6P)</b>															
SoC Verification:- Verification technology options, Verification methodology, Verification languages, Verification approaches, and Verification plans. System level verification, Block level verification, Hardware/software co-verification and Static net list verification.													<b>CO-3 BTL-3</b>		
<b>MODULE 4: MPSoCs (6L+6P)</b>															
MPSoCs: What, Why, How MPSoCs. Techniques for designing MPSoCs, Performance and flexibility for MPSoCs design, MPSoC performance modeling and analysis. System-In-Package (SIP) design.													<b>CO-4 BTL-3</b>		
<b>MODULE 5: Applications of Chip Design (6L+6P)</b>															
High-Performance System-on-a-Chip Designs, Modern On-Chip, High-level Synthesis Interconnects, AI acceleration, embedded machine vision, data collection, telemetry, vector processing and ambient intelligence.													<b>CO-5 BTL-3</b>		
<b>BOOKS</b>															

1.	Michael Keating, Pierre Bricaud, Reuse Methodology manual for System-On-A-Chip Designs, Kluwer Academic Publishers, second edition,2001
2.	PrakashRashinkar, Peter Paterson and Leena Singh, SoC Verification-Methodology and Techniques, Kluwer Academic Publishers,2001.
3.	A.A.Jerraya, W.Wolf, Multiprocessor Systems-on-chips, 1st Edition,Morgan Kaufmann, 2004

#### REFERENCE BOOKS

1	William KLam, Design Verification:Simulation and Formal Method based Approaches,1 <sup>st</sup> Edition, Prentice Hall, 2005.
2	RochitRajsuman, System-on-a-Chip-Design and Test,Artech House, 2000.
3	Dirk Jansen ,The Electronic Design Automation Handbook , Springer, 2003.

#### E BOOKS

1.	<a href="https://www2.deloitte.com/uk/en/insights/industry/technology/technology-media-and-telecom-predictions/2023/ai-in-chip-design.html">https://www2.deloitte.com/uk/en/insights/industry/technology/technology-media-and-telecom-predictions/2023/ai-in-chip-design.html</a>
2.	<a href="https://altair.com/newsroom/executive-insights/top-five-trends-in-chip-design-technology">https://altair.com/newsroom/executive-insights/top-five-trends-in-chip-design-technology</a>
3.	<a href="https://www.electronicsforu.com/tech-zone/chip-design-how-machine-learning-helping">https://www.electronicsforu.com/tech-zone/chip-design-how-machine-learning-helping</a>

#### MOOC

1.	<a href="https://archive.nptel.ac.in/courses/108/106/108106158/">https://archive.nptel.ac.in/courses/108/106/108106158/</a>
2.	<a href="https://nptel.ac.in/courses/108108122">https://nptel.ac.in/courses/108108122</a>

COURSE TITLE	CAD FOR VLSI			CREDITS	
COURSE CODE	EEC51549	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3

#### ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%

Course Description	The design of all VLSI circuits is carried out by making extensive use Computer Aided Design (CAD) VLSI design tool. Due to continuous scaling of semiconductor technology, most of the VLSI designs employ millions of transistors and circuits of this size can only be carried out with the aid of CAD VLSI design tools. As part of the present introductory course the principles of operation of all the important modules that go into the construction of a complete VLSI CAD tool will be discussed. These include the design flow organization for VLSI, the standard cell-based synthesis methodologies for digital VLSI, floor planning and placement principles and related topics will all be covered.
Course Objective	The students shall develop an intuitive understanding of the basics of VLSI Design methodologies and VLSI design automation tools, principles of physical design in VLSI, Simulation and synthesis in High Level design methodologies.

<b>Course Outcome</b>	Upon completion of this course, the students will be able to														
	<ul style="list-style-type: none"> <li>• demonstrate an ability to outline the VLSI design Methodologies</li> <li>• apply algorithms for design automation.</li> <li>• explain various VLSI design concepts.</li> <li>• explain the process of simulation and synthesis is VLSI design.</li> <li>• explain high level synthesis and modeling.</li> </ul>														
<b>Prerequisites: Basics of VLSI Design</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>CO-1</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>1</b>
<b>CO-2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>1</b>
<b>CO-3</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1</b>
<b>CO-4</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>2</b>
<b>CO-5</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>2</b>
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO VLSI DESIGN METHODOLOGIES (6L+6P)</b>															
VLSI Design Cycle - Physical Design Cycle - Design Styles and comparison of different Design Styles Fabrication of VLSI Circuits. <b>Suggested Reading: General purpose methods for combinatorial optimization</b> <b>Lab Experiments: Design Ripple Carry Adder using Verilog HDL</b>													<b>CO-1 BTL-1</b>		
<b>MODULE 2: VLSI DESIGN AUTOMATION (6L+6P)</b>															
VLSI Design Automation Tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable Problems - General Purpose Methods for Combinational Optimization - Back tracking and Branch and Bound - Local Search - Simulated annealing and genetic algorithms. <b>Suggested Reading: FPGA SoCs and HLS using Vivado</b> <b>Lab Experiments: Design carry save Adder using Verilog HDL</b>													<b>CO-2 BTL-2</b>		
<b>MODULE 3: PHYSICAL DESIGN (6L+6P)</b>															
Layout Compaction - Placement and Partitioning - Circuit Representation - placement algorithms - Partitioning - Floor Planning Concepts - Shape Functions and Floor Planning Sizing - types of local routing problems - Area Routing - Channel Routing - Global Routing. <b>Suggested Reading: Channel routing</b> <b>Lab Experiments: BCD Adder Realization In Verilog HDL</b>													<b>CO-3 BTL-2</b>		
<b>MODULE 4: SIMULATION AND SYNTHESIS (6L+6P)</b>															
Simulation - Gate Level Modelling and Simulation - Switch Level Modelling and Simulation – Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis <b>Suggested Reading: Simulation Analysis using Vivado Design Suite</b> <b>Lab Experiments: Design of 4 to 1 multiplexer</b>													<b>CO-4 BTL-3</b>		
<b>MODULE 5: HIGH LEVEL SYNTHESIS (6L+6P)</b>															
Hardware Models - Internal Representation - Allocation assignment and scheduling - Simple Scheduling Algorithm - Assignment Problem. <b>Suggested Reading: High level transformations</b> <b>Lab Experiments: To realize an asynchronous ripple counter in Verilog</b>													<b>CO-5 BTL-1</b>		
<b>BOOKS</b>															
1.	S.H.Gerez, "Algorithms for VLSI Design Automation", John Wiley and Sons, 2002.														
2.	N.A.Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwar Academic Publishers, 2002.														

REFERENCE BOOKS	
1	Drechsler,R., "Evolutionary Algorithms for VLSI CAD", Kluwer Academic Publishers,Boston, 1998.
2	Hill, D.D.Shugard, J. Fishburn and K. Kuetzer, "Algorithms and Techniques for VLSI Layout Synthesis", Kluwer Academic Publishers, Boston, 1989.
3	Gaynor E. Taylor, G. Russell, "Algorithmic and Knowledge Based CAD for VLSI", Peter peregrinus Ltd. London.
E BOOKS	
1.	<a href="https://www.ifte.de/books/eda">https://www.ifte.de/books/eda</a>
2.	<a href="http://cadlab.cs.ucla.edu/~cong/CS258F">cadlab.cs.ucla.edu/~cong/CS258F</a>
3.	<a href="https://archive.nptel.ac.in/courses/106/106/106106088/">https://archive.nptel.ac.in/courses/106/106/106106088/</a>
MOOC	
1.	<a href="https://www.my-mooc.com/en/mooc/vlsi-cad-part-i-logic/">https://www.my-mooc.com/en/mooc/vlsi-cad-part-i-logic/</a>
2.	<a href="https://www.mooc-list.com/tags/vlsi">https://www.mooc-list.com/tags/vlsi</a>

#### VERTICAL-4: SOFTWARE AND SYSTEM MODELLING

COURSE TITLE	Data Structures and Algorithms			CREDITS	3	
COURSE CODE	EEC51506	COURSE CATEGORY	DE	L-T-P-C	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL – 3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Objective	To impart knowledge on					
	1. Linear data structures such as lists, stacks and queues using arrays and pointers 2. Various non-linear data structures like trees, binary trees, binary search trees and AVL trees. 3. Solutions for sorting and indexing problems. 4. Comparison of the space and time complexity of various algorithm design techniques. 5. Graph traversals procedures to design an algorithm to find shortest paths and minimum spanning tree in a graph.					
Course Outcome	Upon completion of this course, the students will be able to					
	1. Design and apply linear ADTs such as List, Stack and Queue. 2. Apply non-linear data structures such as binary tree structure and balanced trees such as AVL tree. 3. Learn different sorting methods and design the various hashing techniques. 4. Implement Graph traversals procedures to find the shortest paths and minimum spanning tree in a graph. 5. Analyse the time and space complexity of different algorithms.					
Prerequisites: C Programming Language						

CO vs PO / PSO MAPPING																	
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO-6	PO 7	PO-8	PO-9	PO-10	PO 11	PO 12	PSO 1	PSO 2	PSO 3		
CO-1	3	3	2	-	1	-	-	2	-	-	-	2	1	1	-		
CO-2	3	3	3	-	-	2	-	-	2	-	-	2	1	1	-		
CO-3	3	3	3	-	3	-	-	-	-	3	-	-	1	1	-		
CO-4	3	3	3	-	2	-	-	-	-	-	-	-	1	1	-		
CO-5	3	3	3	-	0	-	-	-	-	-	2	-	1	1	-		
1: Weakly related, 2: Moderately related and 3: Strongly related																	
MODULE1: Linear Data Structures (6L+6P)																	
List: Operations, Storage Representation – Array, Linked List, Stack: Operations, Storage Representation - Array and Linked List Implementation, Applications: Post fix Expression Evaluation, Infix to Postfix Conversion. Queue: Operations, Storage Representation - Array and Linked List Implementation, Applications.														CO-1  BTL-3			
Practical																	
1. Implementation of List ADT using arrays and Linked List 2. Implementation of Stack ADT. 3. Implementation of Queue ADT.																	
MODULE 2: Non- Linear Data Structures (6L+6P)																	
Trees: Preliminaries - Implementation of Trees, Tree traversals with applications. Binary Trees: Implementation, Expression Trees. Search tree ADT: Operations - MakeEmpty, Find, FindMin and FindMax, Insert and Delete, Average-Case Analysis. AVL Trees: Single Rotation, Double Rotation.														CO-2  BTL-3			
Practical																	
1. Construction of Binary Search tree and perform the various operations (Search, Delete, Modify and Display). 2. Implementation of AVL tree with insert, search, delete and traversal operations.																	
MODULE 3: Searching and Sorting (6L+6P)																	
Divide and conquer methodology - Searching: Linear Search - Binary Search- Sorting: Preliminaries- Insertion sort, Heap sort, Merge sort, Quick sort- hashing techniques.														CO-3  BTL-3			
Practical																	
1. Implementation of Insertion sort and Heap sort, Merge sort, Quick sort. 2. Implementation of Merge sort and Quick sort.																	
MODULE 4: Graphs (6L+6P)																	
Definitions, Representation of Graphs, Topological Sort, Graph Traversals – Breadth First Search and Depth First Search, Shortest Path Algorithms - Weighted Shortest Paths - Dijkstra’s Algorithm, Minimum Spanning Tree - Prim’s Algorithm, Graph Applications.														CO-4  BTL-3			



<b>Practical</b>		
1. Implementation of graph traversal algorithms 2. Finding Minimum Spanning Tree		
<b>MODULE 5: Analysis of Algorithms (6L+6P)</b>		
Algorithms- Algorithm Analysis framework - Performance of algorithms: Space and Time Complexity- Asymptotic Notations: Big-Oh, Big-Omega and Big-Theta - Best, Worst and Average case analysis of algorithms- Algorithm and Analysis of different sorting techniques-Mathematical analysis of Non recursive Algorithms and Recursive Algorithms.		<b>CO-5</b>  <b>BTL-3</b>
<b>Practical</b>  1. Calculate the time taken to sort a given set of items using the Quicksort algorithm. Plot a graph of the time required versus the number of entries in the list to be sorted, n, and repeat the experiment for different values of n. 2. Analyse a graph traversal implementation for Asymptotic Notations.		
<b>TEXT BOOKS</b>		
1.	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education Asia, 3rd Edition, 2021.	
2.	Aho A.V., Hopcroft J.E., and Ullman J.D., “Data Structures and Algorithms”, Pearson Education, 2018	
<b>REFERENCE BOOKS</b>		
1.	Gilberg R.F., Forouzan B.A., “Data Structures: A Pseudocode approach with C”, Thomson India Edition, Second Edition, 2015.	

COURSE TITLE	Circuit Simulation Using Pspice			CREDITS	3	
COURSE CODE	EECS1507	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The students shall develop an intuitive understanding of circuit analysis, electronic systems that has a continuous variable signal through simulation using Pspice. In this course, the simulation of various active and passive circuits that can be used to design amplifiers, oscillators, filters, analog converters, waveform generators and other analog circuits as required for the application is learned by the student.					

Course Objective	This course aims to equip the students with a basic understanding of simulation of electrical circuits and electronics for specific types of applications using methodical approach.It also helps students to analyse various types of analog circuits using simulation.														
Course Outcome	Upon completion of this course, the students will be able to 1. Analyze the basic circuit components and know how to connect them to make a simulated electrical circuit 2. Demonstrate the laws and principles of electrical circuits, explain the relationships and differences between theory and practice 3. Analyze the operation of filters, differentiator and amplifiers through simulation 4. Develop practical circuits and stimulate more interest and motivation for further studies of electrical circuits 5. Interpret various case studies using Pspice for additional electronic circuits.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO-2	3	2	2	1	1	-	-	-	-	-	-	-	1	1	1
CO-3	3	2	2	1	1	-	-	-	-	-	1	1	2	2	2
CO-4	3	2	1	1	1	-	-	-	-	-	-	-	1	1	2
CO-5	3	2	1	1	1	-	-	-	-	-	1	1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE I: INTRODUCTION TO SPICE													(4L+ 4P)		
Introduction to SPICE: Brief History, New Versions Representing Components, Understanding the SPICE Environment, Using Model Editor, Designing a Circuit & doing Simulation <b>Suggested Readings:</b> Simulation with pspice  <b>Lab Experiment :</b> Installing Pspice Working with PSPICE schematic <b>Software Required</b> PSPICE													CO-1 BTL-3		
MODULE II: DESIGNING AND SIMULATION WITH SPICE													(6L+ 6P)		
Understanding the PSPICE Environment, Using Model Editor, Using Magnetic Parts Editor, Using Stimulus Editor, Drawing a Circuit Preparation for Simulation: Preparing schematic for simulation, Understand the sources for simulation, Understand different markers. Semiconductor Devices - Diode Characteristic and Parameters <b>Suggested Readings:</b> BJT and FET characteristics and its application circuits <b>Lab Experiment:</b> simulate RC and RL circuits simulate half wave and full wave rectifiers <b>Software Required</b> PSPICE													CO-2 BTL-3		
MODULE III: DC AND AC CIRCUIT ANALYSIS													(8L+ 8P)		

Basic Definitions and Terminology, Analysing methods, PSpice Examples, Transient Circuits and System Parameters, PSpice Examples. Inverting and non-inverting amplifier, Differential amplifier, LPF and HPF basics <b>Suggested Readings:</b> Inverting and non-inverting amplifier applications, frequency response <b>Lab Experiment :</b> Simulation of inverting and non inverting amplifier simulation of Low pass filter and High pass filter simulation of Differential Amplifier <b>Software Required</b> PSPICE		<b>CO-3</b> <b>BTL-3</b>
<b>MODULE IV: OSCILLATOR AND DIGITAL CIRCUITS</b>		<b>(6L+ 6P)</b>
simulating digital circuits using PSpice , Logic gates, Mux and Demux , Encoder and Decoder <b>Suggested Readings:</b> Digital fundamentals <b>Lab Experiment :</b> simulation of half adder and full adder simulation of multiplexer <b>Software Required</b> PSPICE		<b>CO-4</b> <b>BTL-3</b>
<b>MODULE V: CASE STUDY AND APPLICATIONS</b>		<b>(6L+ 6P)</b>
circuit simulation with spice – case study. Semiconductor Devices- Silicon-Controlled Rectifier, MOSFET- Input and Output Characteristics. SCR and MOSFET Application projects <b>Suggested Readings:</b> Electronics and communication applications <b>Lab Experiment :</b> simulation of buck converter case studies <b>Software Required</b> PSPICE		<b>CO-5</b> <b>BTL-3</b>
<b>BOOKS</b>		
1.	Dennis Fitzpatrick “Analog Design and Simulation using OrCAD Capture and PSpice,” , Newnes, Second Edition, 2018	
2.	James W. Nilsson ,Susan A. Riede (2014), “Introduction to PSpice for Electric Circuits, Addison-Wesley Longman publication, Fifth edition, pp.1-164	
<b>REFERENCE BOOKS</b>		
1	Charles K Alexander (2007), Fundamental of Electric circuits, Tata Mc-Graw-Hill publication, fourth edition	
2	Behzad Razavi (2002), “Design of Analog CMOS Integrated Circuits”, Tata Mc-Graw-Hill publication, Second edition, pp.1-684	
<b>E Resources for Reference</b>		
1.	<a href="https://www.seas.upenn.edu/~jan/spice/PSpicePrimer.pdf">https://www.seas.upenn.edu/~jan/spice/PSpicePrimer.pdf</a>	
2.	<a href="https://www.pspice.com/resources/application-notes">https://www.pspice.com/resources/application-notes</a>	
3.	<a href="https://nptel.ac.in/courses/108/108/108108166/">https://nptel.ac.in/courses/108/108/108108166/</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc20_ee30/preview">https://onlinecourses.nptel.ac.in/noc20_ee30/preview</a>	
2.	<a href="https://nptel.ac.in/courses/117105147">https://nptel.ac.in/courses/117105147</a>	

COURSE TITLE		OBJECT ORIENTED PROGRAMMING USING C++				CREDITS		3							
COURSE CODE		ECS51017		COURSE CATEGORY		DE		L-T-P-C		2-0-2-2					
Version		1.0		Approval Details		37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL		BTL – 3					
ASSESSMENT SCHEME															
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessment		Observation / Lab records		Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)			
15%		15%		10%		5%		5%		25%		25%			
Course Description		This is a course suitable for B. Tech students. It deals with basic C++ programs, classes and objects. This course develops applications using friend function. Also, from this course students are able to understand the concepts of inheritance, polymorphism, exception handling, streaming and file handling mechanisms.													
Course Objective		1. To understand the basics of oops concepts. 2. To develop small programs using classes and objects. 3. To develop the applications using functions and overloading concepts. 4. To create the reusable code using inheritance and polymorphism. 5. To understand the file handling mechanisms and templates.													
Course Outcome		Upon completion of this course, the students will be able to  1. Implement simple Object-Oriented programming concepts using classes. 2. Develop applications using friend functions, constructors and overloading mechanisms. 3. Build reusable code using Inheritance and Runtime Polymorphism. 4. Implement exception handling, streaming and file handling mechanisms. 5. Use templates and standard template libraries.													
Prerequisites: C Programming Language															
CO vs PO / PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	3	2	-	1	-	-	2	-	-	-	2	1	1	-
CO-2	3	3	3	-	-	2	-	-	2	-	-	2	1	1	-
CO-3	3	3	3	-	3	-	-	-	-	3	-	-	1	1	-
CO-4	3	3	3	-	2	-	3	-	-	-	-	-	1	1	-

CO-5	3	3	3	-	-	-	-	-	-	-	2	-	1	1	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO C++ and OOP</b>													<b>(6L+3P)</b>		
<p>Object-Oriented Paradigm – Features of Object-Oriented Programming – C++ Fundamentals – Variables - Data types – Operators - Arrays – Strings- Pointers</p> <p>Introduction to C++ classes –Class Objects- Access Specifiers –Accessing Class Members- Defining Member functions–Arrays of Objects - Objects as Arguments.</p> <p><b>Practical component:</b></p> <ol style="list-style-type: none"> <li>1. Search a given number in an array.</li> <li>2. Perform various string manipulation functions.</li> <li>3. Swap two numbers using call by value and call by reference (Using pointers and reference variables).</li> <li>4. Create a class to read and display student/account/employee details.</li> </ol> <p>Suggested Readings:</p> <p>Classes and Objects - <a href="http://nptel.ac.in/courses/106105151/20">http://nptel.ac.in/courses/106105151/20</a></p>													<p><b>CO-1</b></p> <p><b>BTL-2</b></p>		
<b>MODULE 2: FUNCTIONS AND COMPILE-TIME POLYMORPHISM</b>													<b>(6L+3P)</b>		
<p>Working with Friend functions and Friend Classes – Static Data and Member Functions -Constructors - Copy Constructors- Constructor overloading- Destructors.</p> <p>Polymorphism- Types of Polymorphism – Compile time and Runtime - Function Overloading - Rules of Operator Overloading- Overloading of Unary and Binary Operators as Member function/Friend function.</p> <p><b>Practical component:</b></p> <ol style="list-style-type: none"> <li>1. Add two complex numbers using friend function.</li> <li>2. Calculate the area of different shapes using various constructor types.</li> <li>3. Find average of variables with different types using function overloading.</li> <li>4. Overload unary arithmetic operators using member and friend function.</li> </ol> <p>Suggested readings:</p> <p>Operator Overloading - <a href="http://nptel.ac.in/courses/106105151/15">http://nptel.ac.in/courses/106105151/15</a></p>													<p><b>CO-2</b></p> <p><b>BTL-3</b></p>		
<b>MODULE 3: INHERITANCE AND RUN TIME POLYMORPHISM</b>													<b>(6L+3P)</b>		
<p>Inheritance- Types of Inheritance – Single, Multilevel, Hierarchical, Multiple, Hybrid, Multipath and Virtual base class - Accessing Overridden Function - Constructors and Destructors in derived classes.</p> <p>Understanding Runtime polymorphism - Memory Management operators, Pointers to objects</p> <p><b>Practical component:</b></p> <ol style="list-style-type: none"> <li>1. Manipulate employee/account/student information using various Inheritance types.</li> <li>2. Implement constructors and destructors in derived classes.</li> </ol>													<p><b>CO-3</b></p> <p><b>BTL-3</b></p>		

3. Read and display book details using pointers to objects.		
Suggested Readings:  Dynamic Binding - <a href="http://nptel.ac.in/courses/106105151/41">http://nptel.ac.in/courses/106105151/41</a>		
<b>MODULE 4: EXCEPTION HANDLING, STREAMS AND FILES (6L+3P)</b>		
Understanding of working and implementation of Exception Handling. Streams- Unformatted and formatted console I/O operations – Manipulators, User-Defined Manipulators - Implementation of Files, Writing and Reading Objects.  <b>Practical Component:</b>  1. Handle arithmetic and array index out of bounds exceptions.  2. Read and display the given text using unformatted I/O operations.  3. Create a user-defined manipulator function.  4. Write details of n number of books to a file, then read and display the same.  Suggested Readings:  Exceptions - <a href="http://nptel.ac.in/courses/106105151/">http://nptel.ac.in/courses/106105151/</a>		<b>CO-4</b>  <b>BTL-3</b>
<b>MODULE 5: TEMPLATES AND STANDARD TEMPLATE LIBRARY (9L+6P)</b>		
Generic Programming with Templates - Function Templates- Function Templates with Multiple Arguments - Overloaded Function Templates - Class Templates - Class Templates with Multiple Arguments.  Standard Template Library (STL) – Components of Standard Template Library - Containers, Algorithms and Iterators.  <b>Practical component:</b>  1. Sort n numbers using function template.  2. Perform stack operations using class template.  3. Perform queue operations using containers in STL.  Suggested Readings:  Templates - <a href="http://nptel.ac.in/courses/106105151/54">http://nptel.ac.in/courses/106105151/54</a>		<b>CO-5</b>  <b>BTL-3</b>
<b>TEXT BOOKS</b>		
1.	K.R.Venugopal, RajkumarBuyya , “Mastering C++”,2nd Edition , McGraw Hill Education,2017	
2.	Herbert Schildt, “C++: The Complete Reference”, 4th Edition, McGraw Hill Education,2017.	
<b>REFERENCE BOOKS</b>		
1.	Bjarne Stroustrup, “The C++ Programming Language”,4th Edition, Addison-Wesley Professional, 2013.	
2.	Nell Dale, Chips Weems, “Programming and Problem Solving with C++”, Jones and Bartlett Learning, 5th Edition, 2009.	

3.	Nicolai M. Josuttis, "The C++ Standard Library: A Tutorial and Reference", 2nd Edition, Addison Wesley, 2012.
<b>EBOOKS</b>	
1.	<a href="http://fac.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf">http://fac.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.elsevier.com/books/matrix-calculus/bodewig/978-1-4832-3214-0">https://www.elsevier.com/books/matrix-calculus/bodewig/978-1-4832-3214-0</a>
2.	<a href="https://www.ebooks.com/en-er/book/209983367/matrix-calculus-kronecker-product-and-tensor-product-a-practical-approach-to-linear-algebra-multilinear-algebra-and-tensor-calculus-with-software-implementations-third-edition/yorick-hardy/">https://www.ebooks.com/en-er/book/209983367/matrix-calculus-kronecker-product-and-tensor-product-a-practical-approach-to-linear-algebra-multilinear-algebra-and-tensor-calculus-with-software-implementations-third-edition/yorick-hardy/</a>

COURSE TITLE		PCB Design – Idea to Product										CREDITS		3			
COURSE CODE		EEC51518			COURSE CATEGORY					DE			L-T-P-S		2-0-2-2		
Version		1.0			Approval Details					37 <sup>th</sup> ACM, 20.01.2023			LEARNING LEVEL		BTL-3,5		
ASSESSMENT SCHEME																	
First Periodical Assessment		Second Periodical Assessment		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC			Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)				
15%		15%		10%		5%			5%		25%		25%				
Course Description		The electronics and manufacturing industry with growth demands for the skill set of the individual. With the competitive market, industrial needs and decreasing demand for workforce, it is always advised to learn new things and have a certain skill set under sleeves to work in industry. This course is designed to train students in Printed Circuit Board design, Drafting and Fabrication.															
Course Objective		This course will teach teams of students how to design and fabricate PCB for prototyping as well as in an Industrial Production environment. This will help students to innovate faster with electronics technology															
Course Outcome		Upon completion of this course, the students will be able to 1. Identify different types of Printed Circuit Board (PCB), list the differences between them. 2. Acquire the basics of CAD design and fabrication. 3. Understand the design rules and etching techniques. 4. Acquire the knowledge of manual and automated troubleshooting techniques.															
CO, PO AND PSO MAPPING																	
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3		

[illegible]



3.	Printed Circuits Handbook - 6th edition Clyde F. Coombs,Jr, McGraw Hill ,2008
<b>REFERENCE BOOKS</b>	
1	Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi,2006.
<b>E BOOKS</b>	
1.	Open source EDA Tool KiCad Tutorial: <a href="http://kicad-pcb.org/help/tutorials/">http://kicad-pcb.org/help/tutorials/</a>
<b>MOOC</b>	
1.	<a href="https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/">https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/</a>
2.	<a href="https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/">https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/</a>

COURSE TITLE		ADVANCED PYTHON PROGRAMMING						CREDITS		3					
COURSE CODE		EECS1528		COURSE CATEGORY		DE		L-T-P-S		2-0-2-2					
Version		1.0		Approval Details		37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL		BTL-4					
ASSESSMENT SCHEME															
CIA										ESE					
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY		PRACTICAL			
15%		15%		10%		5%		5%		25%		25%			
Course Description		The students shall develop an intuitive and advanced learning of Python language													
Course Objective		1. Be familiar with various Python libraries and their operations in real time applications 2. To understand and analyse the advanced topics in Python													
Course Outcome		Upon completion of this course, the students will be able to 1. Recall the fundamentals of Python 2. Understand and Apply NumPy library of Python for various use cases 3. To know and apply Pandas and SciPy library for various real time applications 4. Understand and develop knowledge on Matplotlib for different application. 5. Explore the knowledge on advance topics in Python and apply in real time case studies													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	2	-	2	-	`	-	1	`	-	-	2	3	1



1.	<a href="https://devfreebooks.github.io/python/">https://devfreebooks.github.io/python/</a>
<b>MOOC</b>	
1.	<a href="https://nptel.ac.in/courses/106106145">https://nptel.ac.in/courses/106106145</a>

<b>COURSE TITLE</b>	<b>OPTIMIZATION TECHNIQUES FOR SIGNAL PROCESSING</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>	<b>EECS1529</b>	<b>COURSE CATEGORY</b>	<b>DE</b>	<b>L-T-P-S</b>	<b>2-0-2-2</b>
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>	37 <sup>th</sup> ACM, 20.01.2023	<b>LEARNING LEVEL</b>	<b>BTL-3</b>

## ASSESSMENT SCHEME

First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	To make the student develop a knowledge in the field of optimization techniques their basic concepts, principles of linear and integer programming, assignment and transportation problems
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<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. To understand the concept of optimization</li> <li>2. To formulate linear programming model</li> <li>3. To understand the concept of integer programming</li> <li>4. To understand the assignment and transportation problem</li> <li>5. To understand the concept of network analysis</li> </ol>
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<b>Course Outcome</b>	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>1. formulate the linear programming problem</li> <li>2. determine the solutions of the linear programming problem</li> <li>3. obtain the solutions of integer programming problem</li> <li>4. determine the optimal solution of assignment and transportation problem</li> <li>5. construct the network diagram and compute the project duration</li> </ol>
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**Prerequisites:**

## CO, PO AND PSO MAPPING

[illegible]



COURSE TITLE		RF Components and System Design								CREDITS			3		
COURSE CODE		EEC51539			COURSE CATEGORY			DE		L-T-P-S			2-0-2-2		
Version		1.0			Approval Details			37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL			BTL-3		
ASSESSMENT SCHEME															
CIA												ESE			
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*			THE ORY	PRACTICAL	
15%		15%			10%			5%		5%			25%	25%	
Course Description		This course is designed to train the students to RF circuits & systems design techniques for radio communications leading towards the recent research in the domain of advanced radio technology.													
Course Outcome		<div>1. Learn various techniques employed for the design of RF Circuits</div> <div>2. Acquire hands-on skills to analyze and design simple RF components such as matching networks, coupler (different variants), power divider etc, used in the Radio Communication Circuits</div> <div>3. Gain skills in using at least one of the software tools HFSS,PCB Printing Machine, and RF Instruments such as Vector Network Analyzer, Spectrum Analyzer, and Power Sensor.</div> <div>4. Calculation of S parameters using smith chart</div> <div>5. Acquire knowledge on Stability analysis</div>													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	1	1	-	-	-	-	-	-	1	3	1	3
CO-2	3	3	3	1	1	-	-	-	-	-	-	1	3	1	3
CO-3	3	3	3	1	1	-	-	-	-	-	-	1	3	1	3
CO-4	3	3	3	1	1	-	-	-	-	-	-	1	3	1	3
CO-5	3	3	3	1	1	-	-	-	-	-	-	1	3	1	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1:Introduction: (9L+ 6P)															

<p><b>Introduction:</b> Importance of RF and Microwave Concepts and Applications- and Units- Frequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.</p> <p>Suggested Readings:</p> <ol style="list-style-type: none"> <li>1.Electromagnetic Theory</li> <li>2.HFSS</li> </ol> <p><b>Lab Experiments</b></p> <p><b>1.Calculation of Z parameters</b></p> <p><b>Software/Equipment Used</b></p> <p>HFSS</p>	<p><b>CO-1</b> <b>BTL-2</b></p>
<p><b>MODULE 2: The Smith Chart: (9L+ 6P)</b></p>	
<p>Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart, Distributed Circuit Applications, Lumped Element Circuit Applications. SINGLE AND MULTI PORT NETWORKS: Basic Definitions, Interconnecting Networks</p> <p><b>Scattering Parameters:</b> Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion Between S- and Z-parameters, Signal Flow Chart Modelling.</p> <p><b>Lab Experiments</b></p> <p><b>1.Calculation of Z parameters</b></p> <p><b>Software/Equipment Used</b></p> <p>HFSS</p>	<p><b>CO-2</b> <b>BTL-2</b></p>
<p><b>MODULE 3: Stability and Gain Considerations – RF Design (9L+ 6P)</b></p>	
<p>RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, and Stabilization Methods-Unilateral and Bilateral Design for Constant Gain- Noise Figure Circles- Constant VSWR Circles.</p> <p><b>Lab Experiments</b></p> <p><b>1.calculation of Gain, Noise and VSWR</b></p> <p><b>Software/Equipment Used</b></p> <p>HFSS</p>	<p><b>CO-3</b> <b>BTL-2</b></p>
<p><b>MODULE 4: Passive RF components (9L+ 6P)</b></p>	
<p>Coupler Design: analytical technique and HFSS implementation; Power Combiner and Power Divider: analytical techniques and HFSS implementation; Multi-band Component Design Techniques</p> <p><b>Lab Experiments</b></p> <p><b>1.Coupler Design</b></p> <p><b>2.Power divider Design</b></p> <p><b>Software/Equipment Used</b></p> <p>HFSS</p>	<p><b>CO-4</b> <b>BTL-2</b></p>
<p><b>MODULE 5: Active RF Components (9L+ 6P)</b></p>	
<p>Active RF Components (RF Field Effect Transistors, MOSFETs, HEMTs), Power Amplifier (Biasing and Matching Networks Design Techniques and HFSS Implementation; Power Amplifier Topologies, Power Amplifier Operation Modes, Multi-band Matching Techniques for Power Amplifiers</p> <p><b>Lab Experiments</b></p> <p><b>1.Matching network Design</b></p> <p><b>Software/Equipment Used</b></p> <p>HFSS</p>	<p><b>CO-5</b> <b>BTL-2</b></p>
<p><b>BOOKS</b></p>	
<p>1.</p>	<p>Mathew M. Radmanesh, "Radio Frequency &amp; Microwave Electronics", Pearson Education Asia, Second Edition,</p>
<p>2.</p>	<p>Reinhold Ludwig and Powel Bretchko," RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition.</p>
<p>3</p>	<p>R. Ludwig and G. Bogdanov,"RF Circuit Design <i>Theory and Applications</i>", Pearson Economy , 2<sup>nd</sup> edition</p>
<p><b>REFERENCE BOOKS</b></p>	

1	Joseph . J. Carr, "Secrets of RF Circuit Design", McGraw Hill Publishers, Third Edition.
2	Ulrich L. Rohde and David P. New Kirk, "RF / Microwave Circuit Design", John Wiley & Sons USA, 2000.
3	Roland E. Best, "Phase - Locked Loops: Design, simulation and applications", McGraw Hill Publisher 5 <sup>th</sup> edition
4	Devendra K.Misra ,"Radio Frequency and Microwave Communication Circuits – Analysis and Design "John Wiley & Sons, Inc.
5	D. M. Pozar,"Microwave Engineering", Wiley Publication, 3 <sup>rd</sup> Edition
6	Joseph Carr "Secrets of RF Circuit Design ",McGraw Hill Publication, 4 <sup>th</sup> Edition
<b>E BOOKS</b>	
1.	Christopher Bowick "RF Circuit Design ,3 <sup>rd</sup> edition ",Newnen's Publication ,2014
<b>MOOC</b>	
1.	<u>Basic Building Blocks of Microwave Engineering and Design Principles of RF and Microwave Filters and Amplifiers - Course (nptel.ac.in)</u>

COURSE TITLE	Embedded C Programming			CREDITS	3	
COURSE CODE	EEC51540	COURSE CATEGORY		DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details		37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	The Students learns about Embedded C language, and run code on real time hardware					
Course Objective	This course aims to provide knowledge on the basics of Building Blocks of Embedded System.  This course also equips students with Various Embedded Development Strategies with an ability to understand the fundamentals of embedded C Programming					
Course Outcome	Upon completion of this course, the students will be able to  CO 1. Illustrate about fundamentals of microcontrollers  CO2: Deliver insight into basic knowledge about programming and system control to perform a specific task.  CO3: Develop knowledge about devices and buses used in embedded networking  CO4: Make up the programming skills in embedded systems for various applications.  CO5: Improve knowledge about the Life cycle of embedded design and its testing.					
CO, PO AND PSO MAPPING						

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	1	1	1	0	0	0	0	0	0	2	2	1	1
CO-2	3	2	2	1	1	0	0	0	0	1	1	2	2	2	1
CO-3	3	2	2	2	2	0	0	0	0	1	1	2	3	2	2
CO-4	3	2	2	1	2	0	0	0	0	1	2	2	3	3	2
CO-5	3	3	2	2	2	0	0	0	0	2	2	2	3	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: C Overview and Program Structure (9L)															
C Source code- Program Structures- Functions - Declarations -Statement and Expressions- Constants- Bits and Bytes- Syntax of C Constants- Tri-Graph Sequences  Exp 1: Write a C program to generate the first n terms of the Fibonacci sequence.  Exp 2: Write a C program to Check whether given number is Armstrong Number or Not  Requirements: Personal Computer, ANSI C Compiler													CO-1  BTL-3		
MODULE 2: Preprocessor Directives (9L)															
Standard Preprocessor directives- Compatibility notes- Data Types and variables- Expression and operators- Memory- Pointers -Built in functions  Exp 3: Write a C program using macro to print the elements of the array.  Exp 4:Write a C program to illustrate the use of these symbolic constants for the binary arithmetic operators +, -, *, and /  Requirements: Personal Computer, ANSI C Compiler													CO-2  BTL-3		
MODULE 3: PIC Microcontroller (9L)															
PIC architecture- Device programming- Power up considerations- Clock Configurations- Debugging  Exp 5: Logic Functions Design  Exp 6: Delay Loops Applications Flasher & Counter  Requirements: PIC,MPLAB													CO-3  BTL-3		
MODULE 4: Analog Techniques (9L)															
Digital to Analog – Analog to Digital-Comparator- Filtering – Waveform Analysis- Aliasing- Voltage Detect- Compatibilty Notes  Exp 7: Pulse-width modulation (PWM)  Exp 8: Analog Digital Conversion  Requirements: PIC,Proteus													CO-4  BTL-3		
MODULE 5: Serial Busses and Debugging (9L)															
Serial Peripheral Interfaces- I <sup>2</sup> C- RS 232- UART- Data Interrupts- Flow control- ICSP- Power debugging- Data Streaming													CO-5  BTL-3		



Exp 9: Program to transmit message from microcontroller to PC serially using RS232		
Exp 10: Program to receive a message from PC to microcontroller serially using RS232		
Requirements:PC with serial port, Keil evaluation software		
Text Books		
1.	Mark Siegesmund “Embedded C Programming Techniques and Applications of C and PIC MCUS”, Elsevier, 2014	
2.	Michael Barr, Anthony Massa “Programming Embedded Systems With C and GNU Development Tools”O’Reilly Media, 2006	
REFERENCE BOOKS		
1	Michael Barr “Embedded C Coding Standard”,Netrino,2018	
2	Bruce Powel Douglass, “Design Patterns for Embedded Systems in C”, Elsevier, 2010	
E BOOKS		
1.	<a href="https://freecomputerbooks.com/Programming-Embedded-Systems-using-C.html">https://freecomputerbooks.com/Programming-Embedded-Systems-using-C.html</a>	
MOOC		
1.	<a href="https://www.mooc-list.com/tags/embedded-systems">https://www.mooc-list.com/tags/embedded-systems</a>	
2.	<a href="https://onlinecourses.nptel.ac.in/noc20_ee98/preview">https://onlinecourses.nptel.ac.in/noc20_ee98/preview</a>	

COURSE TITLE	FOUNDATION OF QUANTUM COMPUTING			CREDITS	3	
COURSE CODE	EECS1550	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	The objective of this course is to provide the students an introduction to quantum computation. This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory. Quantum computation is an emerging field whose goal is to effectively design atomic sized computers which exploit the parallelism of the quantum mechanical laws of the universe.					
Course Objective	1. To describe the basic principles of quantum computation 2. To obtain a theoretical understanding of quantum circuits and quantum protocols 3. To discuss the basics of quantum cryptography and error-correcting code.					

<b>Course Outcome</b>	Upon completion of this course, the students will be able to													
	1. Understand the basic principles of quantum computation and quantum mechanics.													
	2. Understand the model of quantum computation to design quantum circuits.													
	3. Analyze the behavior of basic quantum algorithms.													
	4. Be familiar with basic quantum protocols such as teleportation and superdense coding and quantum cryptography													
	5. Simulate a simple quantum error-correcting code.													
<b>Prerequisites:</b> Knowledge in basics of computers and computer programming.														
<b>CO, PO AND PSO MAPPING</b>														
<b>CO</b>	<b>PO - 1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO - 10</b>	<b>PO- 11</b>	<b>PO- 12</b>	<b>PSO-1</b>	<b>PSO-2</b>
CO-1	3	-	-	-	2	1	-	-	-	-	-	-	3	1
CO-2	3	-	3	-	2	1	-	-	-	-	-	2	3	1
CO-3	3	-	3	2	1	1	-	-	-	-	-	-	3	1
CO-4	2	-	2	3	1	1	-	-	-	-	-	2	3	1
CO-5	3	-	2	2	1	1	1	-	-	-	-	2	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related														
<b>MODULE 1 :INTRODUCTION TO QUANTUM COMPUTING (9L)</b>														
Introduction: Introduction to quantum computing. Quantum bits, Bloch sphere representation of a qubit, multiple qubits. Quantum states in Hilbert space,The Bloch sphere, Density operators, generalized measurements, Introduction to quantum states and measurements. Postulates of quantum mechanics. Classical computation versus quantum computation.													CO-1  BTL-2	
Lab Experiments: Quantum Circuit														
<b>MODULE 2 : QUANTUM MODEL OF COMPUTATION AND TRANSFORMATION (9L)</b>														
The model of quantum computation. Quantum circuits: single qubit gates, multiple qubit gates, design of quantum circuits. Unitary Transformations, Quantum Gates, Unitary Transformations as Quantum Circuits, Reversible Classical Computations to Quantum Computations, Language for Quantum Implementations.													CO-2  BTL-3	
Lab Experiments: Quantum Gates and design of quantum circuits														
<b>MODULE 3 : QUANTUM ALGORITHMS (9L)</b>														
Deutsch’s algorithm, Deutsch-Jozsa algorithm and the Bernstein-Vazirani Algorithm, Grover’s search algorithm. Simon’s algorithm and Shor’s algorithm for factoring, Quantum Fourier transform, Universal set of gates, quantum circuits, Solovay-Kitaev theorem, factoring.													CO-3  BTL-2	
Lab Experiments: Quantum Fourier transform and Shor’s algorithm for factoring,														
<b>MODULE 4: QUANTUM INFORMATION THEORY AND QUANTUM CRYPTOGRAPHY (9L)</b>														
Comparison between classical and quantum information theory. Applications of quantum information. Bell states. super dense coding and Quantum teleportation, Bell inequalities and entanglement, Schmidt decomposition. Quantum Cryptography, no cloning theorem, quantum key distribution.													CO-4  BTL-2	

Lab Experiments: Quantum Simulation as a Search Algorithm		
MODULE 5: QUANTUM ERROR CORRECTION (9L)		
Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Codes for correct multiple errors Fault – Tolerant Quantum Computation.		CO-5
Lab Experiments: Quantum Error Correction		BTL-3
TEXT BOOKS		
1.	Micheal A. Nielsen. &Issac L. Chiang, “Quantum Computation and Quantum Information”, Cambridge University Press, Fint South Asian edition, 2002.	
2.	P. Kaye, R. Laflamme, and M. Mosca, “An introduction to Quantum Computing”, Oxford University Press, 1999	
REFERENCE BOOKS		
1.	Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. (2004).	
2.	Pittenger A. O., An Introduction to Quantum Computing Algorithms (2000).	
3.	M. A. Nielsen &l.Chuang, Quantum Computation and Quantum Information, Cambridge University Press (2013)	
4.	Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. 2004	
E BOOKS		
1.	<a href="https://github.com/npsHub/quantum-computing">https://github.com/npsHub/quantum-computing</a>	
2.	<a href="https://builtin.com/hardware/quantum-computing">https://builtin.com/hardware/quantum-computing</a>	
3.	<a href="http://theory.caltech.edu/~preskill/ph229/notes/chap7.pdf">http://theory.caltech.edu/~preskill/ph229/notes/chap7.pdf</a>	
MOOC		
1.	<a href="https://nptel.ac.in/courses/106106232">https://nptel.ac.in/courses/106106232</a>	
2.	<a href="https://onlinecourses.nptel.ac.in/noc21_cs103/preview">https://onlinecourses.nptel.ac.in/noc21_cs103/preview</a>	
3.	<a href="https://onlinecourses.nptel.ac.in/noc19_cy31/preview">https://onlinecourses.nptel.ac.in/noc19_cy31/preview</a>	

COURSE TITLE	SPEECH AND IMAGE PROCESSING			CREDITS	3
COURSE CODE	EECS1551	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department	Attendance	End Semester Examination (Theory)
					End Semester Examination

				Examination Committee “DEC							(Practical)				
15%	15%	10%	5%	5%	25%	25%									
Course Description	To provides the foundation knowledge on speech production and perception along with processing of speech signal in digital domain and to the process of recognizing, making algorithmic enhancements and manipulating a digital image.														
Course Objective	1. To understand speech as a means of communication, represent speech for transmission and reproduction 2. To analyze speech for automatic recognition, extraction of information, discover some physiological characteristics of the talker. 3. To become familiar with digital image fundamentals 4. To get exposed to simple image enhancement techniques in Spatial and Frequency domain. 5. To study the image segmentation and representation techniques.														
Course Outcome	Upon completion of this course, the students will be able to  1. Describe the basics of communication, represent speech for transmission and reproduction 2. Demonstrate speech for automatic recognition to solve the given problem. 3. familiarize with digital image fundamentals. 4. Exposed to simple image enhancement techniques in spatial & frequency domain. 5. Identify the need image segmentation and representation techniques.														
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO- 10	PO- 11	PO- 12	PSO- 1	PSO-2	PSO-3
CO-1	3	3	2	2	3	-	-	2	-	-	2	1	2	3	1
CO-2	3	3	2	2	3	2	-	-	3	-	-	1	2	3	1
CO-3	3	3	2	2	3	-	3	-	-	2	-	1	2	3	1
CO-4	3	3	2	2	3	-	-	3	-	-	-	1	2	3	1
CO-5	3	3	2	2	3	-	-	-	-	-	-	1	2	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction & Speech Modelling (6L+6L=12)															
Introduction - knowledge in speech and language processing - ambiguity - models and algorithms - language - thought - understanding - regular expression and automata - words & transducers – N grams SPEECH MODELLING Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation- based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling													CO-1  BTL-1		
MODULE 2: Speech Pronunciation & Identification (6L+6L=12)															
Phonetics - speech sounds and phonetic transcription - articulatory phonetics - phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology SPEECH IDENTIFICATION: Speech synthesis - text normalization - phonetic analysis - prosodic analysis – diphone waveform synthesis - unit selection waveform synthesis – evaluation.													CO-2  BTL-3		

<b>MODULE 3: Fundamentals of Image Processing and Image Transforms (6L+6L=12)</b>	
Introduction, Image Sampling, Quantization, Resolution, Image File Formats, Elements of Image Processing System, Applications Of Digital Image Processing. Introduction, Need For Transform, Image Transforms, Fourier Transform, 2 D Discrete Fourier Transform And Its Transforms, Importance Of Phase, Walsh Transform, Hadamard Transform, Haar Transform, Slant Transform Discrete Cosine Transform, KL Transform, Singular Value Decomposition, Radon Transform, Comparison Of Different Image Transforms.	<b>CO-3 BTL-4</b>
<b>Module 4: Image Enhancement (6L+6L=12)</b>	
Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothingspatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. Image Restoration: Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution.	<b>CO-4 BTL-3</b>
<b>MODULE 5: Image Segmentation (6L+6L=12)</b>	
Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour	<b>CO-5 BTL-2</b>
<b>TEXT BOOKS</b>	
1.	Daniel Jurafsky and James H. Martin, — Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition  , Person education,2013.
2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.
3.	Robert Marmelstein, "Programming Games in C"
<b>REFERENCE BOOKS</b>	
1.	Kai-Fu Lee, —Automatic Speech Recognition  , The Springer International Series in Engineering and Computer Science, 1999.
2.	Himanshu Chaurasiya, —Soft Computing Implementation of Automatic Speech Recognition, LAP Lambert Academic Publishing, 2010.
3.	Claudio Becchetti, Klucio Prina Ricotti, —Speech Recognition: Theory and C++ implementation  ,Wiley publications 2008.
4.	Ikrami Eldirawy , Wesam Ashour, —Visual Speech Recognition  , Wiley publications , 2011
<b>EBOOK</b>	
1.	<a href="https://en.wikibooks.org/wiki/C_Programming">https://en.wikibooks.org/wiki/C_Programming</a>
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc18-cs10/preview">https://onlinecourses.nptel.ac.in/noc18-cs10/preview</a>
2.	<a href="http://nptel.ac.in/courses/106105085/2">http://nptel.ac.in/courses/106105085/2</a>
3.	<a href="https://www.udemy.com/c-programming-for-beginners/">https://www.udemy.com/c-programming-for-beginners/</a>
4.	<a href="https://www.coursera.org/specializations/c-programming">https://www.coursera.org/specializations/c-programming</a>

#### VERTICAL-5: UNDERWATER COMMUNICATION AND SENSORS

COURSE TITLE	INTRODUCTION TO OCEAN ENGINEERING								CREDITS		3				
COURSE CODE	EEC51508				COURSE CATEGORY			DE		L-T-P-S		2-0-2-2			
Version	1.0				Approval Details			37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL		BTL-3			
ASSESSMENT SCHEME															
CIA										ESE					
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)				Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY	PRACTICAL		
15%	15%				10%			5%		5%		25%	25%		
Course Description	The students shall develop an intuitive understanding of the ports and harbors, basic concepts of ocean engineering and be able to apply them in practical situation.														
Course Objective	<ul style="list-style-type: none"><li>To introduce the students to the knowhows in the field of ocean, coastal and harbor engineering.</li><li>The main purpose of coastal engineering is to protect harbors and improve navigation.</li><li>In addition, to provide students understanding of ports and harbor structures.</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Visualize the ocean and harbor related engineering problems</li><li>Visualize the tides and currents in the deep ocean</li><li>Analyze the behavior and the properties of phenomena under the ocean</li><li>Understand the coastal areas and defense mechanisms for preventing of calamities due to Ocean dynamics</li><li>Infer how the ports and harbors are built for secured navigation of transport.</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	1	-	-	1	-	-	1	1	1		2	-	-	-
CO-2	2	1	-	-	2	-	-	1	1	2	-	2	-	1	-

CO-3	2	2	2	-	2	-	-	2	2	2	-	2	-	-	-
CO-4	3	2	2	-	3	-	-	2	2	2	-	2	-	-	-
CO-5	3	1	2	-	-	-	-	1	2	2	-	2	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
<b>MODULE 1: INTRODUCTION TO OCEAN</b>													<b>(6L+ 6P)</b>		
<p>Introduction to Oceanography – Ocean Circulation, Tides, Waves, Currents, Tsunami and Storm surges – origin, generation, propagation and characteristics; Different materials for marine applications - metals, concrete, geosynthetic products and other materials for marine environment; Marine corrosion and control; Introduction to physical modelling of coastal and offshore and harbour engineering problems.</p> <p>Suggested Readings: origin, generation, propagation and characteristics of ocean waves in the coast and ocean</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Case study on Tides waves and currents</li> <li>2. Case study on Tsunami warning systems</li> <li>3. Mathematical modelling of a coastal engineering problem</li> </ol> <p><b>Software/Equipment Used</b> MATLAB or PYTHON if needed for simulation</p>													<b>CO-1 BTL-3</b>		
<b>MODULE 2: OCEAN DYNAMICS</b>													<b>(6L+ 6P)</b>		
<p>Ocean circulation – Conservation equations and transport processes, momentum balances, geostrophic, large-scale circulation, wind-driven circulation, abyssal ocean circulation, boundary currents, friction and Ekman layers; Waves – Origin and evolution, characteristics, classification, Tsunami, Tides – Origin, characteristics, tidal generation forces, equilibrium tide, tidal analysis and prediction.</p> <p><b>Suggested Readings:</b> ocean circulation, boundary currents, friction and Ekman layers; Waves and Tides</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>4. Case study on wind driven and ocean circulation</li> <li>5. Case study on the characteristic behavior of the forces in deep ocean</li> <li>6. Write a code for the analysis and prediction of waves in the ocean using matlab or python</li> </ol> <p><b>Software/Equipment Used</b> MATLAB or Python</p>													<b>CO-2 BTL-3</b>		
<b>MODULE 3: WAVE PROPERTIES AND ANALYSIS</b>													<b>(6L+ 6P)</b>		
<p>Behavior of waves in shallow waters, Introduction to non-linear waves and their properties - Waves in shallow waters - Wave Refraction, Diffraction and Shoaling -Hindcast wave generation models, wave shoaling; wave refraction; wave breaking; wave diffraction random and 3D waves short term wave analysis - wave spectra and its utilities - Long term wave analysis- Statistics analysis of grouped wave data.</p> <p><b>Suggested Readings:</b> Wave Refraction, Diffraction and Shoaling -Hindcast wave generation models</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Case study on Diffraction and Shoaling</li> <li>2. Mathematical modelling of Hindcast wave generation models</li> <li>3. Case study on the statistical analysis of grouped wave data</li> </ol> <p><b>Software/Equipment Used</b> MATLAB if needed</p>													<b>CO-3 BTL-3</b>		
<b>MODULE 4: COASTAL ENGINEERING AND DEFENCE MECHANISMS</b>													<b>(6L+ 6P)</b>		

<p>Indian Scenario - Classification of Harbors. Introduction - wind and waves - Sea and Swell - Introduction to small amplitude wave theory - use of wave tables- Mechanics of water waves - Linear (Airy) wave theory, Introduction to Tsunami. Field measurement; models, groins, sea walls, offshore breakwaters, artificial nourishment - planning of coast protection works - Design of shore defense structures -Case studies.</p> <p><b>Suggested Readings:</b> Classification of Harbors. wind and waves - Sea and Swell-Tsunami</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Case study on the tsunami field measurement models</li> <li>2. Design of shore defense structures</li> <li>3. Collection of data from national and international scenarios on tsunami</li> </ol> <p><b>Software/Equipment Used</b> MATLAB if needed Otherwise Python</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
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<b>MODULE 5: PORTS AND HARBOURS (6L+ 6P)</b>	
<p>Types of ports and harbors; harbor layout and terminal facilities - piers, break waters, wharves, jetties, quays; Spring fenders, dolphins and floating landing stage environmental issues in port planning and operations; Harbor oscillations, seiches; Inlets – siltation of inlets and harbours – remedial measures; Onshore and offshore sediment transport - transport rate – estimation methods; Dredging..</p> <p><b>Suggested Readings:</b> ports and harbors; harbor layout and terminal facilities</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Case study on different types of Wharfs, jetties and fenders</li> <li>2. Simple application using estimation methods</li> </ol> <p><b>Software/Equipment Used</b></p>	<p><b>CO-5</b> <b>BTL-3</b></p>

<b>BOOKS</b>	
1.	Muir Wood, A.M., and Fleming C.A, “Coastal Hydraulics Sea and Inland Port Structures”, 1 st Edition, Hallstead Press, 2002.
2.	Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey,1994.

<b>REFERENCE BOOKS</b>	
1	Ozha&Ozha, “Dock and Harbour Engineering”, 1 st Edition, Charotar Books, Anand., 1990
2	Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, Inc., New York, 1978
3	Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Pub. New York, 1978.

<b>E BOOKS</b>	
1.	Kiyoshi Horikawa, Coastal Engineering: An Introduction to Ocean Engineering, Wiley, 1978
2.	<a href="https://www.pdfdrive.com/second-edition-introduction-to-marine-engineering-e14995229.html">https://www.pdfdrive.com/second-edition-introduction-to-marine-engineering-e14995229.html</a>
3.	<a href="https://link.springer.com/book/10.1007/978-3-319-16649-0">https://link.springer.com/book/10.1007/978-3-319-16649-0</a>

<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a>
2.	<a href="https://www.udemy.com/courses/search/?src=ukw&amp;q=ocean+engineering">https://www.udemy.com/courses/search/?src=ukw&amp;q=ocean+engineering</a>

COURSE TITLE	OCEAN ACOUSTICS			CREDITS	3
COURSE CODE	EEC51519	COURSE CATEGORY	DE	L-T-P-S	2- 0- 2- 2
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3



ASSESSMENT SCHEME															
First Periodical Assessment		Second Periodical Assessment			Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC			Attendance		End Semester Examination (Theory)		End Semester Examination (Practical)	
15%		15%			10%		5%			5%		25%		25%	
Course Description		This course provides introduction to the theory of sound propagation in the ocean. The content treats both ray and wave propagation and pays considerable attention to stochastic problems such as the scattering of sound at rough surfaces. The course use mathematics to gain insight into the underlying physics behind underwater acoustics.													
Course Objective		<div><div>1.</div><div>Comprehend the importance of ocean acoustics for ocean exploration.</div><div>2.</div><div>Interpret the physics of sound propagation and the factors affecting sound signal in the ocean</div><div>3.</div><div>Summarize the sources of ambient noise present in the sea and impacts of sound on marine diversity</div><div>4.</div><div>Classify the types and characteristics of acoustic transducers and arrays used in marine applications</div><div>5.</div><div>Uncover the basics of underwater acoustic signal processing</div></div>													
Course Outcome		<div>On successful completion of this course, the student will be able to</div> <div><div>CO1:</div><div>Interpret the basics of underwater sound and its propagation in ocean.</div><div>CO2:</div><div>To simulate / design any underwater SONAR systems for ocean application.</div><div>CO3:</div><div>To identify different kinds of noises, present in the ocean and its impacts on the marine biodiversity</div><div>CO4:</div><div>Ability to get exposure in analysing and applying suitable techniques for underwater acoustic signals and images</div><div>CO5:</div><div>To recognize different types of SONAR systems used practically .</div></div>													
Prerequisites:															
CO, PO AND PSO MAPPING															
CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	1	1	-	-	-	-	1	1	1	2	2	2
CO-2	3	3	3	1	3	-	-	-	-	1	1	1	2	2	2
CO-3	2	3	3	2	2	-	-	-	-	1	1	1	2	2	2
CO-4	2	3	3	2	3	-	-	-	-	1	1	1	2	2	2
CO-5	1	3	3	2	3	-	-	-	-	1	1	1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1:		INTRODUCTION TO UNDERWATER ACOUSTICS													(6L+6P)

<p>Ocean Acoustic environment; Measuring sound levels and relevant units; Sound propagation in the ocean – sound velocity profiles in the deep water and shallow water; Sound attenuation in the sea – absorption, scattering, transmission loss, reverberation, Snell’s law, target strength; SONAR systems- active, passive SONAR equations and system parameters.</p> <p><b>Lab experiments:</b></p> <ol style="list-style-type: none"> <li>1. Applying sonar equations in the design of ocean instruments</li> <li>2. Auto correlation and Cross Correlation of underwater signals</li> <li>3. Simulation of transmission loss in the ocean</li> </ol>	<p><b>CO-1</b></p> <p><b>BTL-2</b></p>
<b>MODULE 2: SENSORS FOR UNDERWATER ACOUSTICS (6L+6P)</b>	
<p>Principles of transduction and SONAR transducer design; Electromechanical Analog circuits, coupling coefficient, efficiency, Directivity characteristics of receivers, frequency response characteristics of transducers, Transducer measurement techniques; Physical geometry of arrays - linear, planar, cylindrical, spherical, beam patterns, array gain.</p> <p><b>Lab experiments:</b></p> <ol style="list-style-type: none"> <li>1. Comparison of sound velocity gradients for different ocean depths</li> <li>2. Characterization of hydrophones for receiving and transmitting responses</li> </ol>	<p><b>CO-2</b></p> <p><b>BTL-2</b></p>
<b>MODULE 3: SOURCES OF NOISE IN THE OCEAN AND ITS IMPACT (6L+6P)</b>	
<p>Sources of noise, Natural and Physical sounds - Seismic, Wind, Wave, Rain and Turbulence; Biological sounds - Dolphin, Whales, Fishes; Man made Noises- Shipping Machinery noises, Pile driving, Wind Mills; Variability of Ambient noises; Frequency Bands, Noise levels of all above; Impacts of Sound on Marine Animals.</p> <p><b>Lab experiments:</b></p> <ol style="list-style-type: none"> <li>1. Acoustic characterization of whale / any marine animal sound</li> <li>2. Frequency Analysis of underwater ambient noise data</li> <li>3. Acoustic characterization of ship machinery noises</li> </ol>	<p><b>CO-3</b></p> <p><b>BTL-3</b></p>
<b>MODULE 4: UNDERWATER ACOUSTIC SIGNALS PROCESSING (6L+6P)</b>	
<p>Representations of the signals – Fourier representations, Spatial filtering; Matched filters and Autocorrelations, Temporal resolution; Signal to Noise Ratio, Estimation of Auto Covariance, Cross Covariance; Power spectra of different Underwater Signals, Classification of signals; Concept and Types of beamforming techniques</p> <p><b>Lab experiments:</b></p> <ol style="list-style-type: none"> <li>1. Underwater image enhancement - filtering</li> <li>2. Underwater image enhancement – color enhancement</li> </ol>	<p><b>CO-4</b></p> <p><b>BTL-4</b></p>
<b>MODULE 5: TYPES OF UNDERWATER ACOUSTIC INSTRUMENTS AND ITS APPLICATION (6L+6P)</b>	

Principles of Sonar systems, Echosounder – single beam, multi beam; Side scan sonars – Imaging, Underwater acoustic camera; Sub bottom profilers –Sediment classification; Acoustic modem – Tsunami systems; Acoustic Positioning system- Transponders, USBL, SSBL systems, HiPAP; Underwater telephone; Underwater noise recorders; Underwater Beacons.		CO-5  BTL-4
<b>Lab experiments:</b>  1. Applying digital filters to underwater signal  2. Beamforming of vertical linear array data		
TEXT BOOKS		
1.	Robert J Urick,—Principles of underwater sound, Third Edition, Peninsula Publishing,2013	
2.	Herman Medwin and Clarence S. Clay, —Fundamental of acoustical oceanography, First Edition, Academic Press,1998.	
REFERENCE BOOKS		
1.	L.M. Brekhovskikh and Yu. P. Lysanov,—Fundamentals of ocean acoustics, Third Edition, Springer,2003	
2.	John G Proakis and Manolakis, —Digital Signal Processing Principles Algorithms and Applications, Fourth Edition, Pearson, 2006.	
3	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, —Digital Image Processing using MATLAB, Third Edition, Gatesmark Publishing,2020.	
E BOOKS		
1.	<a href="#">Ocean Acoustics   SpringerLink</a>	
2.	<a href="#">Underwater Acoustics - ScienceDirect</a>	
MOOC		
1.	<a href="#">MOOC_2018_ResourceBooklet.pdf (oceanmooc.org)</a>	
2.	<a href="#">Acoustical Oceanography   Mechanical Engineering   MIT OpenCourseWare</a>	

COURSE TITLE		Nano Electronic Devices and Sensors							CREDITS			3			
COURSE CODE		EEEC51530			COURSE CATEGORY			DE		L-T-P-S			2-0-2-2		
Version		1.0			Approval Details			37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL			BTL-3		
ASSESSMENT SCHEME															
CIA												ESE			
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY		PRACTICAL	
15%		15%			10%			5%		5%		25%		25%	
Course Description		The students shall develop an intuitive understanding of the basic concepts of nanoelectronics and fabrication techniques and materials used for making sensors.													
Course Objective		1. This course aims to equip the students with a understanding of basics of nanoelectronics and the nano MOS transistors 2. This course also equips students with an ability to understand materials and techniques used for sensor fabrication 3. Students learn about the effect of dimensionality on the electronic-structure as well as charge distribution on various atoms.													
Course Outcome		Upon completion of this course, Students will be able to 1. show knowledge in basics of nanoelectronics 2. Demonstrate about MOS Transistor 3. Relate with Metal gate transistors 4. Interpret ideas about materials and techniques used for sensor components. 5. Illustrate information about fabrication of different sensors													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	2	2	1	2	-	-	1	1	2	2	3	2
CO-2	3	2	2	2	2	1	1	-	-	-	1	1	1	3	2
CO-3	3	2	1	2	2	-	-	-	-	-	1	1	1	3	2
CO-4	3	2	2	2	2	-	-	-	-	1	1	1	2	3	2
CO-5	3	2	2	2	2	1	1	-	-	1	1	2	2	3	2

1: Weakly related, 2: Moderately related and 3: Strongly related		
MODULE 1: OVERVIEW OF NANO-ELECTRONICS (6L+ 6P)		
Nano-scale electronics; Foundation of nano-electronics – low dimension transport, quantum confinement, Coulomb blockade and quantum dot; Ballistic transport and Quantum interferences; Landauer formula, quantization of conductance, example of Quantum point contact. <b>Lab Experiments</b> 1. MATLAB-based material and device simulations for understanding nanoscale materials, devices, and finally the system design. 2. Band structure calculations for various materials like graphene, nanoribbons, etc.		CO-1 BTL-3
MODULE 2: TWO-TERMINAL JUNCTION TRANSISTORS (6L+ 6P)		
Basic CMOS process flow; MOS scaling theory; Issues in scaling MOS transistors; Requirements for non-classical MOS transistor; PMOS versus NMOS; Design and construction of MOS capacitor; MOS transistor and capacitor characteristics. <b>Lab Experiments</b> 1. I-V characteristics TB-NEGF calculations through PN junction diode, Resonant Tunneling Diode and Field Effect Transistor.		CO-2 BTL-3
MODULE 3: GATE TRANSISTORS (6L+ 6P)		
Metal gate transistors – motivation, basics and requirements; quantum transport in nano MOSFET; Ultrathin body silicon on insulator (SOI) – double gate transistors; Vertical transistors – FinFET and surround gate FET. <b>Lab Experiments</b> 1. Flash memory device characteristics.		CO-3 BTL-3
MODULE 4: SENSORS AND ACTUATOR CHARACTERISTICS (6L+ 6P)		
Basics: types and working principles of sensors and actuators; Characteristic features: Range, Resolution, Sensitivity, Error, Repeatability, Linearity and Accuracy, Impedance, Nonlinearities. <b>Lab Experiments</b> 1. MTJ device characteristics		CO-4 BTL-3
MODULE 5: MEMORY DEVICES AND SENSORS (6L+ 6P)		
Nano ferroelectrics – Ferroelectric random access memory –Fe-RAM circuit design – ferroelectric thin film properties and integration – gas sensitive FETs – resistive semiconductor gas sensors – electronic noses – identification of hazardous solvents and gases – semiconductor sensor array. <b>Lab Experiments</b> 1. Thermoelectric device characteristics		CO-5 BTL-3
BOOKS		
1.	K.E. Drexler, “Nano systems: Molecular Machinery, Manufacturing, and Computation”, Wiley, 2010.	
2.	M.C. Petty, “ Molecular Electronics : From Principles to Practice”, John Wiley & Sons Ltd, 2008	
REFERENCE BOOKS		
1	W. Ranier, “Nano Electronics and Information Technology”, Wiley, 2003.	
2	Dragica Vasileska and Stephen M Goodnick, "Nano-Electronic Devices: Semiclassical and Quantum Transport Modeling", Springer, 2011	
3	Mojtaba Joodaki “Selected Advances in Nanoelectronic Devices: Logic, Memory and RF”, Springer, 2013.	
E BOOKS		
1.	Ning Xi, King Wai Chiu Lai, “Nano Optoelectronic Sensors and Devices”, William Andrew, 2011.	
MOOC		



<b>Module 1: INTRODUCTION TO UNDERWATER ROBOTICS (10L + 2P = 12)</b>	
<p>Basic oceanography and acoustic propagation: speed of sound and oceanographic variability, oceanographic measurement systems - Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – underwater robot and water-surface robot – principles of underwater vehicle construction</p> <p><b>Suggested Readings:</b> Learning of classification of robots and basic robot simulation.</p> <p><b>Lab Experiments (Simulation)</b></p> <ol style="list-style-type: none"> <li>1. Getting started with robotic simulator - to familiarize with the user interface and with the basic concepts of Webots.</li> </ol> <p><b>Software/Equipment Required</b> Virtual Robot Simulator / Webots - an open source and multi-platform desktop application used to simulate robots.</p>	<p><b>CO-1</b> <b>BTL-3</b></p>
<b>MODULE 2: Kinematics of underwater vehicle: (7L +2P = 9)</b>	
<p>Equations for moving frame - rigid motion in a plane -representation of a rotated frame - holonomic and non-holonomic systems.</p> <p><b>Suggested Readings:</b> Basics of kinematic model.</p> <p><b>Lab Experiments (Simulation)</b> - using online simulator (Webots):</p> <ol style="list-style-type: none"> <li>1. <b>Euler axis and angle rotation:</b> Modify the rotation of the Solid node of the dumbbell in order to move the handle's axis (z-axis) parallel to the ground.</li> </ol> <p><b>Software/Equipment Required</b> Webots online simulator</p>	<p><b>CO-2</b> <b>BTL-3</b></p>
<b>MODULE 3: Underwater robots: Sensors and sonar communication systems (8L+7P=15)</b>	
<p>Inertial Sensors and GPS, Camera Sensors, LiDAR – Hydrophone - SONAR (Sound Navigation and Ranging) – Active sonar, Passive sonar - Applications and challenges of underwater acoustic communication technologies</p> <p><b>Suggested Readings:</b> Requirements of a sensor, Principles and applications of underwater sensors.</p> <p><b>Lab Experiments (Simulation)</b> - using online simulator (Webots):</p> <ol style="list-style-type: none"> <li>2. <b>Accelerometer</b> sensor is used to switch on the bottom most LED in the arrangement of four LED.</li> <li>3. <b>Altimeter sensor</b> is used to switch direction when the robot is close to the slope's border.</li> <li>4. <b>Compass:</b> In this example, MyBot moves in a closed arena filled with obstacles. The robot is equipped with a yellow motorized needle which always indicates towards the north. The north direction is computed using a Compass node.</li> <li>5. <b>Distance Sensors:</b> In this example, eight Distance Sensors are mounted at regular intervals around the MyBot body.</li> <li>6. <b>Encoders:</b> This example demonstrates the usage of the wheel encoders of two-wheeled robots. The controller randomly chooses target encoder positions, then it rotates its wheels until the encoder values reach the chosen target position. Then the encoders are reset and the controller chooses new random values. PositionSensor nodes applied on HingeJoint nodes model the encoders. The robot does not pay any attention to obstacles.</li> <li>7. <b>GPS:</b> This example shows two different techniques to find the current position of MyBot. The first technique consists in using an on-board GPS device. The second method uses a Supervisor controller that reads and transmits the position info to the robot.</li> </ol>	<p><b>CO-3</b> <b>BTL-3</b></p>

<p>8. <b>IMU:</b> This example demonstrates the difference between InertialUnit measurements and the fusion of multiple sensors of an IMU (Accelerometer, Gyro and Compass) to estimate the attitude (roll, pitch and yaw angles). The sensors are mounted on a 3 DOF (Degrees Of Freedom) arm which moves from one random target to another. After the 100th target is reached, the attitude is compared between the ground truth (InertialUnit), absolute estimation (Accelerometer and Compass) and relative estimation (Gyro). The drift on relative estimation is clearly visible.</p> <p>9. <b>Lidar:</b> In this example, MyBot demonstrates the use of a Lidar device. The Lidar mounted on the MyBot scans the environment.</p> <p><b>Software/Equipment Required</b> Webots online simulator</p>	
<b>MODULE 4: Guidance and Control (8L+4P=12)</b>	
<p>Introduction to Control Theory, Feedback Control Fundamentals, Proportional-Integral-Derivative (PID), a Linear Quadratic Regulator (LQR) and a Model Predictive Control (MPC) laws.</p> <p><b>Suggested Readings:</b> Usage of different simulators for practicing the guidance and control of robots.</p> <p><b>Lab Experiments</b> using online simulator (Webots):</p> <ol style="list-style-type: none"> <li>1. Linear motor progression: linear motor from position 0 and then progresses by steps of 2 [cm] until it reaches 20 [cm]</li> <li>2. Force feedback applied on the motor and the energy consumed by the robot</li> <li>3. Spherical Camera device is mounted on the MyBot. (2D camera overlay).</li> <li>4. Demonstrate the Propeller.</li> </ol> <p><b>Software/Equipment Required</b> Webots online simulator</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<b>MODULE 5: Path planning and Remote robot control (6L + 6P=12)</b>	
<p>Collision-free Navigation, Structural Inspection Path Planning, Autonomous Exploration, Graphical User Interface design, Robot Remote Control</p> <p><b>Suggested Readings:</b> Guidance and control systems.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Step by step method to Waterproofing the Thruster Motor</li> <li>2. Step by step method to test the developed Underwater robot in the water environment.</li> </ol>	<p><b>CO-5</b> <b>BTL-3</b></p>
<b>BOOKS</b>	
1	Gianluca Antonelli , ‘Underwater Robots’, Springer International Publishing, 4 <sup>th</sup> Edition., 2018
2	Lurton, Xavier. ‘An Introduction to Underwater Acoustics: Principles and Applications’ Germany, Springer Berlin Heidelberg, 2016
3	Faust, Daniel R. Underwater Robots. United States, PowerKids Press, 2016.
<b>REFERENCE BOOKS</b>	
1	Troupe, Thomas Kingsley. Underwater Robots. United States, Black Rabbit Books, 2017.
2	Colins, Luke. Underwater Robots. United States, Black Rabbit Books, 2020.
3	Yu, Junzhi, et al. Visual Perception and Control of Underwater Robots. United States, CRC Press, 2021.
<b>E Resources for Reference</b>	



1.	<a href="https://cyberbotics.com/">https://cyberbotics.com/</a> <a href="http://vrobotsim.org/">http://vrobotsim.org/</a>
<b>MOOC</b>	
1.	1 NPTEL: Wheeled Mobile Robots, IITM IIT Palakkad, NPTEL 2 <a href="https://altasea-project-blue.org/wp-content/uploads/2020/04/Underwater-Robotics-Curriculum.pdf">https://altasea-project-blue.org/wp-content/uploads/2020/04/Underwater-Robotics-Curriculum.pdf</a> 3 <a href="https://www.sciencebuddies.org/science-fair-projects/project-ideas/Robotics_p002/robotics/build-an-underwater-robot?from=Blog">https://www.sciencebuddies.org/science-fair-projects/project-ideas/Robotics_p002/robotics/build-an-underwater-robot?from=Blog</a>

COURSE TITLE		MARINE NAVIGATIONAL SYSTEMS						CREDITS		3					
COURSE CODE		EEC51552		COURSE CATEGORY		DE		L-T-P-S		2-0-2-2					
Version		1.0		Approval Details		37 <sup>th</sup> ACM, 20.01.2023		LEARNING LEVEL		BTL-3					
ASSESSMENT SCHEME															
CIA									ESE						
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY		PRACTICAL			
15%		15%		10%		5%		5%		25%		25%			
Course Description		This course mainly introduces the basic principles and basic knowledge of navigation, navigational support for shipping, navigational planning of voyage, simulator training in the electronic chart system, so that students can have a more in-depth understanding of ship, crew and other navigation related knowledge.													
Course Objective		<ul style="list-style-type: none"><li>• This course equip the students with a basic understanding of navigation.</li><li>• This course provide the knowledge about known locations to begin surveys and create maps.</li><li>• This course describes the physical features of bodies of water and the land areas adjacent to those bodies of water.</li><li>• This course depicts the configuration of the shoreline and seafloor</li><li>• To introduce the students to navigational charts, various methods for plotting ships position and to list out the meaning of Charts symbols</li></ul>													
Course Outcome		<p><b>Upon completion of this course, the students will be able to</b></p> <p>6. Analyze the importance of navigation</p> <p>7. measure and Elaborate the properties and positions of the Earth surface.</p> <p>8. Identify the process maritime transportation system moving safely and efficiently.</p> <p>9. Examine the importance of nautical charts and know the way to create an effective route.</p> <p>10. Illustrate the tool for navigators to plot and monitor their routes using digital charts.</p>													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	2	1	2	0	0	0	0	1	1	3	1	1

CO-2	2	2	2	2	1	2	0	0	0	0	1	1	3	1	1
CO-3	1	1	1	2	1	2	0	0	0	0	1	1	3	1	1
CO-4	1	1	1	2	1	2	0	0	0	0	1	1	3	1	1
CO-5	1	1	1	2	1	2	0	0	0	0	1	1	3	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO MARINE NAVIGATION (9L+ 6P)															
Definitions, Navigation Terms And Conventions, Navigation Organizations, Case studies.														CO-1 BTL-3	
MODULE 2: GEODESY AND DATUMS IN NAVIGATION (9L+ 6P)															
Geodesy, The Basis Of Cartography, Types Of Geodetic Survey, Modern Geodetic Systems, Datums And Navigation.														CO-2 BTL-3	
MODULE 3 : HYDROGRAPHY (9L+ 6P)															
Introduction, Hydrographic Surveys, Hydrographic Survey Planning, Hydrographic Survey Techniques, Processing Hydrographic Data, Other Sources Of Bathymetric Data.														CO-3 BTL-3	
MODULE 4: NAUTICAL CHARTS (9L+ 6P)															
Chart Fundamentals, Polar Charts, Special Charts, Chart Scales, Chart Accuracy, Chart Reading, Reproductions Of Foreign Charts, International Charts, Print On Demand Charts, Chart Numbering, Using Charts.														CO-4 BTL-3	
MODULE 5: ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (9L+ 6P)															
Importance of Electronic Charts, Terminology and Components of ECS and ECDIS, Capabilities And Performance Standards , Data Formats, Integrated Bridge Systems, Military Ecdis, Electronic Charts														CO-5 BTL-3	
TEXT BOOKS															
1.		Capt. Joseph and Capt. Rewari, “Principles of Navigation”, Applied Research International Pvt.Ltd, 2018													
2.		Chaudhari S.S, “Chart Work: Basic Concepts & Miscellaneous Calculations”, Advances A.S. Publication 2014.													
REFERENCE BOOKS															
1		Capt. A. G. Bhatia, “Modern Electronic Navigation Aids”, Gopilata Education Hub, 2021													
2		Ralph Becker-Heins, “Voyage Planning with ECDIS”, STC Publishing, 2016.													
E BOOKS															
1.		<a href="https://www.taylorfrancis.com/books/mono/10.4324/9780080477510/electronic-navigation-systems-david-calcutt-laurie-tetley">https:// www.taylorfrancis.com/books/mono/10.4324/9780080477510/electronic-navigation-systems-david-calcutt-laurie-tetley</a>													
2.		<a href="https://www.taylorfrancis.com/books/mono/10.1201/9781439847640/electronic-chart-display-information-system-ecdis-operational-handbook-adam-weintrit">https://www.taylorfrancis.com/books/mono/10.1201/9781439847640/electronic-chart-display-information-system-ecdis-operational-handbook-adam-weintrit</a>													
MOOC															
1.		<a href="https://www.udemy.com/topic/marine-navigation/">https://www.udemy.com/topic/marine-navigation/</a>													

**VERTICAL-6: ELECTRONICS MANUFACTURING TECHNOLOGY**

COURSE TITLE	TOOLS, COMPONENTS, EQUIPMENT FOR ELECTRONICS MANUFACTURING				CREDITS	3									
COURSE CODE	EEC51509	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2										
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL									
15%	15%	10%	5%	5%	25%	25%									
Course Description	The students shall develop an intuitive understanding of the Electronic Measurements and Instrumentation, basic concepts about the Identification of Components, Tools, SOP & its working. Also understand the Instructions and basics of Equipment and Safety Measures.														
Course Objective	<div>This course aims to equip the students to</div> <ul style="list-style-type: none"><li>Explore various Electronic Measurements and Instrumentation used for Manufacturing technology</li><li>Demonstrate the functionality of measuring equipment and Identification of Components, Tools, SOP &amp; Work Instructions.</li></ul>														
Course Outcome	<div>Upon completion of this course, the students will be able to</div> <ul style="list-style-type: none"><li>Interpret the functionality of electronic measurements and instrumentation</li><li>Identify the components, tools, SOP &amp; work instructions for Electronics manufacturing</li><li>Elaborate the tools, equipment and safety measure techniques applied in EMT</li><li>Demonstrate the soldering &amp; desoldering of manufacturing components</li><li>Analyze the various recent Electronics Manufacturing Equipment available in the market</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	1	1	3	2	2	0	0	0	0	0	0	0	1	0
CO-2	2	1	1	2	3	2	0	0	0	0	0	0	0	1	0
CO-3	2	1	1	1	2	2	0	0	0	0	0	0	0	1	0
CO-4	2	1	1	1	2	0	0	0	1	1	0	0	0	1	1

CO-5	2	1	1	1	2	0	0	0	1	1	0	0	0	1	2
0: Not related, 1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Electronic Manufacturing Process and Instrumentation (6L+ 6P)															
Electronics Manufacturing Process; Bill of Materials (BoM), Designing, Testing, Distribution, Electronics Manufacturing flow; Design, Prototyping, PCB Assembly, Electronic Packaging, Testing, Packing and Shipping. Analog and Digital meters: PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter, Transistor voltmeter circuits, AC electronic voltmeter. Current measurement with electronic instruments, probes Digital voltmeter systems, digital multimeters, digital frequency meter system Lab Experiments 1. 1. a. Study of semiconductor diode voltmeter 1. b. Study of semiconductor diode voltmeter as DC average responding AC voltmeter. 2. 2.a. Study of construction of L.C.R. bridge 2. b. Determination of the value of the given components using LCR Q meter.													CO-1 BTL-3		
MODULE 2: Identification of Components, Tools, SOP & Work Instructions (6L+ 6P)															
Main components & modules/ sub-assemblies of electronic equipment : Control Panel (System Controller), Keypads, Door and Window Contacts, Motion Detectors, Glass Break Detection, Smoke Detectors , Components : Electronic controls in a common way, Counters, Flip- flops, Logic gates, Multiplexers, Decoders, Concept of Amplification factor, Gain & Signal distortion, Protocols like TCP/TP for communication purpose and for digital networks & circuits. Lab Experiments 1. Identification & working of various electronic components (For any three components) 2. 2.a. Measurement using Multimeter 2.b. Measurement using Clamp meter													CO-2 BTL-3		
MODULE 3: Tools, Equipment and Safety Measures (6L+ 6P)															
Basic usage and maintenance of electronic manufacturing tools and equipment, Types of multimeters and oscilloscopes, Basic usage of multimeters and oscilloscopes, Safety measures for using multimeters and oscilloscopes, Potential safety hazards in an electronic manufacturing setting, Personal protective equipment for electronic manufacturing, Safety protocols and procedures for electronic manufacturing, Troubleshooting and repairing electronic manufacturing equipment, Preventative maintenance for electronic manufacturing equipment. Lab Experiments 1. Study of the transistor tester and determination of the parameters of the given transistors. 2. Study of the IC tester and determination of the parameters of the given IC.													CO-3 BTL-3		
MODULE 4: Soldering & Desoldering of Components (6L+ 6P)															
Soldering Tools: Soldering Guns, types of tips, Solder materials and their grading. Soldering and Desoldering Stations and their Specifications, Preparing Component for Soldering, PCB Applications, Desoldering Basic Components, Safety precautions while Soldering & Desoldering, Identification of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards , Join the broken PCB track and test, Desoldering using Pump and wick, Introduction of SMD Components. Lab Experiments 1. Soldering of basic circuits on PCB board and dotted boards 2. De soldering practices on PCB and dotted board													CO-4 BTL-3		
MODULE 5: Electronics Manufacturing and Testing Equipment (6L+ 6P)															
SMT PRODUCTS: Multipoint Fluxer /Soldering, AI-TEC Conformal coating and Curing System, Reflow Oven, Selective Solder, Reflow system, PCB Router.													CO-5 BTL-3		

Automatic Test Equipment: In-Circuit Testers, Flying Probe Testers, Automatic FAI Tester. Process Control Equipments : Paste Mixers, Reflow monitoring systems, Reflow simulator, Syringe Mixers, Tackiness Tester, Viscometers, Wetting Tester, Wave and Selective soldering, PCB Cleaners, Strain Gauges.		
<b>Lab Experiments</b> 1. Battery health check-up 2. Measure and test the voltage of given cells. 3. demonstration and study of working of testing equipment ( For any two equipments)		
<b>BOOKS</b>		
1.	Modern Electronic Instrumentation and Measurement, Albert D. Helfrick, William David Cooper, PHI, 2020	
2.	Sensor Technology Handbook - Volume 1, Jon S. Wilson, Newnes Pub.,2005	
3.	Designing Electronic Systems for EMC, IET Digital Library, William G. Duff, 2011	
<b>REFERENCE BOOKS</b>		
1	PCB Design and Layout Fundamentals for EMC, Roger Hu,2019	
2	Hand and Power Tools, U. S. Department Labor, Occupational Safety Administration ,2014	
3	A Course in Electrical and Electronic Measurements and Instrumentation , A. K. Sawhney,Dhanpat Rai & Co.,2015	
<b>MOOC COURSE</b>		
1.	<a href="http://spokentutorial.org/watch/KiCad/Designing+printed+circuit+board+in+KiCad">http://spokentutorial.org/watch/KiCad/Designing+printed+circuit+board+in+KiCad</a>	
2.	<a href="https://nptel.ac.in/courses/112105267">https://nptel.ac.in/courses/112105267</a>	

COURSE TITLE	CONSUMER AND INDUSTRIAL ELECTRONICS			CREDITS	3	
COURSE CODE	EEC51510	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	This course is designed to enhance the knowledge, skills and attitude in performing testing assembling/disassembling of electronic components, maintaining and repairing audio/video products and systems, terminating/connecting electrical & electronics circuits and maintaining and repairing electrically-controlled domestic appliances. It also covers industry control systems operation of power switching devices and identifying their ratings and applications. Additionally, the introduction of robotics and its industrial applications are addressed.					

<b>Course Objective</b>	<p>This course aims to equip the students with</p> <ul style="list-style-type: none"> <li>a basic understanding of components of electronics and about the working of different TV setup.</li> <li>an ability to understand basics of power supply used in industries, robotics and its industrial applications.</li> </ul>
<b>Course Outcome</b>	<p>Upon completion of this course, the students will be able to</p> <ul style="list-style-type: none"> <li>Troubleshoot different types of audio systems &amp; microphones.</li> <li>Test working of various color TV.</li> <li>Troubleshooting various electronic home appliances.</li> <li>Describe the characteristics, operation of power switching devices and identify their ratings and applications.</li> <li>Describe the characteristics of robotics and its industrial applications</li> </ul>

#### CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	1	1	1	1	2	2	2	3	2	3	2	2	1
CO-2	3	-	-	2	1	1	2	2	-	2	-	-	2	2	-
CO-3	3	-	2	1	1	1	2	2	-	2	-	-	1	-	-
CO-4	3	2	2	1	1	1	2	2	2	-	2	2	-	2	-
CO-5	3	1	2	2	3	3	2	2	2	1	3	2	-	1	3

1: Weakly related, 2: Moderately related and 3: Strongly related

#### MODULE 1: Audio Fundamentals and Devices, Audio Systems

(6L+ 6P)

Audio System : Microphones, loudspeakers baffle and enclosure, Acoustics, mono, stereo, Quad, Amplifying System, Equalizers and Mixers Synthesizers, Commercial Sound, Theater Sound System, Bluetooth Enabled Speakers.

##### Lab Experiments

- To plot the frequency response of a microphone
- To plot the frequency response of a loud speaker

##### Software/Equipment Required

- CRO (100Mhz)
- Digital Multimeter
- Pattern generator
- Audio level meter
- DB Meter
- Microphone of Different Types
- Loudspeaker
- Equalizer Trainer Kit
- Digital TV trainer
- Continuity tester

CO-1  
BTL-3

#### MODULE 2: Elements of Television Systems

(6L+ 6P)

Video Systems and Displays: Monochrome, Color TV standards, TFT, Plasma, HDTV, LCD, LED TV, Direct-To- Home (DTH- Set Top Box), Video Telephone and Video Conferencing.

##### Lab Experiments

- Troubleshoot color TV receivers.
- Demonstration of DVD Player.

##### Software/Equipment Required

- CRO (100Mhz)
- Digital Multimeter
- Pattern generator

CO-2  
BTL-3

iv. DB Meter	
v. Loudspeaker	
vi. Digital TV trainer	
vii. Continuity tester	
<b>MODULE 3: Television Receivers and Video Systems (6L+ 6P)</b>	
<p>PAL-D colour TV receiver, block diagram, Precision IN Line color picture tube. Digital TVs: - LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, DTH receiver. Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI Multimedia Interface), Digital Video Interface. CD and DVD player: working principles, interfaces</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>Demonstration of DVD Player.</li> <li>Primary testing of various electronic home appliances.</li> </ol> <p><b>Software/ Equipment Required</b></p> <ol style="list-style-type: none"> <li>CRO (100Mhz)</li> <li>Digital Multimeter</li> <li>Pattern generator</li> <li>DB Meter</li> <li>Loudspeaker</li> <li>Digital TV trainer</li> <li>Continuity tester</li> </ol>	<b>CO-3 BTL-3</b>
<b>MODULE 4: Introduction to Power Switching devices and its applications (6L+ 6P)</b>	
<p>Description of working &amp; constructional features, Switching Characteristics, ratings and Applications of Power Transistor, Power MOSFET, SCR and MCT.</p> <p>Protection of SCR, SCR Triggering and Commutation Circuits/Methods, Series and Parallel operation of SCR, two transistor model of SCR, Describe Construction &amp; Working of Opto Isolators, Opto-TRIAC, Opto-SCR.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>To study the characteristics of SCR</li> <li>To study the various parametric characteristics of MOSFET, DIAC, TRIAC</li> </ol> <p><b>Software/ Equipment Required</b></p> <ol style="list-style-type: none"> <li>CRO (100Mhz),</li> <li>Digital Multimeter</li> <li>Diodes</li> <li>Resistors, Inductors &amp; Capacitors</li> </ol>	<b>CO-4 BTL-3</b>
<b>MODULE 5: Introduction to Robotics (6L+ 6P)</b>	
<p>Introduction to Industrial Robots, Basic Robot Systems, Robot Controller, Robot Programming Fundamentals, Programming Servo and Non-Servo Robots, and Robot Safety.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>Demonstration of Cartesian/ cylindrical/ spherical robot.</li> <li>Study of robotic system design.</li> </ol> <p><b>Software/ Equipment Required</b></p> <ol style="list-style-type: none"> <li>TPP (Teach Pendant Programming)</li> <li>ROBOGUIDE - the OFFLINE programming tool</li> <li>WINTPE - the Windows-based Teach Pendant editor for generation of TPP files</li> </ol>	<b>CO-5 BTL-3</b>
<b>BOOKS</b>	
1.	Consumer Electronics; SP Bali; Pearson Education, 2018 Reprint
2.	Consumer Electronics; J.S. Chitode; Technical Publications, Pune, 4 <sup>th</sup> Edition, 2021 Reprint
3.	M.S. JamilAsghar, Power Electronics, 1 <sup>st</sup> Edition, PHI Learning Publisher, 2017
4.	Craig, John J. - Introduction to robotics mechanics and control-Pearson New International Edition, 3 <sup>rd</sup> Edition, 2014
<b>REFERENCE BOOKS</b>	



1	Colour Television-principles & practice R.R Gulati by Wiley Eastern Limited, New Delhi, 2016
2	VCR-principles, maintenance & repair by S.P. Sharma, Tata Mc Graw Hill, New Delhi, 2020
3	Chakrabarti & Rai, Fundamentals of Power Electronics & Drives Dhanpat Rai & Sons, 2017 Reprint
4	Ned Mohan, T.M. Undeland and W.P. Robbins, Power Electronics: Converters, Applications and Design, Wiley India, 3 <sup>rd</sup> Edition, 2020
<b>E BOOKS</b>	
1.	Consumer Electronics Troubleshooting and Repair Handbook.
<b>MOOC Courses</b>	
1.	<a href="https://www.coursera.org/learn/introduction-to-power-semiconductor-switches">https://www.coursera.org/learn/introduction-to-power-semiconductor-switches</a> .
2.	<a href="https://www.semtech.com/applications/consumer-electronics">https://www.semtech.com/applications/consumer-electronics</a>
3.	<a href="https://www.futurelearn.com/courses/robotic-future">https://www.futurelearn.com/courses/robotic-future</a>
4.	<a href="https://www.coursera.org/specializations/robotics">https://www.coursera.org/specializations/robotics</a>

COURSE TITLE	PCB Design, Layout and Placement			CREDITS	3	
COURSE CODE	EEC51520	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-4	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	This course is designed to train students in Printed Circuit Board design, Drafting and Fabrication. Enables to learn new things and have a certain skill set under sleeves to work in industry based on needs and decreasing demand for workforce.					
Course Objective	This course will teach teams of students how to design and fabricate PCB for prototyping as well as in an Industrial Production environment. This will help students to innovate faster with electronics technology					
Course Outcome	Upon completion of this course, the students will be able to 1. Identification and selection of different types of Printed Circuit Board (PCB) for specific applications 2. Acquire the basics of CAD design and fabrication. 3. Explore the design rules and etching techniques. 4. Acquire the knowledge of Actual PCB Assembly Process. 5. Develop a PCB for an application.					

CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	0	0	0	0	0	0	0	0	1	3	1	0
CO-2	2	2	3	0	3	3	0	0	2	1	0	2	3	1	0
CO-3	1	1	2	0	0	0	0	0	0	0	0	2	3	0	0
CO-4	1	1	1	0	2	2	2	0	2	1	0	2	3	0	0
CO-5	2	2	3	0	3	3	0	0	2	1	0	2	3	1	0
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to PCB designing concepts (8 L)															
Introduction & Brief History PCB, Difference between PWB and PCB Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials. Information on materials used for multilayer PCB, drill holes, vias, aspect ratio, Study on datasheets of electronic components such as diode, Transistor, MOSFET, LED, SCR, ICs regulator IC, DIP IC & Resistor, Capacitor, Inductor, Transformer, Speaker/Buzzer and study their mechanical dimension and their projection (first angle/ third angle projection, top view, front view). <b>Suggested Activities:</b> 1. Prepare a report on reference designators for components used in PCB. 2. Give a presentation on general guidelines for designing the PCB. 3. Prepare a report on comparison of different types of PCBs.													CO-1 BTL-2		
MODULE 2: Familiarization of PCB Design Simulation tool. (5T+10P=15)															
Introduction to PCBs and general guidelines, PCB design rules for various applications. Creation of new project in Simulation tool, drawing the circuit in the schematic page using the components from the library. Simulation of Circuit using P-spice Simulation for verification of results, adding footprints to the components from the library. Creating the netlist, importing the components on PCB Editor. Placing and moving the components in PCB Editor as per design sequence, Routing between the components. Generating pdf files and Gerber files <b>Suggested Activities:</b> <ul style="list-style-type: none"><li>Develop the schematic of the following circuit: Full Wave rectifier, Clipper.</li><li>Develop the schematic of the following circuit: Astable/Monostable multivibrator using IC555.</li><li>Practice Hello_world PCB design prototype.</li></ul>													CO-2 BTL-4		
MODULE 3: PCB Manufacturing Techniques (3T+9P=12)															
Film Master Generation methods, Plating and Etching Techniques, punching, drilling, milling. Method of Screen Printing for pattern transfer. Printed Circuit Board Manufacturing Methods -Method of Wet film and Dry film for single and Double Sided Board Manufacturing. Method of Solder-mask and Legend Printings. <b>Suggested Activities:</b> 1. A case study on Design for Manufacturability issues. 2. Give a presentation on Electromagnetic Interference in real life and recommendation to solve the problem. 3. Collect details of different types of heat sinks used in PCBs.													CO-3 BTL-3		
MODULE 4: Actual PCBA process (8L)															
Solder Paste Stencil, Pick and Place, Reflow Soldering, Reflow Soldering, Through-Hole Component Insertion, Final Inspection and Functional Test; <b>Suggested Activities:</b> <b>(After PCBA) Explore the below topics which will be useful for Module-5</b> 1. Differences between PCBAs: THT Assembly, SMT Assembly and Mixed Technology 2. Thru-Hole Technology (THT) Assembly Process 3. Surface Mount Technology (SMT) Assembly Process													CO-4 BTL-3		

4.	Mixed Technology - Single Side Mixed Assembly, One Side SMT & One Side THT, Double Side Mixed Assembly.	
<b>MODULE 5: Practical/Tutorial</b>		<b>(6T+11P=17)</b>
<b>Practical component:</b> Project - Design and prototyping of single-sided PCB, mount the components and assemble in a cabinet for the simple electronic system with ICs		<b>CO-5 BTL-4</b>
<b>TEXT TEXT BOOKS</b>		
1.	Printed Circuit Board by RS Khandpur, McGraw Hill Education; 1st edition Hard Copy - 1 July 2017.	
<b>REFERENCE BOOKS</b>		
1.	Mitzner, K., Doe, B., Suponin, A., Akulin, A., Müller, D. (2019). Complete PCB Design Using OrCAD Capture and PCB Editor. Netherlands: Elsevier Science.	
2.	The Printed Circuit Designer's Guide To... Design for Manufacturing (DFM), David Marrakchi, IPC Publishing Group, Incorporated, 2017.	
3.	Printed Circuits Handbook - Coombs, Clyde F., Jr., and Happy T. Holden, eds. 2016, 7th ed. McGraw-Hill Education, New York.	
4.	The Art of Electronics, by Paul Horowitz, Winfield Hill, Cambridge University Press. Edition 3rd, 2015.	
<b>E BOOKS</b>		
1.	Open source EDA Tool KiCad Tutorial: <a href="http://kicad-pcb.org/help/tutorials/">http://kicad-pcb.org/help/tutorials/</a>	
2.	PCB Design Tutorial, by David L. Jones. <a href="https://alternatezone.com/electronics/files/PCBDesignTutorialRevA.pdf">https://alternatezone.com/electronics/files/PCBDesignTutorialRevA.pdf</a>	
3.	<a href="https://www.pcbcart.com/article/content/pcb-assembly-process.html">https://www.pcbcart.com/article/content/pcb-assembly-process.html</a>	
<b>MOOC</b>		
1.	<a href="https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/">https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/</a>	
2.	<a href="https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/">https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/</a>	

COURSE TITLE	1D Simulation			CREDITS	3	
COURSE CODE	EEC51521	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	Modeling is a preliminary phase for simulation through mathematical methodologies, to make the simulation system emulate the behavior of the system being designed. operate the modelled system under all possible conditions to study its behavior and to validate it using simulation. The course provides a sound physical and intuitive understanding of modeling of systems for application specific semiconductor devices.														
Course Objective	<p>This course aims to equip the students to</p> <ul style="list-style-type: none"><li>• Develop framework on modeling of engineering systems through lumped parameter elements.</li><li>• Identify and apply specific mathematical tools to analyze models of engineering systems.</li><li>• Discuss and formulate analytical modeling approaches to predict device operation at specific conditions.</li><li>• Embrace the use of software tools for solving engineering problems.</li><li>• Acquire practical skills in modeling and simulation of industrial use cases.</li></ul>														
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"><li>1. Develop mathematical models for engineering systems and derive analogy</li><li>2. Implement the modeling and simulation of feedback systems using simulation tools</li><li>3. Formulate empirical device model for circuit simulator to predict device operation by implementing mathematically fitted equations.</li><li>4. Familiarize the AMESim modeling and simulation tool for solving engineering problems</li><li>5. Simulate mathematical models of industrial engineering systems using simulation software.</li></ol>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	-	-	1	2	1	-	1	-	-	2	-	-	2
CO-2	3	2	-	-	3	-	-	-	-	-	-	2	-	3	2
CO-3	3	3	3	2	3	2	2	-	2	1	2	2	-	2	2
CO-4	3	3	2	2	3	2	2	-	2	1	2	2	-	2	2
CO-5	3	2	2	-	2	3	2	-	2	1	-	2	-	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Generalizing Lumped Element Modeling													(9L+ 6P)		
Fundamental concepts in mathematical modeling – System, modeling and analysis, Abstraction, Linearity and superposition, Balance and conservation laws and the system boundary approach, Lumped element modelling, RLC Electrical Systems- Charge, voltage and current, interrelationship between currents in different elements, voltage differences across elements, simplifying models through combination of elements. Thermal Systems- Basic concepts of heat transfer, thermal system elements- resistance and mass, heat transfer rate, analogy <b>Suggested Readings:</b> Electrical Basics, Ideal Passive elements <b>Experiments:</b> <b>Faradays Law, Thevenin’s and Nortons Equivalent using MULTISIM</b>													CO-1 BTL-4		
MODULE 2: Modeling of Feedback Systems													(9L+ 6P)		
Representing systems and sub systems using transfer Function, Block diagrams, properties of feedback systems, relative stability, Phase and gain margins, design of controllers  <b>Lab Experiments</b> 1. Feedback circuits based on operational amplifiers, DC servomotors, Tachomotors <b>Software/Equipment Used</b>													CO-2 BTL-3		

MULTISIM		
MODULE 3: Semiconductor Device Modeling and Simulation (9L+ 6P)		
Introduction to device modeling, physics-based model, empirical modeling, TCAD device simulation, SPICE model, MOSFET- MOS Band diagram and C-V characteristics, Threshold voltage and Interface charges, MOSFET I-V, gradual channel approximation and frequency response, non-idealities, and CMOS  Lab Experiments: MOS and CMOS Modeling Software/Equipment Used SPICE / Professional Pads Prop		CO-3 BTL-3
MODULE 4: Modeling of simple mechanical and controller system (9L+ 6P)		
AMESIM Workspace, Creating sketch and libraries, Simple mechanical system, getting AMESim demonstration examples, Linear analysis with a simple mass spring system.Frequency response analysis with a mass-spring damper system, Supercomponent Facility - Constructing a supercomponent PID Controller, types of Supercomponent and managing Supercomponent  Suggested Readings: AMESim Manual4.0  Lab Experiments 1. Simulation of a mass-spring system 2. Creating a generic supercomponent containing global parameters  Software/Equipment Used AMESim 4.0		CO-4 BTL-3
MODULE 5: Modeling interface (9L+ 6P)		
Importing AMESim results into MATLAB running simulations, Importing Linear systems. Overview of cybersecurity in IIoT, Threats and vulnerabilities in IIoT systems, Security solutions for IIoT systems, Cybersecurity regulations and standards for IIoT  Lab Experiments 1. Case of a Transfer function and a state space 2. Design Optimization and exploration features  Software/Equipment Used: AMESim 4.0 & MATLAB		CO-5 BTL-3
BOOKS		
1.	Fundamentals of Modeling and Anlayzing Engineering Systems, Cha P.D, Rosenberg J.J and Dym C.L, Cambridge University Press,1 <sup>st</sup> Edition, 2000.	
2.	Keesman, Karel J. System identification: an introduction. Springer Science & Business Media, 2011.	
REFERENCE BOOKS		
1	AMESim 4.0 user guide Manual, Siemens 2022	
2	Solid State Electronic Devices, G. Streetman, and S. K. Banerjee , Pearson,7th edition,2014.	
E BOOKS		
1.	<a href="https://pages.awscloud.com/industrial-iiot-top-use-cases-ebook.html">https://pages.awscloud.com/industrial-iiot-top-use-cases-ebook.html</a>	
2.	<a href="https://www.pdfdrive.com/iiot-books.html">https://www.pdfdrive.com/iiot-books.html</a>	
MOOC		
1.	Semiconductor device modeling and Simulation - Course (nptel.ac.in)	
2.	State-Space Modelling & Simulation of Electrical Circuits   Udemy	

COURSE TITLE			Design for Manufacturability						CREDITS			3				
COURSE CODE			EEC51531		COURSE CATEGORY			DE		L-T-P-S			2-0-2-0			
Version			1.0		Approval Details			36 <sup>TH</sup> ACM		LEARNING LEVEL			BTL-3			
ASSESSMENT SCHEME																
CIA												ESE				
First Periodical Assessment (Theory)			Second Periodical Assessment (Theory)			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY		PRACTICAL	
15%			15%			10%			5%		5%		25%		25%	
Course Description			This course is intended to prepare students to design products based on product design principles, guidelines and skills. Students will be given experience of designing products through case studies. At the end of the module students will communicate design concepts through sketches, virtual and physical appearance model.													
Course Objective			<ul style="list-style-type: none"><li>To understand the various processes and systems to address human needs by creating tangible Electronic Products.</li><li>To pursue learners with emphasis on learning-by-doing and following a comprehensive process of design, engineering and producing products and systems.</li></ul>													
Course Outcome			Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Design electronic products using user centered design process</li><li>Develop sketches, virtual and physical appearance models to communicate proposed designs</li><li>Refine product design considering engineering design &amp; manufacturing requirements and constraints.</li><li>Demonstrate mock-up model and working prototype along with design documentation.</li><li>Analyze various manufacturing processes and implement value engineering.</li></ul>													
Prerequisites : NIL																
CO, PO AND PSO MAPPING																
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3	
CO-1	3	1	2	0	0	0	0	0	0	0	0	1	0	0	1	
CO-2	3	2	2	1	2	0	0	0	0	0	0	1	0	0	1	
CO-3	2	3	2	2	0	0	0	0	0	0	0	1	0	0	1	
CO-4	2	1	3	3	0-	2	0	0	2	0	0	1	0	0	1	

CO-5	2	3	3	2	0	1	1	0	1	1	0	1	0	0	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Industrial Design (9L+ 6P)															
Introduction to Industrial Design, role of ID in the domain of industry, product innovation, designers philosophy and role in product design. Product development tools and methods. <b>Practical Component:</b> 1. Case study on product innovation 2. Evaluation of various electronic product development tools													CO-1 BTL-3		
MODULE 2: Product Design Methodology and Product Planning (9L+ 6P)															
Product Design Methodology: Electronic product design and development, Methodology, creativity techniques, brain storming, documentation. Product Planning: Defining the task, scheduling the task, estimation of labor cost and amount of documentation. Practical Component: 1. Case study on Proof of Concept for electronic products (PoC) 2. Exercise on various steps involving product planning													CO-2 BTL-3		
MODULE 3 Ergonomics, Aesthetics and Visual Communication Techniques (9L+ 6P)															
Ergonomics: Ergonomics of electronics - electronic use of ergonomics at work places and plant layouts, ergonomics of panel design, case study. Aesthetics: Elements of aesthetics, aesthetics of control design. Visual Communication Techniques: perspective, band sketching and rendering technique, elements of Engineering drawing, assembly drawing part drawing, exploded views Lab Experiments 1. Case study on ergonomics 2. An exercise in product design and development using Drawings Software/Equipment Used NX Software for drawing													CO-3 BTL-3		
MODULE 4: : Product Anatomy and Product Detailing (9L+ 6P)															
Product Anatomy: Layout design, structure design, standard and non standard structures, Industrials standards. Product Detailing: Product detailing in sheet metal and plastics for ease of assembly, Lab Experiments 1. Design a product using freeform features in NX 2. Weight Evaluation of a product in 3D model using NX Software/Equipment Used NX software													CO-4 BTL-3		
MODULE 5 Product Manufacturing and Value Engineering (9L+ 6P)															
Product Manufacturing: Different manufacturing processes in sheet metal and plastics, product finishing, finishing methods like plating, anodization, spray painting, powder coating etc. Value Engineering: Introduction to marketing, graphics & packing Lab Experiments 1. An exercise in product design and development using models. 2. An exercise in product design and development using prototype of simple product. Software/Equipment Used Three dimensional modelling using NX													CO-5 BTL-3		
TEXT BOOKS															
1.		Clarkson P. J, Coleman R. and Keates, S., "Inclusive Design, Design for the whole population", Springer Verlag Gmbh(2003)													
2.		Jordan P. W., "Designing Pleasurable Products: An Introduction to the New Human Factors." Taylor and Francis(2002)													

3.	Cross N. "Engineering Design Methods: Strategies for Product Design", Wiley.(2012)
<b>NCE BOOKS</b>	
1.	Cagan J. and Vogel C. M. (2007) Creating Breakthrough Products, Innovation from Product Planning to Program Approval. Pearson Education
2.	Coats D. , Watches Tell More than Time: Product Design, Information, Quest for elegance McGraw Hill(2002)
3.	Norman D. A., The design of everyday things, Basic Books.(2013)
4.	Chakrabarty D., "Indian Anthropometric Dimensions for Ergonomic Design Practice", NID, Ahmedabad (2016 reprint).
5.	Kelley T. and Littman J. "The Art of Innovation: Lessons in Creativity from Idea, America's Leading Design Firm, Doubleday", Ver: 4 November 2011 MI – PDN2524 Page 4 of 4 (2001)
<b>E BOOKS</b>	
1.	<a href="http://www.ulrich-eppinger.net/">http://www.ulrich-eppinger.net/</a>
2.	<a href="http://www.npd-solutions.com">http://www.npd-solutions.com</a>
3.	<a href="http://www.qfdi.org">http://www.qfdi.org</a>
4.	<a href="http://www.cheshirehenbury.com/rapid/">http://www.cheshirehenbury.com/rapid/</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/lecture/creative-design-prototyping-testing/">https://www.coursera.org/lecture/creative-design-prototyping-testing/</a>

COURSE TITLE	Electronic Product Design - Industrial case study			CREDITS	3	
COURSE CODE	EEC51532	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	01	Approval Details	XX	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	Electronic product design for industrial application is the technology that combines advanced sensors, networking, and analytics to enable smart manufacturing and digital transformation					
Course Objective	This course aims to equip the students to <ul style="list-style-type: none"><li>Understand the concepts and principles of electronic product design flow.</li><li>Learn the applications of electronic manufacturing in industrial sectors.</li><li>Explore the challenges and limitations of IIOT, including security, privacy, and reliability.</li><li>Acquire practical skills in design and implementation of sustainable electronic solutions to industrial problem statement</li></ul>					



Course Outcome	Upon completion of this course, the students will be able to 1. Describe the key characteristics and applications of electronic product design flow 2. Explore the hardware software components of Industrial embedded system architecture 3. Implement the IIoT protocols in real time systems 4. Analyze the data generated from IIoT system in real-world scenarios 5. Develop a sustainable electronic product design for the given industrial problem statement														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	-	-	1	2	1	-	1	-	-	2	-	-	2
CO-2	3	2	-	-	3	-	-	-	-	-	-	2	-	3	2
CO-3	3	3	3	2	3	2	2	-	2	1	2	2	-	2	2
CO-4	3	3	2	2	3	2	2	-	2	1	2	2	-	2	2
CO-5	3	2	2	-	2	3	2	-	2	1	-	2	-	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Electronic Product Design													(6L+ 6P)		
Introduction to Electronic Product Design: Overview of electronic product design process flow-Importance of user-centered design. Market research: Methods for conducting market research, Identifying user needs and requirements. <b>Suggested Readings:</b> Electronic Project design flow  <b>Case study component:</b> Students need to submit the report on design of appropriate product for a specific problem statement based on market need													CO-1 BTL-2		
MODULE 2: Embedded IIoT Architecture and Components													(6L+ 6P)		
Overview of IIoT architecture, Hardware components of IIoT systems: sensors, actuators, gateways, Software components of IIoT systems: platforms, protocols, APIs. <b>Suggested Readings:</b> Raspberry Pi device architecture  <b>Lab Experiments</b> 1. Hardware connectivity with sensors/ Actuators <b>Software/Equipment Used</b> Raspberry Pi Hardware device with required accessories													CO-2 BTL-3		
MODULE 3: IIoT Communication Protocols													(6L+ 6P)		
Importance of communication protocols in IIoT, Common communication protocols used in IIoT: MQTT, CoAP, AMQP, Comparison between communication protocols in IIoT, Implementation of any one communication protocol in IIoT systems <b>Suggested Readings:</b> IIoT Architecture and implementation of real time IIOT systems  <b>Lab Experiments</b> 1. Characteristics of MQTT communication protocol 2. Characteristics of CoAP communication protocol <b>Software/Equipment Used</b> Open source software tools Mosquitto, CoAPthon / Siemen’s MindSphere													CO-3 BTL-3		
MODULE 4: IIoT Data Analytics and Machine Learning													(6L+ 6P)		

Introduction to data analytics in IIoT, Use cases of IIoT data analytics, Machine learning algorithms and techniques for IIoT, Implementation of IIoT data analytics and machine learning in real-world scenarios <b>Suggested Readings:</b> IoT cloud based application		<b>CO-4 BTL-3</b>
<b>Lab Experiments</b> 1. Performance measure of Machine learning algorithm using Mindsphere <b>Software/Equipment Used</b> Siemen’s MindSphere software tool		
<b>MODULE 5: Sustainability and Environmental impact</b>		
Sustainable design principles and practices- Environmental impact of electronic products- Strategies for Intellectual property protection of electronic product design  <b>Suggested Readings:</b> Electronic recycling process  <b>Lab Experiments</b> Case study on Sustainable electronic product design principles for the given industrial problem statement		<b>CO-5 BTL-3</b>
<b>BOOKS</b>		
1.	Perry Lea "Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security" Packt Publishing Limited; 2nd edition,2020	
2.	Sudan Jha, Usman Tariq, Gyanendra Prasad Joshi, Vijender Kumar Solanki “Industrial Internet of Things Technologies, Design, and Applications”,, CRC press 1 <sup>st</sup> Edition, 2022	
<b>REFERENCE BOOKS</b>		
1	R. Anandan, Suseendran Gopalakrishnan, Souvik Pal, Noor Zaman," Industrial Internet of Things (IIoT)", Wiley-Scrivener, 1 <sup>st</sup> Edition, 2022	
2	Perry Lea “IoT and Edge Computing for Architects”,, Packt Publishing Limited; 2nd edition,2020	
3	Anandarup Misra, Sudip   Roy, Chandana   Mukherje “Introduction to Industrial Internet of Things and Industry 4.0”, CRC press 1 <sup>st</sup> Edition, 2020	
<b>E BOOKS</b>		
1.	<a href="https://pages.awscloud.com/industrial-iiot-top-use-cases-ebook.html">https://pages.awscloud.com/industrial-iiot-top-use-cases-ebook.html</a>	
2.	<a href="https://www.pdfdrive.com/iiot-books.html">https://www.pdfdrive.com/iiot-books.html</a>	
3.	<a href="https://www.pdfdrive.com/industry-40-the-industrial-internet-of-things-e176112140.html">https://www.pdfdrive.com/industry-40-the-industrial-internet-of-things-e176112140.html</a>	
<b>MOOC</b>		
1.	<a href="https://www.mooc-list.com/course/industrial-internet-things-iiot-coursera">https://www.mooc-list.com/course/industrial-internet-things-iiot-coursera</a>	
2.	<a href="https://www.mooc-list.com/course/industrial-iiot-markets-and-security-coursera">https://www.mooc-list.com/course/industrial-iiot-markets-and-security-coursera</a>	

COURSE TITLE	PCB DESIGN VERIFICATION			CREDITS	3
COURSE CODE	EECS1542	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA				ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved	Attendance *	THEOR Y PRACTICA L

			by the Department Examination Committee “DEC”												
15%	15%	10%	5%	5%	25%	25%									
Course Description	The objective of this course is to brief the undergraduate students to the all-important aspect of PCB design validation using software and automated test process														
Course Objective	<ul style="list-style-type: none"><li>• We hope to teach students the fundamental principles of PCB design validation.</li><li>• Students will exercise their ability to apply these principles in validating the PCB design through case studies.</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ol style="list-style-type: none"><li>1. Interpret the fabrication process used in PCB</li><li>2. Elaborate the PCB mount technology and thermal analysis techniques</li><li>3. Identify the steps involved in PCB trouble shooting</li><li>4. Explain the concepts involved in PCB testing</li><li>5. Enumerate the design for testability techniques in PCB</li></ol>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	0	0	2	0	0	0	0	0	0	0	2	2	2
CO-2	2	2	1	2	2	0	0	0	0	0	0	0	2	2	2
CO-3	2	2	2	2	2	0	0	0	0	0	0	0	3	3	3
CO-4	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3
CO-5	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: PCB FABRICATION PROCESS							(6 L+ 6 P)								
Designing of single-sided PCB , Using of packaged libraries , Auto routing , Editing and creation of components, Setting up the PCB Layers, Layers Definitions, Copper pouring , Layout extraction. Lab Experiment: Design a simple electronic circuit in single –side PCB							CO-1 BTL-3								
MODULE 2: PCB Mount Technology and Thermal Analysis							(6 L+ 6P)								
Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements.							CO-2 BTL-3								

Case Study: Thermal analysis of a PCB board	
<b>MODULE 3: PCB TROUBLE SHOOTING</b>	<b>(6 L+ 6 P)</b>
<p>Symptom recognition, symptom elaboration Listing of probable faulty functions, Localizing the faulty function, bracketing technique, Localizing the trouble in a circuit, Component failure analysis, types of circuit trouble, failures and faults, breaks in circuit connections, testing devices using test jigs.</p> <p><b>Lab Experiments</b></p> <p>4. Given a Bare Board, find out the following defects made.</p> <p>Breakout, PinHole, Open Circuit, Under Etch, Missing Bite, Missing Conductor, Spur, Short, Wrong Hole size, Conductor Too Close, Spurious Copper and Excessive Short. (Any Four Can be grouped and asked to identify and locate in the board. (Sample Bare Board with These defects can be issued to the student)</p> <p>5. Given a Board, inspect and find out the possible Manufacturing Defects like, Soldering Issue (1) , Poor Quality Components (2), Damaged components(2) . Describe the nature of fault identified.</p> <p><b>Software/Equipment Used</b></p> <p>Sample Board with NAND Circuit to test, Test Equipment, Bare Board with Defects as listed above, Board with Damaged (2)- Poor Quality Components( 2) and Soldering Bridge or Excess (1) can be issued to the students.</p>	<b>CO-3 BTL-3</b>
<b>MODULE 4: PCB Testing</b>	<b>(6 L+ 6 P)</b>
<p>Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced –electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.</p> <p><b>Lab Experiments:</b></p> <p>1. Given a Board, inspect and find out the possible fault like open, short and diode issues.</p>	<b>CO-4 BTL-3</b>
<b>MODULE 5: Design for Testability</b>	<b>(6 L+ 6 P)</b>
<p>Design for testability, PCB in the past, Test methodologies, Mock up test, In circuit test, in circuit test of populated PCBs, When to use thermal test, testing flow, the stuck at fault model, logic simulation, fault simulations, sequential ATPG, built in self-test, types of test patterns, Emulation techniques, Boundary scan test</p> <p><b>Lab Experiments</b></p> <p>5. What is a Unity Gain amplifier circuit? Explain with a simple circuit diagram. Test the given Op Amp to check whether it is working for the application as an i) Inverting Amplifier ii) Non-Inverting Amplifier iii) Voltage follower</p> <p>6. Explain various types of programmable ICs . What is the difference between OTP and EEPROM ICs in its functionality. Test 2764 Programmable IC using an TESTER. Check whether the IC is blank or having data in it. If the data is found save the data file.</p> <p><b>Software/Equipment Used</b></p> <p>IC LM124, IC 2764 (Sample Programmed), Test Equipment, DMM, Scope, Data sheets of IC can be seen from the equipment and referred for connectivity's.</p>	<b>CO-5 BTL-3</b>
<b>BOOKS</b>	

1	Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001.
2	R. S. Khandpur., Printed circuit board design ,fabrication assembly and testing, Tata McGraw Hill 2006
<b>REFERENCE BOOKS</b>	
1	Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.
2	R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005
3	Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.
4	R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
<b>E BOOKS</b>	
1	<a href="https://www.pdfdrive.com/fundamentals-of-microsystems-packaging-e161480159.html">https://www.pdfdrive.com/fundamentals-of-microsystems-packaging-e161480159.html</a>
<b>MOOC</b>	
1	<a href="https://nptel.ac.in/courses/108108031">https://nptel.ac.in/courses/108108031</a>

COURSE TITLE	ELECTRONIC PACKAGING			CREDITS	3	
COURSE CODE	EEEC51543	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0	
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance *	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The objective of this course is to brief the students to the essential multidisciplinary areas of electronics systems packaging at Chip level, board level and system level					
Course Objective	This course aims to equip the students <ul style="list-style-type: none"><li>to examine the principles and methodology of microelectronics design packaging.</li><li>to apply these principles in practical application through case studies.</li></ul>					
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Interpret the types of packages used in various industries</li><li>Analyze the electrical issues involved in electronic packaging</li><li>Identify and Choose the process involved in single chip and multichip packaging for specific applications</li><li>Explain the technologies involved in wafer-level packaging</li><li>Enumerate the system-level printed wire technologies</li></ul>					
CO, PO AND PSO MAPPING						

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO-2	2	2	1	2	-	-	-	-	-	-	-	-	1	1	1
CO-3	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2
CO-4	1	2	2	-	-	-	-	-	1	-	-	1	1	1	2
CO-5	2	2	2	1	1	-	-	-	1	-	-	1	1	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO ELECTRONIC PACKAGING (6 L+ 6 P)															
Microsystems packaging, System-Level Microsystems Technologies, Integrated Circuits Packaging, IC Packaging Challenges, Role of Packaging – Computer industry, Telecommunication industry, Consumer electronics, Micro-Electro- Mechanical Systems (MEMS), Commonly used packages and advanced packages- Materials in packages. <b>Suggested Readings:</b> Multichip modules <b>Case Study:</b> 1. Packaging aspects of handheld products.													CO-1 BTL-2		
MODULE 2: ELECTRICAL DESIGN CONSIDERATIONS IN PACKAGING (6 L+ 6 P)															
Fundamentals of Electrical Package Design, Electrical Anatomy of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Layout guidelines and the Reflection problem. <b>Suggested Readings:</b> Resistive Parasitic, Capacitive and Inductive Parasitic <b>Case Studies:</b> 1. Electrical issues in Interconnection													CO-2 BTL-4		
MODULE 3: SINGLE CHIP PACKAGING AND MULITCHIP PACKAGING (6 L+ 6 P)															
Functions of Single Chip Packages, Types of Single Chip Packages, Fundamentals of Single Chip Packaging, Materials, Processes, and Properties, Multichip Module Functionality, Multichip Module Advantages, Multichip Modules at the System Level, Types of Multichip Module Substrates, Multichip Module Design <b>Suggested Readings:</b> Multichip Module Technology Comparisons <b>Case Studies:</b> 1. Alternatives to Multichip Modules													CO-3 BTL-3		
MODULE 4: IC ASSEMBLY AND WAFER-LEVEL PACKAGING (6 L+ 6 P)															
IC Assembly Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer-level Packaging (WLP) technologies, WLP reliability, Wafer-level Burn-in and Test, System – in - package (SIP); Passives: discrete, integrated, and embedded. <b>Suggested Readings:</b> RF Packaging <b>Case Studies:</b> 1. MEMS Inertial Sensors: A Case Study													CO-4 BTL-3		

MODULE 5:SYSTEM-LEVEL PRINTED WIRING TECHNOLOGIES AND BOARD WIRING (6 L+ 6 P)	
<p>Introduction to System-Level Printed Wiring Board, Types of Printed Wiring Boards, Fundamentals of Printed Wiring Boards, CAD Tools for Printed Wiring Board Design, Printed Wiring Board Materials, Standard Printed Wiring Board Fabrication, Printed Wiring Board Assembly, Surface Mount Technology, Through-Hole Assembly, Generic Assembly Issues, Process Control.</p> <p><b>Suggested Readings:</b> Limitations in Standard Printed Wiring Board Process</p> <p><b>Case Studies:</b> 1. Design challenges in board assembly</p>	<b>CO-5 BTL-3</b>
<b>1</b>	Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2019.
<b>NCE BOOKS</b>	
<b>1</b>	Blackwell (Ed), The electronic packaging handbook, CRC Press, 2017.
<b>2</b>	Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.
<b>3</b>	R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
<b>E BOOKS</b>	
<b>1</b>	<a href="https://www.pdfdrive.com/fundamentals-of-microsystems-packaging-e161480159.html">https://www.pdfdrive.com/fundamentals-of-microsystems-packaging-e161480159.html</a>
<b>MOOC</b>	
<b>1</b>	<a href="https://nptel.ac.in/courses/108108031">https://nptel.ac.in/courses/108108031</a>

COURSE TITLE	RELIABILITY ON ELECTRONIC SYSTEMS			CREDITS	3	
COURSE CODE	EEC51553	COURSE CATEGORY	DE	L-T-P-S	2-0- 2- 2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	This course has been designed to equip students with the knowledge and skills needed to design, test, and validate reliable electronic systems, and troubleshoot issues as they arise.					

<b>Course Objective</b>	<ul style="list-style-type: none"> <li>To summarize the basic concepts of reliability engineering, including failure modes, mechanisms, and metrics</li> <li>To appraise the impact of environmental factors on electronic systems, and how to perform environmental stress testing</li> <li>To learn the performance using statistical analysis to quantify reliability and identify potential failure modes.</li> </ul>
<b>Course Outcome</b>	<p>Upon completion of this course, the students will be able to</p> <ul style="list-style-type: none"> <li>Identify and comprehend the basic concepts of reliability engineering, including failure rates, reliability, maintainability, and availability for manufacturing Sectors</li> <li>Analyze failure data and determine the root cause of failures in electronic systems, including design flaws, manufacturing defects, and environmental factors.</li> <li>Design electronic systems for reliability by considering factors such as redundancy, fault tolerance, and robustness.</li> <li>Analyze the various reliability standards used in the electronics industry, such as MIL-STD-217 and the Telcordia SR-332 standard.</li> </ul>

#### CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	0	0	1	0	0	0	0	0	1	1	1	2
CO-2	3	2	2	1	2	1	0	0	0	0	0	1	1	1	2
CO-3	0	3	2	2	0	1	0	0	0	0	0	1	1	1	2
CO-4	2	1	3	3	0	2	0	0	2	0	0	1	1	1	2
CO-5	2	3	3	2	0	1	0	0	1	1	0	1	1	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related

#### MODULE 1:

#### RELIABILITY CONCEPTS

(6L+ 6P)

Basic Reliability Concepts, Concept of stresses and strains, engineering stress and strain, Young's modulus and Elasticity, effects of strain rate and temperature on stress-strain response of materials, Concept of Probability Density Function, Hazard Rate, Some Properties of the Hazard Function, Conditional Reliability, Percentiles Product Life, Moments of Time to Failure.

#### Suggested Readings:

Hazard Rate, Some Properties of the Hazard Function, Conditional Reliability

#### Lab Experiments/Case study

1. Temperature and humidity testing: Subject electronic systems to a range of temperatures and humidity levels to determine their performance under different environmental conditions.
2. Vibration and shock testing: Apply mechanical shocks and vibrations to electronic systems to determine their durability and ability to withstand harsh operating conditions.

#### Software/Equipment Used

Ansys Sherlock/Ansys Siwave or an opensource software

**CO-1  
BTL-3**

#### MODULE 2: Engineering Design Integrity

(6L+ 6P)



<p>Design Integrity Methodology, Development and Scope of Design Integrity Theory, Designing for Reliability, Availability, Maintainability and Safety, Development of Models and AIB Methodology, Artificial Intelligence in Engineering Design, Industry Perception and Related Research, Intelligent Design Systems. Probability and Life Distributions for Reliability Analysis.</p> <p><b>Suggested Readings:</b> Maintainability and Safety, Development of Models and AIB Methodology,</p> <p><b>Lab Experiments/Casestudy</b></p> <ol style="list-style-type: none"> <li>1. Accelerated life testing: Accelerate the aging process of electronic systems by subjecting them to extreme environmental conditions, such as high temperatures and voltage stresses, to determine their reliability over an extended period.</li> <li>2. Electrical stress testing: Apply electrical stresses to electronic systems to determine their ability to withstand voltage spikes and transient events</li> <li>3. Determine Expected number of failures, variance of failures, probability that n product fail or none.</li> </ol> <p><b>Software/Equipment Used</b> Ansys Sherlock/Ansys Slwave or any software</p>	<p><b>CO-2</b> <b>BTL-3</b></p>
<p><b>MODULE 3: RELIABILITY AND PERFORMANCE IN ENGINEERING DESIGN (6L+ 6P)</b></p>	
<p>Introduction, Theoretical Overview of Reliability and Performance in Engineering Design, Analytic Development of Reliability and Performance in Engineering Design, Application Modelling of Reliability and Performance in Engineering Design.</p> <p><b>Suggested Readings:</b> Analytic Development of Reliability and Performance in Engineering Design</p> <p><b>Lab Experiments/Case Study</b></p> <ol style="list-style-type: none"> <li>1. Failure analysis: Investigate the root causes of failures in electronic systems to identify design flaws, manufacturing defects, or other issues that can impact system reliability.</li> <li>2. Given ToF of a product by Weibull Distribution, estimate the reliability of the product after 'n' hours of operation and determine the MTTF.</li> </ol> <p><b>Software/Equipment Used</b> Ansys Sherlock/Ansys Slwave or any software</p>	<p><b>CO-3</b> <b>BTL-3</b></p>
<p><b>MODULE 4 AVAILABILITY AND MAINTAINABILITY IN ENGINEERING DESIGN (6L+ 6P)</b></p>	
<p>Introduction, Theoretical Overview of Availability and Maintainability, Analytic Development of Availability and Maintainability in Engineering Design, Application Modelling of Availability and Maintainability in Engineering Design</p> <p><b>Suggested Readings:</b> Availability and Maintainability in Engineering Design</p> <p><b>Lab Experiments/Case study</b></p> <ol style="list-style-type: none"> <li>1. Environmental stress screening: Subject electronic systems to a series of thermal cycles and temperature/humidity changes to weed out early failures and improve overall reliability.</li> <li>2. Determine the mean miles between failures or the expected life in miles of these transmissions (b) Find the standard deviation for the miles to failure random variable.</li> </ol> <p><b>Software/Equipment Used</b> Ansys Sherlock/Ansys Slwave or any Open source software</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<p><b>MODULE 5: SAFETY AND RISK IN ENGINEERING DESIGN (6L+ 6P)</b></p>	
<p>Introduction. Theoretical Overview of Safety and Risk in Engineering Design, Analytic Development of Safety and Risk in Engineering Design, Application Modelling of Safety and Risk in Engineering Design.</p> <p><b>Suggested Readings:</b> Safety and Risk in Engineering Design</p> <p><b>Case Study</b> Write a specific case study indicating all the life cycle conditions</p>	<p><b>CO-5</b> <b>BTL-3</b></p>

BOOKS	
1.	"Rudolph Frederick Stapelberg, Handbook of Reliability, Availability, Maintainability and Safety in Engineering Design, Springer-Verlag London Limited, 2009
2.	Carl.S.Carlson, "Effective FMEAs: Achieving Safe, Reliable, and Economical Products and Processes Using Failure Mode and Effects Analysis" John Wiley & Sons, Inc, 2012
3	V. S. Bangad, "Electronic Product Design", Technical Publications Pune,2014
REFERENCE BOOKS	
1	Norman Pascoe , "Reliability Engineering for Electronic Design" taylor and francis,2020
2	Richard Stilwell, "Electronic Product Design for Automated Manufacturing",Rouledge 2017
3	Srinath. L.S., "Reliability Engineering", 4th edition Affiliated East west press, 2011
4	Connor, P.D.T.O., "Practical Reliability Engineering", 5th edition Wiley India, 2012
E BOOKS	
1.	<a href="https://qpr.buaa.edu.cn/_local/2/AA/B8/BB116BBD20312235B2E7F93FAD2_483F18EF_5132FE.pdf">https://qpr.buaa.edu.cn/_local/2/AA/B8/BB116BBD20312235B2E7F93FAD2_483F18EF_5132FE.pdf</a>
2.	<a href="https://www.pdfdrive.com/safety-reliability-and-risk-analysis-theory-methods-and-applications-e176608279.html">https://www.pdfdrive.com/safety-reliability-and-risk-analysis-theory-methods-and-applications-e176608279.html</a>
3.	<a href="https://www.pdfdrive.com/reliable-design-of-electronic-equipment-an-engineering-guide-e177517887.html">https://www.pdfdrive.com/reliable-design-of-electronic-equipment-an-engineering-guide-e177517887.html</a>
4	<a href="https://onlinelibrary.wiley.com/doi/chapter-epub/10.1002/9780470980101.fmatter">https://onlinelibrary.wiley.com/doi/chapter-epub/10.1002/9780470980101.fmatter</a>
MOOC	
1.	<a href="https://onlinecourses.nptel.ac.in/noc23_ge20/preview">https://onlinecourses.nptel.ac.in/noc23_ge20/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc21_ce58/preview">https://onlinecourses.nptel.ac.in/noc21_ce58/preview</a>

COURSE TITLE	Future Trends in Electronics Manufacturing			CREDITS	3	
COURSE CODE	EECS1554	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM, 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	This course focuses on the methodology that technology can be used as a competitive advantage in today’s business environment. First, current trends in computing, visual, connectivity and artificial intelligence are outlined with an emphasis on their impact to businesses. Digital tools for design, manufacturing, and usage of products are described. Finally, applications of these technologies and digital tools across eight key industries are provided.					
Course Objective	This course aims to provide students with the 1. understanding of the different technologies’ digital transformation and the idea behind it. 2. analyze the technologies applied to manufacturing of various electronics industries.					

<b>Course Outcome</b>	Upon completion of this course, your students will be able to: 1. Summarize digital transformation - what, how and why 2. Outline important technical trends within today's economy 3. Identify digital tools that can be applied to transform business processes 4. Apply digital transformation to a variety of industries 5. Enumerate Product life cycle														
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>CO-1</b>	1	1	1	1	0	1	0	0	0	1	1	1	1	3	1
<b>CO-2</b>	1	1	1	1	0	1	0	0	0	1	1	1	1	3	1
<b>CO-3</b>	1	1	1	2	0	1	0	0	0	1	1	1	1	3	1
<b>CO-4</b>	1	1	1	1	0	2	0	0	0	1	1	1	1	3	2
<b>CO-5</b>	1	1	1	1	0	1	0	0	0	1	1	1	1	3	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO DIGITAL TRANSFORMATION</b>													<b>(9L)</b>		
Introduction to Digital Transformation- Factors for Successful Digital Transformation, Closer Look at Digital Transformation, The Product Lifecycle, The Digital Twin <b>Case study:</b> An Introduction to Digital Transformation													<b>CO-1 BTL-3</b>		
<b>MODULE 2: Technology Trends - Computing &amp; Visual</b>													<b>(9L)</b>		
How Computing Drives Digital Transformation, Computing and The Operating System, The Advantages of Cloud & Edge Computing, The Value of Cloud Computing, A Closer Look at Edge Computing and Cloud Computing, The Future of Computing Technology, Augmented Reality, Virtual Reality, and Mixed Reality <b>Case study:</b> Technology Trend - Computing & Visual													<b>CO-2 BTL-3</b>		
<b>MODULE 3: Technology Trends - Connectivity</b>													<b>(9L)</b>		
Digital Connectivity, Wired Communications, Wireless Communications, Evolution of Cellular Networks, 5G Communications, The Internet of Things, How the Internet of Things Can Be Used in Manufacturing <b>Case study:</b> Technology Trend - Connectivity													<b>CO-3 BTL-3</b>		
<b>MODULE 4: Technology Trends - Artificial Intelligence</b>													<b>(9L)</b>		
Artificial Intelligence, AI Approaches, AI and The Future of Manufacturing, AI and Machine Learning, Cognitive Computing, Modern Deep Learning Techniques, The Future of AI: Risks and Challenges <b>Case study:</b> AI Tools													<b>CO-4 BTL-3</b>		
<b>MODULE 5: The Product Lifecycle - Ideation, Realization, and Utilization</b>													<b>(9L)</b>		
Digital Transformation Challenges and Advantages, The Product Lifecycle and Process, Product Lifecycle Management, Application Lifecycle Management, Enterprise Resource Planning, The Digital Twin and The Digital Thread, PLM Software Helps Manufacturing with the Product Lifecycle, Efficient Ideation and Design of New Products, Simulation Driven Design, Design Control and Excellence, Traceability & Verification, Product Realization, Manufacturing Process Management, Product Utilization, Product Support Planning & Management, Product and Production In the Real World <b>Case study:</b> Digital Twin and Additive Manufacturing													<b>CO-5 BTL-3</b>		

TEXT BOOKS	
1.	Digital Transformation in Norwegian Enterprises - Patrick Mikalef, Elena Parmiggiani, Springer Cham - 2022
2.	Digital Transformation: Survive and Thrive in an Era of Mass Extinction, Tom Siebel-2019
REFERENCE BOOKS	
1	Building the Agile Business through Digital Transformation: How to Lead Digital Transformation in Your Workplace - Neil Perkin & Peter Abraham, KoganPage, 2017
E BOOKS	
1.	<a href="https://www.pdfdrive.com/digital-transformation-now-guiding-the-successful-digitalization-of-your-business-model-e158455095.html">https://www.pdfdrive.com/digital-transformation-now-guiding-the-successful-digitalization-of-your-business-model-e158455095.html</a>
MOOC	
1.	<a href="https://resources.sw.siemens.com/en-US/download-introduction-to-digital-transformation">https://resources.sw.siemens.com/en-US/download-introduction-to-digital-transformation</a>
2.	<a href="https://in.coursera.org/learn/digital-transformation-course#syllabus">https://in.coursera.org/learn/digital-transformation-course#syllabus</a>

#### VERTICAL-7: Data Science Specialization

COURSE TITLE	Data Analytics using R			CREDITS	3	
COURSE CODE	EEC51557	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	This course aims to equip the students with a basic understanding of concepts of R programming including different perspectives. This also equip the students with an ability to understand the principles of R and demonstrate how to apply it in real world scenarios and Machine Learning applications.					
Course Objective	1. To demonstrate the students how to set up the R programming environment. 2. To ensure that the students understand the data exporting and importing. 3. To enable the students to manipulate the data using R programming. 4. To enhance the student’s ability to improve their programming skills 5. To guide the students, visualize the data in applications using plots and charts.					

<b>Course Outcome</b>	Upon completion of this course, the students will be able to														
	<ol style="list-style-type: none"> <li>1. Relate the students the importance of R programming in engineering</li> <li>2. Evaluate the approach of R programming for new discovery and innovation</li> <li>3. Choose specific methods to manipulate the data in R programming</li> <li>4. Analyze the application of R Programming.</li> <li>5. Analyze and select the different principles of R programming for development of ML applications.</li> </ol>														
<b>Prerequisite: Statistics for Data Science using Python</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>C O</b>	<b>P O-1</b>	<b>PO-2</b>	<b>P O-3</b>	<b>P O-4</b>	<b>PO-5</b>	<b>P O-6</b>	<b>P O-7</b>	<b>P O-8</b>	<b>PO-9</b>	<b>P O-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>C O-1</b>	3	2	3	0	2	0	0	0	0	0	0	2	3	1	1
<b>C O-2</b>	2	3	2	0	2	0	0	0	0	0	0	2	3	1	1
<b>C O-3</b>	2	3	2	0	2	0	0	0	0	0	0	2	2	1	1
<b>C O-4</b>	2	2	2	0	2	0	0	0	0	0	0	2	2	1	1
<b>C O-5</b>	3	3	3	0	3	0	0	0	0	0	0	2	3	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO R (6L+ 6P)</b>															
Installing R , R environment , How to get help in R . R console and Editor, Variables in R Scalars. Vectors, Matrices , List , Data frames , Using c, Cbind, Rbind, attach and detach functions in R. Factor, If ...else For loop, While loop, Repeat loop, Apply(), sApply(), rApply(), tApply <b>Lab Experiments</b> For loop, While loop, Repeat loop, Apply(), sApply(), rApply(), tApply													<b>CO-1</b> <b>BTL-2</b>		
<b>MODULE 2: DATA IMPORTING (6L +6P)</b>															
Descriptive Statistics: Measures of central tendency (mean, median, mode) - Measures of dispersion (range, variance, standard deviation) - Data distribution and visualization. Probability Fundamentals: Conditional probability and Bayes' theorem - Discrete and continuous probability distributions, Probability Distributions: Binomial distribution - Poisson distribution - Normal distribution - Central Limit Theorem -  <b>Case study: 6-channel ADC Working</b>													<b>CO-2</b> <b>BTL-2</b>		
<b>MODULE 3: MANIPULATING DATA (6L +6P)</b>															

Selecting rows/observations, selecting columns/fields, merging data, Relabeling the column names, Converting variable types, Data sorting, Data aggregation, Importing - XML files, JSON files, Reading & Writing PDF files, Reading & Writing JPEG files, Saving Data in R, Aggregating, dplyr.		CO-3 BTL-3
<b>Lab Experiments</b>		
Reading & Writing PDF files,jpeg files  Data sorting,  Data aggregation		
<b>MODULE 4: FUNCTIONS AND PROGRAMMING (6L +6P)</b>		
Commonly used Mathematical Functions. Commonly used Summary Functions, Commonly used String Functions, User-defined functions, local and global variable, While loop, If loop, For loop, Arithmetic operations		CO-4 BTL-3
<b>Lab Experiments</b>  While loop, If loop, For loop, Arithmetic operations		
<b>MODULE 5: CHARTS AND PLOTS (6L +6P)</b>		
Box plot, Histogram, Pareto charts, Pie graph, Line chart, Scatterplot, Developing graphs, 3D-view, Geo Maps, Null Handling. Merge. Grep, Scan, Text Mining, Exploratory Data Analysis, Machine Learning with R		CO-5 BTL-3
<b>Lab Experiments</b> Box plot, Histogram, Pareto charts, Pie graph		
<b>BOOKS</b>		
1.	Omar Trejo Navarro,” R Programming By Example: Practical, hands-on projects to help you get started with R”,Packt, 1st Edition.2017.	
2.	R Sushitha, R Programming, Notion Press, 2023.	
3	Kaelen Medeiros, R Programming Fundamentals: Deal with data using various modeling techniques, Packt, 1st Edition,2018.	
4	Robert I. Kabacoff, R in Action, Third Edition.2022	
5	Norman Matloff, The art of R programming, no starch press,2022	
<b>REFERENCE BOOKS</b>		
1	Garrett Grolemond, Hadley Wickham, R for Data Science, O reilly ,1st Edition,2017	

COURSE TITLE	INDUSTRIAL PROCESS MINING			CREDITS	3
COURSE CODE	EEC51558	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME															
CIA													ESE		
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY		PRACTICAL				
15%	15%		10%		5%		5%		25%		25%				
Course Description	The course aims to gain knowledge in the model-based process analysis and data-oriented analysis techniques. Through concrete data sets and easy to use software the course provides data science knowledge that can be applied directly to analyze and improve industrial processes, including the challenges and opportunities of implementing process mining in a real-world environment. Students will gain hands-on experience with process mining tools and learn how to apply them in real-world industrial scenarios.														
Course Objective	<div>1. To gain knowledge on Process Intelligence techniques (process mining).</div> <div>2. To gain knowledge about process mining analysis techniques such as simulation, business intelligence, data mining, machine learning, and verification.</div> <div>3. To learn process model, basic conformance checking techniques from an event log.</div> <div>4. To gain knowledge on process models with information extracted from the event log.</div> <div>5. To explore case studies and best practices in industrial process mining</div>														
Course Outcome	<div>Upon completion of this course, the students will be able to</div> <div>1. Explain the Process Intelligence techniques (process mining).</div> <div>2. Relate process mining techniques to other analysis techniques such as simulation, business intelligence, data mining, machine learning, and verification.</div> <div>3. Apply basic process discovery techniques to learn a process model from an event log and apply basic conformance checking techniques to compare event logs and process models.</div> <div>4. Extend a process model with information extracted from the event log (e.g., show bottlenecks)</div> <div>5. Conduct process mining projects in a structured manner.</div>														
Pre-requisites: Data Science															
CO, PO AND PSO MAPPING															
CO	PO-1	PO -2	PO -3	PO -4	PO- 5	PO -6	PO -7	PO- 8	PO -9	PO- 10	PO - 11	PO - 12	PSO-1	PSO-2	PSO-3
CO -1	3	2	2	2	3	-	-	-	1	-	1	2	-	1	1
CO -2	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1
CO -3	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1
CO -4	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1

CO-5	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>Module 1: INTRODUCTION TO INDUSTRIAL PROCESS MINING</b>														<b>(6L + 6P)</b>	
Types of Process Mining - Process mining vs. data mining vs. business process management - Decision Trees - Rule Learning - Cluster Analysis - Evaluation of mining <b>Suggested Readings:</b> Learning of Data Science and Big Data basics. <b>Lab Experiments (Simulation)</b> Getting started with Fluxicon Disco process mining tool. Installing Disco on Windows Installation of PM4PY - python library that supports (state-of-the-art) process mining algorithms in python. <b>Software/Equipment Required</b> Process mining software Disco free academic research license. PM4PY - Python library - Open source														<b>CO-1 BTL-3</b>	
<b>MODULE 2: PROCESS MODELS AND PROCESS DISCOVERY</b>														<b>(4L +5P)</b>	
Event Logs and Process Models - Petri Nets - Workflow Nets and Soundness - Alpha Algorithm: A Process Discovery Algorithm - Introduction to ProM (Process Mining framework) Open Source framework  <b>Suggested Readings:</b> Basics of using event data in Process management  <b>Lab Experiments (Simulation):</b> Getting started with ProM Lite (Process Mining framework) Open Source framework - Disco process mining tool.  <b>Software/Equipment Required</b> ProM (Process Mining framework) Lite- Open Source framework for process mining algorithms - Free														<b>CO-2 BTL-3</b>	
<b>MODULE 3: TYPES OF PROCESS MODEL</b>														<b>(8L+7P)</b>	
Quality Criteria For Process Discovery - Representational Bias of Process Mining - Business Process Model and Notation (BPMN) - Dependency Graphs and Causal Nets - Learning Transition Systems - Using Regions to Discover Concurrency  <b>Suggested Readings:</b> Methods of discovering a process model from event data. <b>Lab Experiments (Simulation)</b> - using Fluxicon Disco process mining tool: Lab Exp. 01: The Demo Scenario Lab Exp 02: Process Discovery and Simplification Lab Exp 03: Statistics, Cases and Variants Lab Exp 04: Bottleneck Analysis Lab Exp 05: Compliance Analysis Lab Exp 06: Keep Copies of your Analysis Lab Exp 07: Take Different Views on your Process Lab Exp 08: Exporting Results Lab Exp 09: Inspect an event log and show you how to convert tabular data from a CSV file to the event log format. (using ProM lite) Lab Exp 10: Converting data into an event log (using ProM lite) Lab Exp 11: Filter certain events and cases out. (using ProM lite) <b>Software/Equipment Required</b> Fluxicon Disco process mining tool														<b>CO-3 BTL-3</b>	



ProM (Process Mining framework) Lite- Open Source framework for process mining algorithms - Free		
MODULE 4: PROCESS DISCOVERY TECHNIQUES		(6L+6P)
<p>Two-Phase Process Discovery And Its Limitations - Alternative Process Discovery Techniques - Introduction to Conformance Checking - Conformance Checking Using Causal Footprints - Conformance Checking Using Token-Based Replay - Aligning Observed and Modeled Behavior</p> <p><b>Suggested Readings:</b> Conformance Checking: Positive and Negative Deviants.</p> <p><b>Lab Experiments</b> using ProM lite:</p> <ol style="list-style-type: none"><li>1. Activity to discuss the conformance of the event log and the process model evaluation.</li><li>2. Performance analysis of a process</li><li>3. Social network analysis from event logs</li></ol> <p><b>Software/Equipment Required</b> ProM (Process Mining framework) Lite- Open Source framework for process mining algorithms - Free</p>		CO-4 BTL-3
MODULE 5: PROCESS MINING IN REAL TIME - CASE STUDY		(6L + 6P)
<p>Guidelines for the conduct of Process Mining Project - Mining Lasagna Processes - Mining Spaghetti Processes - Process Models as Maps - CASE STUDY:Process Mining Techniques for Managing and Improving Healthcare Systems</p> <p><b>Suggested Readings:</b> Holistic Process Mining: Integrating Different Perspectives</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"><li>1. Process Mining Techniques for Managing and Improving Healthcare Systems and</li><li>2. Provide pointers to other process mining case studies.</li></ol> <p><b>Software/Equipment Required</b> ProM (Process Mining framework) Lite- Open Source framework for process mining algorithms - Free</p>		CO-5 BTL-3
TEXT BOOKS		
1	Process Mining in Action: Principles, Use Cases and Outlook. Germany, Springer International Publishing, 2020.	
2	Process Mining Handbook. Switzerland, Springer International Publishing, 2022.	
3	Zayoud, Maha. Process Mining Techniques for Managing and Improving Healthcare Systems. United States, CRC Press, 2023.	
REFERENCE BOOKS		
1	Aalst, Wil van der. Process Mining: Data Science in Action. Germany, Springer Berlin Heidelberg, 2016.	
2	Mans, Ronny S., et al. Process Mining in Healthcare: Evaluating and Exploiting Operational Healthcare Processes. Germany, Springer International Publishing, 2015.	
3	Ouyang, Ye, et al. Mining Over Air: Wireless Communication Networks Analytics. Germany, Springer International Publishing, 2018.	
E Resources for Reference		
1.	<a href="https://link.springer.com/chapter/10.1007/978-3-031-08848-3_14">https://link.springer.com/chapter/10.1007/978-3-031-08848-3_14</a>	
MOOC		



[illegible]

<p>Time series analysis for network traffic- Metrics for network performance- Anomaly detection methods (e.g., clustering, isolation forests)- Network security challenges- Data privacy concerns and solutions-Ethical considerations in data science-Use cases in network security and performance monitoring- Predictive maintenance- Optimization algorithms (e.g., linear programming, genetic algorithms)- Resource allocation and load balancing- Quality of service (QoS) optimization</p> <p>Suggested Readings:</p> <p>Network Performance Metrics Calculation</p> <p>Lab Experiments</p> <p>Deep learning models used for complex pattern recognition and predictive modeling tasks.</p> <p>Software/Equipment Used</p> <p>TensorFlow/Keras/PyTorch</p>	<p>CO-3 BTL-3</p>
<p><b>MODULE 4: Advanced Topics in Data Science for Communication Networks (6L+ 6P)</b></p>	
<p>Deep learning applications in communication networks-Reinforcement learning for network management- Future trends and emerging technologies-Big data technologies- Real-time data processing- Deep learning applications</p> <p>Suggested Readings:</p> <p>Edge Computing with Deep Learning,Distributed Training of Deep Learning Models</p> <p>Lab Experiments</p> <p>Traffic Classification using CNNs</p> <p>Network Routing with Reinforcement Learning</p> <p>Network Intrusion Detection using RNNs</p> <p>Software/Equipment Used</p> <p>Python, TensorFlow/PyTorch, Scapy (for packet processing)</p>	<p>CO-4 BTL-3</p>
<p><b>MODULE 5: Project Work: (6L+ 6P)</b></p>	
<p>Hands-on projects using real-world network data-Implementing and evaluating data science solutions- Real-world projects involving data science applications in communication networks-Data collection, analysis, and model implementation- Presentation and documentation of project results</p> <p>Suggested Readings:</p> <p>Quality of Service (QoS) Optimization</p> <p>Lab Experiments</p> <p>Network Traffic Analysis and Visualization</p> <p>Predictive Maintenance for Network Devices</p> <p>Software/Equipment Used</p> <p>Python (Pandas, Matplotlib/Seaborn), Wireshark (for packet capture), NetworkX (for network visualization).</p>	<p>CO-5 BTL-3</p>
<p><b>TEXT BOOKS</b></p>	
<p>1.</p>	<p>Changqing Luo, Jianxin Wang, Xiaoming Fu, F Richard Yu, Laurence T Yang, “Data Science for Communications: Towards Intelligent Network Management ” Springer, 2022,ISBN: 978-3030768166</p>
<p>2.</p>	<p>Khaled Salah Mohamed, Mohamed Faten Zhani, Abdallah Shami,“Machine Learning for Networking: Techniques, Applications, and Research Directions” Springer, 2021, ISBN: 978-3030868469</p>

REFERENCE BOOKS	
1	F. Richard Yu, Ying He, Victor Leung, Min Chen, "Data-Driven Intelligence in Wireless Networks: Concepts, Technologies, and Applications", CRC Press, 2021, ISBN: 978-0367251108
2	Muhammad Ali Imran, Haroon Khan, "Communication Networks and Service Management in the Era of Artificial Intelligence and Machine Learning", Wiley, 2021, ISBN: 978-1119633555
3	V.N Hoda A. Elsherbiny, Mohamed F. Younis, Yasser A. Eldemerdash, "Big Data Analytics for Communication Networks: Machine Learning and Data Mining", CRC Press, 2022, 978-1032062565
E BOOKS	
1.	"Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross
2.	"Python Data Science Handbook" by Jake VanderPlas
3.	"Machine Learning Yearning" by Andrew Ng
MOOC	
1.	Computer Networks - NPTEL
2.	Data Science for Internet of Things - NPTEL

COURSE TITLE	Cloud and Distributed Computing for Data Analytics			CREDITS	3	
COURSE CODE	EEC51560	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	XX	Approval Details	XX	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance *	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The students shall develop an intuitive understanding of the cloud services platform over the internet with business model					

<b>Course Objective</b>	This course provides an in-depth understanding of distributed computing “concepts”, distributed algorithms and also equips students with an ability to understand basics and the techniques that underlie today's cloud computing technologies. The students will have intimate knowledge about the internals of cloud computing and how the distributed systems concepts work inside clouds.														
<b>Course Outcome</b>	Upon completion of this course, the students will be able to 1. Explain the key dimensions of the challenges and benefits of Cloud Computing 2. Choose the hardware necessary for cloud computing and how components fit together. 3. Discuss the systems, protocols and mechanisms to support cloud computing and develop applications for cloud computing. 4. Design and Implement application programs on distributed computing systems 5. Apply appropriate techniques and tools to design distributed computing systems and deploying in Internet applications														
<b>Pre-requisites: Python Programming</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>P O-1</b>	<b>PO-2</b>	<b>P O-3</b>	<b>P O-4</b>	<b>PO-5</b>	<b>P O-6</b>	<b>P O-7</b>	<b>P O-8</b>	<b>PO-9</b>	<b>P O-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>CO-1</b>	3	2	2	3	3	1			1	1	1	1	1	2	3
<b>CO-2</b>	3	2	2	3	3	1			1	1	1	1	1	2	3
<b>CO-3</b>	3	2	2	3	3	1			1	1	1	1	1	2	3
<b>CO-4</b>	3	2	2	3	3	1			1	1	1	1	1	2	3
<b>CO-5</b>	2	2	2	2	2	1			1	1	1	1	1	2	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: Cloud Computing (6L+ 6P)</b>															
Introduction to Cloud Computing- Cloud computing vs. Distributed computing- Features of today’s Clouds- Categories of Clouds <b>Lab Experiments</b> Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim. <b>Software/Equipment Used</b> CloudSim													<b>CO-1 BTL-3</b>		
<b>MODULE 2: Virtualization and Virtual Machines (6L+ 6P)</b>															
Virtualization- .Types of Virtualization-Virtualization Models- Server Virtualization- Methods of virtualization- Software Defined Network- Evolution and challenges of SDN- Hotspot Mitigation for Virtual Machine Migration <b>Lab Experiments</b>													<b>CO-2 BTL-3</b>		

Find a procedure to transfer the files from one virtual machine to another virtual machine. <b>Software/Equipment Used</b> Open Nebula Simulation		
<b>MODULE 3: Distributed Systems and Industry Systems (6L+ 6P)</b>		
Classical Distributed Algorithms: LCR algorithm- HS algorithm- Ring LE & Bully LE Algorithm- Google’s Chubby and Apache Zookeeper: Zookeeper design: Architecture-Access control list- Zookeeper applications <b>Lab Experiments</b> Implement concurrent echo client-server application . <b>Software/Equipment Used</b> Unix/Linux C Programming Environment		<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: Failures &amp; Recovery Approaches in Distributed Systems (6L+ 6P)</b>		
Local checkpoint, Consistent states, Interaction with outside world, Messages, Domino effect, Problem of Livelock, Rollback recovery schemes, Checkpointing and Recovery Algorithms: Koo-Toueg Coordinated Checkpointing Algorithm <b>Lab Experiments</b> Design XML Schema and XML instance document <b>Software/Equipment Used</b> GUI-IDE Tool NetBeans 6.0		<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: Cloud storages and Cloud computing applications (6L+ 6P)</b>		
Design of Key-Value Stores- Key-value Abstraction- Key-value/NoSQL Data Model- CAP Theorem- Peer to Peer Systems in Cloud Computing-MapReduce-Spark-Kafka <b>Lab Experiments</b>  Cloud Storage: Qwik Start - Cloud Console  <b>Software/Equipment Used</b> Open Google Cloud		<b>CO-5</b> <b>BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Rajiv Mishra, Yashwant Singh Patel “Cloud and Distributed Computing: Algorithms and Systems”, Willey Emerging Series,2020	
2.	A.Srinivasan, J.Suresh, “Cloud Computing: A Practical approach for learning and implementation ”, Pearson Education, First edition,2014	
<b>REFERENCE BOOKS</b>		
1	Zaigham Mahmood, Ricardo Puttini, Thomas Erl “Cloud Computing:Concepts,Technology & Architecture ”, Pearson Education, First edition,2013	
2	Sourav AMzumder,Robin Singh Bahdoria, Ganesh Chandra Deka,“Distributed Computing in Big Data Analytics”Springer,First Edition,2017	
<b>E BOOKS</b>		
1.	Kai Hwang, Geoffrey C.Fox, Jack.J.Dongarra, “Distributed and Cloud Computing”Elseiver,2012	
2.	Charlie Catlett, Wolfgang Gentzsch, Lucio Grandinetti, Gerhard Joubert, José Luis Vazquez-Poletti, “Cloud Computing and Big Data”,IOS Press Ebooks, 2013	
<b>MOOC</b>		

1.	<a href="https://nptel.ac.in/courses/106104182">https://nptel.ac.in/courses/106104182</a>
2.	<a href="https://www.coursera.org/specializations/cloud-computing">https://www.coursera.org/specializations/cloud-computing</a>

COURSE TITLE		Deep Learning For Data Analytics						CREDITS		3					
COURSE CODE		EEC51561		COURSE CATEGORY		DE		L-T-P-S		2-0-2-2					
Version		XX		Approval Details		XX		LEARNING LEVEL		BTL-3					
ASSESSMENT SCHEME															
CIA										ESE					
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY		PRACTICAL			
15%		15%		10%		5%		5%		25%		25%			
Course Description		This course introduces students to the principles and techniques of deep learning as applied to data analysis. Students will learn the theoretical foundations of deep learning models and gain practical experience in implementing and evaluating these models for various data analysis tasks.													
Course Objective		1. Summarize the fundamentals of deep learning architectures 2. Implement Deep Learning methodologies for data analysis 3. Explore advanced topics in deep learning relevant to data analytics 4. Apply deep learning techniques for image analysis 5. Demonstrate the concepts of deep learning techniques to solve real-world data analytics problems													
Course Outcome		Upon completion of this course, the students will be able to 1. Apply basic concepts in Deep Learning for processing high dimensional data 2. Incorporate deep learning methods for data analysis 3. Develop Computer Processing of an image using Deep Neural Network 4. Analyze various types of video data using Deep Learning techniques 5. Implement Deep Learning in multimedia data analysis													
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	3	3	1			1	1	1	1	1	2	3
CO-2	3	2	2	3	3	1			1	1	1	1	1	2	3



CO-3	3	2	2	3	3	1			1	1	1	1	1	2	3
CO-4	3	2	2	3	3	1			1	1	1	1	1	2	3
CO-5	2	2	2	2	2	1			1	1	1	1	1	2	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: - Introduction to Deep Learning (6L+ 6P)															
Overview of neural networks, Basics of deep learning, Activation functions, Gradient descent and backpropagation, Introduction to TensorFlow and Keras														CO-1 BTL-3	
Lab Experiments Deep learning Packages Basics: Tensorflow, Keras															
Software/Equipment Used Matlab/Python															
MODULE 2: Deep Learning Methodologies for Data Analysis (6L+ 6P)															
Optimization for deep learning - model structure optimization, novel methodologies using deep learning for classification, Non linear Feature Extraction for Big Data Analytics, Deep learning on information retrieval and its applications, understanding CNN architecture, convolution and pooling layers, Image classification with CNNs, Transfer learning and fine-tuning pre-trained models														CO-2 BTL-3	
Lab Experiments Object detection using Transfer Learning of CNN architectures															
Software/Equipment Used Matlab/Python															
MODULE 3: - Recurrent Neural Networks (RNNs) in data analytics (6L+ 6P)															
Introduction to RNNs,Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU), Sequence modeling and time series analysis,Applications of RNNs in data														CO-3 BTL-3	
Lab Experiments Language Modeling using RNN, Time Series Prediction using RNN															
Software/Equipment Used Matlab/Python															
MODULE 4: - Deep Learning in Image Analysis (6L+ 6P)															
Attention mechanisms, Generative Adversarial Networks (GANs), Performance analysis of GAN architecture for effective facial expression synthesis, Deep CNN for Object classification ,Variational Autoencoders (VAEs),Reinforcement Learning basics and applications														CO-4 BTL-3	
Lab Experiments Image generation using GAN															
Software/Equipment Used Matlab/Python															
MODULE 5: - Deep Learning for NLP and structured data (6L+ 6P)															
Word embedding's, Text classification with deep learning, Sequence-to-sequence models for NLP tasks ,Sentiment analysis and language generation , Introduction to tabular data analysis with deep learning, Feature engineering for structured data, Deep learning models for regression and classification, Ensemble methods and model evaluation														CO-5 BTL-3	
Lab Experiments Sentiment Analysis using LSTM															

<b>Software/Equipment Used</b>		
Matlab/Python		
<b>TEXT BOOKS</b>		
1.	Debi Prasanna Acharjya, Anirban Mitra, Noor Zaman, “Deep Learning in Data Analytics”, Springer, 2022.	
2.	Himansu Das, Chattaranjan Pradhan, Nilanjan Dey, “Deep Learning for Data Analytics”, Elsevier, May 2020.	
<b>REFERENCE BOOKS</b>		
1	Alex Noel Joseph Raj, Vijayalakshmi G. V. Mahesh and Ruban Nersisson , "Handbook of Research on Deep Learning-Based Image Analysis Under Constrained and Unconstrained Environments", IGI Global, Dec 2020	
2	Stefanos Vrochidis, Benoit Huet, Edward Y. Chang, Ioannis Kompatsiaris , “Big Data Analytics for Large Scale Multimedia Search", WILEY, 2019	
3	N. D. Lewis , “Deep Learning Step by Step with Python: A Very Gentle Introduction to Deep Neural Networks for Practical Data Science, 2016	
<b>E BOOKS</b>		
1.	Student’s Handbook for Associate Analytics-III.	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_cs69/preview">https://onlinecourses.nptel.ac.in/noc21_cs69/preview</a>	
2.	<a href="https://www.shiksha.com/online-courses/data-science-courses-certification-training-by-nptel-ct123">https://www.shiksha.com/online-courses/data-science-courses-certification-training-by-nptel-ct123</a>	

COURSE TITLE	SECURITY IN DATA SCIENCE			CREDITS	3
COURSE CODE	EECS1562	COURSE CATEGORY	PC/DE/NE	L-T-P-S	2-0-2-2
Version	XX	Approval Details	XX	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance*	
15%	15%	10%	5%	5%	
Course Description	A Data Science course equips learners with the ability to manipulate structured and unstructured data through various tools, algorithms, and software, emphasizing the development of critical Data Science skills				

Course Objective	1. Summarize the process of extracting insights from raw data. 2. Demonstrate various processes such as collecting, organizing, filtering, and processing data. 3. Explore prominent topics include machine learning, artificial intelligence, Big Data, modeling, and data visualization.														
Course Outcome	Upon completion of this course, the students will be able to 1. Acquire a fundamental understanding of the analytical techniques and software tools. 2. apply statistical and computational tools to applied problems, and clearly communicate the results in both written reports and oral presentations. 3. Analyze various cloud computing challenges regarding data handling 4. Compare and contrast various threat in IoT based system 5. Judge security threats and vulnerabilities in IoT														
CO, PO AND PSO MAPPING															
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	3	1	3	2	2	1	1		1	1	3	2	1
CO-2	3	1	3	1	3	2	2	1	1		1	1	3	1	1
CO-3	3	1	3	1	3	2	2	1	1		1	1	2	1	1
CO-4	3	1	3	1	3	2	2	1	1		1	1	2	1	1
CO-5	3	1	3	1	3	2	2	1	1		1	1	2	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO DATA SCIENCE (6L+6P)															
Introduction to Data Science, Data Science and Statistics, Role of Statistics in Data Science, A Brief History,Difference between Data Science and Data Analytics, Knowledge and Skills for Data Science Professionals, Some Technologies used in Data Science, Benefits and uses of data science, Facets of data. <b>Suggested Reading:</b> The data science process <b>Lab Experiments / Case study:</b> <ul style="list-style-type: none"><li>Study assignment on Data science Process.</li><li>creating a project charter, retrieving data, Cleansing, integrating, and transforming data,</li></ul>													CO-1 BTL-3		
MODULE 2: DATA ANALYSIS TOOLS FOR DATA SCIENCE AND ANALYTICS (6L+6P)															
Analysis Using Excel: Introduction, Getting Started with Excel, Format Data as a Table, Filter and Sort, Perform Simple Calculations, Data Manipulation Sorting and Filtering Data Derived Data, Highlighting Data, Aggregating Data: Count, Total Sum Basic Calculation using Excel, Analyzing Data using Pivot Table/Pivot Chart, Descriptive Statistics using Excel, Visualizing Data using Excel Charts and Graphs, Visualizing Categorical Data: Bar Charts,Pie Charts, Cross Tabulation, Exploring the Relationship between Two and Three Variables: Scatter Plot Bubble Graph and TimeSeries Plot. <b>Lab Experiments / Case study</b> <ul style="list-style-type: none"><li>Implementation of data manipulation using Excel.</li><li>Implementation of Data Visualization using Excel.</li><li>Study assignment on Kaggle</li></ul>													CO-2 BTL-3		
MODULE 3: CLOUD COMPUTING AND ITS CHALLENGES (6L+6P)															
Cloud Computing Fundamental: Cloud computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. <b>Suggested Reading:</b> Benefits and challenges of cloud computing													CO-3 BTL-4		

<b>Lab Experiments:</b> Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim. Find a procedure to transfer the files from one virtual machine to another virtual machine.		
<b>MODULE 4: ATTACK AGAINST IoT (6L+6P)</b>		
Attacks against IoT system (hardware + software) ,IoT network protocols, industry IoT <b>Suggested Reading:</b> <b>Lab Experiments:</b> <ul style="list-style-type: none"><li>● Case study IoT based network protocols</li><li>● Case study on Industrial IoT</li></ul>		<b>CO-4</b> <b>BTL-4</b>
<b>MODULE 5: IoT SECURITY (6L+6P)</b>		
Vulnerabilities, Attacks and Countermeasures. Information Assurance. Attack types. New security threats and vulnerabilities. Fault Trees and CPS. Threat Modeling. Attack, Defense, and Network Robustness of Internet of Things <b>Suggested Reading:</b> A Solution-Based Analysis of Attack Vectors on Smart Home Systems. <b>Lab Experiments/Case Studies:</b> <ul style="list-style-type: none"><li>● IoT enabled Smart traffic control system</li><li>● IoT enabled Agriculture</li></ul>		<b>CO-5</b> <b>BTL-4</b>
<b>TEXT BOOKS</b>		
1.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science",Manning Publications , 2nd Edition, 2018.	
2.	Drew Van Duren, Brian Russell, "Practical Internet of Things Security", Packt, 1st Edition, 2016	
3.	N. Ida, Sensors, Actuators and Their Interfaces: A Multidisciplinary Introduction, 2nd EditionScitech Publishers, 2020	
<b>REFERENCE BOOKS</b>		
1	Sean Smith, "The Internet of Risky Things", O'Reilly Media, 1st Edition, 2017.	
2	MayurRamgir, Internet of Things- Architecture, Implementation, and Security, New Delhi:Pearson Education, 2019	
3	Cornel Amariei, Arduino Development Cook Book,Birmingham: Packt Publishing Ltd., 2015.	
<b>E BOOKS</b>		
1.	<a href="https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf">https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf</a>	
2.	<a href="https://sectrio.com/complete-guide-to-iot-security/">https://sectrio.com/complete-guide-to-iot-security/</a>	
3.	<a href="https://link.springer.com/book/10.1007/978-981-16-1372-2">https://link.springer.com/book/10.1007/978-981-16-1372-2</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc22_cs53">https://onlinecourses.nptel.ac.in/noc22_cs53</a>	
2.	<a href="https://onlinecourses.nptel.ac.in/noc21_ee85">https://onlinecourses.nptel.ac.in/noc21_ee85</a>	

## NON DEPARTMENT ELECTIVES

### Semester-IV

#### Non Department Elective-1

COURSE TITLE	Arduino Programming and Interfacing			CREDITS	3
COURSE CODE	EECS1700	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					

CIA												ESE			
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)		Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”			Attendance*		THEORY	PRACTICAL			
15%	15%		10%			5%			5%		25%	25%			
Course Description	The students shall understand and explore about Arduino and its features														
Course Objective	1. Be familiar with Arduino and their programming 2. To make real time Arduino projects for different applications														
Course Outcome	<b>Upon completion of this course, the students will be able to</b> 1. Explain the basics of Arduino and its architecture 2. apply the software knowledge of Arduino 3. apply the hardware knowledge of Arduino 4. compose the programming of Arduino using IDE 5. Develop real time model for various applications														
CO, PO AND PSO MAPPING															
CO	P O-1	PO-2	P O-3	P O-4	PO -5	P O-6	P O-7	P O-8	PO -9	P O-10	PO-11	P O-12	PSO-1	PSO-2	PS O-3
CO -1	3	-	1	-	2	-	-	-	1	-	-	-	2	3	1
CO -2	3	3	3	-	2	-	-	-	1	-	-	-	2	2	1
CO -3	3	3	3	-	2	-	-	-	1	-	-	-	1	2	1
CO -4	3	3	3	1	2	-	-	-	-	-	-	2	1	2	1
CO -5	3	3	3	3	2	-	-	-	1	-	1	2	2	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION												(9L+ 6P)			
Introduction to Arduino-Types-Detailed Architecture-Block Diagram-Advantages and Disadvantages-Applications Lab Experiments: Software/Equipment Used: Arduino IDE													CO-1 BTL-3		
MODULE 2: ARDUINO UNO-SOFTWARE												(9L+ 6P)			

Arduino Uno-features-Architecture-Input and Output Ports-Analog and Digital-Capability of ADC & its features- Introduction and features of Tinkercad <b>Lab Experiments:</b> <b>Software/Equipment Used: Arduino IDE</b>	<b>CO-2</b> <b>BTL-3</b>
<b>MODULE 3: ARDUINO UNO-HARDWARE (9L+ 6P)</b>	
Switches-LED-Sensors-Actuators- Interfacing of Digital Input (LED) and output devices(Switch)-Interfacing of Current sensor and LCD <b>Lab Experiments:</b> <b>Software/Equipment Used: Arduino IDE</b>	<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: PROGRAMMING THE ARDUINO (9L+ 6P)</b>	
Introduction and Installation of Arduino IDE- Variables, looping statements, Logical Operators, Mathematical operators, Programming with Arduino IDE, Compiling and Debugging using IDE State Change Detection-Modulo Operator-Analog I/O-Serial Communication <b>Lab Experiments:</b> <b>Software/Equipment Used: Arduino IDE</b>	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: APPLICATIONS (9L+ 6P)</b>	
Design of systems in real time: Temperature Monitoring-Traffic Light Control-Room Automation-Piano-Digital Keypad Security <b>Lab Experiments:</b> <b>Software/Equipment Used: Arduino IDE</b>	<b>CO-5</b> <b>BTL-3</b>
<b>TEXT TEXT BOOKS</b>	
1.	Simon Monk, Programming Arduino, McGraw Hill TAB, 2 <sup>nd</sup> Edition, 2016
2.	Ryan Turner, Arduino Programming, Nelly B.L International Ltd, 2019
<b>REFERENCE BOOKS</b>	
1	J M Hughes, Arduino: A technical Reference, O'Reilly Media, 1 <sup>st</sup> Edition, 2016
<b>E BOOKS</b>	
1.	<a href="#"><u>Arduino Programming: The Ultimate Guide For Making The Best Of Your Arduino Programming Projects</u></a>
<b>MOOC</b>	
1.	<a href="https://onlinecourses.swayam2.ac.in/aic20_sp04/">https://onlinecourses.swayam2.ac.in/aic20_sp04/</a>

COURSE TITLE	Introduction to Bio Inspired Robots			CREDITS	3
COURSE CODE	EEEC51704	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment (Theory)	Second Periodical	Practical Assessments	Observation / lab records as	Attendance *	THEORY PRAC TICAL

	Assessment (Theory)		approved by the Department Examination Committee “DEC”												
15%	15%	10%	5%	5%	25%	25%									
Course Description	The main objective of this course aims to expose students to the robotic systems developed by applying concepts from nature to the design of real world engineered systems. The course intends to enhance students skills for understanding of dynamics, physics of scaling, and locomotion, taking inspiration from nature.														
Course Objective	<ul style="list-style-type: none"> <li>• The students can Work effectively as a group in a professional manner.</li> <li>• The students can Complete a self-directed design and build project relating to biologically inspired robotics.</li> <li>• Develop skills related to the design, construction and testing of advanced robotic systems</li> <li>• Have a deep understanding of biologically inspired robotics and its current impact on robotic research.</li> <li>• students learn the principles behind the bio-inspired robots from biological examples and how they are implemented in robotic systems</li> </ul>														
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <p>CO1: Interpret the features of robots and technology involved in the control.</p> <p>CO2: To build confidence among students to evaluate, choose and incorporate robots in engineering systems.</p> <p>CO 3: Apply Robotics and its concepts in Medical field.</p> <p>CO 4: Simulate a MIS procedure and be aware of the state of art in surgical and oncology robotics. CO 5: Design a medical robotic system given the specific requirements for Rehabilitation and Medical care.</p>														
Prerequisites:															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	1	1								1	3	2	3
CO-2	3	2	1	1								1	3	2	3
CO-3	3	2	1	1								1	3	2	3
CO-4	3	2	1	1								1	3	2	3
CO-5	3	2	1	1								1	3	2	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: FUNDAMENTALS OF ROBOT															
(6L+ 6P)															

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.		CO-1 BTL-3
MODULE 2: PROGRAMMING AND APPLICATIONS OF ROBOT (6L+ 6P)		
Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.		CO-2 BTL-3
MODULE 3: DESIGN OF MEDICAL ROBOTS (6L+ 6P)		
Characterization of gestures to the design of robots - Design methodologies - Technological choices - Security.		CO-3 BTL-3
MODULE 4: SURGICAL ROBOTICS (6L+ 6P)		
Minimally invasive surgery and robotic integration - surgical robotic sub systems - synergistic control - Control Modes - Radiosurgery - Orthopedic Surgery - Urologic Surgery and Robotic Imaging - Cardiac Surgery – Neurosurgery - case studies		CO-4 BTL-3
MODULE 5: ROBOTS I REHABILITATION AND MEDICAL CARE (6L+ 6P)		
Rehabilitation for Limbs - Brain-Machine Interfaces - Steerable Needles - Assistive robots - Robots in Physiotherapy - case studies		CO-5 BTL-3
TEXT BOOKS		
1.	Mikell.P.Groover , “Industrial Robotics – Technology, Programming and applications” McGraw Hill 2ND edition 2012.	
2.	Achim Ernst Floris Schweikard, "Medical Robotics", Springer, 2016.	
3.	Paula Gomes, "Medical robotics Minimally invasive surgery", Woodhead, 2013	
REFERENCE BOOKS		
1	<a href="#">John. J.Craig, “Introduction to Robotics: Mechanics and Control” 2nd Edition, 2002.</a>	
2	Jaydev P Desai, Rajni V Patel, Antoine Ferreira; Sunil Kumar Agrawal, "The Encyclopedia of Medical Robotics", World Scientific Publishing Co. Pvt. Ltd, 2019.	
3	Werfel, Justin, Kirstin Petersen, and Radhika Nagpal. "Designing collective behavior in a termite-inspired robot construction team." Science 343.6172 (2014): 754-758.	
4	Jocelyne Troccaz , "Medical Robotics", John Wiley & Sons Incorporated, 2013.	
5	Farid Gharagozloo "Robotic Surgery", Springer, 2022.	
E BOOKS		
1.	<a href="https://en.wikibooks.org/wiki/Professionalism/Ethics_and_Autonomous_AI">https://en.wikibooks.org/wiki/Professionalism/Ethics_and_Autonomous_AI</a>	
MOOC		
1.	<a href="https://onlinecourses.nptel.ac.in/noc23_me67/preview">https://onlinecourses.nptel.ac.in/noc23_me67/preview</a>	

<b>COURSE TITLE</b>	<b>Foundation on PCB Design and Testing</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>	EEEC51704	<b>COURSE CATEGORY</b>	NE	<b>L-T-P-S</b>	<b>2-0-2-0</b>



Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*											
15%	15%	10%	5%	5%											
Course Description	PCB (Printed Circuit Board) designing is an integral part of each Electronics products and should know to each electronics engineering students and who are working in electronics industry. This program is designed to make student and professionals capable to design PCB up to s standard grade.														
Course Objective	This course aims to equip the students with a basic understanding of PCB design and fabrication of components in PCB.														
Course Outcome	Upon completion of this course, the students will be able to 1. analysedifferent types of Printed Circuit Board (PCB), list the differences between them. 2. Explain the basics of CAD design and fabrication. 3. interpret the design rules and etching techniques. 4. applymanual and automated trouble shooting techniques. 5. Apply soldering techniques and identify defecfts in soldering														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	P O-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PS O-2	PS O-3
CO-1	1	1	1	-	-	-	-	-	-	-	-	-	3	-	-
CO-2	2	2	3	-	3	-	-	-	-	-	-	-	3	-	-
CO-3	1	1	2	-	-	-	-	-	-	-	-	-	3	-	-
CO-4	1	1	1	-	-	-	-	-	-	-	-	-	3	-	-
CO-5	1	1	1	-	-	2	2	-	-	-	-	-	3	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related		
MODULE 1: Introduction to PCB Design (9L)		
History of Printed Circuit Boards, Various types of Printed Circuit Boards-Single Sided Boards, Double-Sided Plated through Hole Boards, Multilayer Boards, Study of Packages of Electronic Components, Study of SMD Components, Process of PCB design and product development flow.		CO-1 BTL-3
MODULE 2: SCHEMATIC DESIGN (4L+5P)		
Starting a project, Working with schematic design tools, Schematic drawing from circuit, Rules for PCB Design, Standards for PCB Design, Placing, editing, and connecting parts and, electrical symbols About libraries and parts, Creating a netlist, Exporting and importing schematic data. <b>Suggested Simulation:</b> Basic Circuit simulation using the EDA tool.		CO-2 BTL-5
MODULE 3: PCB LAYOUT DESIGN (4L+5P)		
Board outline Design, Components placement, Details of layers, Routing methods, Copper Pour Adding reference texts, Build library parts (footprints, schematic symbols), Generation of various Manufacturing, Documents/Output files generation (Gerber file generation) <b>Suggested Readings:</b> IPC standards for printed circuit board design. Using EDA tool generating a Gerber file for a PCB circuit design.		CO-3 BTL-5
MODULE 4: PCB Fabrication Process. (9L)		
PCB Manufacturing Techniques, Film Master Generation methods, Plating and Etching Techniques, punching, drilling, milling. <b>Suggested Activities:</b> 1. Give a presentation on through-hole and surface-mount technology. 2. Collect a case study on DFM issues and present it. 3. Give a presentation on Electromagnetic Interference in real life and provide a solution to solve the problem. 4. Collect details of different types of heat sinks used in PCBs.		CO-4 BTL-3
MODULE 5: Soldering the omponents (2L+7P)		
Study Soldering Techniques, Study of soldering defect and rectification. Based on theory- Practical and Assignment in Design, Manufacturing and Assembly. <b>Suggested Activities:</b> 1. Give a presentation on the importance of spacing and thickness of the tracks in PCB's. 2. Collect information on different types of solder paste. 3. Collect any completed PCB file and explain it 4. Prepare a report on a comparison of manual soldering and machine soldering and present it. 5. Give a presentation on the failures of PCB due to improper soldering. 6. Write a report on testing of PCB. 7. Find different methods for disposing of PCB lab wastes and dispose it.		CO-5 BTL-3
TEXT BOOKS		
1.	Complete PCB Design Using Or-Cad Capture and Layout Book by Kraig Mitzner, Elsevier, 2007.	
2.	Walter C Bosschard, "PCB design & Technology", McGraw Hill, New Delhi., Tata McGraw-Hill, 1983	
3.	Printed Circuits Handbook - 6th edition Clyde F. Coombs,Jr, McGraw Hill ,2008	
REFERENCE BOOKS		
1	Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi,2006.	
E BOOKS		

1.	Open source EDA Tool KiCad Tutorial: <a href="http://kicad-pcb.org/help/tutorials/">http://kicad-pcb.org/help/tutorials/</a>
<b>MOOC</b>	
1.	<a href="https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/">https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/</a>
2.	<a href="https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/">https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/</a>

### Semester V

#### Non Department Elective-2

COURSE TITLE	Programming and Application using Matlab			CREDITS	3	
COURSE CODE	EEC51705	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0	
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*	Theory	Practical
15%	15%	10%	5%	5%	25%	25%
Course Description	The Students learn how to write clean, efficient, and well-documented programs while gaining an understanding of the many practical functions of MATLAB.					
Course Objective	This course aims the student to enhances the programming knowledge in Research and Development This course also introduces the students the technical computing environment. [Themes of data analysis, visualization, and programming]. This course helps the students to solve scientific problem with the use of a high-level programming language, MATLAB					

<b>Course Outcome</b>	Upon completion of this course, the students will be able to														
	CO 1. Understand the need for simulation/implementation for the verification of mathematical functions.														
	CO 2. Understand the main features of the MATLAB program development environment to enable their usage in the higher learning.														
	CO 3. Implement simple mathematical functions/equations in numerical computing environment such as MATLAB.														
	CO4. Interpret and visualize simple mathematical functions and operations thereon using plots/display.														
	CO 5. Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools.														
<b>CO, PO AND PSO MAPPING</b>															
CO	P O-1	PO-2	P O-3	P O-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PS O-3
CO-1	3	-	-	3	3	-	-	-	-	2	-	-	2	2	2
CO-2	2	1	1	2	2	-	-	-	-	1	-	-	3	2	2
CO-3	2	1	-	3	3	-	-	-	-	2	-	1	3	3	2
CO-4	3	-	1	2	2	-	-	-	-	1	-	-	3	3	3
CO-5	1	1	1	1	3	-	-	-	-	1	-	1	3	3	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: MATLAB Basics (9L)</b>															
MATLAB environment- Variable and arrays- Creating and Initializing variables- Multidimensional arrays- Built in functions of MATLAB.													<b>CO-1 BTL-3</b>		
<b>MODULE 2: Constants, Variables and Expressions (9L)</b>															
Numeric constants- Character constants- Variables- Special constants and variables- Arithmetic operators- Relational operators- Logical operators and functions													<b>CO-2 BTL-3</b>		
<b>MODULE 3: Introducing to Plotting (9L)</b>															
Simple xy plots- Printing a plot- Exporting a plot- Multiple plot- Line color- Line Style- Marker style- Legends – Polar Plot- Annotating and Saving Plots													<b>CO-3 BTL-3</b>		
<b>MODULE 4: User defined functions (9L)</b>															
MATLAB Functions- Variable passing- Optional Arguments- Sharing data using global memory- Sorting functions-Random number functions													<b>CO-4 BTL-3</b>		
<b>MODULE 5: Complex number and 3D Plots (9L)</b>															
Complex data- Complex variables- Plotting complex data- Multidimensional arrays- 3D line plots- 3D surface plots- Creating 3D objects using surface and Mesh Plots													<b>CO-5 BTL-3</b>		
<b>TEXT BOOKS</b>															
1.	Stephen J. Chapman ,”MATLAB Programming for Engineers”,5 <sup>th</sup> Edition, Cengage Learning, 2015														

2.	Raj Kumar Bansal, Ashok K. Goel, Manoj Kumar Sharma , “MATLAB and Its Applications in Engineering”, Pearson Education India, 2009
<b>REFERENCE BOOKS</b>	
1	Rudra Pratap, “Getting Started with MATLAB” ,7th Edition, Oxford University Press,2016.
2	Stephen J. Chapman , “MATLAB Programming for Engineers, 5 <sup>th</sup> Edition, Cengage Learning,2020
<b>E BOOKS</b>	
1.	<a href="https://en.wikibooks.org/wiki/MATLAB_Programming">https://en.wikibooks.org/wiki/MATLAB_Programming</a>
2.	<a href="https://in.mathworks.com/">https://in.mathworks.com/</a>
<b>MOOC</b>	
1.	<a href="https://www.edx.org/course/matlab-essentials">https://www.edx.org/course/matlab-essentials</a>
2.	<a href="https://nptel.ac.in/courses/103106118">https://nptel.ac.in/courses/103106118</a>

COURSE TITLE	Ocean Sensor Technology			CREDITS	3	
COURSE CODE	EEC51706	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0	
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*		
15%	15%	10%	5%	5%		
Course Description	The Students learns the theoretical and practical principles of design of oceanographic sensor systems					
Course Objective	This course aims the student to provide introduction to basic oceanographic instrumentation being used today This course also equips the students to learn the requirements, methodology and sampling strategies related to designing scientific and environmental monitoring programs This course also equips the students to understand the theoretical and practical principles of making measurements in the ocean.					

Course Outcome	Upon completion of this course, the students will be able to														
	CO 1. Explains about basic knowledge on ocean and its dynamic upwelling, topography, landforms, currents and circulation														
	CO 2. List and explain the common ocean engineering materials and their basic mechanical property indices														
	CO 3. Describe the instruments used for making optical measurements at sea.														
	CO 4. Evaluate the operational features of the new sensors and related technology in hazardous environment.														
CO 5. Interpret and analysis of Digital Image Processing															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	-	1	-	1	-	2	-	-	-	-	2	2	1	
CO-2	1	2	-	-	2	-	3	-	-	2	-	2	2	2	
CO-3	2	3	1	1	2	-	-	-	-	1	-	1	3	2	
CO-4	2	2	2	1	2	-	3	-	-	1	-	2	3	3	
CO-5	2	3	2	-	2	-	2	-	-	2	-	2	3	3	
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Oceanography (9L)															
Atmospheric Process- Ocean Structure- Ocean Processes-Surface Gravity waves-Ocean currents- Waves and Tides														CO-1 BTL-3	
MODULE 2: Ocean Electromagnetics (9L)															
Electromagnetics in Ocean environment- Electromagnetic Theory-Plane wave propagation- Reflection and transmission of Plane wave- Magnetic and Electric dipoles in Ocean														CO-2 BTL-3	
MODULE 3: Digital Signal Processing and Control Theory (9L)															
Discrete time systems- Digital Filters- FFT- Waveform analysis- System theory- LTI system analysis- SISO system controls														CO-3 BTL-3	
MODULE 4: Autonomous Ocean Vehicles, Subsystems and Control (9L)															
Biorobotics- Animal- Inspired Hydrodynamics- Propagation channel in acoustic communication- Signal processing- AUV- Sensor														CO-4 BTL-3	
MODULE 5: Non acoustic Sensors (9L)															
Non acoustic Ocean sensors: Sourcing and classification-AUV based Chemical Sensor- AUV based Biological Sensors- AUV based physical Sensors – Essential need of Sensors														CO-5 BTL-3	
TEXT BOOKS															

1.	<a href="#">Manhar R. Dhanak, Nikolaos I. Xiros, "Springer Handbook of Ocean Engineering", 1<sup>st</sup> Edition, Springer international Publishing, 2016.</a>
2.	Eric Delory, Jay Pearlman, "Challenges and Innovations in Ocean In Situ Sensors: Measuring Inner Ocean process", 1 <sup>st</sup> Edition, Elsevier, 2018
<b>REFERENCE BOOKS</b>	
1	<a href="#">Enrico Zambianchi, "Topics in Oceanography", Intech open Publisher, 2013.</a>
<b>E BOOKS</b>	
1.	<a href="https://www.kobo.com/au/en/ebook/challenges-and-innovations-in-ocean-in-situ-sensors">https://www.kobo.com/au/en/ebook/challenges-and-innovations-in-ocean-in-situ-sensors</a>
2.	<a href="https://www.nrsc.gov.in/Knowledge_EBooks?language_content_entity=en">https://www.nrsc.gov.in/Knowledge_EBooks?language_content_entity=en</a>
<b>MOOC</b>	
1.	<a href="https://oceanmooc.org/en/index.html">https://oceanmooc.org/en/index.html</a>
2.	<a href="https://onlinecourses.swayam2.ac.in/aic20_ge05/preview">https://onlinecourses.swayam2.ac.in/aic20_ge05/preview</a>

COURSE TITLE	Neural Networks and Fuzzy Logic			CREDITS	3
COURSE CODE	EEEC51707	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0
Version	XX	Approval Details	XX	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY PRACTICAL
15%	15%	10%	5%	5%	25% 25%
Course Description	The objective of this course is to brief the undergraduate students about the biometrics, bioinformatics, multimedia data analysis, medicine and most recently data science. The course gives an insight about the backpropagation algorithms, associative memories, concepts of fuzzy logic and components of fuzzy logic systems.				
Course Objective	<ul style="list-style-type: none"> <li>We hope to teach students the concepts of neural networks</li> <li>Students will exercise their ability to explore the components of Fuzzy Systems.</li> </ul>				

<b>Course Outcome</b>	Upon completion of this course, the students will be able to 1. Interpret the Fuzzy Logic and Artificial Neural Network techniques in building intelligent machines. 2. Elaborate the Fuzzy Logic models to handle uncertainty and solve engineering problems. 3. Identify and recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem.														
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>P O-1</b>	<b>PO-2</b>	<b>P O-3</b>	<b>P O-4</b>	<b>PO-5</b>	<b>P O-6</b>	<b>P O-7</b>	<b>P O-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PS O-1</b>	<b>PS O-2</b>	<b>PSO-3</b>
<b>CO-1</b>	1	1	0	0	2	0	0	0	0	0	0	0	2	2	2
<b>CO-2</b>	2	2	1	2	2	0	0	0	0	0	0	0	2	2	2
<b>CO-3</b>	2	2	2	2	2	0	0	0	0	0	0	0	3	3	3
<b>CO-4</b>	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3
<b>CO-5</b>	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 – FUNDAMENTALS OF NEURAL NETWORKS (6 L+ 6 P)</b>															
Basic concepts of neural networks, Human Brain, Model of an artificial neuron, Neural network architectures, Fire Neuron Model, characteristics of neural networks, learning methods, taxonomy of neural network architectures. Broad application areas in Electronics Engineering  Lab Experiments: Using MATLAB Investigate the Use of ANNs in various kinds of digital circuits as well as in the Cryptography.													<b>CO-1 BTL-3</b>		
<b>MODULE 2: BACKPROPAGATION NETWORKS (6 L+ 6P)</b>															
Architecture of a Backpropagation network, backpropagation Learning, Illustration, Applications, Effect of tuning parameters of the backpropagation neural network, selection of various parameters in BPN Lab Experiments : Design for Facial Recognition using BPN in Deep Learning													<b>CO-2 BTL-3</b>		
<b>MODULE 3: ASSOCIATIVE MEMORIES (6 L+ 6P)</b>															
Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function.  Case Study : To analyze stress in Education using BAM Model.													<b>CO-3 BTL-3</b>		
<b>MODULE 4: CLASSICAL AND FUZZY SETS (6 L+ 6 P)</b>															



Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Lab Experiments: Design a Power Load Balancing system using MATLAB		<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: FUZZY LOGIC SYSTEMS COMPONENTS (6 L+ 6 P)</b>		
Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods  Lab Experiments: Design an Optimal Fuzzy Logic Controller of a DC Motor Case Study: Application of Fuzzy Logic based controller for Electricity Consumption.		<b>CO-5</b> <b>BTL-3</b>
<b>TEXT BOOKS</b>		
<b>1</b>	A Text book on Neural Networks and Deep learning by Charu.C. Agarwal 2023. ( <a href="https://www.deeplearningbook.org/">https://www.deeplearningbook.org/</a> )	
<b>2</b>	A Textbook on Neural Networks for Pattern Recognition by Christopher M.Bishop ,2022	
<b>REFERENCE BOOKS</b>		
<b>1</b>	Neural Networks and Deep Learning by Michael Nielson 2015	
<b>2</b>	Artificial Neural Networks by Francois Duval 2018.	
<b>E BOOKS</b>		
<b>1</b>	<a href="https://drive.google.com/file/d/0B2iRDvP8jUuAUnpfaDBnQTBWLUU/edit">https://drive.google.com/file/d/0B2iRDvP8jUuAUnpfaDBnQTBWLUU/edit</a>	
<b>MOOC</b>		
<b>1</b>	<a href="https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge07/">https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge07/</a>	

COURSE TITLE	Medical Imaging, Signals and Informatics				CREDITS	3
COURSE CODE	EECS1710	COURSE CATEGORY	NE		L-T-P-S	2-0-2-2
Version	1.0	Approval Details	36 <sup>TH</sup> ACM		LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project/Practical	Surprise Test / Quiz	Attendance	ESE (Theory)	ESE (Practical)
15%	15%	10%	5%	5%	25%	25%
Course Description	To provide the students' ability to understanding about the imaging techniques and implement simple Health Informatics solutions.					
Course Objective	1. To impart in-depth knowledge and understanding of imaging technology for disease diagnosis. 2. To understand the principle & working of various imaging equipment for diagnosis and therapeutics. 3. To introduce the characteristics of different biosignals 4. To get exposed to knowledge in health management system 5. To understanding and implement simple Health Informatics solutions.					

<b>Course Outcome</b>	Upon completion of this course, the students will be able to 1. Understanding the principle & working of various imaging equipment for diagnosis. 2. Understanding the interaction of ionising radiation with tissue and principles of radiation protection. 3. Analyse the different types of signals & systems & also Extract the features from biosignal 4. Understand basic principles of knowledge management systems in biomedicine 5. Develop understanding of various aspects of Health Information Technology standards														
<b>Prerequisites: Nil</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>P O -1</b>	<b>PO -2</b>	<b>PO -3</b>	<b>PO -4</b>	<b>P O- 5</b>	<b>P O- 6</b>	<b>P O- 7</b>	<b>P O- 8</b>	<b>P O- 9</b>	<b>P O- 10</b>	<b>PO -11</b>	<b>PO -12</b>	<b>PS O-1</b>	<b>PS O-2</b>	<b>PSO-3</b>
<b>CO -1</b>	2	1	3	1	1	-	-	2	-	-	2	1	2	3	1
<b>CO -2</b>	2	2	1	2	3	2	-	-	3	-	-	1	2	3	1
<b>CO -3</b>	2	1	1	2	2	-	3	-	-	2	-	1	2	3	1
<b>CO -4</b>	3	1	2	1	2	-	-	3	-	-	-	1	2	3	1
<b>CO -5</b>	3	2	2	2	2	-	-	-	-	-	-	1	2	3	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: Imaging with Ionizing Radiation (6L+6L=12)</b>															
<b>Imaging with Ionizing Radiation:</b> Interactions of Radiation with tissue, Production of X Rays,X-ray equipment, Radiation protection, Scattered radiation, Clinical applications,X-Ray Image intensifier, Angiography. <b>Computerized Tomography:</b> Construction, function and operation of a CT Scanner, Clinical applications. Single Photon Emission, Computed Tomography (SPECT), Positron Emission Tomography (PET).														<b>CO-1</b>  <b>BTL-1</b>	
<b>MODULE 2: Magnetic Resonance Imaging &amp; Ultrasound Imaging (6L+6L=12)</b>															
<b>Magnetic Resonance Imaging:</b> Physics of MRI/NMR, T1 and T2 relaxation time, MRI pulse sequences, Instrumentation of MRI, MRI slice selection and encoding, Functional MRI (f-MRI), MRI clinical applications, Fluid flow imaging, Chemical-shift and Spectroscopic imaging. <b>Ultrasound Imaging:</b> Propagation of ultrasound waves in fluids, solids and tissue. Doppler Effect, Ultrasound transducers and instrumentation, Modes of ultrasonic imaging, Clinical applications.														<b>CO-2</b>  <b>BTL-3</b>	
<b>MODULE 3: Signal, System And Spectrum Analysis (6L+6L=12)</b>															
Characteristics of some dynamic biomedical signals, Noises- random, structured and physiological noises. Filters- IIR and FIR filters. Spectrum – power spectral density function, cross-spectral density and coherence function, cepstrum and homomorphic filtering. Estimation of mean of finite time signals. <b>Analysis Of Biosignal</b> Removal of artifact – ECG, Even detection –ECG, P Wave, QRS complex, T wave, Correction analysis of ECG signals, Average of Signals-PCG, ECG and EMG														<b>CO-3</b>  <b>BTL-3</b>	

<b>Module 4: Medical Informatics</b>		<b>(6L+6L=12)</b>
Introduction – Medical Informatics – Bioinformatics – Health Informatics – Structure of Medical Informatics -Functional capabilities of Hospital Information System – On-line services and off – line services – History taken by computer, Dialogue with the computer.		<b>CO-4 BTL-3</b>
<b>MODULE 5: Medical Data Acquisition and Storage</b>		<b>(6L+6L=12)</b>
Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface – Medical Data formats – Signal, Image and Video Formats – Medical Databases – Automation in clinical laboratories – Intelligent Laboratory Information System – PACS , Data mining. Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment – Surgical simulation – Radiation therapy and planning – Telemedicine – virtual Hospitals – Smart Medical Homes – Personalized e-health services – Biometrics – GRID and Cloud Computing in Medicine		<b>CO-5 BTL3</b>
<b>TEXT BOOKS</b>		
1	Steve Webb, “The Physics of Medical Imaging”, Taylor & Francis, New York, 2010.	
2	William R Hendee, Russell Ritenour E, “Medical Imaging Physics” John Wiley, New York, 2002.	
3	Raghuveer M. Rao and AjithS.Bopardikar, Wavelets transform – Introduction to theory and its applications, Pearson Education, India 2000	
4	R.D.Lele, “Computers in Medicine: Progress in Medical Informatics””, Tata McGraw Hill Publishing computers Ltd, New Delhi, 2005.	
5	Mohan Bansal, “Medical informatics”, Tata McGraw Hill Publishing computers Ltd, New Delhi, 2003.	
<b>REFERENCE BOOKS</b>		
	Paul Suetens, "Fundamentals of Medical Imaging", Cambridge University Press, 2002.	
	Joie P Jones, Manbir Singh and Cho Z.H., “Foundations of Medical Imaging”, John Wiley, 1993	
	Rangaraj M. Rangayyan, 2nd edition “Biomedical Signal Analysis-A case study approach”, Wiley-Interscience /IEEE Press, 2015	
	Willis J.Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India, New Delhi, 2006	

### Semester VI

#### Non Department Elective-3

COURSE TITLE	FUN WITH ELECTRONICS			CREDITS	3
COURSE CODE	EEEC51700	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL- 5
ASSESSMENT SCHEME					
First Periodical Assessment (Theory + Practical)	Second Periodical Assessment (Theory + Practical)	Weekly assignment/Observation/lab records and viva	Surprise Test / Quiz	Attendance	End Semester Examination
					<div>Theory</div> <div>Practical</div>

15%	15%	10%			5%	5%	25%	25%						
Course Description	The student will be able to understand various fundamental principles of diodes, transistors and Boolean algebra and become familiar with the basic operation of electronic devices and circuits which are the building blocks of all electronic circuits, devices and gadgets. This course is offered as a Theory Integrated Practical course by practicing Project Based Learning (PBL), emphasizing learning by doing, where the objective is to provide the students with the required hands-on exercises/projects that complement the theoretical understanding of the subject matters. <b>The assessment is through the combination of written tests as well as practical projects.</b>													
Course Outcome	Upon completion of this course, the students will be able to Explore the V-I characteristics of diode, BJT and JFET devices Comprehend the behavior, characteristics and applications of LED, LCD, solar cells and voltage regulators.  explain the basics of Digital system building blocks, effectively can construct simple digital designs with the knowledge of Boolean algebra. Build simple electronic circuits used in various applications													
Prerequisites: NIL														
CO, PO AND PSO MAPPING														
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	0	0	0	1	0	0	1	0	0	1	3	0
CO-2	3	3	2	0	0	1	0	1	1	0	0	1	3	0
CO-3	3	3	3	2		1	0	1	1	0	0	1	3	0
CO-4	3	3	3	2		1	0	1	1	0	0	1	3	0
CO-5	3	3	2	2	2	1	1	1	1	0	1	2	3	0
1: Weakly related, 2: Moderately related, and 3: Strongly related														
MODULE 1 : PN JUNCTION DIODE (6L=6)														
Ideal and practical diodes, Diode Equation and V-I characteristics. Zener diode, Reverse saturation current, Zener and avalanche breakdown ,LED, LCD and solar cells <b>Self-Study / Practical Component:</b> 1.Characteristics of PN junction diode 2. Characteristics of ZENER diode												CO-1 BTL-2		
MODULE 2: VOLTAGE REGULATOR (12L+ 6P=18)														
Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317) <b>Self-Study / Practical Component:</b> 1.Study of Zener diode as a Voltage Regulator using bridge rectifier with shunt capacitor filter [Load and line regulation]												CO-2 BTL-3		

2.Designing and testing of fixed positive and negative voltage regulators using 78xx and 79xx series ICs (Using bridge rectifier and shunt capacitor filter).		
<b>MODULE 3: BIPOLAR JUNCTION TRANSISTOR (9L+ 8P=17)</b>		
Construction, types, CE,CB and CC configurations (mention only), VI characteristics of a transistor in CE mode, Regions of operation (active, cut off and saturation),BJT -amplifiers and frequency response. <b>Self-Study / Practical Component:</b> 1. Characteristics of BJT in CE mode 2. .Study of single stage CE amplifier (frequency response, input and output impedances in mid-band)		<b>CO-3 BTL-3</b>
<b>MODULE 4: JFET (9L+ 8P=17)</b>		
Types - p-channel and n-channel, working and I-V characteristics - n-channel JFET, parameters and their relationships, Comparison of BJT and JFET. MOSFET: n-channel and p-channel, Construction, working, symbols, biasing, drain and transfer characteristics. <b>Self-Study / Practical Component:</b> 1.Characteristics of JFET		<b>CO-4 BTL-2</b>
<b>MODULE 5: DIGITAL CIRCUITS</b>		<b>(9L+8P=17)</b>
Basic logic gates-AND, OR, NOT, Boolean laws, Duality Theorem, De Morgan’s Theorem, simplification of Boolean expressions-SOP and POS. Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. (Numerical examples wherever applicable).  Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, synchronous - asynchronous– Design of Counters- Ripple Counters, Ring Counters, <b>Self-Study / Practical Component:</b> 1.Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs. Realization of XOR and XNOR using basic gates 2. Design and simulation of Flip Flops 3. Design and simulation of Counters		<b>CO-4 BTL- 3</b>
<b>MINI PROJECT (SELF STUDY) – INCLUDED IN THE ASSESSMENT</b>		
The project should have a working model having the basic elements of electronic components su i.e., diode,Transistors,Regulators and basic Gates with a total cost should be less than Rs. 600.		<b>CO-5 BTL- 5</b>
<b>TEXTBOOKS</b>		
<b>1</b>	A.P. Malvino, “Principles of Electronics”, 7th edition .TMH, 2011.	
<b>2</b>	David A. Bell “ Electronic Devices and Circuits”, 5th Edition, Oxford Uni. Press, 2015	
<b>REFERENCE BOOKS</b>		
<b>1</b>	John M. Yarbrough, “Digital logic: Applications and Design”, Thomas – Vikas Publishing House, 2002.	
<b>2</b>	David A. Bell (2018). <i>Electronic devices and circuits</i> , Oxford University higher education, 5 <sup>th</sup> edition reprint.	

3	R.P.Jain, "Modern digital Electronics", 4th Edition, TMH, 2010.
<b>E BOOKS</b>	
1	<a href="http://nptel.ac.in/courses/106108099/Digital%20Syste">http://nptel.ac.in/courses/106108099/Digital%20Syste</a>
2	<a href="https://www.researchgate.net/publication/264005171_Digital_Electronics">https://www.researchgate.net/publication/264005171_Digital_Electronics</a>
<b>MOOC</b>	
1	<a href="http://nptel.ac.in/courses/117106086/1">http://nptel.ac.in/courses/117106086/1</a>
2	2 <a href="https://www.openlearning.com/courses/SKEE1223">https://www.openlearning.com/courses/SKEE1223</a>

COURSE TITLE	FLEXIBLE ELECTRONICS			CREDITS	3	
COURSE CODE	EEC51712	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0	
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*		
15%	15%	10%	5%	5%		
Course Description	The students shall develop a fundamental concept on flexible and wearable Electronics					
Course Objective	1. To acquire knowledge in flexible electronics device technology from materials, processes, devices to systems 2. To gain knowledge on applications: state of the art and current status on commercialization					
Course Outcome	Upon completion of this course, the students will be able to 1. Acquire and develop basic concepts and understanding of flexible electronics. 2. Acquire basic understanding and knowledge of printing and microfabrication technologies. 3. Capability of identifying the most suitable fabrication and characterization methods to realize specific electronic devices for a given targeted application. 4. Acquire basic understanding and knowledge of micro sensors and actuators. 5. Acquire practical experience with different fabrication and characterization techniques.					

CO, PO AND PSO MAPPING															
CO	P O-1	PO-2	P O-3	P O-4	PO -5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PS O-2	PS O-3
CO -1	3	-	2	-	-	1	1	-	-	-	-	-	2	2	1
CO -2	3	3	3	-	2	2	1	-	-	-	-	-	2	2	1
CO -3	3	3	3	-	5	2	1	-	-	-	-	-	1	2	1
CO -4	3	3	3	-	2	2	1	-	-	-	-	-	1	2	2
CO -5	3	3	3	-	1	2	1	-	-	-	-	-	2	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION													(9L)		
Flexible electronics: general introduction - Historical background - Materials, devices, systems, applications - Fabrication techniques - Unique aspects, status in the field and trends-Introduction to Stretchable electronics and Wearable Electronics,													CO-1 BTL-3		
MODULE 2: FABRICATION TECHNIQUES													(9L)		
Basics and fundamentals - Deposition and structuring methods-Fluid formation and rheology for printing - Inks and printing techniques - Additional coating and structuring methods-Laser processing - Additive manufacturing													CO-2 BTL-3		
MODULE 3: THIN FILM CIRCUITS													(9L)		
Thin film transistors (TFTs) - Device operation, materials, and structures - Device characterization and performance - Sub-micrometer Indium-Gallium-Zinc-Oxide TFTs and spray coated carbon nanotube TFTs - Thin film circuits - From transistors to circuits - Other passive and active thin-film components - Digital and analog circuit													CO-3 BTL-3		
MODULE 4: SENSORS AND ACTUATORS													(9L)		
Sensors - Principles and fundamentals - Examples of flexible physical, chemical and optical sensors - Biosensors - Examples of flexible biosensors-Principles and fundamentals - Examples of flexible optical and thermal actuators													CO-4 BTL-3		
MODULE 5: ENERGY HARVESTING AND STORAGE													(9L)		
Energy harvesters - Principles and fundamentals - Examples of flexible energy harvesters - Storage components - Examples of flexible supercapacitors and batteries-Integrated Systems - System integration strategies - Examples of fully flexible and hybrid systems-memory devices, MEMS, lab-on-a-chip, and photovoltaic													CO-5 BTL-3		
REFERENCES															
1.		M. Caironi and Y.Y. Noh, "Large Area and Flexible Electronics", WILEY-VCH, 2015.													
2.		V. Pecunia, M. Fattori, S. Abdinia, H. Sirringhaus, and E. Cantatore "Organic and Amorphous-Metal-Oxide Flexible Analogue Electronics", Cambridge Elements, 2018.													
ADDITIONAL READING BOOKS															
1		G. Nisato, D. Lupo, S. Ganz, "Organic and Printed Electronics: Fundamentals and Applications", CRC Press, 2016													
2		Franky So (Editor), Organic Electronics: Materials, Processing, Devices and Applications, CRC Press, 2009.													
3		W. S. Wong, A. Salleo, "Flexible Electronics: Materials and Applications", Springer, 2009													
ADDITIONAL READING E-BOOKS															

1.	P. Coseddu and M. Caironi, "Organic Flexible Electronics: Fundamentals, Devices, and Applications", Elsevier, 2020.
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/learn/freeform-electronics">https://www.coursera.org/learn/freeform-electronics</a>

COURSE TITLE			Radar Communication						CREDITS		3				
COURSE CODE			EEC51713		COURSE CATEGORY			NE		L-T-P-S		2-0-2-2			
Version			1.0		Approval Details			36 <sup>TH</sup> ACM		LEARNING LEVEL		BTL-3			
ASSESSMENT SCHEME															
CIA												ESE			
First Periodical Assessment		Second Periodical Assessment		Seminar/Assignments/Project			Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”		Attendance*						
15%		15%		10%			5%		5%		50%				
Course Description			This course introduces the student the fundamentals of radar system engineering. The radar range equation in its many forms is developed and applied to different situations. Radar transmitters, antennas, and receivers are covered. The concepts of matched filtering, pulse compression, and the radar ambiguity function are introduced, and the fundamentals of radar target detection in a noise background are discussed. Target radar cross-section models are addressed, as well as the effects of the operating environment, including propagation and clutter. MTI and pulsed Doppler processing and performance are addressed. Range, angle, and Doppler resolution/accuracy, as well as fundamental tracking concepts, will also be discussed												
Course Objective			It covers the theory and practice of radar systems used for detection, tracking and location of targets. Topics include measurement of range and velocity, pulse compression, design of radar transmitters, receivers and antennas.												
Course Outcome			Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Analyze the RADAR range equation.</li><li>Understand the basic operation of pulse and CW radar systems.</li><li>Choose suitable tracking radar for a given problem.</li><li>Select appropriate criterion for detecting a target.</li><li>Understand the working of phased array radars and navigational aids.</li></ul>												
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	P O-3	P O-4	PO -5	PO- 6	PO- 7	PO- 8	PO -9	PO-10	PO -11	PO-12	PS O-1	PS O- 2	PS O- 3



CO-1	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO-2	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO-3	2	2	-	-	-	1	-	-	-	-	-	-	3	-	-
CO-4	2	-	-	-	1	-	-	-	-	-	-	-	3	-	-
CO-5	2	2	-	-	-	-	-	-	-	-	-	2	3	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Radar and Radar Equation (9L)															
Introduction, Radar block diagram and operation, frequencies, applications, types of displays, derivation of radar equation, minimum detectable signal, probability of false alarm and threshold detection, radar cross-section, system losses.														CO-1 BTL-2	
MODULE 2: CW, MTI and Tracking Radar (9L)															
CW Radar – Doppler Effect, CW Radar, applications, FM – CW radar, altimeter, Multiple Frequency Radar. Pulse Radar – MTI, Delay Line Canceller, Multiple Frequencies, Range-gated Doppler Filters, Non-coherent MTI, Pulse Doppler Radar.														CO-2 BTL-3	
MODULE 3: TRACKING RADAR (9L)															
Tracking Radar- Sequential lobing, conical scanning, monopulse, phase comparison monopulse, tracking in range, comparison of trackers.														CO-3 BTL-5	
MODULE 4: DEDUCTION OF SIGNALS IN NOISE (9L)															
Detection – Introduction, Matched Filter, Detection Criteria, Detector characteristics.														CO-4 BTL-3	
MODULE 5: RADAR ANTENNAS and NAVIGATIONAL AIDS (9L)															
Phased Arrays – Basic concepts, feeds, phase shifters, frequency scan arrays, multiple beams, applications, advantages and limitations. Navigational Aids: Direction Finder, VOR, ILS and Loran.														CO-5 BTL-3	
TEXT BOOKS															
1.		Introduction to Radar Systems, Merrill I Skolnik – Tata McGraw Hill – 3rd edition 2001.													
REFERENCE BOOKS															
1.		F.E. Terman, Radio Engineering, Mc Graw Hill Book Co. (for Chapter 7 only), 4Th Edn.													
2.		Simon Kingsley and Shaun Quegan, Understanding RADAR Systems, McGraw Hill Book Co., 1993													
E BOOKS															
1.		<a href="https://www.geo.uzh.ch/microsite/rsi-documents/research/SARlab/GMTILiterature/PDF/Skolnik90.pdf">https://www.geo.uzh.ch/microsite/rsi-documents/research/SARlab/GMTILiterature/PDF/Skolnik90.pdf</a>													
MOOC															
1.		<a href="https://nptel.ac.in/courses/108105154">https://nptel.ac.in/courses/108105154</a>													
2.		<a href="https://www.ll.mit.edu/outreach/radar-introduction-radar-systems-online-course">https://www.ll.mit.edu/outreach/radar-introduction-radar-systems-online-course</a>													

COURSE TITLE	INTRODUCTION TO 5G TECHNOLOGY AND IOT			CREDITS	3
COURSE CODE	EECS1713	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					

CIA												ESE			
First Periodical Assessment (Theory)			Second Periodical Assessment (Theory)		Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance*		THEORY	PRACTICAL		
15%			15%		10%			5%		5%		25%	25%		
Course Description			The course on Introduction to 5G Technology and IoT provides an overview of the 5G technology and the basic requirements for 5G. The course also focuses on the IoT Architecture and its protocols in 5G environment. Resource management and security issues associated with the technology are also dealt with.												
Course Objective			<ul style="list-style-type: none"><li>• This course aims to equip the students with a basic understanding of 5G technology, and its applications.</li><li>• This course aims to equip students with understanding of the emerging technologies in 5G<ul style="list-style-type: none"><li>• This course aims to equip students with understanding of IoT architecture and protocols in 5G environment</li><li>• This course aims to equip students with understanding of resource management in advanced networks</li><li>• This course aims to equip students with understanding of security issues in networks</li></ul></li></ul>												
Course Outcome			<p><b>Upon completion of this course, the students will be able to</b></p> <ul style="list-style-type: none"><li>• Analyze the requirements for 5G and apply it for real time applications</li><li>• Elaborate the emerging technologies in 5G</li><li>• Identify an efficient and scalable IoT architecture for the defined scenario</li><li>• Examine the resource management techniques in 5G environment</li><li>• Illustrate the privacy and security issues in 5G deployed networks</li></ul>												
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-2	2	2	2	2	1	2	0	0	0	0	1	1	3	1	2
CO-3	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-4	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-5	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related															

<b>MODULE 1: INTRODUCTION TO 5G</b>	
<b>(9L+ 6P)</b>	
<p>Journey towards 5G Communication, Background and Future of 5G, 5G system requirements &amp; drivers, Applications of 5G, Case studies.</p> <p><b>Suggested Readings:</b> Fundamentals of Wireless communication.</p> <p><b>Lab Experiments</b> 1. Design of 5G Wireless Technologies</p> <p><b>Software/Equipment Used</b> MATLAB</p>	<b>CO-1</b> <b>BTL-3</b>
<b>MODULE 2: EMERGING TECHNOLOGIES IN 5G (9L+ 6P)</b>	
<p>Massive MIMO, Network Function Virtualization, Software Defined Network, Cognitive Radio, Heterogeneous Networks, Internet of Things.</p> <p><b>Suggested Readings:</b> OFDM, MIMO</p> <p><b>Lab Experiments</b> 1. Model &amp; Simulate 5G system with 5G Toolbox</p> <p><b>Software/Equipment Used</b> MATLAB</p>	<b>CO-2</b> <b>BTL-3</b>
<b>MODULE 3: IOT ARCHITECTURE AND PROTOCOLS IN 5G ENVIRONMENT (9L+ 6P)</b>	
<p>Enabling technologies for IoT, IoT Architecture, Network and Communication Infrastructure for IoT, Importance of scalability for 5G based IoT systems</p> <p><b>Suggested Readings:</b> Fundamentals of Internet of things</p> <p><b>Lab Experiments</b> 1. Model &amp; Simulate 5G based IoT system with 5G Toolbox</p> <p><b>Software/Equipment Used</b> MATLAB</p>	<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: RESOURCE MANAGEMENT (9L+ 6P)</b>	
<p>Use of Content Centric Networking for IoT networks, Millimeter wave communication for 5G enabled IoT, Role coordination in Large scale and Highly dense Internet of Things, Energy harvesting and sustainable M2M communication in 5G</p> <p><b>Suggested Readings:</b> 5G Concepts, IoT Networking</p> <p><b>Lab Experiments</b> 1. Simulating millimeter waves</p> <p><b>Software/Equipment Used</b> MATLAB &amp; Simulink</p>	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: SECURITY CONSIDERATIONS (9L+ 6P)</b>	
<p>IoT enablers- Privacy and Security issues, Security in smart grids and Smart spaces for smooth IoT deployment in 5G, Security challenges in 5G based IoT Middle ware systems.</p> <p><b>Suggested Readings:</b> IPV6, Middle ware systems.</p> <p><b>Lab Experiments</b> 1. Raspberry Pi based security systems</p> <p><b>Software/Equipment Used</b> MATLAB &amp; Simulink</p>	<b>CO-5</b> <b>BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Ramjee Prasad , “5G Outlook – Innovations and Applications”, River Publishers, 2016
2.	Vasuky Mohanan, Rahmat Budiarto and Ismat Aldmour, “ Powering the Internet of Things with 5G networks”, Advances in Wireless Technologies and Telecommunication Book series, IGI Global 2018.
<b>REFERENCE BOOKS</b>	

1	Constandinos X, George M and Jordi M Batalla, "Internet of Things in 5G Mobile Technologies", Springer International Publishing Switzerland, 2016
2	Harri Holma and Antti Toskala, "5G Technology- 3GPP New Radio", Wiley Publishers, 2020.
3	Saad Asif, "5G Mobile Communications: Concepts and Technologies", CRC Press, 2019
<b>E BOOKS</b>	
1.	<a href="https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad">https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad</a>
<b>MOOC</b>	
1.	<a href="https://archive.nptel.ac.in/courses/117/102/117102062/">https://archive.nptel.ac.in/courses/117/102/117102062/</a>
2.	<a href="https://www.digimat.in/nptel/courses/video/117104099/L01.html">https://www.digimat.in/nptel/courses/video/117104099/L01.html</a>

### Semester-VII

#### Non Department Elective-4

COURSE TITLE	INTRODUCTION TO 5G TECHNOLOGY AND IOT			CREDITS	3	
COURSE CODE	EECS1714	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0	
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance *	THEORY	PRAC TICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The course on Introduction to 5G Technology and IoT provides an overview of the 5G technology and the basic requirements for 5G. The course also focuses on the IoT Architecture and its protocols in 5G environment. Resource management and security issues associated with the technology are also dealt with.					
Course Objective	<ul style="list-style-type: none"><li>• This course aims to equip the students with a basic understanding of 5G technology, and its applications.</li><li>• This course aims to equip students with understanding of the emerging technologies in 5G</li><li>• This course aims to equip students with understanding of IoT architecture and protocols in 5G environment</li><li>• This course aims to equip students with understanding of resource management in advanced networks</li><li>• This course aims to equip students with understanding of security issues in networks</li></ul>					

<b>Course Outcome</b>			<b>Upon completion of this course, the students will be able to</b> <ul style="list-style-type: none"><li>Analyze the requirements for 5G and apply it for real time applications</li><li>Elaborate the emerging technologies in 5G</li><li>Identify an efficient and scalable IoT architecture for the defined scenario</li><li>Examine the resource management techniques in 5G environment</li><li>Illustrate the privacy and security issues in 5G deployed network</li></ul>												
<b>CO, PO AND PSO MAPPING</b>															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-2	2	2	2	2	1	2	0	0	0	0	1	1	3	1	2
CO-3	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-4	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-5	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO 5G</b> <b>(9L+ 6P)</b>															
Journey towards 5G Communication, Background and Future of 5G, 5G system requirements & drivers, Applications of 5G, Case studies. <b>Suggested Readings:</b> Fundamentals of Wireless communication. <b>Lab Experiments</b> 1. Design of 5G Wireless Technologies <b>Software/Equipment Used</b> MATLAB													<b>CO-1</b> <b>BTL-3</b>		
<b>MODULE 2: EMERGING TECHNOLOGIES IN 5G (9L+ 6P)</b>															
Massive MIMO, Network Function Virtualization, Software Defined Network, Cognitive Radio, Heterogeneous Networks, Internet of Things. <b>Suggested Readings:</b> OFDM, MIMO <b>Lab Experiments</b> 1. Model & Simulate 5G system with 5G Toolbox <b>Software/Equipment Used</b> MATLAB													<b>CO-2</b> <b>BTL-3</b>		
<b>MODULE 3: IOT ARCHITECTURE AND PROTOCOLS IN 5G ENVIRONMENT (9L+ 6P)</b>															
Enabling technologies for IoT, IoT Architecture, Network and Communication Infrastructure for IoT, Importance of scalability for 5G based IoT systems <b>Suggested Readings:</b> Fundamentals of Internet of things <b>Lab Experiments</b> 1. Model & Simulate 5G based IoT system with 5G Toolbox <b>Software/Equipment Used</b> MATLAB													<b>CO-3</b> <b>BTL-3</b>		

MODULE 4: RESOURCE MANAGEMENT (9L+ 6P)	
Use of Content Centric Networking for IoT networks, Millimeter wave communication for 5G enabled IoT, Role coordination in Large scale and Highly dense Internet of Things, Energy harvesting and sustainable M2M communication in 5G <b>Suggested Readings:</b> 5G Concepts, IoT Networking <b>Lab Experiments</b> 1. Simulating millimeter waves <b>Software/Equipment Used</b> MATLAB & Simulink	<b>CO-4</b> <b>BTL-3</b>
MODULE 5: SECURITY CONSIDERATIONS (9L+ 6P)	
IoT enablers- Privacy and Security issues, Security in smart grids and Smart spaces for smooth IoT deployment in 5G, Security challenges in 5G based IoT Middle ware systems. <b>Suggested Readings:</b> IPV6, Middle ware systems. <b>Lab Experiments</b> 1. Raspberry Pi based security systems <b>Software/Equipment Used</b> MATLAB & Simulink	<b>CO-5</b> <b>BTL-3</b>
BOOKS	
1.	Ramjee Prasad , “5G Outlook – Innovations and Applications”, River Publishers, 2016
2.	Vasuky Mohanan, Rahmat Budiarto and Ismat Aldmour, “ Powering the Internet of Things with 5G networks”, Advances in Wireless Technologies and Telecommunication Book series, IGI Global 2018.
REFERENCE BOOKS	
1	Constandinos X, George M and Jordi M Batalla, “Internet of Things in 5G Mobile Technologies”, Springer International Publishing Switzerland, 2016
2	Harri Holma and Antti Toskala, “5G Technology- 3GPP New Radio”, Wiley Publishers, 2020.
3	Saad Asif, “5G Mobile Communications: Concepts and Technologies”, CRC Press, 2019
E BOOKS	
1.	<a href="https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad">https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad</a>
MOOC	
1.	<a href="https://archive.nptel.ac.in/courses/117/102/117102062/">https://archive.nptel.ac.in/courses/117/102/117102062/</a>
2.	<a href="https://www.digimat.in/nptel/courses/video/117104099/L01.html">https://www.digimat.in/nptel/courses/video/117104099/L01.html</a>

COURSE TITLE	AI & ML IN OCEANOGRAPHY			CREDITS	3
COURSE CODE	EEEC51719	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36 <sup>TH</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA				ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination	Attendance *	THEORY PRACTICAL

			Committee “DEC”												
15%	15%	10%	5%	5%	25%	25%									
Course Descrip tion	This course gives a basic introduction to machine learning (ML) and artificial intelligence (AI). Through an algorithmic approach, the students are given a practical understanding of the methods being taught, through making their own implementations of several of the methods. and be able to apply them in practical situation with respect to oceanography														
Course Objective	<ul style="list-style-type: none"><li>To introduce the students to the field of ocean, and coastal engineering.</li><li>Understand the basics of ANN and comparison with Human brain</li><li>To explain the key concepts of AI models</li><li>To study how to introduce ML in Ocean engineering</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Interpret the climatic conditions of the deep ocean</li><li>Solve real world machine learning problems with fundamental of Machine learning data, variable model representation (Single, gradient and multi etc.)</li><li>Apply basic regression, classification methods, propagation algorithms to train the neural network</li><li>Distinguish between supervised and unsupervised learning and its application in machine learning task (computational problems, models, algorithm etc.,)</li><li>Apply the basic principles, models and algorithms to AI to recognize, model and solve problems in the analysis and design of information systems.</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	P O-3	P O-4	PO -5	P O -6	P O -7	P O -8	PO -9	PO-10	PO -11	PO-12	PS O-1	PS O-2	PSO-3
CO-1	2	2	-	-	-	1	-	-	-	-	-	-	-	-	-
CO-2	3	2	3	2	-	2	2	-	-	-	-	-	-	2	-
CO-3	3	2	3	3	-	-	-	-	-	-	-	-	-	2	-
CO-4	3	2	3	3	-	-	-	-	-	-	-	-	-	2	-
CO-5	-	-	3	3	2	3	-	-	-	-	-	2	-	-	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO OCEANOGRAPHY							(9L+ 6P)								
Concepts of Oceanography, Marine Sciences, Meteorology, Climatology & other relevant topics and their interrelationships, Various Oceans on Earth, their peculiarities pertaining to geographical, climatic & other aspects, Salinity, chlorinity, pH and other parameters in oceans.  Suggested Readings:													CO-1 BTL-3		

<p>Oceans on Earth, their peculiarities pertaining to geographical, climatic &amp; other aspects</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Case study on marine sciences</li> <li>2. Case study and collection of data on the climatic conditions</li> </ol> <p><b>Software/Equipment Used</b></p>	
<p><b>MODULE 2: ARTIFICIAL INTELLIGENCE (9L+ 6P)</b></p>	
<p>Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents &amp; environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs</p> <p><b>Suggested Readings:</b> state space search, production system, problem characteristics, and issues in the design of search program</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>3. Write a solution for 8 Queens problem</li> <li>4. Case study on BFS and DFS</li> </ol> <p><b>Software/Equipment Used</b> MATLAB if needed</p>	<p><b>CO-2</b> <b>BTL-3</b></p>
<p><b>MODULE 3: BASICS OF NEURAL NETWORKS (9L+ 6P)</b></p>	
<p>: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem</p> <p><b>Suggested Readings:</b> XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Write a program in python to implement Multilayer Networks</li> <li>2. Write a suitable code for Perceptron Learning algorithm</li> </ol> <p><b>Software/Equipment Used</b> Python</p>	<p><b>CO-3</b> <b>BTL-3</b></p>
<p><b>MODULE 4: SUPERVISED AND UNSUPERVISED LEARNING (9L+ 6P)</b></p>	
<p>Convolution neural network (CNN) -Layers in CNN - CNN architectures. Recurrent Neural Network -Applications: Speech-to-text conversion-image classification time series prediction.</p> <p><b>Suggested Readings:</b> CNN architectures. Recurrent Neural Network -Applications</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Write a program in python or MATLAB to Implement CNN using any database</li> <li>2. Write a program to convert TEXT to SPEECH</li> </ol> <p><b>Software/Equipment Used</b> Python and MATLAB</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<p><b>MODULE 5: INTRODUCTION TO MACHINE LEARNING (9L+6P)</b></p>	
<p>Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.</p> <p><b>Suggested Readings:</b> Classification problems, Regression problems, Clustering problems</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Build a case study on the difference between Clustering and classification</li> <li>2. Program code for regression analysis three types)</li> </ol>	<p><b>CO-5</b> <b>BTL-3</b></p>



3. Write python programs to classify any four ML algorithms		
<b>Software/Equipment Used</b>		
Python or MATLAB		
<b>TEXT BOOKS</b>		
1.	Satish Kumar, "Neural Networks A Classroom Approach", McGraw Hill Education (India) Pvt. Ltd, 2010.	
2.	Francois Chollet, "Deep Learning with Python", Manning Publications, Shelter Island, New York, 2018	
3	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015	
<b>REFERENCE BOOKS</b>		
1	Ethem Alpaydin, "Introduction to Machine Learning", 3rd Edition, MIT Press, 2014	
2	C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.	
3	J.M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publications 1994.	
4	Grant R. Bigg The Oceans and Climate, Cambridge, 2003	
<b>E BOOKS</b>		
1.	<a href="https://d2l.ai/">https://d2l.ai/</a>	
2.	Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd ed.,2017	
3.	<a href="https://artint.info/AIPython/">https://artint.info/AIPython/</a>	
<b>MOOC</b>		
1.	<a href="https://nptel.ac.in/courses/106102220">https://nptel.ac.in/courses/106102220</a>	
2.	<a href="https://www.udemy.com/course/artificial-intelligence-and-machine-learning-fundamentals/">https://www.udemy.com/course/artificial-intelligence-and-machine-learning-fundamentals/</a>	

#### NON DEPARMENT ELECTIVES

#### SEMESTER 4

COURSE TITLE	Arduino Programming and Interfacing			CREDITS	3
COURSE CODE	EEC51700	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA				ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	THEORY PRACTICAL

15%	15%	10%	5%	5%	25%	25%									
Course Description	The students shall understand and explore about Arduino and its features														
Course Objective	1.Be familiar with Arduino and their programming 2.To make real time Arduino projects for different applications														
Course Outcome	Upon completion of this course, the students will be able to 1.Have knowledge on Arduino and its architecture 2.Understand and explore software knowledge of Arduino 3.Understand and apply the hardware knowledge of Arduino 4.Learn the programming of Arduino using IDE 5.Develop real time model for various applications														
CO, PO AND PSO MAPPING															
CO	PO -1	PO- 2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO- 10	PO -11	PO -12	PSO-1	PSO-2	PSO-3
CO -1	3	-	1	-	2	-	`	-	1	`	-	-	2	3	1
CO -2	3	3	3	-	2	-	-	-	1	-	-	-	2	2	1
CO -3	3	3	3	-	2	-	-	-	1	-	-	-	1	2	1
CO -4	3	3	3	1	2	-	-	-	-	-	-	2	1	2	1
CO -5	3	3	3	3	2	-	-	-	1	-	1	2	2	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION (6L+ 6P)															
Introduction to Arduino-Types-Detailed Architecture-Block Diagram-Advantages and Disadvantages-Applications - Introduction and Installation of Arduino IDE Lab Experiments: Basic Arduino programming with variables Software/Equipment Used: Arduino IDE													CO-1 BTL-3		
MODULE 2: ARDUINO UNO-SOFTWARE (6L+ 6P)															
Arduino Uno-features-Architecture-Input and Output Ports-Analog and Digital-Capability of ADC & its features- Introduction and features of Tinkercad Lab Experiments: LED / Buzzer interfacing with Arduino Interfacing ultrasonic sensor with Arduino Software/Equipment Used: Arduino IDE													CO-2 BTL-3		
MODULE 3: ARDUINO UNO-HARDWARE (6L+ 6P)															
Switches-LED-Sensors-Actuators- Interfacing of Digital Input (LED) and output devices(Switch)-Interfacing of Current sensor and LCD Lab Experiments: Stepper /servo motor interfacing with Arduino Measurement of voltage / current with Arduino Software/Equipment Used: Arduino IDE													CO-3 BTL-3		

MODULE 4: PROGRAMMING THE ARDUINO 6P)		(6L+
Programming: Variables, Looping statements, Logical Operators, Mathematical operators, Programming with Arduino IDE, Compiling and Debugging using IDE State Change Detection-Module Operator-Analog I/O-Serial Communication <b>Lab Experiments:</b> Serial communication with Arduino Interface wireless module with Arduino <b>Software/Equipment Used: Arduino IDE</b>		<b>CO-4 BTL-3</b>
MODULE 5: APPLICATIONS		(6L+ 6P)
Design of systems in real time: Temperature monitoring-Traffic light control-Room automation-Piano-Digital Keypad Security <b>Lab Experiments:</b> Interfacing Temperature & Humidity Sensor with Arduino Traffic light control with Arduino <b>Software/Equipment Used: Arduino IDE</b>		<b>CO-5 BTL-3</b>
TEXT BOOKS		
1.	Simon Monk, Programming Arduino, McGraw Hill TAB, 2 <sup>nd</sup> Edition, 2016	
2.	Ryan Turner,Arduino Programming, Nelly B.L International Ltd, 2019	
REFERENCE BOOKS		
1	J M Hughes, Arduino: A technical Reference, O'Reilly Media, 1 <sup>st</sup> Edition, 2016	
E BOOKS		
1.	Arduino Programming: The Ultimate Guide For Making The Best Of Your Arduino Programming Projects	
MOOC		
1.	<a href="https://onlinecourses.swayam2.ac.in/aic20_sp04/">https://onlinecourses.swayam2.ac.in/aic20_sp04/</a>	

<b>COURSE TITLE</b>	<b>Electronics in Media Studies</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>	EEC51701	<b>COURSE CATEGORY</b>	NE	L-T-P-S	<b>2-0-2-2</b>
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>	<b>37<sup>th</sup> ACM 20.01.2023</b>	<b>LEARNING LEVEL</b>	<b>BTL-3</b>
<b>ASSESSMENT SCHEME</b>					
<b>CIA</b>					<b>ESE</b>
<b>First Periodical Assessment (Theory)</b>	<b>Second Periodical Assessment (Theory)</b>	<b>Practical Assessments</b>	<b>Observation / lab records as approved by the Department Examination Committee "DEC"</b>	<b>Attendance</b>	<b>THEORY PRACTICAL</b>
<b>15%</b>	<b>15%</b>	<b>10%</b>	<b>5%</b>	<b>5%</b>	<b>25% 25%</b>

Course Description	The main objective of this course is to offer quality media studies and research, using state-of-the-art images for building an inter-disciplinary knowledge base, so as to contribute to development and democracy and to create an enabling environment to nurture ideas, freedom of expression, creativity and scholarship, and develop leaders in the area of media Studies.														
Course Objective	1 To train the students with production skills for various electronic media fields like radio, television and types of networks. 2 To equip students with knowledge and skills to work in new media and electronic media communication environment. 3.This course aims to study the basic of digital media & Various media research.														
Course Outcome	<b>Upon completion of this course, the students will be able to</b> 1: Understand various forms of electronic media 2: Learn effective speaking, listening and writing skills for communication in personal life, public life, and in media fields. 3: Get benefited with communication skills in his/her personal, public and professional life. 4: Identify digital content and sources. 5: Figure out the various problems in electronic media field to conduct research.														
Prerequisites: Radio, Television network, Research															
CO, PO AND PSO MAPPING															
CO	PO -1	PO- 2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO- 10	PO -11	PO -12	PSO-1	PSO-2	PSO-3
CO -1	1	2	2	1	1	0	0	0	0	0	1	1	3	0	1
CO -2	2	2	2	1	1	0	0	0	0	0	1	1	3	0	1
CO -3	1	2	2	1	1	0	0	0	0	0	1	1	3	0	1
CO -4	1	2	2	1	1	0	0	0	0	0	1	1	3	0	1
CO -5	1	2	2	1	1	0	0	0	0	0	1	1	3	0	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Electronic Media (6L+ 6P)															
Introduction to radio, Technology and Innovations of Radio, Types of radio, Amplitude Modulation and Frequency Modulation, Analogue and Digital Radio. <b>Suggested Readings:</b> Fundamentals of Radio, Modulations <b>Lab Experiments</b> 1. Amplitude Modulation 2. Frequency Modulation													CO-1 BTL-3		
MODULE 2: Communication in various Fields (6L+ 6P)															
Introduction to Television, Technology and innovations, Historical perspective of television, Terrestrial, cable and Satellite television. <b>Suggested Readings:</b> Televisions & cables. <b>Lab Experiments</b>													CO-2 BTL-3		

1. FSK, PSK Modulation & Demodulations	
<b>MODULE 3: Networks (6L+ 6P)</b>	
Internet, Definitions, Technology and Innovations, Historical perspectives of Internet, Local Area Network (LAN), Metropolitan Area Network (MAN) Wide Area Network (WAN), Wireless Local Area Network (WLAN). <b>Suggested Readings:</b> Computer Networks <b>Lab Experiments</b> Star & Ring Topologies, LAN	<b>CO-3 BTL-3</b>
<b>MODULE 4: Introduction to Digital Media (6L+ 6P)</b>	
Digital Images, Digital video, Video game, Web pages and Websites, Social media, Data and Databases, Digital Audio, Electronic Books, Animation Creation with Flash. <b>Suggested Readings:</b> Images & videos <b>Lab Experiments</b> Animation Creation with Flash.	<b>CO-4 BTL-3</b>
<b>MODULE 5: Media Research Methods (6L+ 6P)</b>	
Research design components, Experimental, Quasi-experimental, Longitudinal studies, Simulation, Panel studies, Field studies, Review of literature, Methods of media research: Census method, Survey method, Observation method, Clinical studies, Case studies, Content analysis. <b>Suggested Readings:</b> Various Research methods <b>Lab Experiments</b> Case studies.	<b>CO-5 BTL-3</b>
<b>BOOKS</b>	
1.	M. M. Gaur," Electronic Media", S.S.S.ENTERPRISESS
2.	Norman J. Medoff, Barbara Kaye," Electronic Media", 2nd Edition, Focal Press,2013.
<b>REFERENCE BOOKS</b>	
1	Antonio Farrell , "Introduction to Electronic Media and Broadcasting ", NY Research Press, 2022.
2	Hubert Reeve," Electronic Media and Broadcasting ", Larsen and Keller Education ,2017.
3	Umar Sama, "Law of Electronic Media",Deep & Deep Publications,2007.
4	Ted Sharp,"Electronic and Digital Media: Past, Present and Future" Murphy & Moore Publishing,2022.
<b>E BOOKS</b>	
1.	<a href="https://en.wikibooks.org/wiki/Communication_Systems/Print_Version">https://en.wikibooks.org/wiki/Communication_Systems/Print_Version</a>
2.	<a href="https://en.wikibooks.org/wiki/Introduction_to_Mass_Media/Television">https://en.wikibooks.org/wiki/Introduction_to_Mass_Media/Television</a>
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc23_ee05/preview">https://onlinecourses.nptel.ac.in/noc23_ee05/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc23_ee73/preview">https://onlinecourses.nptel.ac.in/noc23_ee73/preview</a>

<b>COURSE TITLE</b>	<b>Smart Health Care Systems</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>	EECS1702	<b>COURSE CATEGORY</b>	NE	L-T-P-S	<b>2-0-2-2</b>

Version	XX	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL									
15%	15%	10%	5%	5%	25%	25%									
Course Description	Smart healthcare systems employ cutting-edge technology, such as IoT and AI, to revolutionize the healthcare industry. They enable remote patient monitoring and personalized care through wearable devices and data analytics. These systems enhance efficiency, reduce administrative burdens, and prioritize patient-centric healthcare delivery.														
Course Outcome	Upon completion of this course, the students will be able to  1.List the key components of smart healthcare systems, including electronic health records, IoT devices, and telehealth technologies  2. Explain the fundamental principles of smart healthcare systems, such as the role of data analytics in improving patient care and healthcare operations.  3. Apply the knowledge of smart healthcare systems by designing and implementing a telemedicine system for remote patient consultations.  4. Analyze healthcare data to identify trends and patterns, enabling them to make data-driven decisions that improve patient outcomes and operational efficiency.  5. create innovative solutions, such as proposing new strategies for enhancing data security and privacy in healthcare systems or developing a novel mHealth app to address specific healthcare challenges														
Prerequisites: Health care fundamentals, IoT, AI and machine Learning															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1		2	1	2	1							1	2	2	3
CO-2		2	1	2						2		1	2	2	3
CO-3		2	1									1	2	2	3
CO-4	2	2	1									1	2	2	3
CO-5	2	2	1	3								1	2	2	3
1: Weakly related, 2: Moderately related and 3: Strongly related															

<b>MODULE 1: : Introduction to Smart Healthcare Systems (6L+ 6P)</b>	
Introduction to Smart Healthcare Systems, Overview of healthcare systems, Role of technology in healthcare Challenges and opportunities in healthcare, Healthcare Data Management and Analytics.  Experiment: Healthcare Data Analytics	CO-1 BTL-3
<b>MODULE 2: IoT in Healthcare (6L+ 6P)</b>	
Internet of Things (IoT) in Healthcare, IoT fundamentals, Applications of IoT in healthcare ,IoT devices and sensors in healthcare Experiment: IoT Healthcare Monitoring	CO-2 BTL-3
<b>MODULE 3: Tele medicine (6L+ 6P)</b>	
Tele medicine and Tele health , Telemedicine concepts ,Tele health platforms and services ,Regulatory and ethical considerations  Experiment: Telemedicine Simulation	CO-3 BTL-4
<b>MODULE 4: Mobile Health (mHealth) (6L+ 6P)</b>	
Mobile Health (mHealth) ,mHealth applications and technologies, Wearable health devices ,Remote patient monitoring  Experiment: AI-driven Predictive Analytics	CO-4 BTL-3
<b>MODULE 5: Smart Healthcare System Implementation (6L+ 6P)</b>	
Smart Healthcare System Implementation, Integration, challenges and solutions of smart healthcare systems, Evaluating the impact of smart healthcare systems, Emerging technologies in healthcare, The role of smart healthcare in public health  Experiment: Case studies of smart healthcare system implementations	CO-5 BTL-3
<b>BOOKS</b>	
1.	Megha Rathi and Adwitiya Sinha, "Smart Healthcare Systems", 1st Edition, Chapman and Hall/CRC.
2.	Arshdeep Bhagya, "Internet of things-a hands on approach", universities press, 2015.
3.	Shashi Gogia,, "Fundamentals of Telemedicine and Telehealth", ,Elsevier Science 2019
<b>REFERENCE BOOKS</b>	
1	mHealth: From Smartphones to Smart Systems" by Robert Istepanian, Hasan Zaidi, and Swamy Laxminarayan,2007,Springer US
2	Rajesh N. Dave and Eliot Rich , "Evaluating the Impact of Technology on Healthcare: Principles and Practice"
<b>E BOOKS</b>	
1.	<a href="http://www.oreilly.com/iot/free/">http://www.oreilly.com/iot/free/</a>
<b>MOOC</b>	
1.	<a href="https://iitj.ac.in/shc/">https://iitj.ac.in/shc/</a>

COURSE TITLE		Introduction to Bio Inspired Robots				CREDITS		3							
COURSE CODE		EECS1703		COURSE CATEGORY		NE		L-T-P-S		2-0-2-2					
Version		1.0		Approval Details		37 <sup>th</sup> ACM 20.01.2023		LEARNING LEVEL		BTL-3					
ASSESSMENT SCHEME															
CIA									ESE						
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance		THEORY  PRACTICAL					
15%		15%		10%		5%		5%		25%  25%					
Course Description		The main objective of this course aims to expose students to the robotic systems developed by applying concepts from nature to the design of real world engineered systems. The course intends to enhance students skills for understanding of dynamics, physics of scaling, and locomotion, taking inspiration from nature.													
Course Objective		<div>1.The students can Work effectively as a group in a professional manner.</div> <div>2.The students can Complete a self-directed design and build project relating to biologically inspired robotics.</div> <div>3.Develop skills related to the design, construction and testing of advanced robotic systems</div> <div>4.Have a deep understanding of bilogically inspired robotics and its current impact on robotic research.</div> <div>5.Students learn the principles behind the bio-inspired robots from biological examples and how they are implemented in robotic systems</div>													
Course Outcome		<b>Upon completion of this course, the students will be able to</b> <div>1: Interpret the features of robots and technology involved in the control.</div> <div>2: To build confidence among students to evaluate, choose and incorporate robots in engineering systems.</div> <div>3: Apply Robotics and its concepts in Medical field.</div> <div>4: Simulate a MIS procedure and be aware of the state of art in surgical and oncology robotics.</div> <div>5: Design a medical robotic system given the specific requirements for Rehabilitation and Medical care.</div>													
Prerequisites: Robots															
CO, PO AND PSO MAPPING															
CO	PO -1	PO- 2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO- 10	PO -11	PO -12	PSO-1	PSO-2	PSO-3
CO -1	3	2	1	1								1	3	2	3
CO -2	3	2	1	1								1	3	2	3



CO-3	3	2	1	1							1	3	2	3
CO-4	3	2	1	1							1	3	2	3
CO-5	3	2	1	1							1	3	2	3
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1: FUNDAMENTALS OF ROBOT (6L+ 6P)														
Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.													CO-1 BTL-3	
MODULE 2: PROGRAMMING AND APPLICATIONS OF ROBOT (6L+ 6P)														
Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.													CO-2 BTL-3	
MODULE 3: DESIGN OF MEDICAL ROBOTS (6L+ 6P)														
Characterization of gestures to the design of robots - Design methodologies - Technological choices - Security.													CO-3 BTL-3	
MODULE 4: SURGICAL ROBOTICS (6L+ 6P)														
Minimally invasive surgery and robotic integration - surgical robotic sub systems - synergistic control - Control Modes - Radiosurgery - Orthopedic Surgery - Urologic Surgery and Robotic Imaging - Cardiac Surgery – Neurosurgery - case studies													CO-4 BTL-3	
MODULE 5: ROBOTS I REHABILITATION AND MEDICAL CARE (6L+ 6P)														
Rehabilitation for Limbs - Brain-Machine Interfaces - Steerable Needles - Assistive robots - Robots in Physiotherapy - case studies													CO-5 BTL-3	
BOOKS														
1.	Mikell.P.Groover , “Industrial Robotics – Technology, Programming and applications” McGraw Hill 2ND edition 2012.													
2.	Achim Ernst Floris Schweikard, "Medical Robotics", Springer, 2016.													
3.	Paula Gomes, "Medical robotics Minimally invasive surgery", Woodhead, 2013													
REFERENCE BOOKS														
1	John. J.Craig, “Introduction to Robotics: Mechanics and Control” 2nd Edition, 2002.													
2	Jaydev P Desai, Rajni V Patel, Antoine Ferreira; Sunil Kumar Agrawal, "The Encyclopedia of Medical Robotics", World Scientific Publishing Co. Pvt. Ltd, 2019.													
3	Werfel, Justin, Kirstin Petersen, and Radhika Nagpal. "Designing collective behavior in a termite-inspired robot construction team." Science 343.6172 (2014): 754-758.													
4	Jocelyne Troccaz , "Medical Robotics", John Wiley & Sons Incorporated, 2013.													
5	Farid Gharagozloo "Robotic Surgery", Springer, 2022.													

E BOOKS	
1.	<a href="https://en.wikibooks.org/wiki/Professionalism/Ethics_and_Autonomous_AI">https://en.wikibooks.org/wiki/Professionalism/Ethics_and_Autonomous_AI</a>
MOOC	
1.	<a href="https://onlinecourses.nptel.ac.in/noc23_me67/preview">https://onlinecourses.nptel.ac.in/noc23_me67/preview</a>

COURSE TITLE	Foundation on PCB Design and Testing			CREDITS	3
COURSE CODE	EEC51704	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
<b>Course Description</b>	PCB (Printed Circuit Board) designing is an integral part of each Electronics products and should know to each electronics engineering students and who are working in electronics industry. This program is designed to make student and professionals capable to design PCB up to s standard grade.					
<b>Course Objective</b>	1.This course aims to equip the students with a basic understanding of PCB design and fabrication of components in PCB.					
<b>Course Outcome</b>	<b>Upon completion of this course, the students will be able to</b> 1.Identify different types of Printed Circuit Board (PCB), list the differences between them. 2.Acquire the basics of CAD design and fabrication. 3.Understand the design rules and etching techniques. 4.Acquire the knowledge of manual and automated trouble shooting techniques.					

CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	-	-	-	-	-	-	-	-	-	3	-	-
CO-2	2	2	3	-	3	-	-	-	-	-	-	-	3	-	-
CO-3	1	1	2	-	-	-	-	-	-	-	-	-	3	-	-
CO-4	1	1	1	-	-	-	-	-	-	-	-	-	3	-	-
CO-5	1	1	1	-	-	2	2	-	-	-	-	-	3	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related	
<b>MODULE 1: Introduction to PCB Design</b> (9L)	
History of Printed Circuit Boards, Various types of Printed Circuit Boards-Single Sided Boards, Double-Sided Plated through Hole Boards, Multilayer Boards, Study of Packages of Electronic Components, Study of SMD Components, Process of PCB design and product development flow.	<b>CO-1</b> <b>BTL-3</b>
<b>MODULE 2: SCHEMATIC DESIGN</b> (4L+5P)	
Starting a project, Working with schematic design tools, Schematic drawing from circuit, Rules for PCB Design, Standards for PCB Design, Placing, editing, and connecting parts and, electrical symbols About libraries and parts, Creating a netlist, Exporting and importing schematic data. <b>Suggested Simulation:</b> Basic Circuit simulation using the EDA tool.	<b>CO-2</b> <b>BTL-5</b>
<b>MODULE 3: PCB LAYOUT DESIGN</b> (4L+5P)	
Board outline Design, Components placement, Details of layers, Routing methods, Copper Pour Adding reference texts, Build library parts (footprints, schematic symbols), Generation of various Manufacturing, Documents/Output files generation (Gerber file generation) <b>Suggested Readings:</b> IPC standards for printed circuit board design. Using EDA tool generating a Gerber file for a PCB circuit design.	<b>CO-3</b> <b>BTL-5</b>
<b>MODULE 4: PCB Fabrication Process.</b> (9L)	
PCB Manufacturing Techniques, Film Master Generation methods, Plating and Etching Techniques, punching, drilling, milling. <b>Suggested Activities:</b> 1. Give a presentation on through-hole and surface-mount technology. 2. Collect a case study on DFM issues and present it. 3. Give a presentation on Electromagnetic Interference in real life and provide a solution to solve the problem. 4. Collect details of different types of heat sinks used in PCBs.	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: Soldering the components</b> (2L+7P)	
Study Soldering Techniques, Study of soldering defect and rectification. Based on theory- Practical and Assignment in Design, Manufacturing and Assembly. <b>Suggested Activities:</b> 1. Give a presentation on the importance of spacing and thickness of the tracks in PCB's. 2. Collect information on different types of solder paste. 3. Collect any completed PCB file and explain it 4. Prepare a report on a comparison of manual soldering and machine soldering and present it. 5. Give a presentation on the failures of PCB due to improper soldering. 6. Write a report on testing of PCB. 7. Find different methods for disposing of PCB lab wastes and dispose it.	<b>CO-5</b> <b>BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Complete PCB Design Using Or-Cad Capture and Layout Book by Kraig Mitzner, Elsevier, 2007.
2.	Walter C Bosschard, "PCB design & Technology", McGraw Hill, New Delhi., Tata McGraw-Hill, 1983
3.	Printed Circuits Handbook - 6th edition Clyde F. Coombs,Jr, McGraw Hill ,2008
<b>REFERENCE BOOKS</b>	
1	Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi,2006.

E BOOKS	
1.	Open source EDA Tool KiCad Tutorial: <a href="http://kicad-pcb.org/help/tutorials/">http://kicad-pcb.org/help/tutorials/</a>
MOOC	
1.	<a href="https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/">https://www.udemy.com/course/learning-complete-pcb-design-from-an-idea-to-a-product/</a>
2.	<a href="https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/">https://www.udemy.com/course/learning-the-concept-of-pcb-engineering-with-a-live-project/</a>

### SEMESTER 5

COURSE TITLE		Programming and Application using MATLAB				CREDITS		3							
COURSE CODE		EECS1705	COURSE CATEGORY		NE	L-T-P-S		2-0-2-2							
Version		1.0	Approval Details		37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL		BTL-3							
ASSESSMENT SCHEME															
CIA							ESE								
First Periodical Assessment (Theory)		Second Periodical Assessment (Theory)		Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance		THEORY	PRACTICAL					
15%		15%		10%		5%	5%		25%	25%					
Course Description		The Students learn how to write clean, efficient, and well-documented programs while gaining an understanding of the many practical functions of MATLAB.													
Course Objective		1.This course aims the student to enhances the programming knowledge in Research and Development 2.This course also introduces the students the technical computing environment. [Themes of data analysis, visualization, and programming]. 3.This course helps the students to solve scientific problem with the use of a high-level programming language, MATLAB													
Course Outcome		Upon completion of this course, the students will be able to 1. Simulate the verification of mathematical functions. 2. Acquire the main features of the MATLAB program development environment to enable their usage in the higher learning. 3. Implement simple mathematical functions/equations in numerical computing environment such as MATLAB. 4. Interpret and visualize simple mathematical functions and operations thereon using plots/display. 5. Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools.													
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

[illegible]

1.	Stephen J. Chapman ,”MATLAB Programming for Engineers”,5 <sup>th</sup> Edition, Cengage Learning, 2015
2.	Raj Kumar Bansal, Ashok K. Goel, Manoj Kumar Sharma , “MATLAB and Its Applications in Engineering”,Pearson Education India, 2009
<b>REFERENCE BOOKS</b>	
1	Rudra Pratap, “Getting Started with MATLAB” ,7th Edition, Oxford University Press,2016.
2	Stephen J. Chapman , “MATLAB Programming for Engineers, 5 <sup>th</sup> Edition, Cengage Learning,2020
<b>E BOOKS</b>	
1.	<a href="https://en.wikibooks.org/wiki/MATLAB_Programming">https://en.wikibooks.org/wiki/MATLAB_Programming</a>
2.	<a href="https://in.mathworks.com/">https://in.mathworks.com/</a>
<b>MOOC</b>	
1.	<a href="https://www.edx.org/course/matlab-essentials">https://www.edx.org/course/matlab-essentials</a>
2.	<a href="https://nptel.ac.in/courses/103106118">https://nptel.ac.in/courses/103106118</a>

**Prerequisites: Nil**

CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	-	1	-	1	-	2	-	-	-	-	2	2	1	-
CO-2	1	2	-	-	2	-	3	-	-	2	-	2	2	2	-
CO-3	2	3	1	1	2	-	-	-	-	1	-	1	3	2	-
CO-4	2	2	2	1	2	-	3	-	-	1	-	2	3	3	-
CO-5	2	3	2	-	2	-	2	-	-	2	-	2	3	3	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Oceanography (6L+6P)															
Atmospheric Process- Ocean Structure- Ocean Processes-Surface Gravity waves-Ocean currents- Waves and Tides													CO-1 BTL-3		
Case Study: Indian Ocean Observing System, Evaluating the estuarine tidal Discharge.															
MODULE 2: Ocean Electromagnetics (6L+6P)															
Electromagnetics in Ocean environment- Electromagnetic Theory-Plane wave propagation- Reflection and transmission of Plane wave- Magnetic and Electric dipoles in Ocean													CO-2 BTL-3		
Case Study: Marine Electromagnetic and Electrical Case Studies of Massive Sulfide Systems and Submarine Gas Hydrates in Indian ocean															
MODULE 3: Digital Signal Processing and Control Theory (6L+6P)															
Discrete time systems- Digital Filters- FFT- Waveform analysis- System theory- LTI system analysis- SISO system controls													CO-3 BTL-3		
Case Study: Applications of Signal And Array Processing to Ocean and Structural Acoustics															
MODULE 4: Autonomous Ocean Vehicles, Subsystems and Control (6L+6P)															
Biorobotics- Animal- Inspired Hydrodynamics- Propagation channel in acoustic communication- Signal processing- AUV- Sensor													CO-4 BTL-3		
Field Study in NIOT: Marine Sensor Systems and Ocean Acoustics															
MODULE 5: Non acoustic Sensors (6L+6P)															
Non acoustic Ocean sensors: Sourcing and classification-AUV based Chemical Sensor- AUV based Biological Sensors- AUV based physical Sensors – Essential need of Sensors													CO-5 BTL-3		
Case Study: MEMS based inertial sensors for underwater communication															
TEXT BOOKS															
1.	Manhar R. Dhanak, Nikolaos I. Xiros, "Springer Handbook of Ocean Engineering", 1 <sup>st</sup> Edition, Springer international Publishing, 2016.														
2.	Eric Delory, Jay Pearlman, "Challenges and Innovations in Ocean In Situ Sensors: Measuring Inner Ocean process", 1 <sup>st</sup> Edition, Elsevier, 2018														
REFERENCE BOOKS															
1	Enrico Zambianchi, "Topics in Oceanography", Intech open Publisher, 2013.														
E BOOKS															
1.	<a href="https://www.kobo.com/au/en/ebook/challenges-and-innovations-in-ocean-in-situ-sensors">https://www.kobo.com/au/en/ebook/challenges-and-innovations-in-ocean-in-situ-sensors</a>														
2.	<a href="https://www.nrsc.gov.in/Knowledge_EBooks?language_content_entity=en">https://www.nrsc.gov.in/Knowledge_EBooks?language_content_entity=en</a>														
MOOC															
1.	<a href="https://oceanmooc.org/en/index.html">https://oceanmooc.org/en/index.html</a>														

2.	<a href="https://onlinecourses.swayam2.ac.in/aic20_ge05/preview">https://onlinecourses.swayam2.ac.in/aic20_ge05/preview</a>
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COURSE TITLE	Neural Networks and Fuzzy Logic								CREDITS		3				
COURSE CODE	EECS1707			COURSE CATEGORY					L-T-P-S		2-0-2-2				
Version	1.0			Approval Details		37 <sup>th</sup> ACM 20.01.2023			LEARNING LEVEL		BTL-3				
ASSESSMENT SCHEME															
CIA								ESE							
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)			Practical Assessments		Observation / lab records as approved by the Department Examination Committee “DEC”		Attendance		THEORY	PRACTICAL				
15%	15%			10%		5%		5%		25%	25%				
Course Description	The objective of this course is to brief the undergraduate students about the biometrics, bioinformatics, multimedia data analysis, medicine and most recently datascience. The course gives an insight about the backpropagation algorithms, associative memories, concepts of fuzzy logic and components of fuzzy logic systems.														
Course Objective	1.We hope to teach students the concepts of neural networks 2.Students will exercise their ability to explore the components of Fuzzy Systems.														
Course Outcome	Upon completion of this course, the students will be able to 1.Interpret the Fuzzy Logic and Artificial Neural Network techniques inbuilding intelligent machines. 2.Elaborate the Fuzzy Logic models to handle uncertainty and solve engineering problems. 3.Identify and recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	0	0	2	0	0	0	0	0	0	0	2	2	2
CO-2	2	2	1	2	2	0	0	0	0	0	0	0	2	2	2
CO-3	2	2	2	2	2	0	0	0	0	0	0	0	3	3	3
CO-4	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3
CO-5	2	2	2	2	2	0	0	0	0	0	0	0	2	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1 – FUNDAMENTALS OF NEURAL NETWORKS												(6 L+ 6 P)			



Basic concepts of neural networks, Human Brain, Model of an artificial neuron, Neural network architectures, Fire Neuron Model, characteristics of neural networks, learning methods, taxonomy of neural network architectures. Broad application areas in Electronics Engineering <b>Lab Experiments:</b> Using MATLAB Investigate the Use of ANNs in various kinds of digital circuits as well as in the Cryptography.		<b>CO-1 BTL-3</b>
<b>MODULE 2: BACKPROPAGATION NETWORKS</b>		<b>(6 L+ 6P)</b>
Architecture of a Backpropagation network, backpropagation Learning, Illustration, Applications, Effect of tuning parameters of the backpropagation neural network, selection of various parameters in BPN <b>Lab Experiments :</b> Design for Facial Recognition using BPN in Deep Learning		<b>CO-2 BTL-3</b>
<b>MODULE 3: ASSOCIATIVE MEMORIES</b>		<b>(6 L+ 6P)</b>
Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function. <b>Case Study :</b> To analyze stress in Education using BAM Model.		<b>CO-3 BTL-3</b>
<b>MODULE 4: CLASSICAL AND FUZZY SETS</b>		<b>(6 L+ 6 P)</b>
Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. <b>Lab Experiments:</b> Design a Power Load Balancing system using MATLAB.		<b>CO-4 BTL-3</b>
<b>MODULE 5: FUZZY LOGIC SYSTEMS COMPONENTS</b>		<b>(6 L+ 6 P)</b>
Fuzzification, Membership value assignment, development of rule base and decisionmaking system, Defuzzification to crisp sets, Defuzzification methods <b>Lab Experiments:</b> Design an Optimal Fuzzy Logic Controller of a DC Motor <b>Case Study:</b> Application of Fuzzy Logic based controller for Electricity Consumption.		<b>CO-5 BTL-3</b>
<b>BOOKS</b>		
1	A Text book on Neural Networks and Deep learning by Charu.C. Agarwal 2023.  ( <a href="https://www.deeplearningbook.org/">https://www.deeplearningbook.org/</a> )	
2	A Textbook on Neural Networks for Pattern Recognition by Christopher M.Bishop ,2022	
<b>REFERENCE BOOKS</b>		
1	Neural Networks and Deep Learning by Michael Nielson 2015	
2	Artificial Neural Networks by Francois Duval 2018.	
<b>E BOOKS</b>		
1	<a href="https://drive.google.com/file/d/0B2iRDvP8jUuAUnpfaDBnQTBWLUU/edit">https://drive.google.com/file/d/0B2iRDvP8jUuAUnpfaDBnQTBWLUU/edit</a>	
<b>MOOC</b>		
1	<a href="https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge07/">https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge07/</a>	

COURSE TITLE	Medical Imaging, Signals and Informatics			CREDITS	3
COURSE CODE	EEC51708	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.05.2023	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME															
CIA													ESE		
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments						Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance			THEORY	PRACTICAL		
15%	15%	10%						5%	5%			25%	25%		
Course Description	To provide the students’ ability to understanding about the imaging techniques and implement simple Health Informatics solutions.														
Course Objective	6. To impart in-depth knowledge and understanding of imaging technology for disease diagnosis. 7. To understand the principle & working of various imaging equipment for diagnosis and therapeutics. 8. To introduce the characteristics of different biosignals 9. To get exposed to knowledge in health management system 10. To understanding and implement simple Health Informatics solutions.														
Course Outcome	Upon completion of this course, the students will be able to 1. Understanding the principle & working of various imaging equipment for diagnosis. 2. Understanding the interaction of ionising radiation with tissue and principles of radiation protection. 3. Analyse the different types of signals & systems & also Extract the features from biosignal 4. Understand basic principles of knowledge management systems in biomedicine 5. Develop understanding of various aspects of Health Information Technology standards														
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO- 10	PO- 11	PO- 12	PSO-1	PSO-2	PSO-3
CO-1	2	1	3	1	1	-	-	2	-	-	2	1	2	3	1
CO-2	2	2	1	2	3	2	-	-	3	-	-	1	2	3	1
CO-3	2	1	1	2	2	-	3	-	-	2	-	1	2	3	1
CO-4	3	1	2	1	2	-	-	3	-	-	-	1	2	3	1
CO-5	3	2	2	2	2	-	-	-	-	-	-	1	2	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Imaging with Ionizing Radiation													(6L+6L=12)		
Imaging with Ionizing Radiation: Interactions of Radiation with tissue, Production of X Rays,X-ray equipment, Radiation protection, Scattered radiation, Clinical applications,X-Ray Image intensifier, Angiography.													CO-1 BTL-1		

<b>Computerized Tomography:</b> Construction, function and operation of a CT Scanner, Clinical applications. Single Photon Emission, Computed Tomography (SPECT), Positron Emission Tomography (PET).	
<b>MODULE 2: Magnetic Resonance Imaging &amp; Ultrasound Imaging</b> (6L+6L=12)	
<b>Magnetic Resonance Imaging:</b> Physics of MRI/NMR, T1 and T2 relaxation time, MRI pulse sequences, Instrumentation of MRI, MRI slice selection and encoding, Functional MRI (f-MRI), MRI clinical applications, Fluid flow imaging, Chemical-shift and Spectroscopic imaging. <b>Ultrasound Imaging:</b> Propagation of ultrasound waves in fluids, solids and tissue. Doppler Effect, Ultrasound transducers and instrumentation, Modes of ultrasonic imaging, Clinical applications.	<b>CO-2</b>  <b>BTL-3</b>
<b>MODULE 3: Signal, System And Spectrum Analysis</b> (6L+6L=12)	
Characteristics of some dynamic biomedical signals, Noises- random, structured and physiological noises. Filters- IIR and FIR filters. Spectrum – power spectral density function, cross-spectral density and coherence function, cepstrum and homomorphic filtering. Estimation of mean of finite time signals. <b>Analysis Of Biosignal</b> Removal of artifact – ECG, Even detection –ECG, P Wave, QRS complex, T wave, Correction analysis of ECG signals, Average of Signals-PCG, ECG and EMG	<b>CO-3</b> <b>BTL-3</b>
<b>Module 4: Medical Informatics</b> (6L+6L=12)	
Introduction – Medical Informatics – Bioinformatics – Health Informatics – Structure of Medical Informatics -Functional capabilities of Hospital Information System – On-line services and off – line services – History taken by computer, Dialogue with the computer.	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: Medical Data Acquisition and Storage</b> (6L+6L=12)	
Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface – Medical Data formats – Signal, Image and Video Formats – Medical Databases – Automation in clinical laboratories – Intelligent Laboratory Information System – PACS , Data mining. Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment – Surgical simulation – Radiation therapy and planning – Telemedicine – virtual Hospitals – Smart Medical Homes – Personalized e-health services – Biometrics – GRID and Cloud Computing in Medicine	<b>CO-5</b> <b>BTL3</b>
<b>TEXT BOOKS</b>	
1.	Steve Webb, "The Physics of Medical Imaging", Taylor & Francis, New York, 2010.
2.	William R Hendee, Russell Ritenour E, "Medical Imaging Physics" John Wiley, New York, 2002.
3.	Raghuveer M. Rao and AjithS.Bopardikar, Wavelets transform – Introduction to theory and its applications, Pearson Education, India 2000
4.	R.D.Lele, "Computers in Medicine: Progress in Medical Informatics"", Tata McGraw Hill Publishing computers Ltd, New Delhi, 2005.
5.	Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing computers Ltd, New Delhi, 2003.
<b>REFERENCE BOOKS</b>	
1.	Paul Suetens, "Fundamentals of Medical Imaging", Cambridge University Press, 2002.
2.	Joie P Jones, Manbir Singh and Cho Z.H., "Foundations of Medical Imaging", John Wiley, 1993
3.	Rangaraj M. Rangayyan, 2nd edition "Biomedical Signal Analysis-A case study approach", Wiley- Interscience /IEEE Press, 2015
4.	Willis J.Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India, New Delhi, 2006

#### SEMESTER VI

<b>COURSE TITLE</b>	<b>FUN WITH ELECTRONICS</b>	<b>CREDITS</b>	<b>3</b>
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COURSE CODE	EEC51710	COURSE CATEGORY	NE	L-T-P-S		2-0-2-2								
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL		BTL- 5								
ASSESSMENT SCHEME														
CIA					ESE									
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance	THEORY	PRACTICAL								
15%	15%	10%	5%	5%	25%	25%								
Course Description	The student will be able to understand various fundamental principles of diodes, transistors and Boolean algebra and become familiar with the basic operation of electronic devices and circuits which are the building blocks of all electronic circuits, devices and gadgets.  This course is offered as a Theory Integrated Practical course by practicing Project Based Learning (PBL), emphasizing learning by doing, where the objective is to provide the students with the required hands-on exercises/projects that complement the theoretical understanding of the subject matters. <b>The assessment is through the combination of written tests as well as practical projects.</b>													
Course Outcome	<b>Upon completion of this course, the students will be able to</b> 1.Explore the V-I characteristics of diode, BJT and JFET devices 2.Comprehend the behavior, characteristics and applications of LED, LCD , solar cells and voltage regulators. 3.Understand the basic knowledge of Digital system building blocks, effectively can construct simple digital designs with the knowledge of Boolean algebra. 4. Build simple electronic circuits used in various applications													
Prerequisites: NIL														
CO, PO AND PSO MAPPING														
CO	PO -1	PO -2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO -10	PO-11	PO-12	PSO- 1	PSO- 2
CO-1	3	3	0	0	0	1	0	0	1	0	0	1	3	0
CO-2	3	3	2	0	0	1	0	1	1	0	0	1	3	0
CO-3	3	3	3	2		1	0	1	1	0	0	1	3	0
CO-4	3	3	3	2		1	0	1	1	0	0	1	3	0
CO-5	3	3	2	2	2	1	1	1	1	0	1	2	3	0
1: Weakly related, 2: Moderately related, and 3: Strongly related														

<b>MODULE 1 : PN JUNCTION DIODE (6L=6)</b>	
<p>Ideal and practical diodes, Diode Equation and V-I characteristics. Zener diode, Reverse saturation current, Zener and avalanche breakdown ,LED, LCD and solar cells</p> <p><b>Self-Study / Practical Component:</b></p> <ol style="list-style-type: none"> <li>1.Characteristics of PN junction diode</li> <li>2. Characteristics of ZENER diode</li> </ol>	<p><b>CO-1</b></p> <p><b>BTL-2</b></p>
<b>MODULE 2: VOLTAGE REGULATOR (12L+ 6P=18)</b>	
<p>Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317)</p> <p><b>Self-Study / Practical Component:</b></p> <ol style="list-style-type: none"> <li>1.Study of Zener diode as a Voltage Regulator using bridge rectifier with shunt capacitor filter [Load and line regulation]</li> <li>2.Designing and testing of fixed positive and negative voltage regulators using 78xx and 79xx series ICs (Using bridge rectifier and shunt capacitor filter).</li> </ol>	<p><b>CO-2</b></p> <p><b>BTL-3</b></p>
<b>MODULE 3: BIPOLAR JUNCTION TRANSISTOR (9L+ 8P=17)</b>	
<p>Construction, types, CE,CB and CC configurations (mention only), VI characteristics of a transistor in CE mode, Regions of operation (active, cut off and saturation),BJT -amplifiers and frequency response.</p> <p><b>Self-Study / Practical Component:</b></p> <ol style="list-style-type: none"> <li>1. Characteristics of BJT in CE mode</li> <li>2. .Study of single stage CE amplifier (frequency response, input and output impedances in mid-band)</li> </ol>	<p><b>CO-3</b></p> <p><b>BTL-3</b></p>
<b>MODULE 4: JFET (9L+ 8P=17)</b>	
<p>Types - p-channel and n-channel, working and I-V characteristics - n-channel JFET, parameters and their relationships, Comparison of BJT and JFET. MOSFET: n-channel and p-channel, Construction, working, symbols, biasing, drain and transfer characteristics.</p> <p><b>Self-Study / Practical Component:</b></p> <ol style="list-style-type: none"> <li>1.Characteristics of JFET</li> </ol>	<p><b>CO-4</b></p> <p><b>BTL-2</b></p>
<b>MODULE 5: DIGITAL CIRCUITS (9L+8P=17)</b>	
<p>Basic logic gates-AND, OR, NOT, Boolean laws, Duality Theorem, De Morgan's Theorem, simplification of Boolean expressions-SOP and POS. Derived logic gates (NAND, NOR, XOR &amp; XNOR). Universal property of NOR and NAND gates. (Numerical examples wherever applicable).</p> <p>Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, synchronous - asynchronous– Design of Counters- Ripple Counters, Ring Counters,</p> <p><b>Self-Study / Practical Component:</b></p> <ol style="list-style-type: none"> <li>1.Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs. Realization of XOR and XNOR using basic gates</li> <li>2. Design and simulation of Flip Flops</li> </ol>	<p><b>CO-4</b></p> <p><b>BTL- 3</b></p>

3. Design and simulation of Counters		
MINI PROJECT (SELF STUDY) – INCLUDED IN THE ASSESSMENT		
The project should have a working model having the basic elements of electronic components su i.e., diode,Transistors,Regulators and basic Gates with a total cost should be less than Rs. 600.		CO-5 BTL- 5
TEXTBOOKS		
1	A.P. Malvino, “Principles of Electronics”, 7th edition .TMH, 2011.	
2	David A. Bell “ Electronic Devices and Circuits”, 5th Edition, Oxford Uni. Press, 2015	
REFERENCE BOOKS		
1	John M. Yarbrough, “Digital logic: Applications and Design”, Thomas – Vikas Publishing House, 2002.	
2	David A. Bell (2018). <i>Electronic devices and circuits</i> , Oxford University higher education, 5 <sup>th</sup> edition reprint.	
3	R.P.Jain, “Modern digital Electronics”, 4th Edition, TMH, 2010.	
E BOOKS		
1	<a href="http://nptel.ac.in/courses/106108099/Digital%20Syste">http://nptel.ac.in/courses/106108099/Digital%20Syste</a>	
2	<a href="https://www.researchgate.net/publication/264005171_Digital_Electronics">https://www.researchgate.net/publication/264005171 Digital Electronics</a>	
MOOC		
1	<a href="http://nptel.ac.in/courses/117106086/1">http://nptel.ac.in/courses/117106086/1</a>	
2	2 <a href="https://www.openlearning.com/courses/SKEE1223">https://www.openlearning.com/courses/SKEE1223</a>	

COURSE TITLE	FLEXIBLE ELECTRONICS			CREDITS	3
COURSE CODE	EEC51711	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA				ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department	Attendance	THEORY PRACTICAL

			nt Examinati on Committe e “DEC”												
15%	15%	10%	5%	5%	25%	25%									
Course Description	The students shall develop a fundamental concept on flexible and wearable Electronics														
Course Objective	1.To acquire knowledge in flexible electronics device technology from materials, processes, devices to systems 2.To gain knowledge on applications: state of the art and current status on commercialization														
Course Outcome	<b>Upon completion of this course, the students will be able to</b> 1.Acquire and develop basic concepts and understanding of flexible electronics. 2.Acquire basic understanding and knowledge of printing and microfabrication technologies. 3.Capability of identifying the most suitable fabrication and characterization methods to realize specific electronic devices for a given targeted application. 4.Acquire basic understanding and knowledge of micro sensors and actuators 5.Acquire practical experience with different fabrication and characterization techniques.														
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO -1	PO-2	P C - 3	PO -4	PO-5	P O - 6	PO -7	PO -8	PO -9	PO-10	PO -11	PO-12	PSO-1	PSO-2	PSO-3
CO -1	3	-	2	-	-	1	1	-	-	-	-	-	2	2	1
CO -2	3	3	3	-	2	2	1	-	-	-	-	-	2	2	1
CO -3	3	3	3	-	5	2	1	-	-	-	-	-	1	2	1
CO -4	3	3	3	-	2	2	1	-	-	-	-	-	1	2	2
CO -5	3	3	3	-	1	2	1	-	-	-	-	-	2	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION (9L)															
Flexible electronics: general introduction - Historical background - Materials, devices, systems, applications - Fabrication techniques - Unique aspects, status in the field and trends-Introduction to Stretchable electronics and Wearable Electronics,							CO-1 BTL-3								
MODULE 2: FABRICATION TECHNIQUES (9L)															
Basics and fundamentals - Deposition and structuring methods-Fluid formation and rheology for printing - Inks and printing techniques - Additional coating and structuring methods-Laser processing - Additive manufacturing							CO-2 BTL-3								
MODULE 3: THIN FILM CIRCUITS (9L)															

Thin film transistors (TFTs) - Device operation, materials, and structures - Device characterization and performance - Sub-micrometer Indium-Gallium-Zinc-Oxide TFTs and spray coated carbon nanotube TFTs - Thin film circuits - From transistors to circuits - Other passive and active thin-film components - Digital and analog circuit		CO-3 BTL-3
MODULE 4: SENSORS AND ACTUATORS		(9L)
Sensors - Principles and fundamentals - Examples of flexible physical, chemical and optical sensors - Biosensors - Examples of flexible biosensors-Principles and fundamentals - Examples of flexible optical and thermal actuators		CO-4 BTL-3
MODULE 5: ENERGY HARVESTING AND STORAGE		(9L)
Energy harvesters - Principles and fundamentals - Examples of flexible energy harvesters - Storage components - Examples of flexible supercapacitors and batteries-Integrated Systems - System integration strategies - Examples of fully flexible and hybrid systems- memory devices, MEMS, lab-on-a-chip, and photovoltaic		CO-5 BTL-3
BOOKS		
1.	M. Caironi and Y.Y. Noh, “Large Area and Flexible Electronics”, WILEY-VCH, 2015.	
2.	V. Pecunia, M. Fattori, S. Abdinia, H. Sirringhaus, and E. Cantatore “Organic and Amorphous-Metal-Oxide Flexible Analogue Electronics”, Cambridge Elements, 2018.	
REFERENCE BOOKS		
1	G. Nisato, D. Lupo, S. Ganz, “Organic and Printed Electronics: Fundamentals and Applications”, CRC Press, 2016	
2	Franky So (Editor), Organic Electronics: Materials, Processing, Devices and Applications, CRC Press, 2009.	
3	W. S. Wong, A. Salleo, “Flexible Electronics: Materials and Applications”, Springer, 2009	
E BOOKS		
1.	P. Cosseddu and M. Caironi, “Organic Flexible Electronics: Fundamentals, Devices, and Applications”, Elsevier, 2020.	
MOOC		
1.	<a href="https://www.coursera.org/learn/freeform-electronics">https://www.coursera.org/learn/freeform-electronics</a>	

<b>COURSE TITLE</b>	<b>Radar Communication</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>	<b>EEC51712</b>	<b>COURSE CATEGORY</b>	<b>NE</b>	<b>L-T-P-S</b>	<b>2-0-2-2</b>
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>	<b>37<sup>th</sup> ACM 20.01.2023</b>	<b>LEARNING LEVEL</b>	<b>BTL-5</b>
<b>ASSESSMENT SCHEME</b>					
<b>CIA</b>					<b>ESE</b>



[illegible]

Introduction, Radar block diagram and operation, frequencies, applications, types of displays, derivation of radar equation, minimum detectable signal, probability of false alarm and threshold detection, radar cross-section, system losses. <b>Suggested Activities:</b> 1. Understanding Radar Principles using MATLAB Simulink.		CO-1 BTL-2
<b>MODULE 2: CW, MTI and Tracking Radar</b> (9L)		
CW Radar – Doppler Effect, CW Radar, applications, FM – CW radar, altimeter, Multiple Frequency Radar. Pulse Radar – MTI, Delay Line Canceller, Multiple Frequencies, Range-gated Doppler Filters, Non-coherent MTI, Pulse Doppler Radar. <b>Suggested Activities:</b> 1. Visualizing Radar Performance with the Ambiguity Function using MATLAB Simulink.		CO-2 BTL-3
<b>MODULE 3: TRACKING RADAR</b> (9L)		
Tracking Radar- Sequential lobing, conical scanning, monopulse, phase comparison monopulse, tracking in range, comparison of trackers. <b>Suggested Activities:</b> 1. Tracking Scenario Designer using MATLAB SIMULINK		CO-3 BTL-5
<b>MODULE 4: DEDUCTION OF SIGNALS IN NOISE</b> (9L)		
Detection – Introduction, Matched Filter, Detection Criteria, Detector characteristics. <b>Suggested Activities:</b> 1. Radar Scenario Generation & Data Synthesis with MATLAB.		CO-4 BTL-3
<b>MODULE 5: RADAR ANTENNAS and NAVIGATIONAL AIDS</b> (9L)		
Phased Arrays – Basic concepts, feeds, phase shifters, frequency scan arrays, multiple beams, applications, advantages and limitations. Navigational Aids: Direction Finder, VOR, ILS and Loran. <b>Suggested Activities:</b> 1. Introduction to Radar System Design with MATLAB and Simulink		CO-5 BTL-3
<b>BOOKS</b>		
1.	Introduction to Radar Systems, Merrill I Skolnik – Tata McGraw Hill – 3rd edition 2001.	
<b>REFERENCE BOOKS</b>		
1.	F.E. Terman, Radio Engineering, Mc Graw Hill Book Co. (for Chapter 7 only), 4Th Edn. 1955	
2.	Simon Kingsley and Shaun Quegan, Understanding RADAR Systems, McGraw Hill Book Co., 1993	
<b>E BOOKS</b>		
1.	<a href="https://www.geo.uzh.ch/microsite/rsl-documents/research/SARlab/GMTILiterature/PDF/Skolnik90.pdf">https://www.geo.uzh.ch/microsite/rsl-documents/research/SARlab/GMTILiterature/PDF/Skolnik90.pdf</a>	
<b>MOOC</b>		
1.	<a href="https://nptel.ac.in/courses/108105154">https://nptel.ac.in/courses/108105154</a>	
2.	<a href="https://www.ll.mit.edu/outreach/radar-introduction-radar-systems-online-course">https://www.ll.mit.edu/outreach/radar-introduction-radar-systems-online-course</a>	

COURSE TITLE	INTRODUCTION TO 5G TECHNOLOGY AND IOT			CREDITS	3
COURSE CODE	EECS1713	COURSE CATEGORY	NE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>					

CIA													ESE		
First Periodical Assessment (Theory)			Second Periodical Assessment (Theory)			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”			Attendance *		THEORY	PRACTICAL
15%			15%			10%			5%			5%		25%	25%
Course Description			The course on Introduction to 5G Technology and IoT provides an overview of the 5G technology and the basic requirements for 5G. The course also focuses on the IoT Architecture and its protocols in the 5G environment. Resource management and security issues associated with the technology are also dealt with.												
Course Objective			1.This course aims to equip the students with a basic understanding of 5G technology, and its applications. 2.This course aims to equip students with understanding of the emerging technologies in 5G 3.This course aims to equip students with understanding of IoT architecture and protocols in 5G environment 4.This course aims to equip students with understanding of resource management in advanced networks 5.This course aims to equip students with understanding of security issues in networks												
Course Outcome			<b>Upon completion of this course, the students will be able to</b> 1.Analyze the requirements for 5G and apply it for real time applications 2.Elaborate the emerging technologies in 5G 3.Identify an efficient and scalable IoT architecture for the defined scenario 4.Examine the resource management techniques in 5G environment 5.Illustrate the privacy and security issues in 5G deployed networks												
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-2	2	2	2	2	1	2	0	0	0	0	1	1	3	1	2
CO-3	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-4	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2
CO-5	1	1	1	2	1	2	0	0	0	0	1	1	3	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related	
<b>MODULE 1: INTRODUCTION TO 5G (6L+ 6P)</b>	
<p>Journey towards 5G Communication, Background and Future of 5G, 5G system requirements &amp; drivers, Applications of 5G, Case studies.</p> <p><b>Suggested Readings:</b> Fundamentals of Wireless communication.</p> <p><b>Lab Experiments</b></p> <p>1. Design of 5G Wireless Technologies</p> <p><b>Software/Equipment Used</b> MATLAB</p>	<p><b>CO-1</b> <b>BTL-3</b></p>
<b>MODULE 2: EMERGING TECHNOLOGIES IN 5G (6L+ 6P)</b>	
<p>Massive MIMO, Network Function Virtualization, Software Defined Network, Cognitive Radio, Heterogeneous Networks, Internet of Things.</p> <p><b>Suggested Readings:</b> OFDM, MIMO</p> <p><b>Lab Experiments</b></p> <p>1. Model &amp; Simulate 5G system with 5G Toolbox</p> <p><b>Software/Equipment Used</b> MATLAB</p>	<p><b>CO-2</b> <b>BTL-3</b></p>
<b>MODULE 3: IOT ARCHITECTURE AND PROTOCOLS IN 5G ENVIRONMENT (6L+ 6P)</b>	
<p>Enabling technologies for IoT, IoT Architecture, Network and Communication Infrastructure for IoT, Importance of scalability for 5G based IoT systems</p> <p><b>Suggested Readings:</b> Fundamentals of Internet of things</p> <p><b>Lab Experiments</b></p> <p>1. Model &amp; Simulate 5G based IoT system with 5G Toolbox</p> <p><b>Software/Equipment Used</b> MATLAB</p>	<p><b>CO-3</b> <b>BTL-3</b></p>
<b>MODULE 4: RESOURCE MANAGEMENT (6L+ 6P)</b>	
<p>Use of Content Centric Networking for IoT networks, Millimeter wave communication for 5G enabled IoT, Role coordination in Large scale and Highly dense Internet of Things, Energy harvesting and sustainable M2M communication in 5G</p> <p><b>Suggested Readings:</b> 5G Concepts, IoT Networking</p> <p><b>Lab Experiments</b></p> <p>1. Simulating millimeter waves</p> <p><b>Software/Equipment Used</b> MATLAB &amp; Simulink</p>	<p><b>CO-4</b> <b>BTL-3</b></p>
<b>MODULE 5: SECURITY CONSIDERATIONS (6L+ 6P)</b>	
<p>IoT enablers- Privacy and Security issues, Security in smart grids and Smart spaces for smooth IoT deployment in 5G, Security challenges in 5G based IoT Middle ware systems.</p> <p><b>Suggested Readings:</b> IPV6, Middle ware systems.</p> <p><b>Lab Experiments</b></p> <p>1. Raspberry Pi based security systems</p> <p><b>Software/Equipment Used</b> MATLAB &amp; Simulink</p>	<p><b>CO-5</b> <b>BTL-3</b></p>
<b>TEXT BOOKS</b>	
1.	Ramjee Prasad , “5G Outlook – Innovations and Applications”, River Publishers, 2016

2.	Vasuky Mohanan, Rahmat Budiarto and Ismat Aldmour, "Powering the Internet of Things with 5G networks", Advances in Wireless Technologies and Telecommunication Book series, IGI Global 2018.
<b>REFERENCE BOOKS</b>	
1	Constandinos X, George M and Jordi M Batalla, "Internet of Things in 5G Mobile Technologies", Springer International Publishing Switzerland, 2016
2	Harri Holma and Antti Toskala, "5G Technology- 3GPP New Radio", Wiley Publishers, 2020.
3	Saad Asif, "5G Mobile Communications: Concepts and Technologies", CRC Press, 2019
<b>E BOOKS</b>	
1.	<a href="https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad">https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003336860/5g-outlook-innovations-applications-ramjee-prasad</a>
<b>MOOC</b>	
1.	<a href="https://archive.nptel.ac.in/courses/117/102/117102062/">https://archive.nptel.ac.in/courses/117/102/117102062/</a>
2.	<a href="https://www.digimat.in/nptel/courses/video/117104099/L01.html">https://www.digimat.in/nptel/courses/video/117104099/L01.html</a>

COURSE TITLE	DESIGN AND FABRICATION OF UNDERWATER ROBOT – PROJECT BASED LEARNING			CREDITS	3	
COURSE CODE	EEC51714	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	The course aims to build a simple underwater robot and develop fundamental knowledge in underwater robotics with hands-on training.					
Course Objective	1. To gain knowledge on the underwater robotic design, Underwater Propulsion and Locomotion 2. To learn I/O interfacing – Inertial sensors, GPS, Camera and sonar devices with ESP 32 microcontroller. 3.To learn fabrication techniques of a prototype underwater robot. 4. To gain knowledge on PID control and autonomous systems. 5.To design a prototype underwater robot with remote control using Graphical User Interface.					

Course Outcome	Upon completion of this course, the students will be able to														
	1. Illustrate the fundamentals of Robotics and basic components of an Underwater Robot, propulsion systems and locomotion.														
	2. Interpret various types of Sensors and visualize the functionality using online microcontroller simulators.														
	3. Fabricate a prototype underwater robot.														
	4. Explain PID control and autonomous systems.														
5. Design a remotely operated prototype underwater robot for a typical application.															
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	2	3	-	-	-	1	-	1	2	-	1	1
CO-2	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1
CO-3	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1
CO-4	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1
CO-5	3	3	2	2	3	-	-	-	2	-	1	2	2	2	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
Module 1: INTRODUCTION TO UNDERWATER ROBOTICS												(6L + 6P = 10)			
Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – underwater robot and water-surface robot – principles of underwater vehicle construction <b>Suggested Readings:</b> Learning of Basic oceanography and acoustic propagation: speed of sound and oceanographic variability, oceanographic measurement systems. <b>Lab Experiments (Simulation)</b> 1. Getting started with robotic simulator - to familiarize with the user interface and with the basic concepts of Webots. <b>Software/Equipment Required</b> Virtual Robot Simulator / Webots - an open source and multi-platform desktop application used to simulate robots.												CO-1 BTL-3			
MODULE 2: ESP32 – BASICS, PROGRAM STRUCTURE												(6L +6P = 12)			
ESP32 Overview– Board Types– ESP32 Board Description- ESP32 Program Structure- Functions and Values - ESP32 Time function - ESP32 communication– ESP32 – Pulse Width Modulation <b>Suggested Readings:</b> Basics of electrical circuits. <b>Lab Experiments (Simulation)</b> <b>Lab Experiments</b> Development of algorithm, flowchart and C code for the given programs used in 1. data transfer, 2. Arithmetic/logical operators with the given microcontroller using online simulator and IDE <b>Software/Equipment Required</b> WOKWI online simulator, Arduino IDE												CO-2 BTL-3			

<b>MODULE 3: Underwater robots: Sensors and sonar communication systems Interface with ESP 32 (8L+6P=14)</b>	
<p>Inertial Sensors and GPS, Camera Sensors, LiDAR – Hydrophone - SONAR (Sound Navigation and Ranging) – Active sonar, Passive sonar - Applications and challenges of underwater acoustic communication technologies</p> <p><b>Suggested Readings:</b> Requirements of a sensor, Principles and applications of underwater sensors.</p> <p><b>Lab Experiments (Simulation)</b> with the given microcontroller using online simulator (Wokwi): and IDE</p> <ol style="list-style-type: none"> <li>1. Interface the <b>Accelerometer, IMU, Temperature</b> Sensor.</li> <li>2. Actuators,</li> <li>3. LED,</li> <li>4. 7 segment LED display,</li> <li>5. Optocoupler,</li> <li>6. Relay,</li> <li>7. Piezo buzzer,</li> <li>8. Push button switch, <b>Slide switch</b></li> <li>9. <b>GPS</b></li> </ol> <p><b>Software/Equipment Required</b> Wokwi online simulator</p>	<b>CO-3 BTL-3</b>
<b>MODULE 4: Fabrication of underwater robot, Guidance and Control (8L+4P=12)</b>	
<p><b>Waterproofing the Motor, Attaching the Propeller, Connecting the Motor to the Battery Pack, Building the Robot's Body, robot buoyancy.</b></p> <p>Introduction to Control Theory, Feedback Control Fundamentals, Proportional-Integral-Derivative (PID)</p> <p><b>Suggested Readings:</b> Usage of different simulators for practicing the guidance and control of robots.</p> <p><b>Lab Experiments</b> using online simulator (Wokwi):</p> <ol style="list-style-type: none"> <li>1. Motor interface</li> <li>2. PWM control of motor with Propeller.</li> </ol> <p><b>Software/Equipment Required</b> Wokwi online simulator</p>	<b>CO-4 BTL-3</b>
<b>MODULE 5: Remote robot control (6L + 6P=12)</b>	
<p><b>Buoyancy testing in the pool, Testing the Underwater Robot, Graphical User Interface design, Robot Remote Control - Submission of the developed Prototype Underwater Project.</b></p> <p><b>Suggested Readings:</b> Guidance and control systems.</p> <p><b>Lab Experiments</b></p> <ol style="list-style-type: none"> <li>1. Step by step method to Waterproofing the Thruster Motor</li> <li>2. Step by step method to test the developed Underwater robot in the water environment.</li> </ol>	<b>CO-5 BTL-3</b>
<b>BOOKS</b>	
1	Gianluca Antonelli , 'Underwater Robots', Springer International Publishing, 4 <sup>th</sup> Edition., 2018
2	Lurton, Xavier. 'An Introduction to Underwater Acoustics: Principles and Applications' Germany, Springer Berlin Heidelberg, 2016
3	Faust, Daniel R. Underwater Robots. United States, PowerKids Press, 2016.
<b>REFERENCE BOOKS</b>	
1	Troupe, Thomas Kingsley. Underwater Robots. United States, Black Rabbit Books, 2017.
2	Colins, Luke. Underwater Robots. United States, Black Rabbit Books, 2020.

3	Yu, Junzhi, et al. Visual Perception and Control of Underwater Robots. United States, CRC Press, 2021.
<b>E Resources for Reference</b>	
1.	<a href="https://cyberbotics.com/">https://cyberbotics.com/</a> <a href="http://vrobotsim.org/">http://vrobotsim.org/</a> <a href="https://wokwi.com/projects/new/esp32">https://wokwi.com/projects/new/esp32</a>
<b>MOOC</b>	
1.	<a href="https://altasea-project-blue.org/wp-content/uploads/2020/04/Underwater-Robotics-Curriculum.pdf">https://altasea-project-blue.org/wp-content/uploads/2020/04/Underwater-Robotics-Curriculum.pdf</a> <a href="https://www.sciencebuddies.org/science-fair-projects/project-ideas/Robotics_p002/robotics/build-an-underwater-robot?from=Blog">https://www.sciencebuddies.org/science-fair-projects/project-ideas/Robotics_p002/robotics/build-an-underwater-robot?from=Blog</a>

### SEMESTER 7

COURSE TITLE	Music Signal Processing			CREDITS	3	
COURSE CODE	EEC51715	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee “DEC”	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%
Course Description	To provide an introduction to basic concepts and methodologies for the analysis, modeling, synthesis and coding of speech and music. To provide a foundation for developing applications and for further study in the field. To introduce software tools for the analysis and manipulation of speech and music and to gain practical experience in the design and implementation of speech and music processing algorithms.					
Course Objective	Course Objectives 1. To introduce basic concepts of processing speech and audio signals. 2. To recall the analyses various M-band filter-banks for audio coding. 3. To understand audio coding based on transform coders. 4. To develop the speech synthesis and speech recognition. 5. To study time and frequency domain speech processing methods					
Course Outcome	Upon completion of this course, the students will be able to 1:Evaluate audio coding and transform coders 2:Discuss time and frequency domain methods for speech processing 3:Explain predictive analysis of speech 4:Explain the main principles of common audio signal processing operations 5: Design and implement algorithms for processing audio and speech signals using MATLAB. 6: Compare the different methods of Linear Prediction like VELP, CELP and RELP.					



CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	0	0	0	0	0	0	0	1	2	1
CO-2	3	2	2	1	1	0	0	0	0	0	0	0	1	1	1
CO-3	3	2	2	1	1	0	0	0	0	0	1	1	2	2	2
CO-4	3	2	1	1	1	0	0	0	0	0	0	0	1	1	2
CO-5	3	2	1	1	1	0	0	0	0	0	1	1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE I: MECHANICS OF SPEECH AND AUDIO													(6L+6P)		
<p>Introduction - Review of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Articulatory features. Absolute Threshold of Hearing - Critical Bands-Masking, - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.</p> <p><b>Lab Experiment :</b></p> <ol style="list-style-type: none"> <li>To find the Discrete time modelling of Speech production.</li> <li>Sampling of signal and study of aliasing.</li> </ol> <p><b>Software/Equipment Used</b></p>													CO-1 BTL-3		
MODULE II: TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS													(6L+ 6P)		
<p>Introduction - Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters - Cosine Modulated “Pseudo QMF” M-band Banks -Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Pre-echo Control Strategies.</p> <p><b>Lab Experiment:</b></p> <ol style="list-style-type: none"> <li>Implementation of M-band Filter Banks using algorithm.</li> <li>Implementations of Discrete Fourier and Discrete Cosine Transform in MATLAB</li> </ol>													CO-2 BTL-3		
MODULE 3: AUDIO CODING AND TRANSFORM CODERS													(6L+ 6P)		
<p>Lossless Audio Coding – Lossy Audio Coding - ISO-MPEG-1A, 2A, Audio Coding - Optimum Coding in the Frequency Domain - Perceptual Transform Coder –Brandenburg - Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding –Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization.</p> <p><b>Lab Experiment:</b></p> <ol style="list-style-type: none"> <li>To implement Adaptive Spectral Entropy Coding.</li> <li>Computation of DCT with Vector Quantization.</li> </ol>													CO-3 BTL-3		
MODULE 4: MATHEMATICAL TECHNIQUES DEVICE SIMULATIONS													(6L+ 6P)		

Time domain parameters of Speech signal – Methods for extracting the parameters: Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods Homomorphic Speech Analysis: Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders		CO-4 BTL-3
<b>Lab Experiments</b> 1. To study about Homomorphic Speech Analysis. 2. To Implement Homomorphic Vocoders .		
<b>MODULE 5: PREDICTIVE ANALYSIS OF SPEECH (6L+ 6P)</b>		
Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin’s Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters.		CO-5 BTL-3
<b>Lab Experiments</b> 7. Implementation of Auto correlation method . 8. Filtering of noisy signals		
<b>BOOKS</b>		
1.	L.R.Rabiner and R.W.Schaffer, Digital Processing of Speech Signals, Pearson Education India, 2003.	
2.	Paul Hill, Audio and Speech Processing with MATLAB, First Edition, CRC Press, 2020.	
3.	Udo Zolzer, Digital Audio Signal Processing, Second Edition A John Wiley& sons, 2008.	
<b>REFERENCE BOOKS</b>		
1	Vijay K. Madisetti, The Digital Signal Processing Handbook: Video, Speech and Audio Signal Processing, CRC Press, 2009.	
2	B.Gold and N.Morgan, Speech and Audio Signal Processing, Wiley and Sons, 2000.	
3	Vijay K. Madisetti, The Digital Signal Processing Handbook: Video, Speech and Audio Signal Processing, CRC Press, 2009.	
4	<a href="#">Gold and Morgan, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, 1999, John Wiley &amp; Sons</a>	
<b>E BOOKS</b>		
1.	<a href="https://fmipa.umri.ac.id/wp-content/uploads/2016/03/Udo-Zolzer-digital-audio-signal-processing.9780470997857.40435.pdf">https://fmipa.umri.ac.id/wp-content/uploads/2016/03/Udo-Zolzer-digital-audio-signal-processing.9780470997857.40435.pdf</a>	
2.	<a href="https://mdpi-res.com/bookfiles/book/268/Audio_Signal_Processing.pdf?v=1698596992">https://mdpi-res.com/bookfiles/book/268/Audio_Signal_Processing.pdf?v=1698596992</a>	
3.	<a href="https://www.scribd.com/doc/217906199/Digital-signal-processors-A-Venkatramani">https://www.scribd.com/doc/217906199/Digital-signal-processors-A-Venkatramani</a>	
<b>MOOC</b>		
1.	<a href="https://www.classcentral.com/course/youtube-jan-2021-digital-signal-processing-and-its-applications-47497">https://www.classcentral.com/course/youtube-jan-2021-digital-signal-processing-and-its-applications-47497</a>	
2.	<a href="https://archive.nptel.ac.in/courses/108/108/108108185/">https://archive.nptel.ac.in/courses/108/108/108108185/</a>	

COURSE TITLE	Project Management for Engineers			CREDITS	3
COURSE CODE	EEEC51717	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37 <sup>th</sup> ACM 20.01.2023	LEARNING LEVEL	BTL-4
<b>ASSESSMENT SCHEME</b>					

CIA													ESE		
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)			Practical Assessments			Observation / lab records as approved by the Department Examination Committee “DEC”			Attendance*			THEORY	PRACTICAL	
15%	15%			10%			5%			5%			25%	25%	
Course Description	To make the student to know about the various concepts of Project, Project Planning and facilitating the clients with proper project consulting														
Course Objective	The course will enable the students to: 1. Develop project scope and methodology while considering factors such as customer requirements and internal/external goals 2. Organize the selection and initiation of individual projects by understanding the concepts of project management. 3. Construct plans relevantly to achieve the project's goals 4. Describe the project procurement process 5. Understand the various concepts involved in Project Consulting														
Course Outcome	Upon completion of this course, the students will be able to 1. Outline the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders 2. Demonstrate effective organizational leadership skills for managing projects, project teams, and stakeholders. 3. Organize project planning activities that accurately forecast project costs, timelines, and quality using various techniques in order to achieve project success. 4. Develop a tender document for the purpose of project procurement 5. Analyze client objectives and facilitate appropriate consulting for design and production services.														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	1	2	1	1	-	1	-	-	-	-	-	2	-	2
CO-2	3	1	2	1	1	-	1	-	-	-	-	-	2	-	3
CO-3	3	2	3	2	3	-	3	-	-	3	-	-	2	1	3
CO-4	3	2	3	2	3	-	3	-	-	3	3	3	3	1	3
CO-5	3	2	3	2	3	-	3	-	-	3	3	3	3	1	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Introduction to Projects													(4L+ 4P)		

Introduction to Projects: Project Team, Purpose and Scope of a Project, Project Work Methodology, Project Contracting Types, Characteristics and Categories of a Project, Project Structure <b>Case study:</b> <b>Report preparation on a sample project structure.</b> <b>Report preparation on a sample project work methodology</b>		<b>CO-1</b> <b>BTL-2</b>
<b>MODULE 2: Project Management</b>		<b>(6L+ 6P)</b>
Definition of Project Management, Management Functions, Project Authority and Responsibility, Role and Responsibilities of a Project Manager, Types of Project Organization. Predictability: Definition and Concept, Predictability in a Project <b>Case study</b> Responsibilities of a Project Manager in an organization Predictability in a Project		<b>CO-2</b> <b>BTL-2</b>
<b>MODULE 3: Project Planning and Scheduling</b>		<b>(9L+ 6P)</b>
Project Life Cycle: Statement of Work (SOW), Project Specifications. Project Planning. Project Scheduling: Work Breakdown Structure, Gantt Chart, Program Evaluation and Review Technique (PERT), Critical Path Method (CPM), Differentiation between PERT and CPM. Project Network Analysis: Use of Nodes and Arrows, Situations in a Network Diagram, Drawing PERT/CPM Network, PERT/CPM Backward Pass Activity Diagram. <b>Case study:</b> Drawing PERT/CPM Network, PERT/CPM Backward Pass Activity Diagram		<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: Project Procurement Engineering</b>		<b>(9L+ 6P)</b>
Procurement Process. Preparation of Tender Documents: Tender Process, Procedure for Submission of Bids, Cost of the Tender. Tender Document: Content of the Tender Document, Clarification of Tender Document, Amendment in the Tender Document. Preparation of Bids. Bid Prices. Qualifications of Tenderer. Bid Security. Period of Validity of Bids. Bid Documents - Formats and Signing of Bids. Awarding the Contract. <b>Case study:</b> Preparation of Tender Documents t		<b>CO-4</b> <b>BTL-4</b>
<b>MODULE 5: Project Consulting</b>		<b>(9L+ 6P)</b>
Consulting-Definition, Need for Consultants, Scope of Management Consulting, Consulting Process, Main types of Consulting Organizations, Customer Client Relationship-Defining Expectations and Roles, Client and the Consultant system, Critical Dimensions of consultant client relationship, Behavioral role of consultants, Case Study <b>Case study:</b> Client and the Consultant system		<b>CO-5</b> <b>BTL-4</b>
<b>BOOKS</b>		
1.	Dilip N Pawar, Dattatray K Nikam, <i>Fundamentals of Project Planning and Engineering</i> , SPenram International Publishing, Mumbai, 2017.	
<b>REFERENCE BOOKS</b>		
1	Gary R Heerkens, <i>Project Management</i> , McGraw Hill, 2002.	
2	Milan Kubr, <i>Management Consulting A Guide to the Profession</i> , ILO Publications, Geneva, Switzerland, 2002. 4 <sup>th</sup> Edition	
<b>E BOOKS</b>		
1.	Introduction-to-project-management-beginners-guide-pdf	
2.	<a href="https://www.traceydodd.com/pdfs/Project-Management-eBook.pdf">https://www.traceydodd.com/pdfs/Project-Management-eBook.pdf</a>	
<b>MOOC</b>		
1.	<a href="https://onlinecourses.nptel.ac.in/noc19_mg30/preview">https://onlinecourses.nptel.ac.in/noc19_mg30/preview</a>	
2.	<a href="https://archive.nptel.ac.in/courses/110/104/110104073/">https://archive.nptel.ac.in/courses/110/104/110104073/</a>	

[illegible]

CO-5	-	-	3	3	2	3	-	-	-	-	-	2	-	-	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO OCEANOGRAPHY</b>														<b>(6L+ 6P)</b>	
Concepts of Oceanography, Marine Sciences, Meteorology, Climatology & other relevant topics and their interrelationships, Various Oceans on Earth, their peculiarities pertaining to geographical, climatic & other aspects, Salinity, chlorinity, pH and other parameters in oceans. <b>Suggested Readings:</b> Oceans on Earth, their peculiarities pertaining to geographical, climatic & other aspects <b>Lab Experiments</b> 6. Case study on marine sciences 7. Case study and collection of data on the climatic conditions														<b>CO-1</b> <b>BTL-3</b>	
<b>MODULE 2: ARTIFICIAL INTELLIGENCE</b>														<b>(6L+ 6P)</b>	
Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs <b>Suggested Readings:</b> state space search, production system, problem characteristics, and issues in the design of search program <b>Lab Experiments</b> 8. Write a solution for 8 Queens problem 9. Case study on BFS and DFS <b>Software/Equipment Used</b> MATLAB if needed														<b>CO-2</b> <b>BTL-3</b>	
<b>MODULE 3: BASICS OF NEURAL NETWORKS</b>														<b>(6L+ 6P)</b>	
: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem <b>Suggested Readings:</b> XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules <b>Lab Experiments</b> 1. Write a program in python to implement Multilayer Networks 2. Write a suitable code for Perceptron Learning algorithm <b>Software/Equipment Used</b> Python														<b>CO-3</b> <b>BTL-3</b>	
<b>MODULE 4: SUPERVISED AND UNSUPERVISED LEARNING</b>														<b>(6L+ 6P)</b>	
Convolution neural network (CNN) -Layers in CNN - CNN architectures. Recurrent Neural Network -Applications: Speech-to-text conversion-image classification time series prediction. <b>Suggested Readings:</b> CNN architectures. Recurrent Neural Network -Applications <b>Lab Experiments</b> 3. Write a program in python or MATLAB to Implement CNN using any database 4. Write a program to convert TEXT to SPEECH <b>Software/Equipment Used</b> Python and MATLAB														<b>CO-4</b> <b>BTL-3</b>	
<b>MODULE 5: INTRODUCTION TO MACHINE LEARNING</b>														<b>(6L+ 6P)</b>	
Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning. <b>Suggested Readings:</b>														<b>CO-5</b> <b>BTL-3</b>	

Classification problems, Regression problems, Clustering problems		
<b>Lab Experiments</b>		
9. Build a case study on the difference between Clustering and classification		
10. Program code for regression analysis three types)		
11. Write python programs to classify any four ML algorithms		
<b>Software/Equipment Used</b>		
Python or MATLAB		
<b>BOOKS</b>		
1.	Satish Kumar, “Neural Networks A Classroom Approach”, McGraw Hill Education (India) Pvt. Ltd, 2010.	
2.	Francois Chollet, “Deep Learning with Python”, Manning Publications, Shelter Island, New York, 2018	
3	S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, Third Edition, 2015	
<b>REFERENCE BOOKS</b>		
1	Ethem Alpaydin, “Introduction to Machine Learning”, 3rd Edition, MIT Press, 2014	
2	C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.	
3	J.M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publications 1994.	
4	Grant R. Bigg The Oceans and Climate, Cambridge, 2003	
<b>E BOOKS</b>		
1.	<a href="https://d2l.ai/">https://d2l.ai/</a>	
2.	Elaine Rich, Kevin Knight, & Shivashankar B Nair, “Artificial Intelligence”, McGraw Hill, 3rd ed.,2017	
3.	<a href="https://artint.info/AIPython/">https://artint.info/AIPython/</a>	
<b>MOOC</b>		
1.	<a href="https://nptel.ac.in/courses/106102220">https://nptel.ac.in/courses/106102220</a>	
2.	<a href="https://www.udemy.com/course/artificial-intelligence-and-machine-learning-fundamentals/">https://www.udemy.com/course/artificial-intelligence-and-machine-learning-fundamentals/</a>	

#### MANDATORY COURSES I

COURSE TITLE	INTRODUCTION TO WOMEN AND GENDER STUDIES			CREDITS	Non Credit Course
COURSE CODE	EGE51011	COURSE CATEGORY	MC	L-T-P-S	3--0-0-0
Version	1.0	Approval Details	36 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance*	
15%	15%	10%	5%	5%	
Course Description	This course has been introduced in the light of NEP-2022. It is a mandatory course. The idea is to sensitize the student in understanding gender and women and issues relating to gender in general and women in particular. To dispel ‘stigma’ shun ‘social taboos’ and to ensure break the glass ceiling. Change in perceptions through knowledge is the object of this course.				

Course Objective	<ul style="list-style-type: none"><li>To understand the concept of Gender – norms- theories – types etc.</li><li>To know about Feminism – and the types – jurisprudence of feminism.</li><li>To have an insight into health and legal issues- specific to women – Social barriers.</li><li>To make the students – gender sensitized- to shun ‘stigma’ and ‘social taboos’</li></ul>													
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>enumerate the basis of gender norms and related theories.</li><li>sensitize on issues relating to gender -orientation- issues therein.</li><li>appraise the concept of feminism – as a doctrine.</li><li>classify the types of feminism and highlight the essential features of them</li><li>summarise women related laws and connect to women centric issues in societal arena</li></ul>													
CO, PO AND PSO MAPPING														
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-2	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-3	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-4	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-5	-	-	-	-	-	-	2	3	2	2	-	1	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
Module 1: Basis of Gender norms and theories													(9L)	
Key concepts in Gender studies - Gender and Sexuality, Sex and Gender, Gender and Socialist theory, Gender and Social order Matriarchy and Patriarchy - Women’s Movements – Contemporary Debates- “Mee Too’ -National Commission for Women.													CO-1 BTL-3	
MODULE 2: Types of gender													(9L)	
Types of gender – 1. Masculine, 2, Feminine, 3, Transgender, 4, Trans-Sexuality, 5, Bi-Sexuality, 6. Inter Sex													CO-2 BTL-3	
MODULE 3: Sexual Orientation													(9L)	
Hetro-Sexuality, Homosexuals , 1, Lesbian and their "ism" , 2, Gays and their "Theory", Trans Sexulism , BI - Sexualism													CO-3 BTL-3	
MODULE 4: Introduction to Feminism													(9L)	
Feminism Theory, Types of Feminism (More than 12 feminisms) , 1, Social Feminism 2,Radical Feminism , 3, Black Feminism , 4, Dalit Feminism , 5, Queer Theory -													CO-4 BTL-3	
MODULE 5: Women, Health and Law													(9L)	
Health – Life Cycle Approach- Health Status – Reproductive Rights-Sex Ratio - Women have always Glass Ceiling,													CO-5 BTL-3	



Women Rights as Human Rights- Constitution and Women – Gender Equality – Discrimination- Personal Laws- Family Courts – Crime Against Women-Children-Sexual Harassment at Work Place Act-2013. Human Trafficking - Women as secondary to men in social context / order, Women centric issues in Societal arena		
TEXT BOOKS		
1.	Mamatha Rao – ‘Law Relating to Women and Child’- EBC Publishers, Lucknow	
2.	‘Feminist Jurisprudence’- Rosanne Kennedy, 1993	
3.	Sexual Harassment and Violence against Women- Charles V. Dale	
4.	Sexual Harassment of Working Women- Catharine Mackon	
REFERENCES		
1	Feminist Legal Theory- Rosanne Kennedy, 1993	
2	Sexual Harassment of Women at Workplace- R.C. Jiloha, 2021	
3	Human Trafficking- Virendra Mishra, 2013	
E Resources for Reference		
1.	Theory of Feminism- <a href="https://en.wikipedia.org/wiki/Feminism">https://en.wikipedia.org/wiki/Feminism</a>	
2.	Sexual Harassment of Women at Workplace- <a href="https://www.legalservicesindia.com/article/2114/Sexual-Harassment-of-Women-at-Workplace.html">https://www.legalservicesindia.com/article/2114/Sexual-Harassment-of-Women-at-Workplace.html</a>	
3.	Human Trafficking- <a href="https://www.unodc.org/unodc/en/human-trafficking/human-trafficking.html">https://www.unodc.org/unodc/en/human-trafficking/human-trafficking.html</a>	

COURSE TITLE		PUBLIC AND PERSONAL ADMINISTRATION			CREDITS	Non Credit	
COURSE CODE		EGE51012	COURSE CATEGORY		MC	L-T-P-S	3-0-0-1
Version	1.0	Approval Details		36th ACM		LEARN ING LEV EL	BTL-3
ASSESSMENT SCHEME							
First Periodical Assessme nt	Second Periodical Assessme nt	Seminar/Assignments/ Project		Surprise Test / Quiz etc.,	Attend ance	ESE	
15%	15%	10%		5%	5%	50%	
Course Description	Public Administration has gained immense importance since the emergence of the administrative state. In Ancient Greek, Roman and Indian political system gave more importance to the concept of Administration. Kautily’s “Arthasathra” contributed large scale in the administrative system; it deals every aspect of the state and its relation to subjects. Public Administration is state mechanism. In every Political System, administration have a significant role.						

<b>Course Objective</b>	<ul style="list-style-type: none"><li>● To understand the concept and importance of Public Administration.</li><li>● To analyze the Bases and types of Organization.</li><li>● To examine the types and functions of executive.</li><li>● To identify the Principles of Management.</li><li>● To evaluate the control over Public Administration.</li></ul>														
<b>Course Outcome</b>	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>● acquire knowledge of public administration.</li><li>● summarize the administrative principles of management.</li><li>● Review the salient features of different theories of administration.</li><li>● Enumerate the roles and responsibilities of District administration and Panchayati raj</li><li>● Identify the societal needs and recommend the strategies for administration of public financial funds.</li></ul>														
<b>Prerequisites: Nil</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO</b>	<b>P</b>	<b>PO</b>	<b>P</b>	<b>PO</b>	<b>P</b>	<b>P</b>	<b>P</b>	<b>P</b>	<b>PO</b>	<b>PO</b>	<b>P</b>	<b>PSO</b>	<b>PS</b>	<b>PS</b>
	-1	O	-3	O	-5	O	O	O	O	-	-11	O	-1	O-2	O-3
		-		-		-	-7	-	-	10		-			
		2		4		6		8	9			12			
CO-1	-	-	1	-	-	3	1	1	1	1	2	-			
CO-2	2	2	-	-	-	3	-	1	1	1	2	2			
CO-3	-	-	-	-	-	3	1	2	1	1	2	-			
CO-4	-	-	-	-	-	3	2	3	2	2	2	2			
CO-5	2	2	3	-	-	3	2	3	2	2	2	2			
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: Components of Public Administration</b> <b>9 Hours</b>															
Meaning, Nature and Scope of Public Administration – Public Administration and Private Administration–Public Administration Arts, Science or Both–Public Administration and Its Relations with Other Social Sciences – New Public Administration- Classical & Neo-Classical Theories of Administration.														<b>CO-1</b> <b>BTL-2</b>	
<b>MODULE 2: Principles of Organization</b> <b>9 Hours</b>															
Meaning, Nature, Scope and Importance of Organization-Types and kinds of organization - Bases of organization – Steps in Organizational Process- Principles of Organization – Hierarchy- Span of control – Unity of Command – Delegation of Authority – Co-Ordination- Integration Vs. Disintegration – Centralization Vs. Decentralization.														<b>CO-2</b> <b>BTL-2</b>	
<b>MODULE 3: Theories Of Administration</b> <b>9 Hours</b>															

Scientific management (Taylor and movement)- Classical theory- Fayol,Urwick and others- Bureaucratic theory- Max Weber- Ideas of Mary Parker Follett- C.I. Barnard- Behavioural Approach - Systems Approach	<b>CO-3</b> <b>BTL-3</b>
<b>MODULE 4: District Administration And Panchayati Raj</b> <b>Hours</b>	<b>9</b>
District Administration- Block Administration- Constitutional Body under 73rd and 74th Constitutional Amendment- Planning and Development- Rural and Urban	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: Financial Administration</b> <b>Hours</b>	<b>9</b>
Budget concept and forms - Formulation - Enactment of Budget - Execution of Budget - Deficit Financing- Public Debt	<b>CO-5</b> <b>BTL-3</b>
<b>TEXTBOOKS</b>	
1	Avasthi, A. and Maheswari, S.R.- Public Administration, Laxshmi Narain Publications, 2017.
2	Dr.G. Venkatesan, Public Administration, VC Publishers, Rajapalayam,2009.
3	Mohit Bahattacharya, New Horizons of Public Administration, Macmillan Publishers, 2002
<b>REFERENCE BOOKS</b>	
1	Shriram Maheswari, Administrative Theory: An Introduction, New Delhi, Macmillan India Ltd.,1984.
2	Vishnoo Bhagwan and – Public Administration, Chand & co., New Delhi1994
3	Bhambhri, C.P – Public administration – Theory and Practice, Jain Prakash, Nath&co., Meerut, 2002.
<b>E BOOKS</b>	
1	Sapru, Administrative Theories and Management Thought, Prentice Hall of India, New Delhi, 2005.
2	Sharma. M. P.: Public Administration in theory and practice, Kithab Mahal, Allahabad ,2006.

COURSE TITLE	CONSTITUTION OF INDIA			CREDITS	Non Credit
COURSE CODE	EGE51013	COURSE CATEGORY	MC	L-T-P-S	3-0-0-1
Version	1	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the	Attendance*	

																Department Examination Committee "DEC"		
15%	15%	15%	10%	5%	5%	50%												
Course Description	The very purpose of the course is to learn basic law of the land- to know about constitutional values- to carry our constitutional legacy and to imbibe constitutional discipline. To make the student as an informed citizen about his rights and duties expecting a vibrant role in democratic polity of the nation.																	
Course Objective	<ul style="list-style-type: none"><li>To understand the Constitution and Governance of our country.</li><li>To inspire the students towards -Constitutionalism and its core values</li><li>To imbibe the values cherished in our Constitution.</li></ul>																	
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>summarize the basic notions on which the Indian Constitution is based.</li><li>appraise the functioning of democracy and related systems in place.</li><li>classify the center and state relations and various Constitutional forums.</li><li>identify and discuss upon Governor’s rule and related amendments</li><li>interpret Indian Polity and its challenges for modern India</li></ul>																	
CO, PO AND PSO MAPPING																		
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2				
CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-				
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-				
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-				
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-				
CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-				
1: Weakly related, 2: Moderately related and 3: Strongly related																		
Module 1: Indian Constitution and Governance (9L+1T)																		
Constitution – salient features, Preamble, - Core values – Democratic - Secular, Socialist, Republic, Sovereign, - Basic structure – Constitutional Morality – Federal Features – Fundamental Rights – Fundamental duties														CO-1 BTL-3				
MODULE 2: Democracy – in functioning (9L+1T)																		
Democracy- Elections - Union Government- State Governments - Systems in place – Legislative- Executive- Judiciary- Constitutional Bodies: Election Commission – UPSC- Controller and Auditor General of India.														CO-2 BTL-3				
MODULE 3: Center -State Relations (9L+1T)																		
Legislative powers of the Central Government – State Government – Center-State Relations – Roll of Governor - Niti Ayog – National Integration Council														CO-3 BTL-3				
MODULE 4: Emergency – and Amendments (9L+1T)																		
Governors Rule – National Emergency – Financial Emergency- Constitutional Amendments – 42 <sup>nd</sup> Amendment - Procedures- Number of Amendments														CO-4 BTL-3				

MODULE 5: Indian Polity (9L+1T)	
Roll of the Civil Society – Roll of the Youth – Major Challenges before the nation - Political parties – Programs- in the Country – Indian polity at cross roads.	
CO-5 BTL-3	
TEXT BOOKS	
1.	M.P. Jain <i>Indian Constitutional Law</i> , Wadhwa & Co. 2005
2.	'Indian Parliament' – National Book Trust of India publications – New Delhi, 2007
3.	'Indian Judiciary' - National Book Trust of India publication., 2013
REFERENCES	
1	Constitution of India – visit Union Ministry of Law and Justice website – for latest text.
2	Lectures on Administrative Law – C.K. Takwani, 2021
3	Separation of Powers and Independence of Judiciary- Steve Cann, 2013.
E Resources for Reference	
1.	Constitution of India- Administrative & Adjudicatory process- <a href="https://www.strath.ac.uk/research/subjects/law/constitutionaladministrativeaw/">https://www.strath.ac.uk/research/subjects/law/constitutionaladministrativeaw/</a>
2.	Lectures on Administrative Law- <a href="http://msrlawbooks.in/file/ADMINISTRATIVE_LAW_FF.pdf">http://msrlawbooks.in/file/ADMINISTRATIVE_LAW_FF.pdf</a>
3.	Separation of powers & Independence of Judiciary- <a href="https://blog.ipleaders.in/separation-of-powers-and-its-relevance/">https://blog.ipleaders.in/separation-of-powers-and-its-relevance/</a>

COURSE TITLE	LAW FOR ENGINEERS			CREDITS	Non Credit	
COURSE CODE	EGE51014	COURSE CATEGORY	MC	L-T-P-S	3-0-0-1	
Version	1.0	Approval Details	36 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*		
15%	15%	10%	5%	5%		
Course Description	Every one of us should know the Law of the land. This is truer when it comes to engineers, wherein they are expected to work in a legal environment. Basic knowledge about the legal systems, the redressal mechanism in place. Legal knowledge will help them to start their own enterprise/startup/and also when it comes to IPR relate issues.					
Course Objective	<ul style="list-style-type: none"><li>To understand the Constitution and Governance of our country.</li><li>To apprise the students of their rights - local to national redressal mechanism.</li><li>To have an insight into general laws in general, labour and employment law in particular.</li><li>To familiarize with intellectual property laws and practices.</li></ul>					
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Classify the basic concepts of Indian Constitution, Governance and the role of citizens.</li></ul>					

	<ul style="list-style-type: none"><li>acquire knowledge in significant legislations that affect their lives.</li><li>enumerate the laws that governs corporate and business world along with legislations that govern management – worker relations.</li><li>relate to Intellectual Property Rights and related aspects.</li></ul>													
CO, PO AND PSO MAPPING														
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
Module 1: Indian Constitution and Governance (9L+1T)														
Constitution – salient features, Preamble, - Fundamental Rights and duties. Democracy- Elections Union Government- State Governments – Systems in place - Judiciary- the Supreme Court and High Courts, Good Governance.												CO-1 BTL-3		
MODULE 2: Significant Legislations (9L+1T)														
Consumer Protection Act -2019; Right to information Act 2005. Provident Fund Act – ESI – Employment (Standing Orders) Act 1946 Maternity Benefit Act-2017, Labor Codes- Courts												CO-2 BTL-3		
MODULE 3: Industrial, Corporate and Labour laws (9L+1T)														
Business Laws in general – Partnership Act - Companies Act – 2013- Private and Public Limited Companies, LLP, OPC, Corporate Governance – Directors position.												CO-3 BTL-3		
MODULE 4: Laws related to IPR (9L+1T)														
Introduction to IPR – meaning and scope, Patents- Copy Right – Trade Marks – Industrial Design- GI – Trade Secrets – WIPO.												CO-4 BTL-3		
MODULE 5: Law of Contracts (9L+1T)														
Essentials of a Contract – Enforceability. Various Legal forums that provide relief in various matters.												CO-5 BTL-3		
TEXT BOOKS														
1.		M.P. Jain (2005) <i>Indian Constitutional Law</i> , Wadhwa & Co.												
2.		Rao, Meena (2006), <i>Fundamental Concepts in Law of Contract</i> , 3 <sup>rd</sup> edn., Professional offset.												
3.		Ramappa (2010), <i>Intellectual Property Rights Law in India</i> , Asia Law House.												
4.		Singh, Avtar (2007), <i>Company Law</i> , Eastern Book Co.												

5.	R.F, Rustamji (1967), <i>Introduction to the Law of Industrial Disputes</i> , Asia Publishing House.
<b>REFERENCES</b>	
1	Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act. Maternity Benefit Act – Provident Fund Act – ESI Act – etc.
2	R.F, Rustamji (1967), <i>Introduction to the Law of Industrial Disputes</i> , Asia Publishing House.
3	Copyrights Act,1957, Trademarks Act 1999.
<b>E Resources for Reference</b>	
1.	Intellectual Property rights and Competition Law- <a href="https://en.wikipedia.org/wiki/Intellectual_property">https://en.wikipedia.org/wiki/Intellectual_property</a>
2.	Patent search for engineers and Lawyers - <a href="https://www.wipo.int/patents/en/">https://www.wipo.int/patents/en/</a>

COURSE TITLE		INDIAN KNOWLEDGE SYSTEM								CREDITS		Non Credit		
COURSE CODE		EGE51015		COURSE CATEGORY				MC		L-T-P-S		3-0-0-0		
Version		1.0		Approval Details				36 <sup>th</sup> ACM		LEARNING LEVEL		BTL - 2		
ASSESSMENT SCHEME														
CIA												ESE		
First Periodical Assessment		Second Periodical Assessment		Seminar/Assignments/Project				Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"		Attendance *				
15%		15%		10%				5%		5%				
50%														
Course Description		The course provides an appreciation of Indian Knowledge System and its relevance to contemporary society. Indian Knowledge System encompass a wide range of ancient wisdom, including traditional medicine, astrology, yoga, meditation, and more. These systems have been passed down through generations and have played a significant role in shaping India’s history and culture.												
Course Objective		To provide a general introduction to Indian Knowledge System (IKS) and sensitize the students to the contributions made by ancient Indians in the field of Science, Philosophy and related applications and concepts.												
Course Outcome		Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>● Explain the salient features of Indian Knowledge System and Vedic Corpus</li><li>● Summarize the concepts of Philosophical systems and wisdom through puranas</li><li>● Describe the Indian Knowledge Framework and Linguistics</li><li>● Brief on ancient strategies to focus on Health, Wellness and Psychology</li><li>● Appreciate Town Planning and Architecture, Governance and Public Administration</li></ul>												
CO, PO AND PSO MAPPING														
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PSO -2

CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>														
<b>MODULE 1: Indian Knowledge Systems and Vedic Corpus</b>													<b>(9L)</b>	
India Knowledge Systems – Organization, History and Salient features – synopsis of the four Vedas - Sub-classification of Vedas - Messages in Vedas - Introduction to Vedangas - Prologue on Siksa and Vyakarana - Basics of Nirukta and Chandas - Introduction to Kalpa and Jyotiṣa - Vedic Life: A Distinctive Feature													<b>CO-1 BTL-2</b>	
<b>MODULE 2: Philosophical Systems and Wisdom</b>													<b>(9L)</b>	
Philosophical systems - Development of philosophy - Features of philosophy - Sankhya approach of philosophy - Introduction to Yoga - Tenet of Nyaya philosophy - Principles of Vaiśeṣika - Doctrine of Purva Mimamsa Darsana - Thesis of Vedanta and synopsis of Advaita - Philosophy of Viśiṣṭadvaita - Ideology of Dvaita - Tenets of Jaina - Doctrine of Buddhism - Notions of Carvaka Gateways of ancestral wisdoms - Introduction to Purana - The Puranic repository - Issues of interest in Puranas - Introduction to Itihasas - Key messages in Itihasas - Wisdom through Niti-sastras 8. Wisdom through Subhāṣita													<b>CO-2 BTL-2</b>	
<b>MODULE 3: Knowledge Framework and classifications, Linguistics</b>													<b>(9L)</b>	
Indian scheme of knowledge - The knowledge triangle – Prameya - A vaiśeṣikan approach to physical reality - Dravyas - the constituents of the physical reality – Attributes - the properties of substances and Action - the driver of conjunction and disjunction - Samanya, viśeṣa, samavaya - Pramana -the means of valid knowledge - Samsaya - ambiguities in existing knowledge - Framework for establishing valid knowledge - Deductive or inductive logic framework - Potential fallacies in the reasoning process - Siddhanta: established tenets in a field of study Linguistics - Aṣṭadhyayi - Phonetics - Word generation - Computational aspects – Mnemonics - Recursive operations - Rule based operations - Sentence formation -Verbs and prefixes - Role of Sanskrit in natural language processing													<b>CO-3 BTL-2</b>	
<b>MODULE 4: Number Systems, Health Wellness and Psychology</b>													<b>(9L )</b>	
Number systems in India - Historical evidence - Salient aspects of Indian Mathematics - Bhuta-Samkhya system - Kaṭapayadi system - Measurements for time, distance, and weight - Pingala and the Binary system  Ayurveda: approach to health - Sapta-dhatavaḥ: seven-tissues - Role of Agni in health - Tri-dosas - Ayurveda: definition of health - Psychological aspects of health - Disease management elements - Dinacarya: daily regimen for health & wellness - Importance of sleep - Food intake methods and drugs - Approach to lead a healthy life - Indian approach to psychology - The tri guṇa system & holistic picture of the individual - The Nature of Consciousness - Consciousness studies and issues													<b>CO-4 BTL-2</b>	
<b>MODULE 5: Town Planning and Architecture, Governance and Public Administration</b>													<b>(9L)</b>	
Perspective of Arthashastra on town planning - Vastu-sastra - The science of architecture - Eight limbs of Vaastu - Town planning -Temples in India: marvelous stone architecture for eternity - Temple architecture in India - Iconography  Introduction to raja dharma - Arthashastra: a historical perspective - Elements of a kauṭilyan state - The king & the amatya - Janapada & durga - Treasury and the State Economy (Kosa) -													<b>CO-5 BTL-2</b>	



Danda 8. Mitra - The Administrative Setup - Relevance of Arthasastra - Public Administration in Epics	
<b>REFERENCE BOOKS</b>	
1	"Introduction to Indian Knowledge System: Concepts and Applications", Mahadevan B., Bhat Vinayak Rajat, Nagendra Pavana R.N., PHI Learning Private Ltd., 2022.
<b>MOOC Source</b>	
1.	<a href="https://onlinecourses.swayam2.ac.in/imb23_mg55/preview">https://onlinecourses.swayam2.ac.in/imb23_mg55/preview</a>

## MANDATORY COURSES II

COURSE TITLE	TRADITIONAL INDIAN SYSTEMS OF MEDICINE AND THERAPIES			CREDITS	Non Credit
COURSE CODE	EGE51021	COURSE CATEGORY	MC	L-T-P-S	3-0-0-1
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL – 2
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	End Semester Exam
15%	15%	10%	5%	5%	50%
<b>Course Description</b>	This comprehensive course aims to provide students with a deep understanding of various aspects of health and well-being while incorporating traditional healing systems like Ayurveda and Siddha medicine. Participants will explore the importance of maintaining physical, mental, emotional, social, and spiritual health for overall well-being.				
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>Understand the importance of maintaining various aspects of health for overall well-being.</li> <li>Explore the unique approach of Ayurveda and its focus on balance and well-being</li> <li>Understand the principles and concepts of Siddha medicine.</li> <li>Understand the importance of a balanced diet in maintaining overall health and preventing diseases.</li> <li>Learn and practice various yogic exercises and postures (Asanas) for physical fitness.</li> </ol>				
<b>Course Outcome</b>	<ol style="list-style-type: none"> <li>To identify and prioritize different aspects of health such as physical, mental, social, emotional, etc.</li> <li>To apply Ayurvedic concepts to enhance their well-being and make informed decisions for better health.</li> <li>To explain the underlying philosophy and the use of natural remedies in Siddha medicine for maintaining health and treating various ailments</li> <li>To comprehend the significance of a balanced diet in providing essential nutrients for growth, repair, and overall health.</li> <li>To gain practical experience in performing various yogic exercises and asanas</li> </ol>				

<b>Prerequisites:</b> Nil															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	-	-	-	-	2	1	-	1	-	1	-			
CO-2	2	1	-	-	-	2	1	-	1	-	1	-			
CO-3	2	2	-	-	-	2	1	-	1	-	2	-			
CO-4	1	1	-	2	1	2	2	2	1	-	2	-			
CO-5	3	1	-	3	1	2	2	2	1	-	2	-			
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: Health and Importance of Prevention</b>													<b>9 Hours</b>		
Health: Definition - Importance of maintaining health - More importance on prevention than treatment. Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational / Professional health. Present health status - The life expectancy - present status - mortality rate - dreadful diseases - non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer - diabetes - chronic pulmonary diseases - risk factors - tobacco - alcohol - unhealthy diet - lack of physical activities.													<b>CO 1</b> <b>BTL 1</b>		
<b>MODULE 2: Ayurveda and Holistic Wellness</b>													<b>9 Hours</b>		
Origin of Ayurveda - Aim and importance of Ayurveda, Philosophy and goals of Ayurveda, Unique Approach of Ayurveda - Ayurveda texts, chakra samhita, Sushruta Samhita, Kashyapa Samhita, Rasatantra, Unique features of Ayurveda - Hygienic principles of Ayurveda (Dhinacharya) - Five elements of Ayurveda Doshas, Gunas, Dhatus, Upahatus, Eight Categories or branches of treatment - Nadisvijnana - Nadis and Chakras, - Characteristics of different prakritis - Ayurveda diet. Ayurveda effects of yogic principles & therapies - Ayurvedic purification practices -Panchakarma - vamanam, virechanam, basti, Anuvasana, Nasya, RaktaMoksana - Abhyanga, Swedanam, Nasayam, Njavarakizhi, Pizhichil.													<b>CO 2</b> <b>BTL 1</b>		
<b>MODULE 3: Siddha Medicine and Naturopathy</b>													<b>9 Hours</b>		
History and concepts of Siddha medicine: Principles of Siddha Medicine System, Five Elements Theory, Three Biological Humors, Seven Physical Constituents, Pancha Bhutas, Pancha Koshas, Types of Siddha Medicine, Importance of Karakalpak, Kitchen and herbal medicine, Diet Regulations, Varmam and Thokkanam, Treatment of Siddha Medicine for lifestyle diseases. Concept of Naturopathy, Principles of Naturopathy, Methods of Naturopathy: Diet, Fasting, Treatment by earth, water treatment, Treatment by rays, Massage. Acupuncture, Acupressure, Exercise therapy, Physiotherapy, Music therapy, Color therapy, Magneto Therapy, Reiki.													<b>CO 3</b> <b>BTL 1</b>		
<b>MODULE 4: Role of Diet, Emotional Health, and Stress Management</b>													<b>9 Hours</b>		
Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes - arthritis -													<b>CO 4</b> <b>BTL 1</b>		

hypertension - PCOD - infertility - ADHD - sleeplessness - helps to reduce the risk of heart diseases – keeps the teeth and bones strong. Balanced Diet		
Stress management - Stress definition - Stress in daily life – How stress affects one’s life - Identifying the cause of stress - Symptoms of stress -Managing stress (habits, tools, training, professional help) – Complications of stress mismanagement.		
Sleep - Sleep and its importance for mental wellness-Sleep and digestion.		
Immunity- Types and importance – Ways to develop immunity		
<b>MODULE 5: Yogic Practices for Physical and Mental Well-being</b>		<b>9 Hours</b>
Essentials of Yogic Practices: Emptying the bowels and stomach counter pose, contra-indications,duration, straining, special provisions for women and patients, fitness, posture, side effects,pregnancy women, Group yoga, Individual yoga.Loosening Exercise (Pawana muktasana series 2) and Surya Namaskar (Surya Namaskar: for children 10 Steps, Vivekananda Kendra Model) - Meaning, Definition, Guidelines, Procedure, Breathing technique, Awareness, Contra-indication, and Benefits.Asana: Name, Meaning, Definition, Guidelines, Procedure, Breathing technique, Awareness, Contra-indication, Benefits, Type and Category of each asana. Pranayama and Kriyas: Name, Meaning, Definition, Guidelines, Procedure, Breathing technique, Awareness, Contra-indication, Benefits, Type and Category of each one..Bandhas: Mudras:.Meditation: Rajayoga meditation, Trataka Meditation, Soham Meditation, Walking Meditation.		<b>CO 5</b> <b>BTL 1</b>
<b>Skill Development Activities:</b>		
<b>TEXT BOOKS</b>		
1	Kumar, D. S. (Ed.). (2020). Ayurveda in the New Millennium: Emerging Roles and Future Challenges. CRC Press.	
<b>REFERENCE BOOKS</b>		
1	Balakrishnan Acharya(2006) Ayurveda its principles and philophies, Hardwar, Divya Prakashan.	
2	AtharaleV.B.(1980) basic principles of Ayurveda, Bombay, Pediatric Clinics.	
<b>E-BOOKS / MAGAZINE / ARTICLES</b>		
1	Micozzi, M. S. (2014). <i>Fundamentals of complementary and alternative medicine-E-book</i> . Elsevier Health Sciences.	
2	Chaudhry, B. (2019). <i>A handbook of common medicinal plants used in Ayurveda</i> . Kojo Press.	
<b>ONLINE RESOURCES</b>		
1.	<a href="https://cdn.ayush.gov.in/wp-content/uploads/2021/06/Introduction.pdf">https://cdn.ayush.gov.in/wp-content/uploads/2021/06/Introduction.pdf</a>	
2.	<a href="https://www.ism.kerala.gov.in/index.php/downloadss/iec-materials">https://www.ism.kerala.gov.in/index.php/downloadss/iec-materials</a>	

COURSE TITLE		HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA								CREDITS		Non Credit		
COURSE CODE		EGE51022		COURSE CATEGORY				MC		L-T-P-S		3-0-0-3		
Version		1.0		Approval Details				36 <sup>TH</sup> ACM		LEARNING LEVEL		BTL - 2		
ASSESSMENT SCHEME														
CIA												ESE		
First Periodical Assessment		Second Periodical Assessment		Seminar/Assignments/Project			Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"		Attendance *					
15%		15%		10%			5%		5%		50%			
Course Description		This course covers the richness of ancient India and their notable contributions in the field of Science and Technology. Details on the living styles of ancient Indians and their application of science and technology in day-to-day life is briefed. Covers the notable contributions of eminent Indian scientists and their contributions to the field of Science and Technology in building a modern India.												
Course Objective		<ul style="list-style-type: none"><li>• This course aims to educate upon the notable contributions of ancient indian scientists to the field of Science and Technology</li><li>• This course details the contributions made by eminent Indian scientists in the various fields of Science and Technology.</li></ul>												
Course Outcome		<p>Upon completion of this course, the students will be able to</p> <ul style="list-style-type: none"><li>• summarize the notable contributions in ancient India in the field of Science and Technology</li><li>• explain the different techniques adapted by ancient Indians in the field of Irrigation, Water resources and Ship Building</li><li>• appreciate the noteworthy contributions of Indians in the field of Mathematics and Science</li><li>• describe the role of Indians in the field of Biotechnology, Space technology and Nanotechnology</li><li>• report on the prominent scientists of India and present a survey on their noteworthy contributions to the world.</li></ul>												
CO, PO AND PSO MAPPING														
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PSO -2
CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-

CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1: Contributions made by Ancient Indians to the world of Science and Technology														(9L)
Ancient India’s contribution to science and technology – Mathematics – Sulvasutra - Ganita– Medicine - Atharva Veda - Charak Samhita - Sushruta Samhita – Chemistry - iron pillar of Mehrauli – Nagarjuna – Ras Ratnakar - Wootz Steel – Smelting of Zinc – Seamless metal globe – Physics – Kanad – Anu – Pancha Bhootas – Vikramaditya – Medicine - Plastic Surgery, Sushruta Samhita – Cataract Surgery, Jabamukhi Salaka – Ayurveda, Charaka Samhita													CO-1 BTL-2	
MODULE 2: Irrigation, water resources and Ship Building														(9L)
20 traditional water conservation systems of India - 7 Ways Indian Villages Adopted Water Management to Combat Drought - Ship building - Mukti Kalptaru – Sarvamandir – Madhyamandir – Agramandir													CO-2 BTL-2	
MODULE 3: Mathematics and Science														(9L)
Idea of Zero, Aryabhata – The Decimal System – Numerical Notations and numerals– Fibonacci numbers, Pingala, Virahanka, Gopala and Hemacandra – Binary Numbers - Chhanda Shastra, Chakravala method of Algorithms – Ruler Methods – Heliocentric Theory, Aryabhata’s , quantum physics in Vaisheshika Atomic theory													CO-3 BTL-2	
MODULE 4: Biotechnology, Defence Technology and Nanotechnology														(9L)
Biotechnology, Genome sequencing initiatives by India, DNA technology regulation Bill – Space Technology, GAGANYAN, Seven Mega Missions by ISRO, Nuclear Technology, India’s three stage Nuclear Programme, India’s Nuclear Policy – Defence Technology, Vikrant, Vikramaditya – Nano Technology, India’s Mission on Nano Science and Technology -													CO-4 BTL-2	
MODULE 5: CONTRIBUTIONS OF INDIANS IN SCIENCE AND TECHNOLOGY														(9L)
JC Bose, Homi J. Baba, Vikram Sarabhai, Satyendranath Bose, CV Raman, APJ Abdul Kalam <b>Suggested Activity:</b> To submit a detailed report on Recent contributions by India in the field of Science and Technology													CO-5 BTL-3	
REFERENCE BOOKS														
1	“Science and Technology   UPSC   Civil Services Exam   State Administrative Exams”, Ravi P. Agrahari, McGraw Hill Publications, ISBN-10 935532555X, 7th Edition, 2023													
2	“A Brief History of Science & Technology In India”, Dr. P Lathwal, Indu Book Services Pvt Ltd., ISBN: 9789391377205, First Edition, 2022													
E Resources for Reference														
1.	https://www.thebetterindia.com/63119/ancient-india-science-technology													
2.	https://www.ijedr.org/papers/IJEDR2210086.pdf													
3.	https://www.insightsonindia.com/science-technology/													

COURSE TITLE	POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY			CREDITS	Non Credit
COURSE CODE	EGE51023	COURSE CATEGORY	MC	L-T-P-S	3-0-0-1
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-2
ASSESSMENT SCHEME					
CIA					ESE

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc.,	Attendance											
15%	15%	10%	5%	5%	50%										
Course Description	The students shall develop an intuitive understanding of the political and economic thoughts of thinkers from various ages to have an explicit insight into the ideas, values and ethics provided by them.														
Course Objective	<ul style="list-style-type: none"><li>• This course aims to equip the students with value building through analyzing the ideas of the thinkers of various ages</li><li>• This course also equips students with an ability to critically analyse the social, economic and political conditions.</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>• Brief on the historic background of economic issues in India.</li><li>• Summarize the theories emerging from western economic and political thought.</li><li>• Describe the emergence of the welfare state and their security implications.</li><li>• Appreciate the significance of Gandhian thoughts and Ambedkar thoughts and the impact on the progress of the nation.</li><li>• Debate on current trends of secularism and their effects on building a nation.</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	-	-	1	1	-	-	1	-			
CO-2	-	-	-	-	-	1	-	-	1	-	1	-			
CO-3	-	-	-	1	-	1	1	1	-	-	2	-			
CO-4	-	-	-	-	-	1	2	3	-	-	2	-			
CO-5	2	1	1	-	-	2	1	3	2	2	2	1			
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: Historical background of Economic Issues in India 9 Hours															
Impact of colonial rule on Indian Economy; Dadabhai Naoroji- Drain Theory; Post Independence- Nehru and Idea of Socialism, Evolution of Public sector in India.													BTL-1,2		
MODULE 2: Western Economic and Political thought 9 Hours															
Liberalism- Free market, Laissez Faire, Industrial revolution. Communism- Mode of production, theory of Surplus value, Class struggle; Gramsci- Theory of Hegemony													BTL-1,2		
MODULE 3: Emergence of Welfare State 9 Hours															
Welfare state- Meaning, Womb to Tomb concept and its current state; Security- Shift from traditional security to non-traditional security threats: Human security, Food security and social security													BTL-1,2		
MODULE 4: Gandhian and Ambedkar Thought 9 Hours															
Gandhi: Swaraj, Decentralization and Ramarajya; Ambedkar: Cultural hegemony.													BTL-1,2		
MODULE 5: Current trends 9 Hours															
Secularism: Positive and Negative secularism; Affirmative actions, Public distribution system.													BTL-1,2		
TEXT BOOKS															
1.	Subrata Mukherjee,Sushila Ramasamy,"A history of Political Thought- Plato to Marx",PHI learning private limited,2nd edition,2011														
2.	Shefali Jha,"Western Political Thought: From the Ancient Greeks to Modern Times", 2nd Edition by Pearson														
REFERENCE BOOKS															
1	Indian Political Thinkers:Modern Political Thought,Atlantic Publishers & Dist, 2000														
2	Marx, Karl, 1818-1883. The Communist Manifesto. London; Chicago, Ill. :Pluto Press, 1996.														
3	Nehru, Jawaharlal, 1889-1964. The Discovery of India. Garden City, N.Y. :Anchor Books,														
4	Gandhi, Mahatma, 1869-1948. The Collected Works of Mahatma Gandhi. New Delhi :Publications Division, Ministry of Information and Broadcasting, Govt. of India,														

COURSE TITLE			State, Nation Building & Politics in India						CREDITS			Non Credit			
COURSE CODE			EGE51024			COURSE CATEGORY			MC		L-T-P-S		3-0-0-1		
Version			1.0			Approval Details			36th ACM		LEARNING LEVEL		BTL – 3		
ASSESSMENT SCHEME															
First Periodical Assessment			Second Periodical Assessment			Seminar/ Assignments/ Project			Surprise Test / Quiz		Attendance		End Semester Exam		
15%			15%			10%			5%		5%		50%		
Course Description			After studying the course, the students should be able to gain knowledge of Nation building and the constituents of Indian politics												
Course Objective			<ul style="list-style-type: none"><li>• This course will enlighten the students to learn about the basics of nation building</li><li>• Indian secularism and the salient features of Secular India.</li><li>• To brief on the principles of federalism and its working</li><li>• To understand the administrative framework of Indian Government</li></ul>												
Course Outcome			<ul style="list-style-type: none"><li>• Summarize the basics of nation building with a special reference to Indian constitution.</li><li>• Identify and relate the components that constitute Indian constitution</li><li>• Appraise the salient features of Indian secularism.</li><li>• Classify the principles of Federalism and its relation to central and state autonomy.</li><li>• Illustrate the Indian central administration system and the hierarchy of operations.</li></ul>												
Prerequisites: Nil															
CO, PO AND PSO MAPPING															
CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2	PSO -3
CO-1	-	-	1	1	-	3	2	3	2	2	2	-			
CO-2	-	-	-	1	-	2	2	2	2	1	2	-			
CO-3	-	-	-	-	-	2	2	2	2	1	2	-			
CO-4	-	-	-	-	-	2	2	2	2	1	2	-			
CO-5	1	1	1	1	-	3	2	3	2	2	2	-			

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: Basic of Nation Building	
9 Hours	
Indian government and politics: basics Nation-Building in India: Theoretical, Historical, Cultural perspective, National Movements in India	CO-1 BTL-1,2
MODULE 2: Indian Constitution	
9 Hours	
Making of the Indian Constitution: The Constituent Assembly - Background, Composition, Nature and its working, Ideological Contents: Preamble, fundamental Rights and Directive Principles of State Policy.	CO-2 BTL-2,3
MODULE 3: Indian Secularism	
9 Hours	
Distinctiveness of Indian Secularism, Constitution as an instrument of social change: Constitutional Amendments.	CO-3 BTL-3
MODULE 4: Federalism	
9 Hours	
Federalism and its working: Nature, the Areas of Tension in Centre-State relations, Demands for State Autonomy, Separatist Movements.	CO-4 BTL-3
MODULE 5: Central Administration	
9 Hours	
Executive and Central Administration: President, Prime Minister, and council of ministers, Unio Territories: Administration, Critical Appreciation.	CO-5 BTL-3
TEXT BOOKS	
1.	Indian Government and Politics: Basics / Political Ideologies/ Nation Building, Dr. Jayanta Kumar Dash & Dr. Ratnaprava Barik, Geetanjali Publication 2012
2.	An Introduction to the Constitution of India. New Delhi: Vikas, 1998. Sikri, S.L. <b>Indian Government and Politics</b> . New Delhi: Kalyani Publishers, 1999 (Reprint).
REFERENCE BOOKS	
1.	R.N Gilchrist, Principles of Political Science, Bombay: Orient Longmans, Seventh Edition, 1952
2.	Andrew Heywood, Political Theory: An Introduction, United Kingdom: Palgrave Mac Milan, 4 <sup>th</sup> Edition, 2015.
E-BOOKS / MAGAZINE / ARTICLES	
1.	<a href="https://cepr.org/voxeu/columns/nation-building-new-ebook">https://cepr.org/voxeu/columns/nation-building-new-ebook</a>

<b>COURSE TITLE</b>	<b>INDUSTRIAL SAFETY (MANDATORY COURSE)</b>	<b>CREDITS</b>	<b>Non Credit</b>
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COURSE CODE	EGE51025	COURSE CATEGORY	MC	L-T-P-S	3-0-0-1										
Version	01	Approval Details	36 <sup>th</sup> ACM	LEARNING LEVEL	BTL-3										
ASSESSMENT SCHEME															
CIA					ESE										
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance*											
15%	15%	10%	5%	5%											
15%	15%	10%	5%	5%											
Course Description	Upon completion of the Industrial Safety course, participants will be equipped with the knowledge and skills necessary to foster a safer and healthier workplace, thereby safeguarding workers, assets, and the environment. Whether the students are an industry professional seeking to enhance their safety expertise or a manager responsible for the well-being of their team, this course will empower them to make informed decisions and contribute to a culture of safety excellence within their organization.														
Course Objective	The objective of this course is to equip students with the knowledge, skills, and mind set necessary to promote a safe and healthy work environment, protect workers and assets, and contribute to the overall success and sustainability of industrial operations. It provides / covers <ul style="list-style-type: none"><li>comprehensive understanding of safety protocols, standards, and practices within industrial settings.</li><li>course covers a wide range of safety terminologies used in the industry, enabling students to effectively communicate and engage with safety professionals and colleagues.</li><li>delve into the fundamental principles of safety regulations, ensuring compliance with the highest safety standards</li></ul>														
Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"><li>Realize the importance and basic Terminologies of safety.</li><li>Enable the students to learn about the Important Statutory Regulations and standards.</li><li>Enable students to Conduct and participate the various Safety activities in the industry.</li><li>Appreciate about Workplace Exposures and Hazards.</li><li>Assess the various Hazards and consequences through various Risk Assessment Techniques.</li></ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	3	3	2	-	-	2	2	-	-	1	1	2			
CO-2	3	3	2	-	-	2	2	-	-	1	1	2			
CO-3	3	3	2	-	-	2	2	-	-	1	1	2			
CO-4	3	3	2	-	-	2	2	-	-	1	1	2			

CO-5	3	3	2	-	-	2	2	-	-	1	1	2			
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION (9L)															
Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government, and voluntary agencies in safety. Safety policy - Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.													CO-1 BTL-2		
<b>Suggested Reading:</b> <ul style="list-style-type: none"> <li>Importance of Safety, Health and Environment policies at Workplace</li> </ul>															
MODULE 2: STANDARDS AND REGULATIONS (9L)															
Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006													CO-2 BTL-3		
<b>Suggested Readings:</b> <ul style="list-style-type: none"> <li>Industrial Safety Signs: Types of Signs, Regulations, Standards and Best Practices to Promote Safety in the Workplace</li> </ul>															
MODULE 3: SAFETY ACTIVITIES (9L)															
Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping.													CO-3 BTL-3		
<b>Suggested Readings:</b> <ul style="list-style-type: none"> <li>Roles and Responsibilities of Safety Officers and Safety Representatives</li> </ul>															
MODULE 4: HAZARDS AND RISKS (9L)															
Hazard and risk, Types of hazards- Mechanical Hazard, Electrical Hazard, Noise hazard and Fire Hazard - Particulate matter- musculoskeletal disorder improper sitting posture and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition. Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants													CO-4 BTL-3		
<b>Suggested Readings / Activities:</b> <ul style="list-style-type: none"> <li>Personal Protective Equipment (PPE), Types of PPE and their appropriate use, PPE selection, maintenance, and training, Assessing PPE effectiveness in hazard control</li> </ul>															
MODULE 5: HAZARD IDENTIFICATION TECHNIQUES (9L)															
Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment													CO-5 BTL-3		
<b>Suggested Readings:</b> <ul style="list-style-type: none"> <li>Guidelines for safe handling, storage, and disposal of hazardous materials in various industries</li> </ul>															
TEXTBOOKS															
1.	R.K. Jain and Prof. Sunil S. Rao, Industrial Safety, Health and Environment management systems, Khanna														

	Publications, 2000.
2.	L. M. Deshmukh, Industrial Safety Management: Hazard Identification and Risk Control, McGraw-Hill Education, 2005.
<b>REFERENCE BOOKS</b>	
1	Frank Lees, 'Lees' Loss Prevention in Process Industries, Butterworth-Heinemann publications, UK, 4th Edition, 2012.
2	John Ridley, John Channing, Safety at Work, 7 <sup>th</sup> edition, Routedledge, 2007.
3	Das Akhil Kumar, Principles of Industrial Safety Management Understanding the Ws of Safety at Work, PHI Learning Pvt Ltd, 2020.
<b>E Resources for Reference</b>	
1.	<a href="https://hsseworld.com/wp-content/uploads/2020/08/Industrial-Safety-Management.pdf">https://hsseworld.com/wp-content/uploads/2020/08/Industrial-Safety-Management.pdf</a>
<b>MOOC</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc20_mg43/preview">https://onlinecourses.nptel.ac.in/noc20_mg43/preview</a>

### MANDATORY COURSES III

[illegible]

CO-2	2	-	3	-	-	-	-	-	-	-	-	-	2	-	-
CO-3	-	-	-		-	-	-	-	-	-	-	-	-	-	-
CO-4	-	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-5	-	-	-	3	-	-	-	-	-	-	-	-	2	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE – 1: INTRODUCTION														(6L)	
Definition – Importance – Nature and Scope of Management – Process of Management - Role and functions of Managers - Levels of Management- Managerial Skills- Scientific Management Contributions to Management by different Schools of thought.														CO-1 BTL-2	
MODULE – 2: PLANNING AND DECISION MAKING														(6L)	
Nature and purpose of planning - Planning process – Objectives - Management by objective (MBO)- Strategic Planning - Decision Making - Decision Making Process.														CO-2 BTL-3	
MODULE – 3: ORGANIZING														(6L)	
Structure, Nature, Types of Organizations, Principles of Organizing; Departmentalization; Delegation; Decentralization of Authority; Span of Control - Line and Staff Functions														CO-3 BTL-4	
MODULE – 4: LEADING														(6L)	
Introduction, Characteristics of a Leader, Functions of a Leader; Leadership and Management; Principles of Leadership, Styles of Leaders.														CO-4 BTL-4	
MODULE – 5: CONTROLLING														(6L)	
Introduction, Concept of Controlling, Purpose of Controlling; Types of Control; Steps in Controlling; Techniques in Controlling in ethical aspects of management problems.														CO-5 BTL-3	
TEXT BOOKS															
1	Stephen P. Robbins, David A. Decenzo, Fundamentals of Management,11 <sup>th</sup> edition, Pearson Education, 2020.														
2.	Harold Koontz, O'Donnell and Heinz Weihrich, Essentials of Management. New Delhi, 11th edition, Tata McGraw Hill, 2020.														
REFERENCE BOOKS															
1	L.M.Prasad, Principles and Practice of Management ,20th Edition, Sultan Chand & Sons, 2020.														
2	R.N Gupta,Principles of Management, 2nd Edition, Sultan Chand Ltd. 2005.														
E BOOKS															
1	<a href="https://d3bxy9euw4e147.cloudfront.net/oscmsprodcms/media/documents/PrinciplesofManagement-OP.pdf">https://d3bxy9euw4e147.cloudfront.net/oscmsprodcms/media/documents/PrinciplesofManagement-OP.pdf</a>														
2	<a href="https://open.lib.umn.edu/principlesmanagement/">https://open.lib.umn.edu/principlesmanagement/</a>														
MOOC															
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_mg30/">https://onlinecourses.nptel.ac.in/noc21_mg30/</a>														

<b>COURSE TITLE</b>	<b>HUMAN RESOURCE MANAGEMENT</b>	<b>CREDITS</b>	<b>Non Credit</b>
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COURSE CODE	EGE51032	COURSE CATEGORY	MC	L-T-P-S	3-0-0-1										
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-4										
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE										
15%	15%	10%	5%	5%	50%										
Course Description	To train the students on management of Human Resources by exposing them to theories and practices on HR management														
Course Objective	1. To understand and appreciate the importance and functions of the human resources. 2. To distinguish between Recruitment and Selection. 3. To study the training practices and performance appraisal. 4. To develop an understanding about basics of compensation management. 5. To identify and appreciate the significance of the ethical issues in HR														
Course Outcome	1. Conceptualize, the basic concept of Human Resource Philosophy to changing Environment. 2. Applying the Recruitment and Training methods. 3. Determine the effectiveness with which goals are defined and achieved in team environments to assess the contributions of Managers. 4. Creating and selecting, and apply appropriate techniques, in compensation and quality. 5. Applying ethical principles and commit to professional ethics and responsibilities in labour laws, relations and security														
Prerequisites:															
CO, PO AND PSO MAPPING															
CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO -10	PO- 11	PO- 12	PSO -1	PSO -2	PSO -3
CO-1	2	-	2	-	-	2	-	-	-	-	-	1			
CO-2	2	2	-	1	1	2	1	2	-	-	2	2			
CO-3	2	1	2	2	-	2	1	3	-	-	2	3			

[illegible]

1	Gary Dessler, “Human Resource Management”, 16 <sup>th</sup> edition, Prentice-Hall of India.2020				
2.	David A. DeCenzo, Stephen P. Robbins , David A. DeCenzo, Stephen P. Robbins, Personnel/Human Resource Management,3 <sup>rd</sup> edition, Pearson.2022.				
REFERENCE BOOKS					
1	John Bernardin H & Joyee E.A Russel, Human Resource Management- An experimental approach, 6 <sup>th</sup> edition, McGraw-Hill International Edition.,2012.				
2	Aswathappa, Human Resource Management, 9 <sup>th</sup> edition, Tata McGraw Hill, New Delhi, 2021				
E BOOKS					
1	<a href="https://www.ascdegreecollege.ac.in/wp-content/uploads/2020/12/Human-Resource-Management-by-Pravin-Durai.pdf">https://www.ascdegreecollege.ac.in/wp-content/uploads/2020/12/Human-Resource-Management-by-Pravin-Durai.pdf</a>				
2	<a href="https://www.yyu.edu.tr/images/files/Turizmde_Insan_Kaynaklari_Gelisimi_Doc_Dr__Zekeriya_NAS(1).pdf">https://www.yyu.edu.tr/images/files/Turizmde_Insan_Kaynaklari_Gelisimi_Doc_Dr__Zekeriya_NAS(1).pdf</a>				
MOOC					
1.	<a href="https://www.coursera.org/specializations/human-resource-management">https://www.coursera.org/specializations/human-resource-management</a>				
COURSE TITLE		GREEN TECHNOLOGY		CREDITS	Non Credit
COURSE CODE		EGE51033	COURSE CATEGORY	PC	L-T-P-S
Version		1.0	Approval Details	36 <sup>th</sup> ACM	LEARNING LEVEL
					BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC”	Attendance *	
15%	15%	10%	5%	5%	
Course Description					
This course aims to equip the students with a basic understanding of concept of sustainable development including different perspectives, consequences of societal resource use and strategies for changing this concept towards a sustainable direction. This course also equips students with an ability to understand the principles of Green Technology and demonstrate how chemical production could be achieved without posing hazard to human health and environment.					
Course Objective					
<ul style="list-style-type: none"><li>To guide the students in understanding the concepts of green technology and its need.</li><li>To ensure that the students understand the term green oxidation and nanotechnology.</li><li>To enable the students to explore the Green industrial processes.</li><li>To enable the student’s ability to describe Cleaner Production measures applicable to different industries</li><li>To guide the students in the application of green chemistry using advanced technologies.</li></ul>					

Course Outcome	Upon completion of this course, the students will be able to <ul style="list-style-type: none"> <li>● examine the principles of green chemistry and engineering</li> <li>● evaluate the approach on green technology towards the new discovery and innovation</li> <li>● gain knowledge on Green industrial processes</li> <li>● analyze the concept of sustainable development and its importance</li> <li>● analyze and select the different principles of green chemistry and sustainable development for various applications.</li> </ul>														
CO, PO AND PSO MAPPING															
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	2	3	1	1	1	2	3	1	2	1	3	1	1	1
CO-2	-	-	3	2	2	1	2	3	1	2	1	2	1	1	3
CO-3	-	-	3	2	2	1	2	3	1	2	1	2	3	2	1
CO-4	-	-	3	2	2	1	2	3	1	2	1	1	1	1	2
CO-5	-	-	3	2	2	1	2	3	1	2	1	1	3	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO GREEN TECHNOLOGY													(9L=9)		
Principles of green technology, concepts of green chemistry and process intensification.													CO-1 BTL-3		
MODULE 2: GREEN SYNTHESIS AND CATALYSIS													(9L=9)		
Green oxidation and photochemical reactions, Microwave and Ultrasound assisted reactions, Synthesis of Green Reagents, Green solvents, Green nanotechnology and Ionic liquids.													CO-2 BTL-3		
MODULE 3: GREEN INDUSTRIAL PROCESSES													(9L=9)		
Pollution statistics from various industries like polymer, textile, pharmaceutical, dyes, pesticides and wastewater treatment. A greener approach towards all these industries.													CO3 BTL-3		
MODULE 4: GREEN CHEMISTRY & SUSTAINABLE CHEMICAL PROCESSES													(9L=9)		
Resources/Tools for Green Alternatives, Green laws compliance, Examples and impact of green chemistry, Development of Specialized Synthetic Techniques.													CO-4 BTL-3		
MODULE 5: CHALLENGES AND PRACTICAL IMPLEMENTATION													(9L=9)		
Responsibilities and potentials of companies for action. Green Productivity and emerging technologies. Implementation of the practical applications of Green emerging technologies and sustainable development with Case studies.													CO5 BTL-3		
BOOKS															
1	Bishop P. L. McGraw-Hill, Pollution Prevention: Fundamentals and Practice, Boston, 2000.														
2	Anastas P.T. and Warner J.C, Green Chemistry: Theory and Practice, Oxford University Press, 1998.														
3	Marcel Dekker, Introduction to Green Chemistry, A.S. Publisher, Newyork, 2001.														
4	Modak P., Visvanathan C. and Parasnis M, Cleaner Production Audit Environmental System Reviews,														



	Asian Institute of Technology, Bangkok, 1995.				
5	Clark J.H. and Macquarrie D.J, Handbook of Green Chemistry and Technology, Wiley-Blackwell Publishers, 2002				
REFERENCE BOOKS					
1	Ahluwalia, Green Chemistry: Environmentally Benign Reactions, V.K. Ane Books India, New Delhi, India, 2006.				
2	Sawyer C.N, McCarty P.L and Parkin G.F, Chemistry for Environmental Engineering and Science, 5th ed. McGraw-Hill Professional, 2003.				
3	Lancaster M, Green Chemistry: An Introductory Text, Royal Society of Chemistry, Cambridge, 2002.				
E Resources for Reference					
1.	<a href="https://link.springer.com/article/10.1007/s11356-022-20024-4">https://link.springer.com/article/10.1007/s11356-022-20024-4</a>				
2.	<a href="https://iopscience.iop.org/article/10.1088/1755-1315/94/1/012115/pdf">https://iopscience.iop.org/article/10.1088/1755-1315/94/1/012115/pdf</a>				
3.	<a href="https://iaeme.com/MasterAdmin/Journal_uploads/IJMET/VOLUME_9_ISSUE_3/IJMET_09_03_113.pdf">https://iaeme.com/MasterAdmin/Journal_uploads/IJMET/VOLUME_9_ISSUE_3/IJMET_09_03_113.pdf</a>				
MOOC					
1.	<a href="https://onlinecourses.swayam2.ac.in/aic21_ge16/preview">https://onlinecourses.swayam2.ac.in/aic21_ge16/preview</a>				
COURSE TITLE	INDUSTRIAL MANAGEMENT			CREDITS	Non Credit
COURSE CODE	EGE51034	COURSE CATEGORY	MC	L-T-P-S	3-0-0-1
Version	1.0	Approval Details	37 <sup>th</sup> ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description					
Course Objective	1. To provide brief introduction about the management principles and their functions. 2. To study the concepts of product design, product layout and PPC functions. 3. To know the material requirement planning and store keeping procedure. 4. To explain the basic principles of TQM. 5. To understand the social responsibilities of engineer and ways to protect our environment				
Course Outcome	1. Interpret given organization structure, and acquire major management skills, familiarize with different leadership styles. 2. Implement product design, and explain different types of plant layout, production modes and PPC functions. 3. Understand the material requirement planning and store keeping procedure and analyze importance of inventory control. 4. Analyze the need of Total Quality management and appreciate the usage of TQM tools in quality control. 5. Incorporate the social responsibilities of engineer and ways to protect our environment				
Prerequisites: Knowledge of English Communication					
CO, PO AND PSO MAPPING					

[illegible]

COURSE TITLE		FINTECH AND FINANCING NEW BUSINESS								CREDITS		Non Credit			
COURSE CODE		EGE51035		COURSE CATEGORY		MC		L-T-P-S		3-0-0-1					
Version		1.0		Approval Details		36 <sup>th</sup> ACM		LEARNING LEVEL		BTL-4					
ASSESSMENT SCHEME															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz		Attendance		ESE					
15%		15%		10%		5%		5%		50%					
Course Description		FinTech, is a combination of traditional financial techniques with technology and innovation. It aims at the application of new technological advancements to the financial industry. At the core, FinTech is used by companies to manage their financial operations in a better way.													
Course Objective		1. To study the overview of Fin Tech. 2. To understand the role of FinTech in financial markets 3. To Identify the key cybersecurity challenges facing FinTech companies. 4. To provide exposure to various banking services and understand various Ancillary Services. 5. To take stock of the technological trends sweeping the financial services sector.													
Course Outcome		1. To identify the key trends driving the growth of FinTech and analyze the challenges and opportunities facing FinTech companies. 2. Analyze the impact of FinTech on the efficiency and liquidity of financial markets. 3. Develop strategies to mitigate cybersecurity risks in FinTech. 4. Use banking services with clear understanding about the various delivery channels. 5. Outline the current global landscape of financial technology Industry.													
Prerequisites: Knowledge of English Communication															
CO, PO AND PSO MAPPING															
CO	P O - 1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	P O - 10	PO -11	PO -12	PSO -1	PSO -2	PSO -3
CO-1	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO -2	2	-	-	2	1	-	-	-	-	-	-	-	1	-	-
CO -3	2	1	-	-	-	2	-	-	-	-	-	-	-	1	-
CO -4	1	1	2	-	1	-	-	-	-	-	-	-	-	1	-
CO -5	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE – 1: INTRODUCTION TO FIN TECH													(9L)		
Introduction to FinTech, history of FinTech-key trends driving the growth of FinTech, challenges and opportunities facing FinTech companies- future of FinTech													CO-1 BTL-2		

<b>MODULE – 2: FIN TECH AND FINANCIAL MARKETS</b>		<b>(9L)</b>
Primary markets and Secondary market an overview-FinTech and payments, FinTech and lending-FinTech and investments-FinTech and insurance- regulatory landscape for FinTech in financial markets		<b>CO-2 BTL-3</b>
<b>MODULE – 3: FIN TECH AND CYBERSECURITY</b>		<b>(9L)</b>
Cybersecurity threats to FinTech-Cybersecurity best practices for FinTech companies-role of government in regulating FinTech cybersecurity.		<b>CO-3 BTL-4</b>
<b>MODULE – 4: BRANCHLESS BANKING</b>		<b>(9L)</b>
Branchless Banking: Management of alternate delivery channels -Automated Teller Machine (ATM), Phone Banking, Mobile Banking, Card technologies, Internet Banking, Ancillary Services: Interbank Transfer - Electronic Clearing Services (ECS), Electronic Funds Transfer - NEFT, RTGS, SWIFT, Electronic cheques; New payment settlement systems- IM PS -Safe Deposit Lockers; FOREX service; DEMAT and Custodial service.		<b>CO-4 BTL -4</b>
<b>MODULE – 5: TECHNOLOGY DISRUPTIONS ENABLING FINTECH INNOVATION</b>		<b>(9L)</b>
4 G and 5 G networks fueling Fin Tech opportunities, transforming customer experience using Mobile Application and smart phones ,embedded sensors and social media, cloud computing, web 2.0/3.0/4.0,rapid web design, Java Script, Technologies, IoT, Big Data analytics and AI and Block chain.		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1	Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, John Wiley & Sons. 2016	
2.	Parag Y Arjunwadkar, Fintech: The Technology Driving Disruption in the financial service industry CRC press.	
<b>REFERENCE BOOKS</b>		
1	Jonathan Aronson and Peter F. Cowhey ,Digital DNA: Disruption and the Challenges for Global Governance, OUP USA, 2017	
2	Rajesh, R., & Sivagnana Siddhi T., “Banking Theory Law & Practice”,Tata Mc Graw Hill.2009.	
<b>E BOOKS</b>		
1.	<a href="https://www.amazon.in/Fintech-Founders-Inspiring-Entrepreneurs-Changing-ebook/dp/B08295NZ2T?asin=B08295NZ2T&amp;revisionId=e61ddfa1&amp;format=1&amp;depth=1">https://www.amazon.in/Fintech-Founders-Inspiring-Entrepreneurs-Changing-ebook/dp/B08295NZ2T?asin=B08295NZ2T&amp;revisionId=e61ddfa1&amp;format=1&amp;depth=1</a>	
2.	<a href="https://www.ebooknetworking.net/ebooks/banking-theory-and-law-practice-by-gurusamy.html">https://www.ebooknetworking.net/ebooks/banking-theory-and-law-practice-by-gurusamy.html</a>	
<b>MOOC</b>		
1.	<a href="https://www.edx.org/course/introduction-to-fintech">https://www.edx.org/course/introduction-to-fintech</a>	