Sri Krishna College of Engineering and Technology

An Autonomous Institution, Affiliated to Anna University

Coimbatore – 641 008

CURRICULUM AND SYLLABI

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Regulation 2022 (Batch 2023-27)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION AND MISSION OF THE INSTITUTION

Vision

To Produce Globally Competitive Engineers with High Ethical Values and Social Responsibilities.

Mission

- To impart the highest quality state-of-the-art technical education by providing impetus to innovation, research, and development and empowering students with entrepreneurship skills.
- To instill ethical values, imbibe a sense of social responsibility, and strive for societal well-being.
- To identify the needs of society and offer sustainable solutions through outreach programs.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION AND MISSION OF THE DEPARTMENT

VISION

To equip future engineers with high academic knowledge, ethical values, leadership skills and a passion to contribute to the society.

MISSION

- **To provide quality and contemporary education in Electronics and Communication Engineering through continuous upgradation of Curriculum and laboratory facilities, industrial collaboration and effective teaching learning process.**
- **To facilitate research activities and entrepreneurship skills to cope up with the changes in industrial demand and meet the global and societal needs.**
- **To inculcate professional attitude and ethical values.**

PROGRAMME OBJECTIVES (POs)

At the time of their graduation students of Electronics and Communication Engineering Programme should be in possession of the following Programme Outcomes

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 and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and 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 and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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 EDUCATIONAL OBJECTIVES (PEOs)

The following Programme Educational Objectives are designed based on the department mission

PEO1: Exhibit technical competence in Electronics and Communication Engineering by providing innovative engineering solutions and excel in professional career.

PEO2: Indulge in problem identification, analysis and formulation to provide technically superior, economically feasible, environmentally compatible and socially acceptable design solutions.

PEO3: Contribute towards entrepreneurship and research, and exercise leadership through effective communication, teamwork and knowledge upgradation through lifelong learning.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On successful completion of Bachelor of Engineering in Electronics and Communication Engineering Programme from Sri Krishna College of Engineering and Technology, the graduate will demonstrate:

PSO1: Potential to analyse, design, synthesize and provide technical solutions in the field of VLSI, Embedded Systems and Communication Networks.

PSO2: Emerge as ethical leaders, excel in research, engage in lifelong learning, pursue entrepreneurship and contribute towards the field of Electronics and Communication Engineering.

Mapping of PO's to PEO's

Programme Educational Objectives	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
PEO 1	3	3	3	3	2	2	2	1	1	1	1	2
PEO 2	3	3	3	3	3	3	3	1	1	1	1	2
PEO 3	1	1	1	1	1	2	1	3	3	3	3	1

1	Reasonably agreed	**2**	Moderately agreed	**3**	Strongly agreed

PROGRAMME ARTICULATION MATRIX

YEAR	SEM	COURSES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS02
I	I	Circuit Theory and Electron Devices	3	2	2	1	-	-	-	-	-	-	-	2	2	-
		Applied Science	3	2	2	1	1	-	-	-	-	-	-	1	-	-
		Mathematics I	3	3	-	-	-	-	-	-	-	-	-	-	1	-
		Engineering Biology	3	2	2	2	2	1	1	1	-	1	-	2	2	1
		Heritage of Tamils	-	-	-	-	-	-	-	1	1	-	-	1	-	-
		Problem Solving using C++	3	3	3	3	3	-	-	-	3	2	-	2	3	2
		Application Development Practices	3	2	3	3	3	2	-	-	-	-	-	2	3	3
		Applied Science Laboratory	3	2	1	2	-	-	-	-	2	-	-	1	1	-
		Mandatory Course I: Induction Programme	-	-	-	-	-	3	3	3	3	3	3	3	-	1
	III	Digital System Design	3	2	2	1	-	-	-	-	1	-	-	-	2	-
		Electronic Circuits	3	3	2	2	2	-	-	-	1	1	-	-	2	-
		Mathematics II	2	2	2	-	-	-	-	-	-	-	-	-	2	-
		Tamils and Technology	-	-	-	-	-	-	-	-	-	1	-	1	-	1
		Oral and Written Communication Skills	-	-	-	-	-	-	-	2	-	3	2	3	-	-
		Database Management Systems	3	3	3	2	2	-	-	-	2	2	2	3	3	2
		Java Programming	3	3	3	-	2	-	-	2	2	2	-	3	2	2
		Digital System Design Laboratory	3	3	1	2	1	-	-	-	1	1	-	-	3	-
		Circuits Laboratory	3	3	2	3	2	-	-	-	1	1	3	-	3	1
		Mandatory Course II: Environmental Sciences	-	-	-	-	-	2	3	-	-	-	-	-	2	2
II	III	Universal Human Values	-	-	-	-	-	3	3	3	3	-	2	-	1	1
		Mathematics III	3	3	-	-	-	-	-	-	-	-	-	-	1	-

		Signals and Systems	3	3	3	3	2	-	-	-	2	-	-	1	3	1
		Operating Systems for Electronic Devices	3	2	2	2	3	-	-	-	1	2	-	2	3	1
		Data Structures and Algorithms	3	3	3	3	3	-	-	-	2	1	-	2	3	2
		Advanced Java Programming	3	3	3	2	3	-	-	-	2	2	-	2	3	3
		IDEA Lab	3	2	2	2	3	-	-	-	1	-	-	1	3	1
	IV	Analog Integrated Circuits	1	2	2	2	1	2	-	-	1	1	-	-	2	-
		Electromagnetics	3	3	3	2	1	-	-	-	-	-	-	2	2	1
		Embedded C++	3	3	3	3	3	-	-	-	3	2	-	3	3	2
		Professional Elective-I	3	3	3	-	-	-	-	-	-	-	-	3	3	3
		Open Elective-I (Fundamentals of Python Programming)	3	3	3	3	3	-	-	-	-	-	-	2	3	3
		Analog Integrated Circuits – Lab	3	2	3	3	2	-	-	-	-	-	-	1	3	1
		Mini project I (MERN Stack)	3	3	3	3	3	3	3	3	3	3	3	3	3	3

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATION 2022

CHOICE BASED CREDIT SYSTEM

I – VIII SEMESTER CURRICULUM AND SYLLABI

SEMESTER I							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**C**	**Ext/Int**	**Cat.**
1	23AS101	Applied Science	4/0/0	4	4	60/40	BSC
2	23EC101	Circuit Theory and Electron Devices	3/0/0	3	3	60/40	ESC
3	23MA101	Mathematics I	3/1/0	4	4	60/40	BSC
4	23SB101	Engineering Biology	3/0/0	3	3	60/40	BSC
5	23TA101	Heritage of Tamils	1/0/0	1	1	60/40	HSMC
6	23IT101	Application Development Practices	1/0/4	5	3	50/50	ESC
7	23CS101	Problem Solving using C++	1/0/4	5	3	50/50	ESC
8	23AS102	Applied Science Laboratory	0/0/4	4	2	40/60	BSC
9	23MC101	Mandatory Course I: Induction Programme	3 Weeks		0	0/100	MC
		Total	**16/1/12**	**29**	**23**	**900**	

SEMESTER II							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**C**	**Ext/Int**	**Cat.**
1	23EC201	Electronic Circuits	3/0/0	3	3	60/40	PCC
2	23EC202	Digital System Design	3/0/0	3	3	60/40	PCC
3	23MA201	Mathematics II	3/1/0	4	4	60/40	BSC
4	23TA201	Tamils and Technology	1/0/0	1	1	60/40	HSMC
5	23CD201	Database Management Systems	1/0/4	5	3	50/50	ESC
6	23CY201	Java Programming	1/0/4	5	3	50/50	ESC
7	23EN101	Oral and Written Communication Skills	2/0/2	4	3	50/50	HSMC
8	23EC203	Circuits Laboratory	0/0/3	3	1.5	40/60	PCC
9	23EC204	Digital System Design Laboratory	0/0/2	2	1	40/60	PCC
10	23MC102	Mandatory Course II: Environmental Sciences	1/0/0	1	0	0/100	MC
		Total	**15/1/15**	**31**	**22.5**	**1000**	

SEMESTER III

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Ext/Int	Cat.
1	23GE301	Universal Human Values	3/0/0	3	3	60/40	HSMC
2	23MA302	Mathematics III	3/1/0	4	4	60/40	BSC
3	23EC301	Signals and Systems	4/0/0	4	4	60/40	PCC
4	23EC302	Operating Systems for Electronic Devices	3/0/2	5	4	50/50	PCC
5	23CS201	Data Structures and Algorithms	1/0/4	5	3	50/50	PCC
6	23CS301	Advanced Java Programming	1/0/4	5	3	50/50	PCC
7	23EC303	IDEA Lab	0/0/2	2	1	40/60	ESC
8	23MC1XX	Mandatory Course III	1/0/0	3 Weeks	0	0/100	MC
		Total	**16/1/12**	**28**	**22**	**800**	

SEMESTER IV

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Ext/Int	Cat.
1	23EC401	Analog Integrated Circuits	3/0/0	3	3	60/40	PCC
2	23EC402	Electromagnetics	4/0/0	4	4	60/40	PCC
3	23EC403	Embedded C++	3/0/2	5	4	50/50	PCC
4	23MT907	Professional Elective-I	3/0/0	3	3	60/40	PEC
5	23IT004	Open Elective-I (Fundamentals of Python Programming)	1/0/4	5	3	50/50	OEC
6	23EC404	Analog Integrated Circuits – Lab	0/0/3	3	1.5	40/60	PCC
7	23EC405	Mini project I (MERN Stack)	0/0/4	4	2	40/60	PROJ
8	23MC1XX	Mandatory Course IV	1/0/0	3 Weeks	0	0/100	MC
		Total	**15/0/13**	**27**	**20.5**	**800**	

SEMESTER V

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Ext/Int	Cat.
1	23EC501	Analog and Digital Communication	3/0/0	3	3	60/40	PCC
2	23EC502	Antennas and Microwave Engineering	4/0/0	4	4	60/40	PCC
3	23EC503	Control Engineering	3/0/0	3	3	60/40	PCC
4	23EC504	Digital Signal Processing	4/0/0	4	4	60/40	PCC
5	23EC505	Internet of Things	3/0/0	3	3	60/40	PCC
6	23EC9XX	Professional Elective-II	3/0/0	3	3	60/40	PEC
7	23EC506	Analog and Digital Communication Laboratory	0/0/3	3	1.5	40/60	PCC
8	23EC507	Digital Signal Processing Laboratory	0/0/3	3	1.5	40/60	PCC
		Total	**20/0/6**	**26**	**23**	**800**	

SEMESTER VI							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**C**	**Ext/Int**	**Cat.**
1	23EC601	Data Communication and Networks	3/0/0	3	3	60/40	PCC
2	23EC602	VLSI Design	4/0/0	4	4	60/40	PCC
3	23EC0XX	Emerging Elective-I	3/0/0	3	3	60/40	EEC
4	23EC9XX	Professional Elective-III	3/0/0	3	3	60/40	PEC
5	23EC9XX	Professional Elective-IV	3/0/0	3	3	60/40	PEC
6	23XXXX	Open Elective-II	3/0/0	3	3	60/40	OEC
7	23EC603	VLSI Design Laboratory	0/0/3	3	1.5	40/60	PCC
8	23EC604	Mini Project II	0/0/4	2	2	40/60	PROJ
		Total	**19/0/7**	**24**	**22.5**	**800**	

SEMESTER VII							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**C**	**Ext/Int**	**Cat.**
1	23EC701	Wireless and Optical Communication	4/0/0	4	4	60/40	PCC
2	23MG701	Principles of Management	3/0/0	3	3	60/40	HSMC
3	23EC0XX	Emerging Elective-II	3/0/0	3	3	60/40	EEC
4	23EE9XX	Professional Elective-V	3/0/0	3	3	60/40	PEC
5	23EE9XX	Professional Elective-VI	3/0/0	3	3	60/40	PEC
6	23EC702	Wireless and Optical Communication Laboratory	0/0/3	3	1.5	40/60	PCC
7	23EES01	Employment Enhancement Skills	-	-	2	40/60	EES
		Total	**16/0/3**	**19**	**19.5**	**700**	

SEMESTER VIII							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**C**	**Ext/Int**	**Cat.**
1	23EC801	Project	0/0/24	24	12	40/60	PROJ
		Total	**0/0/24**	**24**	**12**	**100**	

SCHEME OF CREDIT DISTRIBUTION - SUMMARY

S.No	Stream	Credits/Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences Including Management (HSMC)	1	4	3				3		11
2.	Basic Science Courses (BSC)	13	4	4						21
3.	Engineering Science Courses (ESC)	9	6	1						16
4.	Professional Core Courses (PCC)		8.5	14	12.5	20	8.5	5.5		69
5.	Professional Elective Courses (PEC)				3	3	6	6		18
6.	Open Elective Course (OEC) /Emerging Elective Course (EEC)				3		6	3		12
7	Project work				2		2		12	16
8.	Employability Enhancement Skills (EES)							2		2
9.	Mandatory Courses (MC)	0	0	-	-					-
	Total	**23**	**22.5**	**22**	**20.5**	**23**	**22.5**	**19.5**	**12**	**165**

CURRICULUM STRUCTURE FOR UG DEGREE PROGRAMME

S.No	Course Work – Subject Area	AICTE Suggested Breakdown of Credits	SKCET Credits
1.	Humanities and Social Sciences (HS), including Management Courses	15*	**11**
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology	23*	**21**
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation	17*	**16**
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch	61*	**69**
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	12*	**18**
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas	12*	**12**
7.	Project Work, Seminar and/or Internship in Industry or elsewhere	17*	**16**
8.	Employability Enhancement Skills	3*	**2**
9.	Mandatory Courses (MC)	Non-credit	Non-credit
	Total	**160***	**165**

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (11 Credits)

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Cat.
1.	23TA101	Heritage of Tamils	1/0/0	1	1	HSMC
2.	23GE201	Universal Human Values	3/0/0	3	3	HSMC
3.	23EN101	Oral and Written Communication Skills	2/0/2	4	3	HSMC
4.	23TA201	Tamils and Technology	1/0/0	1	1	HSMC
5.	23MG701	Principles of Management	3/0/0	3	3	HSMC

BASIC SCIENCE COURSES (21 Credits)

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Cat.
1.	23AS101	Applied Sciences	4/0/0	3	4	BSC
2.	23MA101	Mathemetics I	3/1/0	4	4	BSC
3.	23SB101	Engineering Biology	3/0/0	3	3	BSC
4.	23AS103	Applied Sciences Laboratory	0/0/4	4	2	BSC
5.	23MA201	Mathematics II	3/1/0	4	4	BSC
6.	23MA302	Mathematics III	3/1/0	4	4	BSC

ENGINEERING SCIENCE COURSES (16 Credits)

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Cat.
1.	23EC101	Circuit Theory and Electron Devices	3/0/0	3	3	ESC
2.	23IT101	Application Development Practices	1/0/4	5	3	ESC
3.	23CS101	Problem Solving using C++	1/0/4	5	3	ESC
4.	23CD201	Database Management Systems	1/0/4	5	3	ESC
5.	23CY201	Java Programming	1/0/4	5	3	ESC
6.	23EC303	IDEA Lab	0/0/2	2	1	ESC

PROFESSIONAL CORE COURSES (69 Credits)

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Cat.
1.	23EC201	Electronic Circuits	3/0/0	3	3	PCC
2.	23EC202	Digital System Design	3/0/0	3	3	PCC
3.	23EC203	Circuits Laboratory	0/0/3	3	1.5	PCC
4.	23EC204	Digital System Design Laboratory	0/0/2	2	1	PCC
5.	23EC301	Signals and Systems	4/0/0	4	4	PCC

6.	23EC302	Operating Systems for Electronic Devices	3/0/2	5	4	PCC
7.	23CS201	Data Structures and Algorithms	1/0/4	5	3	PCC
8.	23CS301	Advanced Java Programming	1/0/4	5	3	PCC
9.	23EC401	Analog Integrated Circuits	3/0/0	3	3	PCC
10.	23EC402	Electromagnetics	4/0/0	4	4	PCC
11.	23EC403	Embedded C++	3/0/2	5	4	PCC
12.	23EC404	Analog Integrated Circuits – Lab	0/0/3	3	1.5	PCC
13.	23EC501	Analog and Digital Communication	3/0/0	3	3	PCC
14.	23EC502	Antennas and Microwave Engineering	4/0/0	4	4	PCC
15.	23EC503	Digital Signal Processing	4/0/0	4	4	PCC
16.	23EC504	Control Engineering	3/0/0	3	3	PCC
17.	23EC505	Internet of Things	3/0/0	3	3	PCC
18.	23EC506	Analog and Digital Communication Laboratory	0/0/3	3	1.5	PCC
19.	23EC507	Digital Signal Processing Laboratory	0/0/3	3	1.5	PCC
20.	23EC601	Data Communication and Networks	3/0/0	3	3	PCC
21.	23EC602	VLSI Design	4/0/0	4	4	PCC
22.	23EC603	VLSI Design Laboratory	0/0/3	3	1.5	PCC
23.	23EC701	Wireless & Optical Communication	4/0/0	4	4	PCC
24.	23EC702	Wireless & Optical Communication Laboratory	0/0/3	3	1.5	PCC

PROFESSIONAL ELECTIVE COURSES (18 Credits)

S.No	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
Elective Stream I: Embedded Systems						
1	23EC901	Embedded Processors	3/0/0	3	3	PEC
2	23EC902	ARM Processor Architecture and Programming	3/0/0	3	3	PEC
3	23EC903	Real Time Operating Systems	3/0/0	3	3	PEC
4	23EC904	Embedded Product Design	3/0/0	3	3	PEC
5	23EC905	Embedded Systems for Edge computing	3/0/0	3	3	PEC
6	23EC906	Microcontroller Based System Design	3/0/0	3	3	PEC
7	23MT907	Product Design	3/0/0	3	3	PEC
Elective Stream II: VLSI						
1	23EC907	ASIC Design	3/0/0	3	3	PEC
2	23EC908	System on Chip Design	3/0/0	3	3	PEC
3	23EC909	Electronic Design Automation Tools	3/0/0	3	3	PEC
4	23EC910	Low Power VLSI Design	3/0/0	3	3	PEC
5	23EC911	VLSI for Image and Video Processing	3/0/0	3	3	PEC
6	23EC912	Reconfigurable Architectures	3/0/0	3	3	PEC
Elective Stream III – Networks, Image and Video Processing						
1	23EC913	Wireless Sensor Networks	3/0/0	3	3	PEC
2	23EC914	High Speed Networks	3/0/0	3	3	PEC
3	23EC915	Neural Networks and Deep Learning	3/0/0	3	3	PEC
4	23EC916	Digital Image and Video Processing	3/0/0	3	3	PEC
5	23EC917	Pattern Recognition Techniques	3/0/0	3	3	PEC

6	23EC918	Information Security	3/0/0	3	3	PEC
Elective Stream IV – Next Generation Communication Systems						
1	23EC919	Advanced Wireless Technologies	3/0/0	3	3	PEC
2	23EC920	Satellite Communication and GPS	3/0/0	3	3	PEC
3	23EC921	Smart Antennas	3/0/0	3	3	PEC
4	23EC922	Cognitive Radio Networks	3/0/0	3	3	PEC
5	23EC923	Advanced wireless networks for 5G	3/0/0	3	3	PEC
6	23EC924	Signal Integrity in high speed design	3/0/0	3	3	PEC
Elective Stream V – Microelectronics, IC Design and Photonics						
1	23EC925	SOI device modelling and simulation	3/0/0	3	3	PEC
2	23EC926	Architectural Design of Digital Integrated Circuits	3/0/0	3	3	PEC
3	23EC927	IC Design & Technology	3/0/0	3	3	PEC
4	23EC928	Power Semiconductor Devices and Technology	3/0/0	3	3	PEC
5	23EC929	Photonic integrated circuits	3/0/0	3	3	PEC
6	23EC930	Biophotonics and optical sensors	3/0/0	3	3	PEC
Elective Stream VI – Smart Sensor Technologies and Biomedical Engineering						
1	23EC931	Flexible and Wearable Sensors	3/0/0	3	3	PEC
2	23EC932	Sensor Technology	3/0/0	3	3	PEC
3	23EC933	Medical Robotics	3/0/0	3	3	PEC
4	23EC934	Sensors for Industrial Applications	3/0/0	3	3	PEC
5	23EC935	Biomaterials and its Applications	3/0/0	3	3	PEC
6	23EC936	Ergonomics	3/0/0	3	3	PEC

OPEN ELECTIVE COURSES (Offered to Other Branches)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	23EC001	Principles of Cyber Physical Systems	3/0/0	3	3	OEC
2.	23EC002	Introduction to Raspberry Pi and Arduino	3/0/0	3	3	OEC
3.	23EC003	IT Workshop SCILAB/MATLAB	3/0/0	3	3	OEC
4.	23EC004	Brain Computer Interface and its Applications	3/0/0	3	3	OEC
5.	23EC005	Wireless wearable Sensors	3/0/0	3	3	OEC
6.	23EC006	Organizational Behavior	3/0/0	3	3	OEC
7.	23EC007	Fundamentals of Digital Signal Processing	3/0/0	3	3	OEC
8	23EC008	Principles of Embedded Systems	3/0/0	3	3	OEC

EMERGING ELECTIVE COURSES (6 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	23EC009	Robotics	3/0/0	3	3	EEC
2.	23EC010	AR/VR Programming	3/0/0	3	3	EEC
3.	23EC011	Computer Vision	3/0/0	3	3	EEC
4.	23EC012	Bio – inspired Human Machine Interface	3/0/0	3	3	EEC
5.	23EC013	Industrial IoT	3/0/0	3	3	EEC

MANDATORY COURSES (0 credits)

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	C	Cat.
1.	23MC101	Induction Programme	3 weeks		0	MC
2.	23MC102	Environmental Sciences	1/0/0	1	0	MC
3.	23MC103	Soft Skills	1/0/0	1	0	MC
4.	23MC104	Patent Drafting and Effective Writing	1/0/0	1	0	MC
5.	23MC105	Emotional Intelligence	1/0/0	1	0	MC
6.	23MC106	Life Skills and Ethics	1/0/0	1	0	MC
7.	23MC107	Stress Management	1/0/0	1	0	MC
8.	23MC108	Constitution of India	1/0/0	1	0	MC
9.	23MC109	Electronic Waste management – Issues and Challenges	1/0/0	1	0	MC

VALUE ADDED COURSES OFFERED BY ECE

S.No	Course Code	Course Title	Credits
1.	23VA401	Antenna Design using simulation software	1
2.	23VA402	System Modelling using Simulink	1
3.	23VA403	The Agriculture in Industry 4.0	1
4.	23VA404	Connecting Technologies with Real World	1
5.	23VA405	Arduino Programming model	1
6.	23VA406	PCB Design for Electronic Circuits	1
7.	23VA407	Energy Harvesting and Security Issues in Cognitive Networks	1
8.	23VA408	System Design using IoT	1
9.	23VA409	UAV and UGV Technologies	1
10.	23VA410	Mobile Application Development	1

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

S.No	Course Code	Name of the Course	L/T/P	Contact Hrs/Wk	C	Cat.
1.	23EES01	Industrial Practice (14 days- 1 Credit) / Publications in Journals (National / Internation - 1 Credit)	-	-	2	EES

SEMESTER WISE CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	23	23	22	20.5	23	22.5	19.5	12	165

Total Credits: 165

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **Cat.:** Category **Hrs/Wk:** Hours/Week

HSMC : Humanities and Social Sciences (including Management Courses)

BSC : Basic Science Courses

ESC : Engineering Science Courses

PCC : Professional Core Courses

PEC : Professional Elective Courses

OEC : Open Elective Courses

PROJ : Project Work

EEC : Emerging Elective Courses

MC : Mandatory Course

EES : Employability Enhancement Skills

23AS101	APPLIED SCIENCE (Common to B.E. CSD, CSE, CSE (CYBER SECURITY), ECE, EEE, MCT & B.Tech. AI&DS, IT	4/0/0/4

Nature of Course	: E (Theory based)
Pre requisites	: Fundamental knowledge in applied sciences

Course Objectives:

1	To learn the fundamental, concepts of physics and apply this knowledge to both scientific and engineering problems.
2	To make the students enrich basic knowledge in various fields such as Electrostatics and magnetism.
3	To understand the principle and applications of electrochemistry and Polymer science, and explore the knowledge of various energy sources and storage devices.
4	To understand the concepts of photo-physical and photochemical processes in spectroscopy.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Understand the principles of electrostatics and problems relating to electric field and electric potential.	[U]
C101.2	Realize the nature of magnets, properties and the magnetic effect of electric current.	[U]
C101.3	Describe the nature of electromagnetic wave and its propagation through different media and interfaces involved in different situations.	[AP]
C101.4	Understand the principle and working of reference electrodes, energy storage devices and polymer products in engineering fields.	[U]
C101.5	Interpret the principle and working of analytical techniques.	[AP]

Course Contents:

Course Contents:

Electrostatics: 15 hours

Charges and their conservation; Coulomb's law - superposition principle. Electric field – electric field due to a point charge, electric field lines; electric dipole, electric field intensity due to a dipole - behaviour of a dipole in a uniform electric field. Electric potential - potential difference - electric potential due to a point charge and dipole - equipotential surfaces – electrical potential energy of a system of two point charges.

Electric flux-Gauss's law and its applications. Electrostatic induction-capacitor and capacitance – dielectrics- electric polarisation – parallel plate capacitor with and without dielectric – applications of capacitor – energy stored in a capacitor - Capacitors in series and in parallel – Van de Graaff generator.

Magnetism: 15 hours

Definitions of fundamental terms – Magnetic field around a current carrying conductor – Direction of magnetic field and current – Biot-Savart law and its application: Magnetic field due to Line charge – Ampere's law and its application: magnetic field due to a solenoid.

Electromagnetic Induction and Alternating Current:

Electromagnetic induction - Faraday's law - induced emf and current - Lenz's law. Self-induction - Mutual induction - self-inductance of a long solenoid - mutual inductance of two long solenoids. Methods of inducing emf - (i) by changing magnetic induction (ii) by changing area enclosed by the coil and (iii) by changing the orientation of the coil. AC generator - (Single phase, three phase). Eddy current - applications - transformer - Alternating current - AC circuit with resistance - AC circuit with inductor - AC circuit with capacitor - LCR series circuit - Resonance and Q - factor - power in AC circuits.

Chemistry of Batteries and Polymers: 15 hours

Chemistry of batteries-Introduction-Cells and its types-emf series-Nernst equation and its applications. Reference electrodes-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH-measurement. **Discussion of energy storage-**Lead acid, Nickel cadmium and Lithium-ion batteries-Energy Sources-Fuel cells (H_2-O_2). **Polymers-**Classifications-addition and condensation polymerization-free radical mechanism.

Atomic and molecular Spectroscopy: Beer Lambert's law, principle, instrumentation, and applications of electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and atomic spectrum-Flame emission spectroscopy (FES).

.

Total Hours:	**45**

Text Books:

1	Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2017.
2	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11th edition, Wiley, 2018.
3	Gaur, R.K. and Gupta, S.L., "Engineering Physics", DhanpatRai Publishers, 2017.
4	Bhattacharya, D.K. and Poonam, T., "Engineering Physics", Oxford University Press, 2017.
5	Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015.
6	Jain P. C. & Monica Jain., "Engineering Chemistry", 17 th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, Reprint-2020.
7	Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 2001.

Reference Books:

1	Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics"S.Chand& Co Ltd, 2018.
2	Sadiku M H, "Principles of Electromagnetics", Oxford University Press Inc.,New Delhi,2015
3	R. Wolfson, "Essential University Physics", Volume 1 & 2. Pearson, 2020.
4	S.O. Kasap, "Principles of Electronic Materials and Devices", McGraw Hill Education, 2017.
5	David Griffiths 'Introduction to Electrodynamics' 4th Edition, Cambridge University Press 2017.
6	Perez, Nestor," Electrochemistry and Corrosion Science", Springer, 2016.
7	Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and

	Francis group, 2012.
Web References:	
1	https://nptel.ac.in/courses/115101005
2	https://www.udemy.com/course/electrostatics-1-electric-charges-fields-and-related-laws/
3	https://openlearninglibrary.mit.edu/courses/course-v1:MITx+8.02.1x+1T2019/about
4	https://onlinecourses.nptel.ac.in/noc22_ph31/preview
5	https://ocw.mit.edu/courses/8-02t-electricity-and-magnetism-spring-2005/
6	https://unacademy.com/batch/legend-2o-for-jee-main-and-advanced-2022/7IXHRCZE/topics/WQCLD/courses/RAATL
7	https://archive.nptel.ac.in/courses/108/106/108106073/
8	https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry
9	www.corrosionsource.com/
10	https://www.sciencedirect.com/book/9780750646253/battery
11	http://www.rnlkwc.ac.in/pdf/study-material/chemistry/Spectroscopy
12	https://ocw.mit.edu/courses/chemistry
13	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf
14	https://ocw.mit.edu/courses/chemistry

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Understand	Assignment - I	20
C101.2	Understand	Quiz - I	20
C101.3	Apply		
C101.4	Understand	Assignment - II	20
C101.5	Apply	Quiz – II	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	30	30	30
Understand	50	50	50
Apply	20	20	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Outcomes (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
C101.1	3	2	2		1							1		
C101.2	3	2	2		1							1		
C101.3	3	2	2	1	1							1		
C101.4	3	2	2		1							1		
C101.5	3	2	2	1	1							1		

23EC101	CIRCUIT THEORY AND ELECTRON DEVICES	3/0/0/3

Nature of Course	: G (Theory Analytical)

Course Objectives:

1	To introduce the various circuit components of an electrical network.
2	To enable the students to understand and simplify circuits using network theorems.
3	To introduce the basic electronic devices and discuss their operations.
4	To enable the student to select appropriate devices to design a circuit for a particular application.
5	To study the characteristics of diodes, BJT, FET, rectifiers and filters

Course Outcomes:
Upon completion of the course, students shall have the ability to

C101.1	Recalling the basic circuits laws and the basic concepts of DC circuits	[U]
C101.2	Understand the basic principles of network theorems	[U]
C101.3	Construct circuits by applying the theoretical knowledge gained in electron devices	[AP]
C101.4	Analyse the electrical characteristics of diodes, rectifiers, filters and voltage regulators	[AN]
C101.5	Observe and analyse the characteristics of BJT	[AN]
C101.6	Analyse the electrical characteristics of unipolar devices with the constructed circuits	[AN]

Course Contents:

BASIC CIRCUIT CONCEPTS **15**

Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohm's law - Kirchhoff's current law – Kirchhoff's voltage law– series and parallel Connected sources- resistors in series and parallel – voltage and current division– Nodal analysis - mesh analysis – source Transformation –problems on delta wye conversion- -Thevenin and Norton theorem, Maximum power transfer, Superposition theorem, Reciprocity theorem. (Only DC)

DIODES AND THEIR APPLICATIONS **15**

Formation of P-N junction, forward and reverse biased P-N junction - depletion and diffusion capacitances, switching characteristics, V-I characteristics, Zener breakdown, Avalanche breakdown, Tunnel diode. Rectifiers, Filters, Clipper, Clamper, Voltage Doubler, Voltage Dividers, Voltage Regulator.

TRANSISTORS **15**

BJT:Principle of transistor action–Current components–Cutoff, active and saturation region– Input and output characteristics–CE, CB, & CC Configurations – Transistor as a switch, Fundamentals of JFETs and the device characteristics – JFET parameters, MOSFET – principle of operation-Depletion and enhancement modes.

Total Hours:	**45**

Text Books:	
1	Sudhakar. A and Shyam Mohan. SP “Circuits and Network Analysis & Synthesis”5th edition, Tata McGraw Hill, 2015.
2	William H.Hayt, JV Jack E.Kemmerly and Steven M. Durbin,” Engineering Circuits Analysis”, McGraw Hill India, 8h edition, 2014.
3	Jacob Millman, Chritos C Halkias, Satyabrata Jit, ‘Electronic Devices and Circuits’, 4th edition (SIE), McGraw Hill Education India Private Ltd., 2015
4	Robert Boylestad and Louis Nashelsky, ‘Electron Devices and Circuit Theory’, 11th edition , Pearson New International Edition , 2013
Reference Books:	
1	Chakrabati A “Circuit Theory Analysis and Synthesis” Dhanpath Rai & Sons New Delhi 2014
2	Salivhanan, ‘Electron Devices and Circuits’, 4th edition, McGraw Hill Education India Private Ltd., 2016
Web References:	
1	http://nptel.ac.in/courses/117106101/
2	http://www.thelearningpoint.net/home/electrical-science-and-engineering/circuit-theory
3	http://www.tina.com/course/coursex
4	www.allaboutcircuits.com
Online Resources:	
1	https://www.edx.org/course/circuits-electronics-1-basic-circuit
2	http://www.electronics-tutorials.ws

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Understand	Assignment	20
C101.2, C101.5	Understand, Apply	Quiz	20
C101.3, C101.4	Understand	Quiz	20
C101.6	Analyse	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	30	30	30
Analyse	40	40	40
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Articulation Matrix														
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**
1	2	2	2	-	-	-	-	-	-	-	-	-	1	-
2	3	2	1	-	-	-	-	-	-	-	-	-	1	-
3	2	1	2	1	-	-	-	-	-	-	-	-	1	-
4	3	1	1	-	-	-	-	-	-	-	-	2	2	-
5	2	1	2	-	-	-	-	-	-	-	-	1	2	-
6	3	2	1	-	-	-	-	-	-	-	-	2	2	-
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23MA101	MATHEMATICS I (COMMON TO ALL BRANCHES)	3/1/0/4

Nature of Course	: (Analytical)

Course Objectives:

1	To use logical notation to define the fundamental data types and structures used in computer algorithms and systems.
2	To use the concepts of graph theory in practical situations.
3	To acquire thorough knowledge of fundamental notions of proof's and its application in Cryptography.
4	To analyse data pertaining to discrete and continuous random variables to interpret the results.
5	To impart the knowledge of counting principles, to think critically and apply it in real world problems.

Course Outcomes:

Upon completion of the course, students shall have the ability to

C101.1	Recall the basic concepts of logical laws, structures and probability.	[R]
C101.2	Understand the concepts of proof techniques, structures and random variables.	[U]
C101.3	*Apply* the logical and foundational structures of mathematics with an emphasis on *writing proofs.*	[AP]
C101.4	Apply the concepts of graph and number theory in cryptography.	[AP]
C101.5	Apply the probability concepts in transition from real problem to a probabilistic model.	[AP]

Course Contents:

MODULE I : LOGICAL PROOF'S & FUNCTIONS (20 Hrs)

Proofs: Definitions - Proof by cases - Proof by contradiction - Logical formulas - Propositions - Truth table - Logical operators - Tautologies and Contradictions – Contrapositive - Equivalences and implications - Predicates - Free and bound variables – Quantifiers - Universe of discourse - **Sets:** Basic sets - Operations on Sets – Law on Sets (without proof) - Cartesian product of sets. **Relations:** Binary relation -Types of relations and their properties - Relational matrix and graph of a relation - Equivalence relations - Partial ordering relation **Functions:** Classifications of functions – Induction - Ordinary induction and Strong induction - Recursive data types - Definition of recursive and structural induction.

MODULE II : NUMBER THEORY & GRAPH THEORY (20 Hrs)

Number Theory: Divisibility - Greatest common divisor - Euclid's algorithm - Prime numbers - Fundamental theorem of arithmetic - Modular arithmetic - Remainder arithmetic - Multiplicative inverses and cancelling - Relatively prime - Euler's theorem.- Chinese Reminder Theorem **Graph Theory:** Vertices and Degrees - Types of graphs - Handshaking theorem - Adjacency matrices - Walks and paths - Connectivity - Isomorphism - Directed acyclic graphs and scheduling – Matchings - The Stable marriage problem –Forests and trees - Spanning trees - Minimum weight spanning trees – Prim's algorithm - Kruskal's algorithm..

MODULE III : COUNTING & PROBABILITY (20 Hrs)

Sums and Asymptotics - Sums of Powers - Harmonic Numbers - Asymptotic Notation -The Division Rule - Counting Subsets - Sequences with Repetitions - The Pigeonhole Principle -Events and

Probability Spaces - The Four Step Method - Conditional Probability - The Four-Step Method for Conditional Probability - The Law of Total Probability - Baye's theorem - Random Variables – Discrete and continuous random variables - Distribution Functions - Bernoulli Distribution - Uniform Distribution - Binomial Distribution - Great Expectations - Conditional Expectation - Linearity of Expectation - Infinite Sums - Expectations of Products	
Total Hours:	**60**
Text Books:	
1	Tremblay J.P and Manohar R, "Discrete Mathematical Structures with applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
2	Koshy. T, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, Second Edition, 2007.
3	Eric Lehman, F. Thomson Leighton and Albert R. Meyer, "Mathematics for Computer Science", 14thEdition, MIT Open courseware, 2018.
Reference Books:	
1	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", sixth edition, Pearson Education Pvt Ltd., New Delhi, 2017
2	Kenneth H. Rosen, "Discrete Mathematics and its Applications", Eighth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Eighth Edition, 2021.
3	Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2004.
4	P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, New Delhi, Fifth Edition, 2019.
Web References:	
1	https://onlinecourses.nptel.ac.in/noc23_cs109/preview
2	https://onlinecourses.nptel.ac.in/noc23_cs120/preview
3	https://onlinecourses.nptel.ac.in/noc23_ma77/preview
4	https://onlinecourses.nptel.ac.in/noc23_ma72/preview
Online Resources:	
1	https://www.coursera.org/specializations/discrete-mathematics
2	https://www.cs.ucdavis.edu/~rogaway/classes/20/fall21/mit-book.pdf
3	https://mathworld.wolfram.com/topics/DiscreteMathematics.html
4	https://mathworld.wolfram.com/topics/NumberTheory.html

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C101.1	Remember	Quiz	20
C101.2	Understand	Presentation	20
C101.3 – C101.5	Apply	Tutorial	20
C101.3 – C101.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination							
Continuous Assessment (40%) [200 Marks]							End Semester Examination (60%) [100 Marks]
CA 1: 100 Marks			CA 2: 100 Marks				
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)			
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)		

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)(Theory)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
C101.1	1	1											1	
C101.2	2	2											1	
C101.3	3	3												
C101.4	3	3											1	
C101.5	3	3												

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

23SB101	ENGINEERING BIOLOGY	3/0/0/3

Nature of Course	C (Theory Concept)

Course Objectives:

1	To grasp biological engineering principles, procedures needed to solve real-world problems.
2	To give a basic knowledge of the applications of biological systems in relevant Industries
3	To understand the mutual dependence of modern biology and engineering
4	To give a basic knowledge of artificial organs and physiological assist devices.
5	To understand about the use of various nanomaterials towards biological applications

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Explain the structure of human physiology	[R]
C101.2	Compare biological and artificial neural networks.	[AN]
C101.3	Understand the compatibility and functioning of artificial organs inside the human being	[U]
C101.4	Understand the basic concepts of brain computer interface	[U]
C101.5	Understand the concepts of Nanomaterials for biotechnology	[U]

Course Contents:

HUMAN PHYSIOLOGY AND ARTIFICIAL ORGANS: 15

Cell and their structure-Transport of ions through cell - Different systems of human body-Biological neural networks- Artificial neural networks-applications of neural networks - Artificial Kidney-Artificial Pancreas

BCI: **15**

Fundamentals of BCI –Working of BCI – Classification of BCI – measuring of surgical and non-surgical BCI –Neurofeedback Training for BCI Control-signal processing and application.

NANOBIOLOGY: 15

Introduction to Nanobiology, Nanomaterials for antimicrobial coatings- medical implants– medical and defence textiles. Biosensors- biodevices and implantable devices. Nanomaterials for diagnosis and therapy- Implications of Drug delivery- various forms of nanocarriers -Polymeric Nanoparticles as drug carriers - Drug release mechanism-Targeted drug delivery.

Total Hours:	**45**

Text Books:

1	Leslie Cromwell.Bomedical Instrumentation and measurements-Prentice Hall,2011
2	Bernhard Graimann,BrendenAllison,GertPfurtscheller, Computer Interfaces:Revolutionizing Human-Computer Interaction, Springer 2010
3.	M Arumugam , Bio medical instrumentation,Anuradha Publications,2002

4.	B. Bhushan, Springer Handbook of Nanotechnology, Springer-Verlag, 2004
Reference Books:	
1	Malcom Carpenter, ―Textbook of Neuroanatomy‖, Mc. Graw hill Edition, 1996.
2	Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
3	MatewsG.G.,Neurobiology,SecondEdition,Blackwell Science,UK,2000
Web References:	
1	https://ocw.mit.edu/courses/biological-engineering/20-010j-introduction-to-bioengineering-be-010j-spring-2006/videos/Lecture-1-bioengineering/
2	https://www.technicalsymposium.com/alllecturenotes_biomed.html
3	https://ocw.mit.edu/courses/biology/7-28-molecular-biology-spring-2005/
Online Resources:	
1	https://onlinecourses.nptel.ac.in/noc16_ge03
2	https://onlinecourses.nptel.ac.in/noc17_ge04
3	https://onlinecourses.nptel.ac.in/nanobiotechnology

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1, C101.4,	Remember, Understand	Assignment	20
C101.2	Analyse	Seminar	20
C101.5	Understand	Assignment	20
C101.3	Understand	Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	40	40
Understand	40	40	40
Apply	10	10	10
Analyse	10	10	10
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Articulation Matrix														
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**
1	2	1	-	-	-	-	-	-	-	-	-	2	-	-
2	2	2	2	2	1	1	1	1	-	1	-	2	2	-
3	3	3	2	2	2	1	1	1	-	-	-	2	2	1
4	3	3	2	2	2	1	1	1	-	-	-	2	2	1
5	2	1	1	1	2	1	1	1	-	-	-	2	2	1
1	Reasonably agreed			2	Moderately agreed					3	Strongly agreed			

23TA101	HERITAGE OF TAMILS	1/0/0/1

Nature of Course:	C (Theory Concept)
Pre requisites:	NIL

Course Objectives:

1	To know various concepts of Tamil Language families.
2	To know about the essentialities of Heritage.
3	To understand the Aram concepts of Tamils and the cultural influence.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Know about the language families in India, impact of religions and the contribution of Bharathiyar and Bharathidhasan.	[U]
C101.2	Observe the growth of sculpture, making of musical instruments and the role of temples in socio and economic lives.	[U]
C101.3	Understand the significance of folklore and martial arts.	[U]
C101.4	Learn the sangam literature, sangam age and overseas conquest of Cholas.	[U]
C101.5	Understand the contribution of Tamils to Indian Freedom Struggle, role of Siddha medicine and print history of Tamil Books.	[U]

Course Contents:

Language and Literature: Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

Heritage - Rock Art Paintings to Modern Art – Sculpture: Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils. **Folk And Martial Arts:** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

Thinai Concept Of Tamils- Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature- Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.ContributionofTamilstoIndiannationalmovementandindianculture:Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total Hours:	**15**

Text-cum-Reference Books:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை(வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ்–முனைவர்இல. சுந்தரம் . (விகடன்பிரசுரம்).
3	கீழடி–வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4	பொருநை–ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Understand	Quiz	20
C101.2	Understand	Seminar	20
C101.3	Understand	Seminar	20
C101.4	Understand	Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	40	40
Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
C101.1	-	-	-	-	-	-	-	-	1	-	-	1	-	-
C101.2	-	-	-	-	-	-	-	1	1	-	-	1	-	-
C101.3	-	-	-	-	-	-	-	1	1	-	-	1	-	-
C101.4	-	-	-	-	-	-	-	-	1	-	-	-	-	-
C101.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-

23IT101	APPLICATION DEVELOPMENT PRACTICES	1/0/4/3
Nature of Course	F (Theory programming)	
Pre requisites	Nil	

Course Objectives:

1.	To discuss the essence of agile development methods.
2.	Ability to understand and apply Scrum framework.
3.	To set up and create a GitHub repository.
4.	To impart the knowledge of web application development platforms.
5.	To create interactive websites using HTML, CSS.
6.	To recognize the user experience design methodologies like Java script for responsive web design.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Relate the concepts of agile software engineering and its advantages in software development.	[R]
C101.2	Demonstrate the roles and responsibilities of Scrum, Lean Software Development and how to setup the GitHub repository.	[U]
C101.3	Analyze the working model and learn basic web concepts to develop Static and Dynamic websites.	[A]
C101.4	Utilize the knowledge of HTML, CSS and Bootstrap using forms to build modern interactive web applications.	[AP]
C101.5	Develop dynamic web pages using HTML5 with validation using Java Script objects and by applying different event handling mechanisms.	[AP]

Course Contents:

Module - I: 15 Hours

History of Traditional Software Development Model, Software Development Model and SDLC, “Waterfall Model” – An Overview, Waterfall or Sequential Based Development Model, “Real Life” – Waterfall Model, “Waterfall Model” – Advantages, “Waterfall Model” – Disadvantages, Agile Software Development – Definition, Agile Development Model, Graphical Illustration of Agile Development Model, Why use Agile?, Agile Manifesto and Principles, 12 Principles of Agile Methods, Agile Values, What is NOT an Agile software development?, Foundation of an Agile software development Method, Common Characteristics of Agile Methods, Agile Methods and Practices, When to use Agile Model?, Advantages of Agile Model, Disadvantages of Agile Model, Difference between Agile and Waterfall Model, Agile – Myths and Reality, Agile Market Insight. Introduction to SCRUM, Scrum Roles and Responsibilities, Scrum Core Practices and Artifacts, User Story, Sprint, Release Planning Meeting, Sprint Planning Meeting, Daily Scrum Meeting (Daily Stand up), Sprint Review Meeting, Retrospective, Product Backlog, Sprint Backlog, Burn-Down Chart, Velocity, Impediment Backlog. Definition of “Done”, Splitting User Story into Task, Why to Split User Story into Task?, Guidelines for Breaking Down a User Story into Tasks, Examples of Scrum Task Board, Planning Poker®, Planning Poker - Process/Steps, What are Story Points?, How do We Estimate in Story Points?, What Goes into Story Points? Introduction to Extreme Programming, The Rules of Extreme Programming, Extreme Programming (XP) – Principles, Extreme Programming (XP)

– Key Terms, Introduction to Lean Software Development, Principles of Lean Software Development, What is Kanban? Introduction to Git - Getting a Git Repository, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Tagging, Git Aliases, Git Branching, Branches in a Nutshell, Basic Branching and Merging, Branch Management, Remote Branches, Rebasing. Introduction to GitHub – Introduction, Set up Git, Create a repository, GitHub Flow, Contribution to Projects, Communicating on GitHub. Linux Basic Commands - Linux Basic Commands, Linux File Permissions, Basic System Administration, Process Management, Archival. Linux Shell Script - Shell Basics, Writing first script, Conditional statements, Loops, Command line arguments, Functions & file manipulations, Background processes, Scheduling processes -At, batch & Cron -Networking.

Module - II: 15 Hours

HTML Basics - Understand the structure of an HTML page, New Semantic Elements in HTML 5, Learn to apply physical/logical character effects, Learn to manage document spacing. Tables - Understand the structure of an HTML table, Learn to control table format like cell spanning, cell spacing, border. List - Numbered List, Bulleted List, Working with Links, Understand the working of hyperlinks in web pages, Learn to create hyperlinks in web pages, Add hyperlinks to list items and table contents. Image Handling - Understand the role of images in web pages, Learn to add images to web pages, Learn to use images as hyperlinks. Frames - Understand the need for frames in web pages, Learn to create and work with frames. HTML Forms for User Input - Understand the role of forms in web pages, Understand various HTML elements used in forms, Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box. New Form Elements - Understand the new HTML form elements such as date, number, range, email, search and data list, Understand audio, video, article tags.

Module - III: 15 Hours

Introduction to Cascading Style Sheets - What CSS can do, CSS Syntax, Types of CSS. Working with Text and Fonts - Text Formatting, Text Effects, Fonts. CSS Selectors - Type Selector, Universal Selector, ID Selector, Class selector. Colors and Borders – Background, Multiple Background, Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border, Implementing CSS3 in the "Real World" – Modernizr, HTML5 Shims, SASS, and Other CSS Preprocessors, CSS Grid Systems, CSS Frameworks. Introduction to Bootstrap – Introduction, Getting Started with Bootstrap, Bootstrap Basics, Bootstrap grid system, Bootstrap Basic Components, Bootstrap Components, Page Header, Breadcrumb, Button Groups, Dropdown, Nav & Navbars. JavaScript Essentials - Var, Let and Const keyword, Arrow functions, default arguments, Template Strings, String methods, Object de-structuring, Create, apply, prototype, bind method, Spread and Rest operator, Typescript Fundamentals, Types & type assertions, Creating custom object types, function types, Typescript OOPS - Classes, Interfaces, Constructor, Decorator & Spread Operator, Difference == & === ,

Asynchronous Programming in ES6, Promise Constructor, Promise with Chain, Promise Race.	
Total Hours	**45**

Lab Component:

S. No	List of Experiments
1	Design a web page using HTML basic tags.
2	Develop web site with suitable contents and links.
3	Design web pages using lists and tables.
4	Build a web client-side Login, Registration form and Dashboard with drop down menus.
5	Develop a HTML form and validation using HTML5 features.
6	Create a website using HTML: To embed an image map in a web page. To fix the hot spots. Show all the related information when the hot spots are clicked.
7	Apply style specification in HTML page using CSS.
8	Develop dynamic web application using HTML, CSS and JavaScript.
Total Hours	**30**

Text Books:

1.	Roman Pichler, “Agile Product Management with Scrum Creating Products that Customers Love”, Pearson Education, 1st Edition, 2010.
2.	Jeff Sutherland, “Scrum the Art of Doing Twice the Work in Half the Time”, Random House Publisher,1st Edition, 2015.
3.	Scott Chacon, Ben Straub, “Pro GIT”, CreateSpace Independent Publishing Platform, 2017.
4.	Richard Blum, Christine Bresnahan, “Linux Command Line and Shell Scripting BIBLE”, Wiley India Pvt. Limited, 2020.
5.	Jennifer Niederst Robbins., “Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics”, O'Reilly Media, 5th Edition, 2018.
6.	Jennifer Smith and the AGI Creative Team, “Web Design with HTML and CSS”,Wiley Publisher,1st Edition, 2011.
7.	Stephen Blumenthal, “JavaScript: JavaScript for Beginners - Learn JavaScript Programming with ease”,1st Edition, 2017.

Reference Books:

1.	Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Prentice Hall, 2nd Edition, 2014.
2.	Mike Cohn, “User Stories Applied: For Agile Software”, Addison Wesley,2nd Edition, 2016.
3.	Thomas a Powell, “HTML & CSS: The Complete Reference”, 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
4.	Russ Ferguson, “Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development”, Apress Publishers, 3rd Edition, 2019.

5.	Deitel, Deitel, Goldberg, “Internet and World Wide Web – How to program”, 5th Edition, Prentice Hall Publishers, 2012.
Web References:	
1.	https://www.coursera.org/specializations/agile-development
2.	https://www.edx.org/learn/agile
3.	https://nptel.ac.in/courses/106/105/106105182/
4.	https://developer.mozilla.org/en-US/docs/Web/HTML
5.	https://developer.mozilla.org/en-US/docs/Web/CSS
6.	https://developer.mozilla.org/en-US/docs/Web/JavaScript
Online Resources:	
1.	http://www.agilenutshell.com/
2.	https://www.atlassian.com/agile/scrum
3.	https://www.youtube.com/user/AgileMikeCohn
4.	https://www.coursera.org/learn/html-css-javascript-for-web-developers
5.	https://online-learning.harvard.edu/subject/javascript

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C101.1	Remember	Assignment - 1	**20**
C101.2, C101.3	Understand Analyze	Quiz	**20**
C101.4	Apply	Case Study	**20**
C101.5	Apply	Assignment - 2	**20**

Assessment based on Summative - Theory		
Bloom's Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	20	10
Understand	30	30
Apply	40	50
Analyse	10	10
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (50%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	30	20	20
Understand	20	30	30
Apply	40	40	40
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								**End Semester Practical Examination (50%)**
CA 1 (100 Marks)			**CA 2 (100 Marks)**			**Practical Exam (100 Marks)**		
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75M)**	**SA (25M)**	
	Component-I (20 Marks)	**Component-II (20 Marks)**		**Component-I (20 Marks)**	**Component-II (20 Marks)**			

Course Outcomes (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C101.1	2	2	1	1								2	3	2	2
C101.2	3	2	3	3	3	2						2	3	3	2
C101.3	3	2	3	3	3	2						2	3	3	2
C101.4	3	2	3	3	3	2						2	3	3	2
C101.5	3	2	3	3	3	2						1	3	3	2

23CS101	PROBLEM SOLVING USING C++	1/0/4/3
Nature of Course	K (Problem Programming)	
Pre requisites	NIL	

Course Objectives:

1	To learn the fundamental programming concepts and methodologies which are essential to build good C++ programs.
2	To gain knowledge on control structures and functions in C++.
3	To provide the basic object-oriented programming concepts and apply them in problem solving.
4	To introduce file streams and operations for storing data permanently.
5	To know generic programming paradigm.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Illustrate the fundamental concepts and methodologies required to develop a program for given problems.	[U]
C101.2	Develop a program for real-time problems with pointers and objects.	[AP]
C101.3	Apply the Constructors, destructors, and Overloading concepts to solve the solve.	[AP]
C101.4	Develop C++ programs with Interfaces, Exception and File processing	[AP]
C101.5	Implement the concepts on file streams, I/O and Lambda Expression.	[AP]

Course Contents:

Module I C++ Programming Fundamentals **15 Hours**

C vs C++, Basic of OOPS, the main () function, Header files, Basic Input and Output (I/O) using cin and cout, Variable, Constant. **Operators:** Arithmetic Operators, Assignment Operators, Relational Operators, Logical Operators, Bitwise Operators, Other Operators, Operator Precedence. Control Statements: if, if...else and Nested if...else, switch case, break and continue, Loops - for loop, while loop, do while loop, goto. **Arrays and Strings:** 1D array, 2D array, Strings, String functions. **Function:** Basics, call by value, call by reference & return by reference, Inline function, overloading Functions, inline Functions, Recursive Functions. **Pointers:** Pointer, Dynamic Memory Allocation.

Module II Object Oriented Concepts **15 Hours**

Classes and Objects, public, private, protected. **Constructors and destructors**: Overloaded Constructor, Copy Constructor, Shallow Copying Deep Copying. **Overloading:** this' Pointer, structs vs Classes, Friends of a class, Operator Overloading, Inheritance, Overloading vs Overriding, Polymorphism, Virtual Functions, Pure Virtual Functions and Abstract Classes.

Module III Files and Generic Programming **15 Hours**

Abstract Classes as Interfaces, Exception, Files, Streams and I/O, STL, Generic Programming, Lambda Expression.

Total Hours (Theory)	**45 Hours**

Lab Component

S.No.	Lab Exercise
1.	Practice of C Programming using Branching and Iterative constructs.
2.	Programs using arrays and strings.

3.	Programs using Functions.
4.	Programs using Structures and Pointers.
5.	Programs using classes and objects.
6.	Programs using constructor and destructor.
7.	Programs using method overloading, operator overloading and polymorphism concepts.
8.	Programs using friend class.
9.	Programs using virtual functions and abstract class.
10.	Programs using inheritance concepts.
11.	Programs using exception handling concept.
12.	Programs using Files.
13.	Mini project
Total Hours (Lab)	**30 Hours**
Total Hours(45+30)	**75 Hours**

Text Books:	
1.	E Balagurusamy,"Object Oriented Programming With C++", 4th Edition, Tata McGraw-Hill Education, 2008.
2.	YashavantP. Kanetkar, "Let us C++", BPB Publications, 2020.
3.	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.
Reference Books:	
1.	Herbert Schildt, "The Complete Reference C++", 4th edition,MH, 2015.
2.	John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.
Web References:	
1.	https://www.geeksforgeeks.org/c-plus-plus/
2.	http://web.stanford.edu/class/cs106l/
Online Resources:	
1.	https://nptel.ac.in/courses/106101208
2.	https://www.hackerrank.com/domains/cpp
3.	https://codeforces.com/blog/entry/74684
4.	https://www.hackerearth.com/practice/notes/tricky-and-fun-programming-in-c/

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment,Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C101.1	Understand	Quiz	20
C101.2 & C101.3	Apply	Assignment	20
C101.4	Apply	Group Assignment	20
C101.5	Apply	Case Study	20

Assessment based on Summative Assessment - Theory		
Bloom's Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	20	20
Understand	40	30
Apply	40	50
Analyse	-	-
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Practical Examination (50%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	20	20
Understand	30	20	20
Apply	50	50	50
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Practical Examination									
Continuous Assessment (50%)									End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)			
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)		
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)				

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C101.1	3	3											3	
C101.2	3	3	3	2	2				2	1		3	3	2
C101.3	3	3	3	2	3				2	1		3	3	2
C101.4	3	3	3	3	3				3	2		3	3	2
C101.5	3	3	3	3	3				2	2		2	3	2
C101	**3**	**3**	**3**	**3**	**3**				**3**	**2**		**2**	**3**	**2**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

23AS102	APPLIED SCIENCE LABORATORY (Common to B.E. CSD, CSE, CSE (CYBER SECURITY), ECE, EEE, MCT & B.Tech. AI&DS, IT	0/0/4/2

Nature of Course	: E (Skill based)
Pre requisites	: Basic Applied Science laboratory skills

Course Objectives:

1.	To carry out experiments to understand the basic laws of magnetism.
2.	To Understand of how objects become electrically charged and how electrical charge is transferred from one object to another.
3.	To understand the principles and applications of electrochemistry and learning electro-analytical methods, and explore the knowledge of various energy sources and storage devices.
4.	To understand the concepts of photo-physical and photochemical processes in spectroscopy.

Course Outcomes:
Upon completion of the course, students shall have ability to

C102.1	To determine the magnetic field around a current carrying conductor	[E]
C102.2	To determine the rate of growth or decay in a resistor -capacitor circuit and to estimate the resonant frequency and Q-factor.	[E]
C102.3	To determine the relationship between the magnetic flux density and the magnetizing field strength and to find the specific resistance of the wire.	[E]
C102.4	To determine the pH, single electrode potential using reference electrodes and Electroplating process based on electrolytic cell.	[E]
C102.5	Interpret the principle and working of Spectroscopic technique.	[E]

Lab Components:

1	Determination of Magnetic field along the axis of current carrying coil-Stewart and Gee method.	[E]
2	Determination of characteristics of RC circuit to find the time constant.	[E]
3	Determination of characteristics of LCR circuits.	[E]
4	Determination of Hysteresis loss.	[E]
5	Determine the Specific resistance- Carey fosters bridge	[E]
6	Determination of strength of strong acid by pH metry.	[E]
7	Estimation of dissolved oxygen in waste water using Winkler's method.	[E]
8	Determination of single electrode potential of Zinc and Copper by Potentiometric method.	[E]
9	Determination of cathode efficiency of Nickel using electroplating process.	[E]
10	Spectrophotometry-Estimation of iron in sample water.	[E]
	Total Hours:	**30**

Text Book:

1	Anoop Sing Yadav "Applied Physics Lab Manual" Vayu Education of India Publisher, 2018.
2	Sesha Sai Kumar Vemula, Manual for Experiments in Engineering Physics, LAP LAMBERT Academic Publishing 2017

3	C. S. Robinson, Dr. Ruby Das, “A text book of Engineering practical physics”, Laxmi Publications Pvt. Ltd., 2016.
4	S.L.Gupta and V Kumar “Practical Physics Volume -II”, Pragati Prakashan ., 2023.
5	Method of Sampling and Test (Physical and Chemical) for Water and Wastewater- Iron, 2003, Part-53; First Revision.
6	Method of Sampling and Test (Physical and Chemical) for Water and Wastewater: pH Value (2001; Part-50; Coagulation Test).
7	Method of Sampling and Test (Physical and Chemical) for Water and Wastewater, Chemical Oxygen Demand, 2012, Part-58.
8	Science and Technology Laboratory Manual. E-Book. NIOS, 2012.
References:	
1	Dr. Ruby Das and Prashant Kumar Sahu,A Textbook of Engineering Physics Practical , 2016,2nd Edition
2	S. L. Gupta and Dr. V. Kumar, “Practical physics with viva voice”, Pragati Prakashan Publishers, Revised Edition, 2009.
3	M. N. Avadhanulu, A. A. Dani and Pokely P.M, “Experiments in Engineering Physics”, S. Chand&Co,2008.
4	Sawyer, C. N., McCarty, P. L., and Parkin, G. F. 2017. Chemistry for Environmental Engineering. Fifth Edition, McGraw-Hill, Inc., New York.
5	American Public Health Association et al, Standard Methods for the Examinations of Water and Waste Water, APHA. 2017.
6	AWWA, WEF, APHA, 2017, Standard Methods for the Examination of Water and Wastewater (Method: 5210B, BOD).
Web References:	
1	https://vlab.amrita.edu/
2	https://bop-iitk.vlabs.ac.in/basics-of-physics/
3	http://vlabs.iitb.ac.in/
4	https://www.iitg.ac.in/
5	https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html
6	https://ee1-nitk.vlabs.ac.in/exp/determination-of-biological-oxygen/simulation.html
7	https://www.youtube.com/watch?v=pORJQyP-2j8
8	https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html
9	https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (60%) [100 Marks]**		**End SemesterPractical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	0	0	0
Understand	10	10	10
Apply	30	30	30
Analyze	30	30	30
Evaluate	30	30	30
Create	0	0	0

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
C102.1	3	2	1	2					2			1	1	
C102.2	3	2	1	2					2			1	1	
C102.3	3	2	1	2					2			1	1	
C102.4	3	2	1	2					2			1	1	
C102.5	3	2	1	2					2			1	1	
	3	Strongly agreed		2	Moderately agreed				1	Reasonably agreed				

23EC201	ELECTRONIC CIRCUITS	3/0/0/3

Nature of Course	G (Theory analytical)

Course Objectives:

1	To introduce the concept of biasing of BJTs and MOSFETs and enable the students to understand the frequency analysis of amplifiers
2	To enable the students to understand the concept of negative feedback in amplifiers
3	To study about the power amplifiers and their thermal stability.
4	To understand the analysis and design of oscillators
5	To allow students to get familiarized with the concept of tuned amplifiers and applications

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Understand the biasing of BJT & the Basic Concepts of BJT Amplifiers	[U]
C201.2	Understand the biasing of MOSFET & the Basic Concepts of MOSFET Amplifiers	[U]
C201.3	Analyze & Understand the small signal analysis of BJT amplifiers	[AN]
C201.4	Illustrate the operation of various types of Power Amplifiers	[AN]
C201.5	Apply the concepts of negative feedback and positive feedback in amplifiers	[AP]
C201.6	Design and develop a circuit based on the concepts of oscillators	[AN]

Course Contents:

Transistor biasing & Amplifiers: **15**

Biasing: Operating point, Bias Stability, BJT- Voltage divider biasing, Collector feedback biasing, MOSFET Biasing, Bias Compensation, Amplifiers – Small Signal Analysis of transistor using hybrid model BJT (CE & CC), MOSFET (CS & CD), High Frequency Model of BJT, Cascaded Amplifiers(Two Stage)

Power amplifiers: **15**

Power Amplifiers: Classification of amplifiers (Class A, B, AB, C) - Efficiency of Class A (Direct coupled and transformer), Class B - Complementary-Symmetry, Push-Pull power amplifiers - Calculation of Power Output, Efficiency and power dissipation - Crossover distortion, heat sink

Feedback amplifiers and Signal generation: **15**

Feedback amplifiers: Impact of negative feedback on amplifiers properties, Feedback topologies and their properties, analysis of practical feedback amplifiers. Signal Generation: Principles of Oscillators, Sinusoidal oscillators: RC, LC and Crystal oscillators.

Total Hours:	**45**

Text Books:

1	Jacob Millman, Chritos C Halkias, Satyabrata Jit, 'Electronic Devices and Circuits', 4th edition (SIE), McGraw Hill Education India Private Ltd., 2015
2	Salivhanan, 'Electron Devices and Circuits', 4th edition, McGraw Hill Education India Private Ltd., 2016
3	Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011

Reference Books:

1	Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education / PHI, 2014.
2	Floyd, "Electronic Devices", 9th Edition, Pearson Education, 2011
3	David A. Bell, Electronic Devices & Circuits, 5th Edition, PHI, 2008
4	Donald.A. Neamen, Electronic Circuit Analysis and Design –2 nd Edition, Tata Mc Graw Hill, 2009.

Web References:	
1	http://www.allaboutcircuits.com/
2	http://www.circuitstoday.com/
3	https://circuitdigest.com/electronic-circuits/
4	https://www.eleccircuit.com/
Online Resources:	
1	http://www.nesoacademy.org/electronics-engineering/analog-electronics/analog
2	https://onlinecourses.nptel.ac.in/noc18_ee11

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Ca-se Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C201.1	Understand	Quiz	20
C201.2	Understand	Assignment	20
C201.3, C201.4	Apply	Quiz	20
C201.5, C201.6	Apply	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1: [60 Marks]	CIA2: [60 Marks]	
Remember	20	10	10
Understand	40	40	40
Apply	40	40	30
Analyse		10	20
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Articulation Matrix														
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**
1	2	2	2	2	-	-	-	-	-	-	-	-	2	-
2	2	2	2	2	-	-	-	-	-	-	-	-	2	-
3	2	2	2	2	-	-	-	-	-	-	-	-	1	-
4	3	3	2	2	-	-	-	-	-	-	-	-	2	-
5	3	3	2	2	2	-	-	-	1	1	-	-	3	-
6	1	2	2	2	-	-	-	-	-	-	-	-	1	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed		

23EC202	DIGITAL SYSTEM DESIGN	3/0/0/3

Nature of Course	:G (Theory & Analytical)

Course Objectives:

1	To introduce the principles of Canonical forms to minimize the logic expression
2	To enable the students to understand the operation of various combinational and sequential logic circuits.
3	To allow students to analyze synchronous sequential circuits.
4	To enable the students to construct PLD's and their roles in digital systems
5	To enable the students to write verilog code for combinational logical circuits.

Course Outcomes:
Upon completion of the course, students shall have ability to

C202.1	Demonstrate knowledge on canonical forms and their realization using logic gates	[U]
C202.2	Applying K- Map and Tabulation method to minimize the Boolean functions.	[AP]
C202.3	Understand various combinational logic and sequential logic circuits and their implementation	[AP]
C202.4	Apply synchronous sequential logic for reducing state reduction.	[AP]
C202.5	Understanding Programmable logic devices and applying for logical function implementation.	[AP]
C202.6	Apply verilog code for realization of combinational logical circuits.	[AP]

Course Contents:

Canonical Forms and Minimization **15**

Minterms, Maxterms, Complements, Implementation using universal logic gates, Minimizing functions using Karnaugh maps – 2,3 & 4 Variables, Minimization using Quine McClusky method – 4 Variables.

Combinational and Sequential logic circuits: **15**

Adders and Subtractors, Multiplexer, Demultiplexer, Encoders, Decoders, Two Bit Magnitude comparator, Carry Look-ahead adder, Code converters, – Binary to Gray, BCD to Excess-3 Parity generator and Checker. **Sequential logic circuits:** Latches and flip flops, Realization of one flip flop using other flip flops, Asynchronous Up counter and Synchronous counters, Shift registers –SISO,SIPO,PISO,PIPO, Application of Shift registers. Case Study: DTMF Decoder.

Synchronous Sequential logic: **15**

Analysis of Synchronous Sequential Circuits, Sequence generator, State transition diagrams and state transition tables. PLD's - PLA, PAL, Modelling basic combinational circuits using Verilog**.**

Total Hours:	**45**

Text Books:

1	M. Morris Mano, Michael D.Ciletti., "Digital Design",6th Edition, Pearson education, 2018
2	Donald D. Givone, "Digital principles and Design", 2004, McGraw Hill Education India Private Ltd., 29th Reprint, 2018
3	Samir Palnitkar,"Verilog HDL: A Guide to Digital Design and Synthesis" Prentice Hall, Second Edition, 2018

Reference Books:

1	J. F. Wakerly, "Digital Design - principles and practices", 4th Edition, Pearson Education, 2008.
2	Thomas L. Floyd, Digital Fundamentals, 10th Edition, Pearson Education, New Delhi, 2017

3	John.M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2006.
Web References:	
1	https://www.tutorialspoint.com/digital_circuits/digital_circuits_useful_resources.htm
2	http://www.technologystudent.com/elec1/dig1.htm
3	*https://www.electronicsforu.com/technology-trends/learn-electronics/digital-electronics-basics*
4	*https://www.electrical4u.com/digital-electronics/*
Online Resources:	
1	https://nesoacademy.org/ec/05-digital-electronics
2	https://www.electronics-tutorials.com/basics/digital-basics.htm
3	https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
4	https://www.tutorialandexample.com/digital-electronics-tutorial

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C202.1	Understand	Quiz	20
C202.2, C202.3	Apply	Assignment	20
C202.4, C202.5	Apply	Assignment	20
C202.6	Apply	Simulation using Logisim	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	10	10
Understand	40	40	40
Apply	40	40	30
Analyse		10	20
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Articulation Matrix														
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
1	3	2	1	1	-	-	-	-	1	-	-	-	2	-
2	3	2	1	1	-	-	-	-	-	-	-	-	2	-
3	3	2	1	1	-	-	-	-	-	-	-	-	2	-
4	3	2	2	1	-	-	-	-	-	-	-	-	2	-
5	3	2	2	1	-	-	-	-	-	-	-	-	2	-
6	3	2	2	1	-	-	-	-	-	-	-	-	2	-
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23MA201	MATHEMATICS II CSE/IT/AI&DS/CSD/CYBER/EEE/ECE/MCT	3/1/0/4

Nature of Course	J (Problem analytical)
Prerequisites	-

Course Objectives:

1	To study the basic probability concepts
2	To apply mathematical linear programming techniques to solve constrained problems.
3	To formalize the notion of strategic thinking and rational choice by using the tools of game theory
4	To acquaint the student with transform techniques which are used in variety of engineering fields.
5	To introduce the concepts of Group theory

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Recall the concepts of basic probability	[R]
C201.2	Formulate and analyze the existence of solutions to optimization problems	[U]
C201.3	Formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.	[AP]
C201.4	To apply game theory in searching, auctioning and trading.	[AP]
C201.5	Apply Fourier transform to discrete time sequence and use of group theory and coding theory in communication.	[AP]

Course Contents

MODULE 1: Probability theory **(20 hrs)**

Deviation from mean - Markov's inequality – Chebyshev's theorem - properties of variance – sums of random variables – Gambler's ruin - Random walk on graphs - Chebyshev's inequality – Deviation on sum of independent random variables - weak law of large numbers – Van der Waerden's theorem (Statement only) - Chernoff bounds – above the mean and under the mean of Chernoff Bound.

MODULE 2: Linear Programming and Game Theory **(20 hrs)**

Basics of Linear Programming – Formulations of Linear Programming Problems - Graphical method - Simplex Method - Linear Programming in Matrix Form – Two phase method - Duality - Transportation Problem - Initial Basic Feasible solutions - Optimal solution by MODI method. Game theory: Introduction - Zero-Sum Matrix Games – payoff matrix - The Minimax and Maximin theorem - mixed strategies – graphic solution of games.

MODULE 3: Fourier Analysis & Group Codes **(20 hrs)**

Fourier series: Half range series – Discrete Fourier transform - Properties: Statement and Problems – Computing using convolution of sequences using Fast Fourier transform – Fourier transforms modulo p and faster integer multiplication. Concept and simple Applications of Groups, subgroups, cosets – linear codes – error correcting codes – hamming codes – perfect codes.

Total Hours:	**60 Hrs**

Text Books:

1	H. Pishro-Nik, "Introduction to probability, statistics, and random processes", Kappa Research LLC, 2014.
2	Hamdy A. Taha, Operations Research: An Introduction, 10th Edition, Pearson,2019.
3	T Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGrawHill, New Delhi, 2007.
4.	Erwin Kreyszig, "Advanced Engineering Mathematics", 13th Edition, John Wiley & Sons, Inc.

Reference Books:

1	S.C. Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, twelth edition, Sulthan Chand and sons,2014.
2	Eric Lehman, F.Thomson Leighton and Albert R.Meyer, Mathematics for Computer Science, 14th Edition, MIT Open courseware, 2018.
3	Kanti Swarup, P.K.Gupta, Manmohan, Operations research, 2nd Edition, Sultan Chand and Sons, 2015
Web References:	
1	https://archive.nptel.ac.in/courses/111/105/111105090/
2	https://archive.nptel.ac.in/courses/110/104/110104063/
3	https://archive.nptel.ac.in/courses/111/101/111101164/
4	https://archive.nptel.ac.in/courses/111/106/111106113/
Online Resources:	
1	http://discrete.openmathbooks.org/dmoi3.html
2	https://ocw.mit.edu/courses/18-310-principles-of-discrete-applied-mathematics-fall-2013/pages/syllabus/
3	https://www.csie.ntu.edu.tw/~sylee/courses/dm/resources.htm
4	https://www.maa.org/press/ebooks/resources-for-teaching-discrete-mathematics
5	https://see.stanford.edu/Course/EE261/137

Continuous Assessment				End Semester Examination	Total
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C201.1	Remember	Quiz	20
C201.2	Understand	Seminar	20
C201.3 – C201.5	Apply	Tutorial	20
C201.3 – C201.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1: 100 Marks			**CA 2: 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Outcomes (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C201.1	1	1	1										1		
C201.2	1	2	1										2		
C201.3	3	3	2										2		
C201.4	1	1	2										1		
C201.5	2	1	2										2		

23TA201	TAMILS AND TECHNOLOGY	1/0/0/1
Nature of Course	C (Theory Concept)	
Pre requisites	NIL	

Course Objectives:

1	To know about weaving, ceramic, design and construction technologies in sangam age.
2	To know the significance of technologies such as manufacturing, agriculture and irrigation.
3	To understand the development of Scientific Tamils and Tamil Computing.

Course Outcomes :
Upon completion of the course, students shall have ability to

C201.1	Describe about the weaving industry in sangam age and ceramic technology.	[U]
C201.2	Observe the design of houses, sculptures and construction of temples.	[U]
C201.3	Relate the various manufacturing materials and stone types in Silappathikaram.	[U]
C201.4	Understand the significance of agriculture and irrigation technology in ancient period.	[U]
C201.5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.	[U]

Course Contents:

Module – I: **5 Hours**

Weaving and Ceramic Technology: Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. **Design and Construction Technology:** Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Module – II: **5 Hours**

Manufacturing Technology: Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and gold - Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram. **Agriculture and Irrigation Technology:** Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

Module – III : **5 Hours**

Scientific Tamil & Tamil Computing: Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total Hours	**15**

Text Books:

1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4.	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
Reference Books:	
1.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C201.1	Understand	Seminar	20
C201.2	Understand	Quiz	20
C201.3, C201.4	Understand	Quiz	20
C201.5	Understand	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	40	40
Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.3	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.5	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1

23CD201	DATABASE MANAGEMENT SYSTEMS	1/0/4/3
Nature of Course:	D (Theory Application)	
Prerequisites:	Nil	

Course Objectives:

1	To introduce fundamental concepts of Data Base Management Systems and concepts of Relational Data Models.
2	To explain Relational algebra, Relational calculus and Normalization.
3	To implement different relational model constraints and SQL queries.
4	To manage Database using transactions, concurrency and query optimization.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C201.1	Discuss the basic concepts and various data models used in database design	[U]
C201.2	Illustrate Relational algebra, Relational calculus and Normalization.	[AP]
C201.3	Write SQL commands and Subqueries with Constraints.	[AP]
C201.4	Determine Appropriate transactions, views, cursors and triggers to perform the given task.	[AP]
C201.5	Analyze database storage structures, query processing and recovery system.	[A]

Course Contents:

MODULE I INTRODUCTION **15 Hours**

Introduction to DBMS, Characteristics of DBMS, DBMS vs File Systems, need for DBMS, Three Level DBMS Architecture, Data Models – Introduction, Benefits, and Phases, ER Diagrams – Symbols, Components, Relationships, Weak entities, Attributes, Cardinality, Relational Algebra, Domain Relational Calculus, Tuple Relational Calculus, Normalization - 1NF, 2NF, 3NF, BCNF, 4NF

MODULE II CONSTRAINTS AND SQL COMMANDS **15 Hours**

DDL Commands - Create, Drop, Alter, Truncate, Rename, Keys - primary Key, Foreign Key DML Commands - Select, Insert, Update, Delete, Any, All, In, Exists, Non Exists, Union, Intersection, Subqueries - nested, correlated, Joins- Inner, Outer, and Equi, Functions - SUM, COUNT, AVG, MIN, MAX, Clauses - Group By, Having By, Embedded SQL, Dynamic SQL, Transaction Concepts – Transaction model – ACID Properties – Serializability –Transactions as SQL statements.

MODULE III QUERIES AND TRANSACTIONS **15 Hours**

Creation and Dropping of Views, Creation and Execution of Stored Procedures Cursors and Triggers - Opening, Fetching and Closing, Creation , Insertion, Deletion and Updating Database Applications: Payroll Processing Systems, Railway Reservation Systems, Bank Management System Introduction, Storage media and file structures, B+ Tree Hashing – static and Dynamic, Introduction to Query Processing – Issues in query optimization – Steps in query processing, Concurrency control and transactions, Lock based protocols Recovery System – Failure classification

Lab Experiments:

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views
7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
8. Mini Project (Application Development)

i) IT Training Group Database ii) Blood Donation System iii) Salary Management System iv) Traffic Light Information System	
Total Hours:	**45+30**
Text Books:	
1	Abraham Silberschatz, Henry F Korth, S Sudarshan, “Data base System Concepts”, 7th Edition, McGraw hill, 2020.
2	Vijay Krishna Pallaw, “Database Management Systems”, 2nd Edition Asian Books Private Limited, 2010.
3	Mark L. Gillenson, "Fundamentals of Database Systems", 7th Edition, Wiley India Pvt. Limited, 2008.
Reference Books:	
1	Raghu Ramakrishnan, Johannes Gehrke, Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw-Hill Education, 2017
2	C. Date, "SQL and Relational Theory", O'Reilly Media, Incorporated, 2011.
Web References:	
1	http://www.sqlcourse.com/
2	https://www.w3schools.com/sql/
3	https://www.geeksforgeeks.org/dbms/
Online Resources:	
1	https://www.coursera.org/learn/database-management
2	https://www.udemy.com/database-management-system/
3	https://onlinecourses.swayam2.ac.in/cec22_cs18/preview

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C201.1	Understand	Quiz	**20**
C201.2	Apply	Case Study	**20**
C201.3, C201.4	Apply	Tutorial	**20**
C201.5	Analyse	Assignment	**20**

Assessment based on Summative and End Semester Examination - Theory		
Bloom’s Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	10	10
Understand	40	30
Apply	50	40

Analyse	-	20
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (50%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	20	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	20	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination							
Continuous Assessment (50%)							**End Semester Practical Examination (50%)**
CA 1 (100 Marks)			**CA 2 (100 Marks)**			**Practical Exam (100 Marks)**	
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75M)**	**SA (25M)**
	Component-I (20 Marks)	**Component-II (20 Marks)**		**Component-I (20 Marks)**	**Component-II (20 Marks)**		

Course Articulation Matrix															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C201.1	3	1			1					1		1	2		1
C201.2	3	3	3	3					2	2		3	3	2	2
C201.3	3	3	2	1					2	1	2	3	3	2	2
C201.4	3	3	2	2	2				2	1	2	2	3	2	2
C201.5	3	2	2		2				1	2	2	3	2	2	2

23CY201	JAVA PROGRAMMING	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	-	

Course Objectives:

1	To understand the basic concepts of core java.
2	To employ different types of modifiers and Control statements
3	To implement and interpret Arrays and Strings concepts
4	To implement streams and java console formatting features

Course Outcomes :
Upon completion of the course, students shall have ability to

C201.1	Infer the basic concepts of java programming.	[U]
C201.2	Illustrate the usage of different aspects of Controls statements in real world scenarios.	[AP]
C201.3	Apply Array and strings in real time environment.	[AP]
C201.4	Analyse and Interpret StringBuffer and StringBuilder Classes	[A]
C201.5	Utilize the functionalities of streams and java console class.	[AP]

Course Contents:

MODULE I Introduction to Java **15 hours**

Introduction to Java: Java Architecture- JVM, JRE & JDK, Keywords, Features of Java, Console input and output statements, variables and Identifiers, Scope of Variables, Data types, Type Conversion, Comments, Command Line Arguments, Access Modifiers **Operators** - Unary Operator- Arithmetic Operator- Shift Operator - Relational Operator - Bitwise Operator - Logical Operator - Ternary Operator and Assignment Operator. **Decision Statements** - if Statements, if-else Branching, switch Statements.

MODULE II Loops, Array & Strings **15 Hours**

Looping Statements : using for loop, using while Loops, Using do Loops. **Jump Statements:** using break and continue, Unlabelled Statements, Labelled Statements. **Arrays:** Declaration, Instantiation and Initialization of Java Array, Types of Array - Single Dimension array, Multi-dimension array **Strings:** String, StringBuilder, and StringBuffer, The String Class, Important Facts About Strings and Memory, Important Methods in the String Class, The StringBuffer and StringBuilder Classes, Important Methods in the StringBuffer and StringBuilder Classes, File Navigation and I/O.

MODULE III Java I/O **15 Hours**

Streams: Types of Streams, The Byte-stream I/O hierarchy, Character Stream Hierarchy, Random Access File class, The java.io.Console Class, Serialization, Dates, Numbers, and Currency, Working with Dates, Numbers, and Currencies, Parsing, Tokenizing, and Formatting, Locating Data via Pattern Matching, Tokenizing.

Total Hours	**45**

List of Component:

S. No.	Lab Exercises
1	Implementation of simple java program using Command Line Arguments
2	Implementation of simple java programs using decision making statements
3	Implementation of simple java programs using Looping statements
4	Implementation of Simple java programs using Jump statements
5	Implementation of 1D Array
6	Implementation of 2D Array
7	Implementation of String functions
8	Implementation of simple java program using Streams
9	Implementation of simple java program using Date and Number classes
10	Implementation of simple java program using Tokenizing
	Total Hours 30

Text Books:

1.	Herbert Schildt, “Java: The Complete Reference”, 9th edition, Tata McGraw Hill, 2014.
2.	Kathy Sierra, “Head First Java: A Brain-Friendly Guide, 2nd Edition, Oreilly, 2009.
3.	Herbert Schildt, “Java A Beginner's Guide, Create, Compile and Run Java Programs Today”, 8th edition, Tata McGraw Hill, 2020.

Reference Books:

1.	Paul Deitel, Harvey Deitel, ”Java How To Program”, 10th Edition, Prentice Hall Publications, 2014.
2.	Y. Daniel Liang, ”Introduction to Java Programming”, 9th Edition, Prentice Hall Publications, 2015.
3.	Ed Roman, RIma Patel, Sriganesh, Gerald Brose, “Mastering Enterprise JavaBeans” 3rd edition, Wikely, 2005.
Web References:	
1	http://www.nptel.ac.in
2	http://www.javaworld.com
3	https://www.learnjavaonline.org/
4	https://www.codecademy.com/learn/learn-java
Online Resources:	
1	https://www.coursera.org/courses?query=java
2	https://www.tutorialspoint.com/java/index.htm
3	https://www.w3schools.com/java/java_intro.asp

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+ B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model – Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C201.1	Apply	Quiz & Assignment	**20**
C201.2	Apply	Assignment	**20**
C201.3	Apply	Case study	**20**
C201.4	Analyze	Group Assignment	**20**
C201.5	Analyze		**20**

Assessment based on Summative Assessment – Theory		
Bloom’s Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	-	-
Understand	20	-
Apply	80	80
Analyse	-	20
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom’s Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (50%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	-	-	
Understand	20	-	10
Apply	80	80	80
Analyze	-	20	10

Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	2	2	2	-	-	-	-		2	-	-	2	2	-	2
C201.2	3	3	3	-	-	-	-	2	2	2	-	2	2	2	2
C201.3	2	2	3	-	2	-	-		2	-	-	3	-	-	3
C201.4	3	2	2	-	2	-	-	2	2	2	-	3	-	2	3
C201.5	3	2	2	-	2	-	-	2	2	2	-	3	-	2	3

23EN101	ORAL AND WRITTEN COMMUNICATION SKILLS (CSE/CSD/CY/IT/AI&DS - SEMESTER I) (ECE/EEE/MCT/MECH/CIVIL - SEMESTER II)	2/0/2/3

Nature of Course	Theory Skill Based
Pre requisites	Basics of English Language

Course Objectives:

1	To empower students to comprehend different aspects of communication using LSRW skills.
2	To highlight the essential aspects of effective oral and written communication necessary for professional success.
3	To expand the skills of the students in preparing job search artefacts and negotiating their use in GDs and interviews.
4	To enable students to communicate contextually in specific, personal and professional situations with courtesy.
5	To enrich students to carry out day-to-day communication at the workplace and facilitate efficient interpersonal communication.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Remember and expand writing skills through guided activities.	R
C101.2	Apply communication skills in a corporate environment.	AP
C101.3	Analyse and collaborate better with colleagues, building stronger professional and personal relationships.	AN
C101.4	Apply technical writing skills to write letters, emails and prepare technical documents.	AP
C101.5	Analyze and communicate effectively in personal and professional situations.	AN

Course Contents:

Course Contents:

Module I

Reading : Reading techniques -Skimming and scanning - Cloze reading - Reading and understanding technical articles – Reading for detailed comprehension: Email and letters - Reading advertisements - Table completion: Interpreting charts and graphs - Verbal reasoning – Comprehending reviews – Reading and responding to instant messages.

Module II

Writing : Formal letters (Sales letter, calling for quotations, seeking clarification, placing an order, complaint letter, inviting, accepting and declining letters) - Emails - Minutes of meeting - Professional report writing - Proposal writing - Resume / job application letter - Case study.

Module III

Listening : Situational listening - Listening about an experience - Listening about short extracts - Listening an interview - Conversational speaking. Speaking : Conversational speaking - Decipher the picture given and answer the question posed along with it - Decipher the mind map given and speak about it - Listen to the questions posed and answer them appropriately.

Laboratory Component:	
S. No	**List of Experiments**
1	Conversational listening
2	Speaking - Pictography
3	Listening about an experience
4	Listening to short extracts
5	Writing - Resume Writing, Job application letter
6	Mock interview
Total Hours	**60**

Text Books:	
1	Jay Sullivan, “Simply Said: Communicating Better at Work and Beyond”, Wiley Publication, 2018.
2	Alred J Gerald, Brusaw T Charles,. Oliu E Walter, “Handbook of Technical Writing”, Bedford/St. Martin’s Boston publication,New York, 2012.
3	Liz Hamp-Lyons and Ben Heasly, “Study Writing :A Course in Written English for Academic Purposes”, Updated Edition, Cambridge University Press, 2006.
4	Dr.Praveen Sam and K N Shoba - A Course in Technical English by Cambridge University press, 2020.
Reference Books:	
1	Rutherfoord J Andrea, “ Basic Communication Skills for Technology”, Upper Saddle River, N.J. : Prentice Hall, 2001.
2	Singh Hardeep (Author), Kothari (Author), “Written & Oral Technical Communication Skills For Engineers/Scientists” - LAMBERT Publications, 2019.
Web References:	
1	http://www.academiccourses.com/Courses/English/Business-English
2	https://www.liveworksheets.com/worksheets/en/English_as_a_Second_Language_(ESL)/Technical_English
Online Resources:	
1	https://www.coursera.org/specializations/business-english
2	https://www.businessenglishresources.com/learn-english-for-business/student-section/practice-exercises-new/

Assessment									End Semester Examinatio Continuous n	Total
Theory				Practical			Total (A+ B)	Total Continuous Assessmen t		
Formativ e Assess ment	Summati ve Assessm ent	Tot al	Tot al (A)	Formative Assessme nt	Summati ve Assess ment	Tota l (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C101.1 C101.2	Understand	Listening to Short Extracts	**20**
C101.3	Apply	Speaking - Pictography	**20**
C101.4	Apply	Mock Interview	**20**
C101.5	Apply	Assignment	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (25%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (25%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1										3					
C101.2								2		3					
C101.3								2		3	2				
C101.4										3					
C101.5										3		3			

23EC203	CIRCUITS LABORATORY	0/0/3/1.5
Nature of Course	: G (Theory Analytical)	
Course Objectives:		
1	To introduce the various circuit components of an electrical network.	
2	To enable the students to understand and simplify circuits using network theorems.	
3	To study experimentally the characteristics of diodes, BJT, FET, thyristors, rectifiers and filters	
4	To design and construct single stage, multistage amplifier circuits and to verify the voltage gain improvements & frequency response characteristics. To design and construct circuits to generate sinusoidal waveforms.	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C203.1	Understand the basic principles of network theorems	[U]
C203.2	Understand and construct various types of BJT and MOSFET Audio Amplifiers	[AP]
C203.3	Construct the power amplifier circuits and analyse the efficiency of power amplifiers	[AN]
C203.4	Analyse the performance of amplifier circuits with and without negative feedback	[AN]
C203.5	Construct different circuits to generate sinusoidal and non-sinusoidal waveforms	[AP]
Course Contents		
1	Verification of ohm's laws and kirchoff's laws	[E]
2	Verification of Thevenin's and Norton's Theorem	[E]
3	Verification of superposition Theorem, maximum power transfer theorem	[E]
4	Characteristic analysis of PN Junction Diode	[E]
5	Characteristic analysis of BJT	[E]
6	Characteristic analysis of JFET devices	[E]
7	Design of simple Audio amplifiers (CE Amplifier)	[AP]
8	Design and implementation of Class B Power Amplifier	[AN]
9	Design and implementation of Current Series feedback amplifier	[AN]
10	Design and Implementation of radio frequency oscillator	[AP]
	Total Hours:	**75**
Text Books:		
1	Sudhakar. A and Shyam Mohan. SP "Circuits and Network Analysis & Synthesis"5th edition, Tata McGraw Hill, 2015.	
2	William H.Hayt, JV Jack E.Kemmerly and Steven M. Durbin," Engineering Circuits Analysis", McGraw Hill India, 8h edition, 2014	
3	Jacob Millman, Chritos C Halkias, Satyabrata Jit, 'Electronic Devices and Circuits', 4th edition (SIE), McGraw Hill Education India Private Ltd., 2015	
Reference Books:		
1	Chakrabati A "Circuit Theory Analysis and Synthesis" Dhanpath Rai & Sons New Delhi 2014	
2	NageswaraRao T "Electric Circuit analysis",A R Publications 2007	
3	Salivhanan, 'Electron Devices and Circuits', 4th edition, McGraw Hill Education (India) Private Ltd., 2016	
Web References:		
1	http://nptel.ac.in/courses/117106101/	
2	http://www.thelearningpoint.net/home/electrical-science-and-engineering/ circuit-theory	
3	http://www.tina.com/course/coursex	
Online Resources:		
1	https://www.edx.org/course/circuits-electronics-1-basic-circuit	

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
75	25	100	60	40	100

Assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (60%) [100 Marks]		End Semester Practical Examination (40%) [100 Marks]
	FA (75 Marks)	SA (25 Marks)	
Remember			
Understand			
Apply			
Analyse	30	20	20
Evaluate	30	40	40
Create	40	40	40

Course Articulation Matrix														
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
1	3	2	1	2	1	-	-	-	1	1	2	-	3	1
2	2	3	1	2	1	-	-	-	1	1	2	-	3	1
3	2	2	1	2	3	-	-	-	1	1	2	-	3	1
4	2	2	1	3	1	-	-	-	1	1	3	-	3	1
5	2	2	3	2	1	-	-	-	1	1	2	-	3	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23EC204	DIGITAL SYSTEM DESIGN LABORATORY	0/0/2/1

Nature of Course: M (Practical application)

Course Objectives:

1. To design, construct and debug combinational and sequential circuits based on an abstract functional specification.
2. To simulate and design Digital logic circuits using software Tools.

Course Outcomes

C204.1	Ability to design and analyze various combinational and sequential circuits.	[AP]
C204.2	Analyzing and implementing the various combinational logic circuits and verifying its truth table.	[AN]
C204.3	Analyzing the various sequential logic circuits and its characterization.	[AN]
C204.4	Design of any Digital display using digital IC's.	[AP]
C204.5	Simulation of digital circuits using simulation Tool.	[AP]

Course Content:

S.No	List of Experiments	BT
1	Analysis and Synthesis of Arithmetic Expressions using Adders/Subtractors	[AN]
2	Analysis and Synthesis of Logic Functions using 4 x 1 Multiplexers & 1 x 4 Demultiplexer	[AN]
3	Analysis and Synthesis of Logic Functions using Decoders & Encoders	[AN]
4	Analysis and Synthesis of Boolean Relations using two bit Digital Comparator	[AN]
5	Analysis and synthesis of Code Converter (Binary to Gray and BCD to Excess-3)	[AN]
6	Analysis and Synthesis of Multi-bit Sequential Circuits using Shift Registers (SISO,SIPO,PIPO)	[AN]
7	Analysis and Synthesis of Multi-bit Sequential Circuits using Asynchronous Counter	[AN]
8	Combinational logic circuits design using Verilog	[AN]
9	Design a seven segment Electronic clock / Name display.	[AN]
10	Design of an Arithmetic and Logical Unit using simulation Tool.	[AN]
	Total Hours	**30**

Reference Books:

1. M. Morris Mano, Michael D.Ciletti., "Digital Design",4th Edition Pearson education,2018
2. C. H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2019
3. Thomas L. Floyd, Digital Fundamentals, 10th Edition, Pearson Education, New Delhi, 2011

Web References:

1. http://www.electrical4u.com/digital-electronics.htm
2. http://www.technologystudent.com/elec1/dig1.htm
3. http://www.allaboutcircuits.com/education/

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
75	25	100	60	40	100

Assessment based on Continuous and End Semester Examination		
Bloom's Level	Continuous Assessment (60%) [100 Marks]	End Semester Practical Examination

	FA (75 Marks)	SA (25 Marks)	(40%) [100 Marks]
Remember			
Understand			
Apply			
Analyse	**30**	**20**	**20**
Evaluate	**30**	**40**	**40**
Create	**40**	**40**	**40**

Course Articulation Matrix														
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**
1	3	2	1	1	-	-	-	-	1	1	-	-	3	-
2	2	3	1	1	-	-	-	-	1	1	-	-	3	-
3	2	2	1	1	-	-	-	-	1	1	-	-	3	-
4	2	2	1	2	-	-	-	-	1	1	-	-	3	-
5	2	2	1	1	1	-	-	-	1	1	-	-	3	-
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23GE301	UNIVERSAL HUMAN VALUES (Common to all branches)	3/0/0/3

Nature of Course	Descriptive
Pre-Requisites	Interpersonal Communication and Value Sciences

Course Objectives:

1	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2	Understanding (or developing clarity) of the harmony in the human being ,family, society and nature/existence.
3	Strengthening of self-reflection.
4	Development of commitment and courage to act.
5	Helping the students to appreciate the essential complementarily between 'VALUES' and' SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
6	Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:
Upon completion of the course, students shall have ability to

C301.1	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
C301.2	Apply responsibilities towards their commitments (human values , human relationship and human society).	[AP]
C301.3	Apply what they have learnt to their own self indifferent day-to-day settings in real life, atleast a beginning would be made in this direction.	[AP]
C301.4	Analyze ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[AN]
C301.5	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in nature.	[U]

Course Contents:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being-Harmony in Myself!

15 Hours

Self-evaluation of the students- Pre-test of UHV**-** Purpose and motivation for the course.Self-Exploration–Its content and process- A look at basic Human Aspirations. Understanding Happiness and Prosperity correctly-Understanding the needs of Self('I') and 'Body'-Understanding the Body as an instrument of 'I'(being the doer, seer and enjoyer)-Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding theharmony of'I' with the Body- Social activities – Waste Management - Water Conservation-Soil Pollution - Physical Health and related activities - Lectures by eminent persons- Literary activities.

Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence- Whole existence as Coexistence

15 Hours

Understanding values in human relationship - Understanding the harmony in the society (society being an extension of family): - Visualizing a universal harmonious order in society-Understanding the harmony in Nature.-Understanding Existence as Coexistence of mutually

Interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence-Buddy program- Relationships-Homesickness- Managing peer pressure-Projects-Socially responsible engineers-Visit to local areas (orphanages, special children)- Physicalactivities(games).

Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics

15 Hours

Natural acceptance of human values- Definitiveness of Ethical Human Conduct- Basis for Humanistic Education-Humanistic Constitution and Humanistic Universal Order-Competence in professional ethics-Case studies of typical holistic technologies, management models and eco-friendly production systems - Strategy for transition from the present state to Universal Human Order-Sum up: Self-evaluation of the students-Post test of UHV.

	Total Hours:	**45**
Text Books:		
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010	
2	Rajni Setia, Priyanka Sharma, “Human Values”, Genius Publication”, Jaipur, 2019.	
Reference Books:		
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.	
2	The Story of My Experiments with Truth –by Mohandas Karamchand Gandhi	
3	India Wins Freedom-Maulana Abdul Kalam Azad.	
Web References:		
1	https://examupdates.in/professional-ethics-and-human-values/	
2	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html	
3	https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf	
Online Resources:		
1	https://nptel.ac.in/courses/109/104/109104068/	
2	https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b	
3	https://www.thebalancecareers.com/life-skills-list-and-examples-4147222	

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C301.1	Understand & Apply	Online Quiz	20
C301.2	Understand & Apply	Group Assignment	20
C301.3	Understand	Presentation	20
C301.4	Apply		
C301.5	Apply	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	10	20	20
Apply	40	40	40
Analyse	40	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Outcomes(CO)	**Programme Outcomes(PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C301.1						3							1	1	1
C301.2						3			3				1	1	1
C301.3						3		3					1	1	1
C301.4						3	3	3			2		1	1	1
C301.5						3	3						1	1	1

23MA302	MATHEMATICS III (ECE/EEE/MCT)	3/1/0/4

Nature of Course	B (100% Analytical)

Course Objectives:

1	To define a subspace of a vector space and to discuss the existence of a basis of an abstract vector space.
2	To determine a basis and the dimension of a finite-dimensional space.
3	To develop the skill to use matrix algebra techniques that are needed by engineers for practical applications.
4	To familiarize with determinants and eigenvalues applicable in many branches of engineering.
5	To acquaint with knowledge of Positive definite matrices used in wide applications.

Course Outcomes:
Upon completion of the course, students shall have ability to

C302.1	Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.	[R]
C302.2	Relate matrices and linear transformations, compute Eigen values and Eigen vectors of linear transformations.	[U]
C302.3	Apply the properties of inner product spaces and determine orthogonality.	[AP]
C302.4	Obtain the matrix of linear transformation and its eigenvalues and eigenvectors	[AP]
C302.5	Apply the concepts of positive definite matrices and its properties to perform matrix decomposition.	[AP]

Course Contents:

MODULE I : Ax = b and the Four Subspaces

The Geometry of Linear equations: Linear combination – Dependence and Independence vectors – Basis and Dimension – Solving Ax=0: Rank of a matrix – Elimination and Solving Ax=b in matrices: Gauss Elimination method – Gauss Jordan method – Multiplication and Inverse Matrices: Inverse of a matrix using Gauss Jordan method – Solving system of equations using LU Decomposition method – The Four Fundamental Subspaces – Column Space, Row Space, Null space and Left hand null space.

MODULE II :Orthogonality, Determinants and Eigenvalues

Orthogonal vectors – Projections– Orthogonal Matrices and Gram Schmidt Orthogonalization process – Determinants: Properties of Determinants – Determinant Formulas and Cofactors – Solving system of linear equations using Cramer's Rule, Inverse of a Matrix using determinant – Eigenvalues and Eigenvectors – Inverse and Powers of a matrix using Cayley Hamilton theorem.

MODULE III : Positive Definite Matrices and Applications

Symmetric Matrices and Positive Definiteness – Positive Definite Matrices – Diagonalization – Quadratic form to Canonical Form by orthogonal Transformation - Similar Matrices and Jordan Form – QR Decomposition – Singular value Decomposition – Linear transformations and their matrices – Change of basis: Image compression.

Total Hours:	**60**

Text Books:	
1	Gilbert Strang, “Introduction to Linear Algebra”, Sixth Edition, Wellesley-Cambridge Press, 2023.
2	Kreyszig. E, “Advanced Engineering Mathematics” Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.
3	Grewal. B.S, “Higher Engineering Mathematics”, 43rd edition, Khanna Publications, Delhi, 2018.
4	Howard Anton and Chris Rorrs, “Elementary Linear Algebra”, 9th Edition, John Wiley & Sons, 2000.
5	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14thEdition,Pearson, Reprint,2018
Reference Books:	
1	Kenneth Hoffman and Ray Kunze, Linear Algebra, Pearsons, 2015.
2	Veerarajan. T, “Engineering Mathematics I”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
3	Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012.
4	N.P.Bali and Dr.ManishGoyal,”A Textbook of Engineering Mathematics” 9th edition, Laxmi publications ltd, 2014.
5	D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
Web References:	
1	https://archive.nptel.ac.in/courses/111/104/111104137/
2	https://onlinecourses.nptel.ac.in/noc21_ma16/preview
3	https://archive.nptel.ac.in/courses/111/106/111106046/
Online Resources:	
1	https://www.coursera.org/learn/linearalgebra1
2	https://www.coursera.org/learn/linearalgebra2/
3	https://see.stanford.edu/course/ee261/

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C302.1	Remember	Quiz	20
C302.2	Understand	Presentation	20
C302.3 – C302.5	Apply	Tutorial	20
C302.3 – C302.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]				End Semester Examination (60%) [100 Marks]
CA 1: 100 Marks		CA 2: 100 Marks		
SA 1	FA 1 (40 Marks)	SA 2	FA 2 (40 Marks)	

(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)(Theory)

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C302.1	1	1											1		
C302.2	2	2											1		
C302.3	3	3											1		
C302.4	3	3											1		
C302.5	3	3											1		

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

23EC301	SIGNALS AND SYSTEMS	4/0/0/4
Nature of Course	G (Theory Analytical)	
Course Objectives:		
1	Understanding the fundamental characteristics of signals and systems.	
2	Understanding the characterization of LTI systems in time domain.	
3	Understanding time domain and frequency domain analysis of Continuous and Discrete systems.	
4	Imparting analytical skills to solve problems involving convolution integral and convolution sum.	
5	Imparting the knowledge of correlation between signals	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C301.1	Acquire the knowledge of signal, system and its classifications	[R]
C301.2	Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier Transform.	[AN]
C301.3	Analyze the response of LTI system using convolution integral and LSI system using convolution.	[AN]
C301.4	Analyze system properties based on impulse response and Frequency Response	[AN]
C301.5	Apply Laplace transform for the analysis of continuous-time systems and Z-transform for the analysis of discrete-time signals and systems.	[AP]

Course Contents:

SIGNALS AND SYSTEMS **20**

Signals (discrete / continuous) – Basic signals - Representation of signals, Signal classification, Types of signals, Operations on signals – Time reversal, Scaling, Shifting, Transformation of independent variables, Systems – Classification of systems- Static and dynamic, Linear and non-linear, Time-variant and time-invariant, Causal and non-causal, Stable and unstable, Continuous-time Linear Time Invariant (LTI) systems and Discrete-time Linear Shift Invariant (LSI) systems and its properties

ANALYSIS OF CT SYSTEMS **20**

Continuous-time Fourier transform (CTFT) - Existence, Properties, Inverse Fourier transform, Laplace Transform- Properties, Inverse Laplace transform, Region of convergence, Stability analysis, Relationship between Laplace and Fourier transform , system representation using differential equations – System Analysis using Laplace transform and Fourier transform –Input-output behaviour with periodic and aperiodic convergent inputs -Impulse response and step response – Frequency response , Convolution integral

ANALYSIS OF DT SYSTEMS **20**

Fourier series representation of discrete-time signals – Discrete Time Fourier Transform (DTFT) and its properties – z-transform, Properties, s-plane to z-plane mapping, Inverse z-transform, Region of convergence, Stability analysis, System representation using difference equations – Relationship between Z-transform and DTFT-System Analysis using Z-transform and DTFT – poles and zeros – stability – impulse response and step response – frequency response , convolution sum, Correlation between signals – Autocorrelation and Cross correlation

Total Hours:	**60**
Text Books:	
1	Allan V. Oppenheim et al," Signals and Systems", Prentice Hall of India, 2/E, 2015
2	Ramakrishna Rao P, "Signals and Systems", McGraw Hill Education, New Delhi, 2/E, 2013.
3	Simon Haykin and Barry VanVeen, Signals and systems, 2007, second edition, Wiley, India.
Reference Books:	
1	J. Roberts, "Fundamentals of Signals and Systems", Tata McGraw Hill, 2007.
2	B. P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, 1998.
3	R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems – Continuous and Discrete", Prentice Hall, 4/E, 1998.
Web References:	
1	http://www.nptelvideos.in/2012/12/signals-and-system.html
2	http://freevideolectures.com/Course/3177/Signals-and-Systems
Online Resources:	
1	https://www.edx.org/course/signals-systems-part-1-iitbombayx-ee210-1x-2
2	https://www.edx.org/course/signals-systems-part-2-iitbombayx-ee210-2x-2

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C301.1	Remember	Quiz	20
C301.2	Analyze	Assignment	20
C301.3	Analyze	Assignment	20
C301.4 and C301.5	Analyze, Apply	Group Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	10	10
Understand	40	40	40
Apply	40	40	30
Analyse		10	20
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Articulation Matrix														
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**
1	3	2	1	1	-	-	-	-	2	-	-	1	2	-
2	3	2	2	3	-	-	-	-	2	-	-	-	2	-
3	3	3	2	2	2	-	-	-	2	-	-	-	2	-
4	2	2	3	3	-	-	-	-	2	-	-	-	3	-
5	2	2	3	3	-	-	-	-	-	-	-	-	3	-
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23EC302	OPERATING SYSTEMS FOR ELECTRONIC DEVICES	3/0/2/4
Nature of Course	E (Theory skill Based)	
Course Pre-requisites	NIL	

Course Objectives:

1	To introduce 8051 Microcontroller programming.
2	To Understanding the role of the kernel in an OS
3	To Understanding the role of Signals, System Calls, and Shell Scripting in Linux
4	To design embedded system using embedded Linux platform

Course Outcomes:
Upon completion of the course, students shall have ability to

C302.1	Introduce 8051 architecture and microcontroller programming.	[A]
C302.2	Describe the Linux operating system and its functionalities.	[A]
C302.3	Apply Linux knowledge and skills to solve practical problems.	[AP]
C302.4	Analyse the various concepts in RTOS and its Programming concepts.	[AP]
C302.5	Create Simple programs in Embedded Linux Platform.	[A]

Course Contents:

Module 1: Microcontrollers and Peripherals **15 Hrs**

Microcontroller Programming - 8051 Microcontroller: Architecture – Addressing Modes - Instruction set - pipelines - Registers banks/mode and states - Clock and reset systems, timers - Memory Organisation and Interrupts. **Peripherals**: I2C, SPI, UART, GPIO, Timer, PWM, ADC, CAN protocol. Required Memory devices for an Automatic chocolate vending machine, Digital Camera and Voice recorder.

Module 2: Embedded Linux **15 Hrs**

Introduction to Linux - OS Organisation, Kernel, Kernel types, Booting Sequence and Modes **-** Operating System components - Intro to Process management sub system. Intro to Memory management sub system, Intro to File sub system, Intro to Device drivers , Signals and System calls - Linux shell commands & shell scripting - Linux File system - accessing of files/different filesystems - proc/sys etc. - Linux directory structure - File system security - Linux groups ,Read, write, and execute access ,Changing permissions with chmod chown,chgrp - Linux Device driver architecture - IRQ programming. Case study: IOT based Embedded Applications.

Module 3: RTOS and Embedded Systems **15 Hrs**

RTOS Introduction - Scheduler Algortihms overview - Co-operative and PreEmptive - Memory organisation and Porting on Microcontroller - Task and IPC handling API in RTOS - Peripheral Programming and Application on Controller using RTOS - **Testing -**Levels of testing and methodologies - Unit Testing using G-Test Framework. Real time programming languages and operating systems for embedded systems. Selection of operating systems for commercial applications.

Total Theory Hours	**45**

Lab Components

S.No	List of Experiments	CO Mapping	BT
1	Study the instruction set of 8051 microcontroller and execute simple instructions. (Arithmetic and code conversions)	C302.1	[A]
2	Write Embedded C code to control LEDs, buttons, or other simple peripherals.	C302.1	[AP]
3	Keypad and Display Interfacing Microcontroller.	C302.1	[AP]
4	Develop a small embedded systems project adhering to real time Applications using Keil.	C302.1	[AP]
5	Study basic & User status Unix/Linux Commands.	C302.2	[U]
6	Study & use of commands for performing arithmetic operations with Unix/Linux.	C302.2	[A]
7	Execute shell commands through VI editor.	C302.3	[AP]
8	Study and use of the Command for changing file permissions.	C302.3	[A]
9	Develop scheduling algorithm for Real time Applications.	C302.4	[AP]
10	Mini project using Embedded Linux Platform.	C302.5	[AP]
		Total Lab Hours	**30**
		Total Hours	**75**

Text Books:	
1	Michael T. Goodrich, “Data Structures and Algorithms in C++”, 2nd Edition, Wiley Publication, 2011
2	Subrata Ghoshal, 8051 Microcontroller Internals, Instructions, Programming and Interfacing, Second edition, Pearson Education Asia, 2014.
3	Richard Peterson, ‘Linux Fundamentals’, TataMcGrawHill, 6th Edition, reprint**,**2018.
4	J. W. S. Liu, Real-time Systems, Pearson Education, 2018.
Reference Books:	
1	Narasimha Karumanchi, ”Data Structures and Algorithms Made Easy: Data Structures andAlgorithmic Puzzles”, 5th Edition, CareerMonk,2016
2	Muhammad Tahir and Kashif Javed, „ARM Microprocessor Systems - Cortex-M Architecture, Programming, and Interfacing“, CRC Press, 2011.
3	Richard Fox,‘Linux with Operating System Concepts ’,CRC Press,2017.
4	D.M.Dhamdhere,” Operating Systems,A Concept-Based Approch,TMH,2008.
5	Kopetz H. Real-time Systems: Design Principles for Distributed Embedded Applications. Springer Science & Business Media; 2011 Apr 15.
Web References:	
1	https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms
2	https://nptel.ac.in/courses/108107029/

3	https://archive.nptel.ac.in/courses/117/106/117106113/

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C302.1	Analyze	Quiz	20
C302.2	Analyze	Class Presentation	20
C302.3	Apply	Assignment	20
C302.4	Apply	Case Study	20
C302.5	Analyze		

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	20	20
Understand	20	20	20
Apply	30	30	30
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	Continuous Assessment (25%) [100 Marks]	End Semester Examination (15%)

	FA: (75 Marks)	SA: (25 Marks)	[100 Marks]
Remember	0	0	0
Understand	40	40	40
Apply	30	30	30
Analyse	30	30	30
Evaluate	0	0	0
Create	0	0	0

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								End Semester Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Theory Examination (35%) Practical Examination (15%)
SA 1 (60M)	FA 1		SA 2 (60 M)	FA 2		FA (75 M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

No. of the 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
C302.1	3	2	2	2									3	1	
C302.2	3	2	2	2									3	1	
C302.3	3	2	2	2									3	1	
C302.4	3	2	2	2									3	1	
C302.5	2	2	2	2	3				1	2		2	3	1	

1	Reasonably Agreed	2	Moderately Agreed	3	Strongly Agreed

23CS201	DATA STRUCTURES AND ALGORITHMS	1/0/4/3

Nature of Course:	F (Theory Programming)
Prerequisites:	Problem Solving using C++

Course Objectives:

1.	To introduce list data structure and its applications.
2.	To impart the importance of stacks and queues in problem solving.
3.	To provide knowledge on Tree and Graph data structures.
4.	To discuss the role of hashing in information storage and retrieval.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C201.1	Implement the basic data structures like array and LinkedList.	[AP]
C201.2	Solve real world problems efficiently by applying stack and queue data structures.	[AP]
C201.3	Enumerate the applications with tree data structures.	[AP]
C201.4	Discuss the importance of hashing techniques in information storage.	[U]
C201.5	Employ graph algorithms for solving real time computing problems and analyze them.	[A]

Course Contents:

Module I Linked List & Stack **15 Hours**

Linked List: Array vs Linked list - Types of linked list - Singly, Doubly and Circular Linked list - Applications of linked list. **Stack:** Stack Model**,** Array and Linked list implementation of Stack –Applications of Stack - Infix, Prefix and Postfix expressions - infix to postfix conversion - Expression Evaluation- Balancing Parenthesis.

Module II Queue and Trees **15 Hours**

Queue: Queue Model, Array and Linked list implementation of Queue-Priority Queue - Applications of Queue. **Trees:** Binary Tree - Binary Search Tree - Insertion, Deletion, Traversal - Inorder, Preorder, Postorder, Level order traversal.

Module III Graphs and Hashing **15 Hours**

Graphs: Weighted and Directed graphs - Adjacency matrix and list implementation - Traversal – Breadth First Search & Depth First Search. **Hashing:** Direct Address Table, Hash function, Collision resolution techniques, Linear Probing, quadratic probing, double hashing.

Total Hours (Theory):	**45**

Lab Component

S. No.	Lab Exercises
1	Implementation of Singly, Doubly and Circular Linked List.
2	Implementation of Stack using Arrays.
3	Implementation of Stack using Linked List.
4	Implementation of Stack applications
5	Implementation of Queue using Arrays.

6	Implementation of Queue using Linked List.	
7	Implementation of Queue applications.	
8	Implementation of Hashing techniques	
9	Implementation of Binary Search Tree.	
10	Implementation of Graph Traversal algorithms	
	Total Hours (Lab):	**30 Hours**
	Total Hours: (45+30)	**75 Hours**
Text Books:		
1	Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.	
2	Anany Levitin, Introduction to the design & analysis of algorithms, 3rd Edition, Pearson Education, 2021.	
3	Michael T. Goodrich, "Data Structures and Algorithms in C++", 2nd Edition, Wiley Publication, 2011.	
Reference Books:		
1	Seymour Lipschutz,"Data Structures by Schaum Series",2nd Edition, Tata McGraw Hill, 2013.	
2	Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles",5thEdition, CareerMonk,2016.	
3	Debasis Samanta, "Classic data structures", Prentice Hall of India, 2nd Edition,2014.	
Web References:		
1	https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms	
2	https://www.edx.org/course/data-structures-algorithms-using-c	
Online Resources:		
1	https://www.programiz.com/dsa l	
2	https://freevideolectures.com/course/2519/c-programming-and-data-structures	
3	https://www.cprogramming.com/algorithms-and-data-structures.html	

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C201.1	Apply	Quiz	20
C201.2	Apply	Case Study	20
C201.3,	Apply	Group Assignment	20

C201.5			
C201.4	Understand	Assignment	20

Assessment based on Summative Assessment - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]	
	CIA1: (60 Marks)	CIA2: (60 Marks)
Remember	20	20
Understand	40	30
Apply	40	40
Analyse	-	10
Evaluate	-	-
Create	-	-

Assessment based on Continuous Assessment - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Practical Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	30	30	30
Apply	60	40	40
Analyse	-	20	20
Evaluate		-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	3	3	2									1	3	1	1
C201.2	3	3	3	3	3				2	1		2	3	2	2

C201.3	3	3	3	3	3				2	1		2	3	2	2
C201.4	3	3	3	3	3				2	1		2	3	2	2
C201.5	3	3	3	3	3				2	1		2	3	2	2
C201	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**2**	**3**	**2**	**2**

	3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed	

23CS301	ADVANCED JAVA PROGRAMMING	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	Java Programming	

Course Objectives:

1	To provide insight knowledge of OOP concepts and usage of this, static, super and final keywords.
2	To discuss about different type of Collection Frameworks.
3	To demonstrate threads, JDBC & exception handling with real world examples.
4	To illustrate designing of GUI applications using swing component.

Course Outcomes :
Upon completion of the course, students shall have ability to

C301.1	Illustrate the OOPs concepts like Constructors, Inheritance, Polymorphism and the usage of this, static, super and final keywords.	[AP]
C301.2	Apply the concepts of Exception Handling in real world applications and usage of collection frameworks.	[AP]
C301.3	Develop Multithreaded applications.	[AP]
C301.4	Develop GUI Applications using swing component and to explain the concept of Servlets.	[AP]
C301.5	Develop java application to interact with database by using relevant JDBC Driver.	[AP]

Course Contents:

Module I Introduction to OOPS 15 Hours

Class and Object, Encapsulation and Abstraction, Inheritance, Polymorphism, Message Passing, Keywords : this, super, static, final, extends and implements. Method Signature and Prototype, Mutator Methods and Accessor Methods, Var-Arg Method, hashCode() and toString() methods. Immutable Objects Vs Mutable Objects, User defined Immutable Class, Constructors : Introduction, Default Constructor, User Defined Constructors, Constructor Overloading, Instance Variable, Instance Methods, Instance Block and Instance Flow Of Execution. Regular Expressions (RegEx).

Inheritance Introduction, Types of Inheritance, Up Casting, Down Casting, IS-A Relationship & HAS-A Relationship, Composition Vs Aggregation, **Polymorphism:** Method Overloading, & Method Overriding.

Module II Abstraction, Exception Handling & Collections 15 Hours

Abstraction: Abstract Methods and Abstract classes. Interfaces, abstract classes and Interfaces, Concrete Methods Vs Abstract Methods, Differences between classes, abstract classes and Interfaces, Marker Interfaces

Exception - try catch block, Finally Block, Exception Hierarchy, Multiple Exceptions In a Catch Block, Parameterized Try Block, Overriding Methods And Exception. Creating Your Own Exception, The Assert Keyword, The Generics Framework, **Collections:** Set, List, Map & Tree, The Iterator Interface. Working with Hashtable Collection **Threads:** Introduction to Threads, Creating And Starting Threads, Basic Thread Control Methods. Multithreading, Working with Multiple, threads, Thread Life Cycle, Thread Priorities, Synchronizing Methods.

Module III Swings, Servlets & JDBC 15 Hours

Swings: Introduction, JLabel, JButton, JTextField ,JTextArea, JPasswordField, JCheckbox,

JComboBox, JRadioButton, JScrollBar, JMenuItem and JMenu.

JDBC: Drivers, CURD operations, Database connectivity
Servlets : Overview of Servlets , Servlet Life Cycle, Servlet Request and Response , web.xml and its need, Servlet Configuration, Session Tracking

Total Hours 45 Hours

List of Experiments

1. Implementation of default and parameterized constructors.
2. Implementation of method overloading and overriding.
3. Implementation of Inheritance.
4. Implementation of Abstract and Interface concepts.
5. Programs using collection Interface.
6. Implementation of multithreading Concepts.
7. Program to handle multiple exception using try, catch and finally block.
8. Implementation of swing components.
9. Implement Simple application using servlets.
10. Implement CURD operation using JDBC.

Total Hours 30 Hours

Text Books:

1.	Herbert Schildt,"Java:TheCompleteReference",12th edition, Mc craw Hill, 2021.
2.	Robert Liguori, Patricia Liguori, "Java 8 Pocket Guide", O'Reilly Media, 2014.
3.	ShagunBakliwal, Hands-on Application Development using Spring Boot, bpb publisher, 2021.

Reference Books:

1.	Paul Deitel, Harvey Deitel, "Java How To Program",10th Edition, Prentice Hall Publications,2014.
2.	Cay S.Horstmann and GaryCornell, "Core Java, Vol.2: Advanced Features", 9th Edition, Prentice Hall,2013.

Web References:

1	https://www.javatpoint.com/java-tutorial
2	https://www.geeksforgeeks.org/java/
3	http://www.javatpoint.com/java-tutorial

Online Resources:

1	http://www.coursera.org/specializations/object-oriented-programming
2	http://www.udemy.com/topic/java-certification/
3	http://www.edx.org/learn/jav

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model – Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C301.1 & C301.3	Apply	Quiz	20
C301.2	Apply	Assignment	20
C301.4 & C301.5	Apply	Case Study	40

Assessment based on Summative Assessment – Theory		
Bloom's Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	20	20
Understand	40	40
Apply	40	40
Analyse	-	-
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (50%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								**End Semester Practical Examination (50%)**
CA 1 (100 Marks)			**CA 2 (100 Marks)**			**Practical Exam (100 Marks)**		
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75M)**	**SA (25M)**	
	Component-I (20 Marks)	**Component-II (20 Marks)**		**Component-I (20 Marks)**	**Component-II (20 Marks)**			

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
C301.1	3	3	3	1					2	2		2	3	2
C301.2	3	3	3	3	2				3	2		2	3	2
C301.3	3	3	3	2	3				2	2		2	3	3
C301.4	3	3	3	2	3				2	2		2	3	3
C301.5	3	3	3	2	3				2	2		2	3	3
C301	**3**	**3**	**3**	**3**	**3**				**3**	**2**		**2**	**3**	**3**

23EC303	IDEA LABORATORY	0/0/2/1

Nature of Course	: M (Practical application)

Course Objectives:

1. To learn all the skills associated with the tools and inventory associated with the IDEA Lab.
2. To Learn useful electronic fabrication processes and enhance the skills in PCB.
3. To Learn necessary skills to build useful and standalone system/ project with enclosures.
4. To acquire knowledge to create electronic documentation for the system/project design
5. T demonstrate the basic skills associated with Robotics and 3-D printing of models.

Course Outcomes:

Upon completion of the course, students shall have ability to

C303.1	Understand the basics of electronic components and effectively use them for designing the PCB with fabrication	[AP]
C303.2	Observe the methods to design a product using various simulators and analyse the data sheet reports	[AP]
C303.3	Analyse and inspect the products using standard procedure of design and perform the verification in pre fabrication level	[AN]
C303.4	Familiarize about the embedded controller and learn the methods to convert the controllers as IoT devices	[AN]
C303.5	Develop new ways of creative thinking and learning the innovation cycle for developing embedded based IoT products	[C]
C303.6	Analyse system requirements and create the product design for implementation of micro projects using embedded -IoT skills and 3-D printing	[C]

Course Contents:

Sl.**No**	**List of Experiments**	**CO Mapping**	**RBT**
1.	Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.	C303.1	[AP]
2.	Electrical Wiring of House hold applications / Electrical vehicles basics	C303.2	[AN]
3.	Simulation of Circuits / Device -using NI Multisim / Pspice tools	C303.3	[AN]
4.	3D – Printing for Robot / Line follower Autonomous vehicle	C303.4	[AP]

5.	Familiarity and use of Tinker CAD – For embedded basic blocks	C303.4	[AP]
6.	Familiarity and use of Welding methods (Any two method) & Carpentry	C303.5	[AP
7.	Familiarity and use of Arduino bords, simulation environments and programming	C303.5	[AP]
8.	Embedded programming using Arduino and/or Raspberry Pi. ESP8266 - IoT	C303.6	[C]
9.	Micro Project: Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure	C303.6	[C]

Total Hours:	**30**

Text / Reference Books:

1.	E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.
2.	AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.
3.	All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
4.	Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
5.	3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
6.	The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
7.	The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978- 1681881584.
8.	Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374
9.	The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269
10.	Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542

11.	Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945, 978-9352131952, 978-9352133703
12.	Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586
Web References:	
1.	https://www.electronicshub.org/getting-started-with-esp32/
2.	https://learn.rumie.org
3.	https://www.techtarget.com/whatis/feature/IoT-basics-A-guide-for-beginners
4.	https://www.javatpoint.com/iot-internet-of-things
5.	https://www.electronics-tutorials.ws/
Online Resources:	
1.	https://www.coursera.org/learn/raspberry-pi-platform
2.	https://www.coursera.org/learn/raspberry-pi-platform
3.	https://www.coursera.org/learn/raspberry-pi-platform
4.	https://www.coursera.org/learn/raspberry-pi-platform
5.	https://www.electronics-tutorials.ws/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember			
Understand			
Apply			
Analyse	**30**	**20**	**20**
Evaluate	**30**	**40**	**40**
Create	**40**	**40**	**40**

Course Articulation Matrix														
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**
1	3	2	2	1	-	-	-	-	-	-	-	-	2	-
2	3	2	2	1	-	-	-	-	-	-	-	-	2	-
3	3	1	2	2		-	-	-	-	-	-	-	2	1
4	3	2	2	2	3	-	-	-	1	-	-	1	3	-
5	3	2	2	2	3	-	-	-	1	-	-	1	3	1
6	3	2	2	2	3	-	-	-	1	-	-	1	3	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23EC401	ANALOG INTEGRATED CIRCUITS	3/0/0/3
Nature of Course	G (Theory Analytical)	
Course Objectives:		
1	To construct the platform for understanding the various functionality of Linear Integrated Circuits	
2	To familiarize the linear and non-linear applications of IC 741 operational amplifiers	
3	To sense the concepts of VCO and PLL with its applications	
4	To interpret the real time signal analysis based on ADC and DAC IC	
5	To impart knowledge of integrated circuits on Application specific functions.	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C401.1	Understand the functional blocks of Linear IC and conceive the Linear application based on Operation amplifier	[U]
C401.2	Understand the operations and characteristics and application areas of operational amplifiers	[U]
C401.3	Enumerate the concept of VCO and PLL	[AP]
C401.4	Apply the properties of operational amplifier in designing ADC's, DAC's for real time signal analysis.	[AP]
C401.5	Apply the concept of Integrated circuits to design Voltage Regulator	[AP]
C401.6	Perform simulation based analysis of AC and DC circuits to verify the results and functionality	[AN]
Course Contents:		
Basic information of Op-Amp, **Differential amplifier and OP-AMP applications:** **15** Differential amplifier with constant current source–current mirror-characteristics of Op –Amp – Wilson Current –Mirror Circuit and Widlar Current –Mirror Circuit, OP-AMP design**,** inverting and non-inverting amplifiers, instrumentation amplifier, integrator and differentiator, voltage-to-current converter, Precision rectifier, Schmitt trigger, peak detector, clipper and clamper, Active filters: Butterworth filter –LP,HP,BP,BR. **Digital-to-analog converters (DAC), Analog-to-digital converters (ADC)**: **15** VCO, PLL and its applications, Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell, Types of DAC**:** Weighted resistor, R-2R ladder, Sample and Hold circuit, Types of ADC**:** flash, counter type, Single slope, dual slope, successive approximation, Astable and Monostable Multivibrators using 555 Timer. **Voltage regulators and Special Function ICs :** **15** 723 General Purpose regulators & L4938 Voltage regulator , switching regulator –Audio Power Amplifier –Video amplifiers – Opto couplers –Isolation Amplifiers –Fiber optic ICs – ac and dc analysis using circuit simulation using SPICE.		
Total Hours:		**45**
Text Books:		
1	Sergio Franco, "Design with operational amplifiers and analog integrated circuits", McGraw-Hill, 4th edition, 2016. (Reprint)	
2	D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd.,2010 (Reprint)	

Reference Books:	
1	S.Salivahanan, V S Kanchana Bhaaskaran, “Linear Integrated Circuits”, McGraw-Hill, 2nd edition,2015
2	WilliamD.Stanely, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education, 2004
Web References:	
1	http://www.electronics-tutorials.ws
2	http://www.allaboutcircuits.com
Online Resources:	
1	http://www.nesoacademy.org/electronics-engineering/analog-electronics/analog

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C401.1	Understand	Quiz	20
C401.2	Understand	Assignment	20
C401.3, C401.4,C401.5	Apply	Quiz	20
C401.6	Analyse	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	10	10
Understand	60	40	40
Apply		40	30
Analyse		10	20
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Articulation Matrix														
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**
1	1	2	1	-	-	-	-	-	-	-	-	-	1	-
2	1	2	2	1	-	-	-	-	-	1	-	-	2	-
3	1	1	2	1	-	-	-	-	1	-	-	-	1	-
4	1	2	3	2	-	-	-	-	-	-	-	-	2	-
5	1	3	2	2	-	-	-	-	-	-	-	-	3	-
6	1	2	1	-	1	2	-	-	-	-	-	-	1	-
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23EC402	ELECTROMAGNETICS	4/0/0/4
Nature of Course	G (Theory Analytical)	
Course Objectives:		
1	To review about co-ordinate systems and to enable the students to understand the concepts of electrostatics	
2	To enable the students to understand the concepts of static and vector magnetic fields	
3	To understand how electric and magnetic fields affect materials and the relation between the fields under time varying situations.	
4	To analyze the principles of propagation of uniform plane waves and emphasize the significance of waveguides.	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C402.1	Understand the concepts of Electrostatics for various geometries	[U]
C402.2	Apply boundary conditions to solve for fields at interface between two different charge medium	[AP]
C402.3	Understand the basic Magneto static laws and interpret the nature of magnetic fields	[U]
C402.4	Understand the concepts of time varying electric and magnetic fields	[U]
C402.5	Apply the concepts of Maxwell's equations in propagation of uniform plane waves	[AP]
C402.6	Analyze the propagation of electromagnetic waves and emphasize the significance of waveguides.	[AN]

Course Contents:

ELECTROSTATICS: **20**

Introduction to Co-ordinate System, Gradient, Divergence and Divergence theorem, Curl and Stoke's theorem, Laplacian of a Scalar. Coulomb's law, Electric field, Electric potential, Charge densities – Line, Surface, Volume charge densities, Electric flux, Electric flux density. Electric potential due to dipole - Capacitance Energy density in the electrostatic field. Laplace and Poisson's equations- Applications for Laplace's equation - Capacitance - Parallel Plate-Boundary conditions, Electric current, Current density, Point form of Ohm's law.

MAGNETOSTATICS & TIME VARYING FIELD: **20**

Magnetic field, Biot-Savart's law, Ampere's law, Magnetic vector potential, Magnetic flux density, Definition of Inductance and inductors-Inductance due to Solenoid and Toroid, Boundary conditions, Time Varying Field-Equation of continuity for time varying fields-
--Maxwells equations, Faraday's law and its significance

UNIFORM PLANE WAVE & WAVEGUIDES: **20**

Wave, Wave equation, Wave propagation in space, conducting media and Dielectric loss, travelling waves and standing waves Plane waves at interfaces, Normal incidence, Phase velocity, Group velocity, Index of refraction, Power and energy relations,Poynting theorem Polarizations - Linear, Elliptic and Circular,Characteristics of TE &TM waves –TEM waves, Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Impossibility of TEM Mode

Total Hours:	**60**

Text Books:	
1	Sadiku M H, "Principles of Electromagnetics", Oxford University Press Inc., New Delhi, 2015.
2	John D Kraus and Daniel A Fleisch," Electromagnetic with applications", 5th Edition, McGraw-Hill, 2017
3	William H. Hayt, John A. Buck, "Engineering Electromagnetic", 8th Edition, McGraw-Hill, 2017.
4	Edward Jordan and KG Balmain, "Electromagnetic Waves and Radiating Systems", Pearson education,2nd edition,2015.
Reference Books:	
1	Nathan Ida, "Engineering Electromagnetics", Springer (India) Pvt. Ltd. New Delhi,3nd edition,2015,
2	David K Cheng,"Fields and Wave Electromagnetics", Pearson new international edition, Pearson Education Limited 2013.
3	J. Edminister, "Schaum's Outline of Electromagnetics", 4th Edition, McGraw-Hill, 2013
Web References:	
1	nptel.ac.in/courses/108104087
2	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-630-electromagnetics-fall-2006/
3	http://nptel.ac.in/courses/117103065/
4	http://nptel.ac.in/video.php?subjectId=108106073
Online Resources:	
1	Biological effects of EMF –radiation hazards of wearable antennas by Dr. Heather Song University of Colorado Springs, 2014
2	Wearable antennas for off-body radio links at VHF and UHF bandsP Nepa, H Rogier - IEEE antennas and Propagation Magazine, 2015 - ieeexplore.ieee.org
3	On the evaluation of biological effects of wearable antennas on contact with dispersive medium in terms of SAR and bio-heat by using FIT technique https://ieeexplore.ieee.org/document/6521719

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C402.1,	Understand	Assignment	20
C402.2, C402.3	Apply, Understand	Problem Solving	20
C402.4 C402.5	Understand, Apply	Quiz	20
C402.6	Analyze	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	20	20	20
Apply	30	30	30
Analyse	30	30	30
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I	**Component - II**		**Component - I**	**Component - II**	

	(20 Marks)	**(20 Marks)**		**(20 Marks)**	**(20 Marks)**	

Course Articulation Matrix														
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**	**PSO1**	**PSO2**
1	3	3	3	2	1	-	-	-	-	-	-	2	2	1
2	3	2	3	2	1	-	-	-	-	-	-	2	2	1
3	3	2	2	2	1	-	-	-	-	-	-	2	2	1
4	3	2	3	2	1	-	-	-	-	-	-	2	2	1
5	3	2	2	2	1	-	-	-	-	-	-	2	2	1
6	3	2	3	2	1	-	-	-	-	-	-	2	2	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23EC403	EMBEDDED C++	3/0/2/4

Nature of Course	: F (Theory Programming)

Course Objectives:

1	To introduce the requirements of embedded system design.
2	To set the embedded environment and handle the interrupts.
3	To write real time C++ programmes with their build processes.
4	To understand real time embedded operating systems.
5	To apply embedded C++ and build real time projects using LPC2148

Course Outcomes:

Upon completion of the course, students shall have ability to

C403.1	Understand the fundamentals of embedded system design.	[U]
C403.2	Understand the embedded environment and handling interrupts	[U]
C403.3	Understand the basics of real time C++ programming.	[U]
C403.4	Apply the real time C++ program on embedded board.	[AP]
C403.5	Understand the embedded operating systems and peripherals.	[U]
C403.6	To build real time projects using embedded C++ programming.	[AP]

Course Contents:

Fundamentals of Embedded Systems **15 Hours**

Exploring embedded systems - Working with limited resources - Working with different architectures - Working with hardware errors - Setting Up the Environment - Handling Interrupts Data polling.

Real Time C++ **15 Hours**

C++ as an Embedded Language - Getting Started with Real-Time C++. - Working with a Real-Time C++ Program on a Board - Optimized C++ Programming for Microcontrollers - Components for Real-Time C++ - Accessing Microcontroller Registers - Low-Level Hardware Drivers in C++

Embedded Programming and Applications **15 Hours**

Embedded operating systems - Real-time OSes - Custom peripherals and drivers - Resource limitations - Monitoring System - Resource-Restricted Embedded Systems - Embedded IDEs and frameworks - Soil Humidity Monitor with Wi-Fi

Total Hours:	45

Lab Component:

S. No.	List of Experiments
1	Interface LED Module using LPC2148
2	Interface seven segment Display using LPC2148
3	Interface LCD using LPC2148
4	Interface Temperature Sensor using LPC2148
5	Interface Gas Sensor using LPC2148
6	Interface ADC and DAC using LPC2148
7	Interface UART using LPC2148
8	Interface Bluetooth using LPC2148
	Total Hours **30**

Text Books:

1	Igor Viarheichyk, “Embedded Programming with Modern C++ Cookbook”, Packt Publishing Ltd., 1st Edition, 2020.

2	Christopher Kormanyos, “Real-Time C++ - Efficient Object-Oriented and Template Microcontroller Programming”, 4th Edition, 2021.
3	Maya Posch, “Hands-On Embedded Programming with C++17”, Packt Publishing Ltd., 1st Edition, 2019.
4	Lyla B. Das," Embedded Systems an Integrated Approach", Pearson Education, 2013
Reference Books:	
1	Shibu K V," Introduction to Embedded Systems", McGraw Hill Education(India) Private Limited, 2014
2	Steve Heath, “Embedded Systems Design”, EDN Series, 2013.
3	Herma K., Real Time Systems, Design for distributed Embedded Applications, 2011, 2nd edition, Springer, USA
Web References:	
1	https://www.tutorialspoint.com/embedded_systems/es_overview.htm
2	https://www.electronics-notes.com/articles/digital-embedded-processing/embeddedsystems/basics-primer.php
3	https://www.mathworks.com/solutions/embedded-systems.html
Online Resources:	
1	https://www.coursera.org/specializations/real-time-embedded-systems
2	https://onlinecourses.nptel.ac.in/noc20_ee98
3	https://www.udemy.com/course/master-cembedded-c-for-embedded-system-learn-in-depth-com/
4	https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-inputoutput

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model-Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list- Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA(10%) [80Marks]**
C403.1 C403.2	Understand	Coding 1	**20**
C403.3	Understand	Coding 2	**20**

C403.4	Apply	Assignment	**20**
C403.5 C403.6	Apply	Group Assignment	**20**

Assessment based on Summative Assessment –Theory		
Bloom'sLevel	**SummativeAssessment(15%) [120Marks]**	
	CIA1:(60Marks)	**CIA2:(60Marks)**
Remember	20	20
Understand	40	30
Apply	40	50
Analyse	-	-
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination- Practical			
Bloom'sLevel	**ContinuousAssessment(25%) [100Marks]**		**End SemesterPractical Examination(50%) [100Marks]**
	FA:(75 Marks)	**SA:(25 Marks)**	
Remember	10	20	20
Understand	30	20	20
Apply	50	50	50
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Course Outcome(CO)	Programme Outcomes(PO)												Programme Specific Outcomes (PSO)	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
C404.1	3	3											3	
C404.2	3	3	3	2	2				2	1		3	3	2
C404.3	3	3	3	2	3				2	1		3	3	2
C404.4	3	3	3	3	3				3	2		3	3	2
C404.5	3	3	3	3	3				2	2		2	3	2
C404.6	3	3	3	3	3				3	2		2	3	2

	3	Stronglyagreed	2	Moderatelyagreed	1	Reasonablyagreed

23EC404	ANALOG INTEGRATED CIRCUITS LABORATORY	0/0/3/1.5

Nature of Course	M (Practical application)

Course Objectives:

1	To illustrate the working of linear application based circuits using IC 741.
2	To verify the functionality of Linear application based circuits using simulation tools
3	To enumerate the design values of wave form generators and filters for Non linear applications.

Course Outcomes:
Upon completion of the course, students shall have ability to

C404.1	Observe the Applications of operational amplifiers	[U]
C404.2	Analyse the characteristic performance of Integrator and Differentiator	[AN]
C404.3	Design and Implement Instrumentation Amplifier	[AN]
C404.4	Design and Construct the circuit using Operational amplifiers to generate Waveform and Design of Active filters	[AP]
C404.5	Perform the Simulation of ADC DAC, Multivibrator and oscillators and verify the obtained result.	[AN]

Course Contents:

S.No	List of Experiments	CO Mapping	BT
1	Inverting and Non Inverting Op – amp. Applications of Op-Amp (Adder, Subtractor, adder-subtractor, average amplifier).	C403.1	[U]
2	Applications of Op-Amp (Adder, Subtractor, adder-subtractor, average amplifier).	C403.1	[U]
3	Integrator and Differentiator using Op-amp.	C403.2	[AN]
4	Instrumentation Amplifier using Op-Amp.	C403.3	[AN]
5	Waveform generation using Op-Amp.	C403.4	[AP]
6	Design of Active filters (LPF, HPF).	C403.4	[AP]
7	**Using Multisim/ Orcad/ Pspice** Simulation of Analog to Digital Converter.	C403.5	[AN]
8	Simulation of Digital to Analog Converter.	C403.5	[AN]
9	Simulation of Multivibrators.	C403.5	[AN]
10	Simulation of Weinbridge and RC phaseshift oscillator	C403.6	[AN]
	Total Hours:		**30**

Reference Books:

1	Sergio Franco, “Design with operational amplifiers and analog integrated circuits”, McGraw-Hill, Fourth edition, 2008.

2	D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd.,2010
3	S.Salivahanan, V S KanchanaBhaaskaran, Linear Integrated Circuits, McGraw-Hill, 2nd edition,2015
4	WilliamD.Stanely, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education, 2004
Web References:	
1	http://nptel.ac.in/courses/117107094/
2	http://www.technologystudent.com/elec1/elecex.htm

Assessment Methods & Levels (based on Bloom’sTaxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom’s Level	**Rubric based Continuous Assessment[60 marks] (in %)**	**End Semester Examination [40 marks] (in %)**
Remember	10	10
Understand	20	20
Apply	20	20
Analyse	20	20
Evaluate	10	10
Create	20	20

Course Articulation Matrix														
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**
1	3	2	2	1		-	-	-	-	-	-	1	2	1
2	3	2	2	1		-	-	-	-	-	-	-	2	-
3	3	1	2	2		-	-	-	-	-	-	1	2	1
4	3	2	3	3		-	-	-	-	-	-	-	3	-
5	3	2	3	3		-	-	-	-	-	-	1	3	1
6	3	2	2	3	2	-	-	-	-	-	-	1	3	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed			

23MT907	PRODUCT DESIGN	3/0/0/3

Nature of Course: Theory

Pre requisites: Nil

Course Objectives:

1	To develop a better understanding of the perspective of Industrial Design and to gain experience regarding the role of an industrial designer.
2	To apply appropriate design methods and tools to design and develop innovative products.
3	To learn the key considerations for embodying an electronic product concept to make it suitable for manufacturing and production.

Course Outcomes:
Upon completion of the course, students shall have ability to

C907.1	Examine the design history, philosophy, and diverse approaches.	[R]
C907.2	Apply varied product design methods for user-centered outcomes.	[AP]
C907.3	Infer the consumer products, design perspectives, and innovation modes.	[U]
C907.4	Understand electronic product design, manufacturing, and automation.	[U]
C907.5	Apply PCB guidelines, control systems, and electromechanical principles.	[AP]

Course Contents:

Module 1

FUNDAMENTALS OF PRODUCT DESIGN:

Introduction to Product Design, Evolution of Design - industrial revolution; Design philosophy; Interrelationship of and engineering; User centered considerations in Design; Diversity of design approaches; Design thinking; Material-driven design; Prototype-driven design; Brand driven design; Industry approaches to Product Design. Types of consumer products; Design space; User's perspective to products; Designer's perspective to products; New product development processes and methods.

(15 hours)

Module 2

ADVANCED DESIGN PRINCIPLES AND INNOVATION

Design Innovation, Modes of innovation by design and exploring problem structure; Methods to understand design intent, design context and users; Methods to frame insights, generate creative concepts, frame solutions and realize offerings. Introduction to electronic product design; Principles of Embodiment Design: Product architecture development, Steps and guidelines, Product modularity; Introduction to manufacturing. **(15 hours)**

Module 3

PROCESSES AND GUIDELINES FOR ELECTRONIC PRODUCT DESIGN

Processes for Electronic Product Design - Die casting, Injection molding, Sheet metal fabrication, PCB manufacturing, Automation. Guidelines for PCB Design - Demonstration on PCB design - Batch and mass production, High speed automation, Robotic assembly, EM shielding. Design for X: Guidelines for aesthetics, Corrosion, Manual handling, Assembly, Disassembly. Design for Quality: Quality function deployment, FMEA, Product reliability, Standards and certification in electronic product design

(15 hours)

Total Hours	**45**

Text Books:

1	V. Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, John Wiley & Sons, 2012.
2	K. T. Ulrich and S. D. Eppinger, Product Design and Development, 7th Edition, McGraw Hill, 2020.
3	G. Pahl, W. Beitz, J. Feldhusen, and K. Grote, Engineering Design: A Systematic Approach, 3rd Edition, Berlin, Springer, 2007.

Reference Books:	
1	D. Norman, The Design of Everyday Things: Revised and Expanded Edition, Basic Books, New York, 2013.
2	R.G. Kaduskar and V.B. Baru, Electronic Product Design, 2nd Edition, Wiley, 2011.
Web References:	
1	https://onlinecourses.nptel.ac.in/noc21_ee90/preview
2	https://onlinecourses.nptel.ac.in/noc21_me83/preview
3	https://www.udemy.com/course/drawing-for-product-design/
4	https://www.pluralsight.com/courses/electronic-product-design-rhino-1169

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (16%) [80 Marks]

Course Outcome	Bloom's Level	Assessment Component	Marks
C907.1	Remember	Technical Quiz	20
C907.2 & C907.5	Apply	Seminar Presentation	20
C907.3	Understand	Assignment	20
C907.4	Understand	Test	20

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Internal Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 [60 Marks]	CIA2 [60 Marks]	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse			
Evaluate			
Create			

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1: 100 Marks			CA 2: 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component – II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Articulation Matrix														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C907.1	3	3	3									3	3	3
C907.2	3	3	3									3	3	3
C907.3	3	3	3									3	3	3
C907.4	3	3	3									3	3	3
C907.5	3	3	3									3	3	3
C907	**3**	**3**	**3**									**3**	**3**	**3**

MANDATORY COURSE

23MC101	INDUCTION PROGRAMME (FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES)	1/0/0/0
Nature of Course	Induction Programme	
Pre requisites	Nil	
Course Objectives:		
1	To have broad understanding of society and relationships	
2	To nurture the character and fulfil one's responsibility as an engineer, a citizenand a human being	
3	To incorporate meta skills and values	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C101.1	Explore academic interest and activities	[AP]
C101.2	Work for excellence	[AP]
C101.3	Promote bonding and give a broader view of life and character	[AP]

Course Contents:

PHYSICAL ACTIVITY: Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.(CO mapping: C101.1, C101.2, C101.3)

CREATIVE ARTS (students can select any one of their choice): Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on. .(CO mapping: C101.1, C101.2, C101.3)

UNIVERSAL HUMAN VALUES: Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community – local and global- and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills. .(CO mapping: C101.1, C101.2, C101.3)

LITERARY AND PROFICIENCY MODULES: Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage with societal institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of Reading, writing, speaking – debate, role play etc. Communication and computer skills. (CO mapping: C101.1, C101.2, C101.3)

LECTURES BY EMINENT PEOPLE: Teaching with Lectures. ... It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts.(CO mapping: C101.1, C101.2, C101.3)

VISIT TO LOCAL AREAS: Traveling is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near

college to learn new things. Eg.Meditation centre/orphanage/Hospital.(CO mapping: C101.1, C101.2, C101.3)

FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION: Hod's of different branches will present about their department followed by department visit to view various facilities available at their department, new innovations from students and faculties etc. .(CO mapping: C101.1, C101.2, C101.3)

23MC102	ENVIRONMENTAL SCIENCES	1 /0 /0 /0

Nature of Course	:C (Theory Concept)

Course Objectives:

1	To learn the integrated themes on various natural resources.
2	To gain knowledge on the type of pollution and its control methods.
3	To have an awareness about the current environmental issues and the social problems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C102.1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
C102.2	Understand the importance of natural resources and conservation of biodiversity.	[U]
C102.3	Understand and analyze the impact of engineering solutions in a global and societal context.	[U]
C102.4	Apply the gained knowledge to overcome pollution problems.	[AP]
C102.5	Apply the gained knowledge in various environmental issues and sustainable development.	[AP]

Course Contents:

Module 1: Natural Resources **10**

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources- Soil erosion and desertification — Role of an individual in conservation of natural resources.

Module 2: Environmental Pollutions **10**

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Greenhouse effect-Global warming- Ozone layer depletion — case study- Bhopal gas tragedy. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

Module 3: Social issues and the Environment **10**

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS.

Total Hours	**30**

Text Books:

1	Anubha Kaushik and C P Kaushik “Perspectives in Environmental Studies”4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi
2	Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press2015.

Reference Books:

1	Tyler Miller, Jr., “Environmental Science”, Brooks/Cole a part of Cengage Learning, 2014.
2	William Cunningham and Mary Cunningham, “Environmental Science”, 13th Edition,McGraw Hill,2015.
3	Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Third Edition, Pearson Education, 2014.

Web References:

1	http://nptel.ac.in/courses/104103020/20
2	http://nptel.ac.in/courses/120108002
3	http://nptel.ac.in/courses/122106030
4	http://nptel.ac.in/courses/120108004/

5	http://nptel.ac.in/courses/122102006/20
Online Resources:	
1	https://www.edx.org/course/subject/environmental-studies
2	www.environmentalscience.org

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
C201.1	Remember	Quiz	10
C201.2	Understand	Case study based on environmental aspect	20
C201.3	Understand	Class presentation	10
C201.4 & C201.5	Apply	Assignment	10

Summative assessment based on Continuous Assessment			
Bloom's Level	**Continuous Assessment**		
	CIA-I [0 marks]	**CIA-II [0 marks]**	**Term End Assessment [50 marks]**
Remember	-	-	30
Understand	-	-	40
Apply	-	-	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

23MC103	SOFT SKILLS	1/0/0/0
Nature of Course	Theory Concept	

Course Objectives:

1.	To develop the students competency level and their capabilities.
2.	To teach the students to be effective in workplace and social environments.
3.	To create self confidence among the students and to resolve stress and conflictwithin themselves.
4.	To help the students to enhance their career skills by increasing their productivity and performances.
5.	To concentrate more on conversation skills, presentation skills, verbal ability,critical and creative thinking.

Course Outcomes:
Upon completion of the course, students shall have ability to

C103.1	Remember the principles of soft skills required for their profession.	[R]
C103.2	Understand the importance of Interpersonal communication Skillsamong individuals, groups and cultures.	[U]
C103.3	Apply verbal and non-verbal communication skills in corporate environment.	[AP]
C103.4	Analyze and apply creativity skills, critical thinking skills and problemsolving skills.	[A]
C103.5	Articulate oral and written messages in an appropriate and persuasive manner to suit specific purposes, audiences and contextsat work place.	[AP]
C103.6	Apply good teamwork skills and Leadership Skills	[AP]

Course Contents:

Module 1: Professional Communication Skills **10**

Introduction to the Soft Skills, Performance Evaluation 1 –Significance of Soft Skills- Understanding the basic Communication Principles –Listening Skills- Listening Exercises- Speaking Skills- How to start and Sustain a Conversation- Speaking in Groups- Understandingself and Personal Branding, attitude, types of attitude, Positive Attitude, Self Confidence and Self-Motivation - Personal Application/Action Taken.

Advanced Writing Skills-Principles of Business Writing- E mails- Writing Reports- Types of Reports- Strategies for Report Writing- Personal Application/Action Taken.

Verbal Ability- Analogy- Classification- Odd One Out- Idioms and Phrases- Sentence Correction- Empathy and its importance in career -Personal Application/Action Taken.

Module 2: Interpersonal Communication **10**

Nonverbal Communication- Individual, Groups and Cultures- Body Language- Attire and Etiquettes- Interpersonal Skills- dealing with diverse People- Networking- Emotional Intelligence and its importance. Personal Application/Action Taken. Developing Creativity- Critical Thinking and Problem Solving Skills- Making the Right Choice- Never Give Up- Beginto Grow- Personal Application/Action Taken.

Interviews- Facing Job Interviews - Planning and Preparing- Effective Resume along with Covering Letter- Planning and Preparing- Personal Application/Action Taken.

Self-Discipline - Self Presentation - Personal Application/Action Taken.

Module 3: Teamwork and Leadership Skills **10**

Industry Expectations- Universal Hiring Rule- Personal Application/Action Taken.

Importance of Human Values-Importance of Team Work- Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player- Personal Application/Action Taken.

Planning- Prioritization – Delegation - Conflict Management - Decision and its necessity in crucial situations- Group Discussion - Personal Application/Action Taken. Essential Skills in working Strategies- Presentation and Interaction Skills- What to Present and How- Being Assertive- Multimedia Presentation-Making Effective Presentations. Interview Skills - Do's and Don'ts - Body Language - Answering the Common Questions ofInterview- Performance Evaluation 2 - Mock Interview

	Total Hours	**30**
Text Books:		
1.	Business Communication for managers: An advanced approach, by Penrose, Cengage learning.	
2.	Professional Communication in Engineering. by H.E. Sales. Palgrave Macmillan 2009.	
3.	Communication for professional engineers by W. P. Scott, Bertil Billing. Thomas Telford, 1998.	
Reference Books:		
1.	Reason and professional ethics by Peter Davson-Galle. Ashgate Publishing, Ltd., 2009.	
2.	Cross Cultural and Inter Cultural Communication. by William B. Gudykunst. Sage Publications India Pvt Ltd, New Delhi.2003.	
3.	Corporate Communications: Theory and Practice. ByJoepCornelissen. Sage Publications India Pvt Ltd, New Delhi.2004.	
Web References:		
1	https://onlinecourses.nptel.ac.in/noc16_hs15/preview	
2	https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication.	
3	https://smude.edu.in/smude/programs/bca/soft-skills.html	
Online Resources:		
1	https://swayam.gov.in/course/4047-developing-soft-skills-and-personality	
2	https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/	
3	https://www.bizlibrary.com/soft-skills-training/	

Assessment Methods & Levels (based on Revised Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:100)

Course Outcome	Revised Bloom's Level	Assessment Component	Marks
C103.1	Remember	Group Discussion	30
C103.2 & C103.3	Understand	Listening Skills	20
C103.4	Apply	Interview	20
C103.5 & C103.6	Apply	Formal Presentation	30

23MC106	LIFE SKILLS AND ETHICS	1 /0 /0 /0

Nature of Course	Theory Concept
Pre requisites	NIL

Course Objectives:

1	To develop communication competence in prospective engineers.
2	To enable them to convey thoughts and ideas with clarity and focus.
3	To develop report writing skills.
4	To equip them to face interview & Group Discussion.
5	To inculcate critical thinking process.
6	To prepare them on problem solving skills.
7	To provide symbolic, verbal, and graphical interpretations of statements in a problem description.

Course Outcomes:

Upon completion of the course, students shall have ability to

C106.1	Define and Identify different life skills required in personal and professionallife.	[U]
C106.2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.	[AP]
C106.3	Explain the basic mechanics of effective communication and demonstratethese through presentations.	[AN]
C106.4	Use appropriate thinking and problem solving techniques to solve new problems.	[AP]
C106.5	Understand the basics of teamwork and leadership	[U]

Course Contents:

Module 1 **10**

Communication Skill: Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Writing Skills, Technical Writing, Letter Writing, Job Application, Report Writing, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication.

Module 2 **10**

Critical Thinking & Problem Solving: Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats Mind Mapping & Analytical Thinking. Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

Module 3 **10**

Ethics, Moral & Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE. **Leadership Skills:** Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation

Total Hours	**30**

Reference Books:

1	Barun K. Mitra; (2011), “Personality Development & Soft Skills”, First Edition; OxfordPublishers.
2	Kalyana; (2015) “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd.
3	Larry James (2016); “The First Book of Life Skills”; First Edition; Embassy Books.
4	ShaliniVerma (2014); “Development of Life Skills and Professional Practice”; FirstEdition; Sultan Chand (G/L) & Company
5	John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division ofHachette Book Group Inc

Web References:

1	https://www.coursera.org/courses?query=ethics

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:100)

Course Outcome	Bloom's Level	Assessment Component	Marks
C106.1	Remember	Quiz	**20**
C106.2	Understand	Assignment	**20**
C106.3	Understand	Presentation	**30**
C106.4 C106.5	Apply	Group Discussion	**30**

23MC107	STRESS MANAGEMENT	1 /0 /0 /0

Nature of Course	Theory Concept
Pre requisites	NIL

Course Objectives:

1	Understand the basic principles of stress management
2	Recognize your stress triggers and how to manage them
3	Develop proactive responses to stressful situations
4	Use coping tips for managing stress both on and off the job
5	Learn to manage stress through diet, sleep and other lifestyle factors
6	Develop a long term action plan to minimize and better manage stress
7	Understand the basic principles of stress management

Course Outcomes:

Upon completion of the course, students shall have ability to

C107.1	Understand the basic principles of stress management	[U]
C107.2	Apply the concept of recognizing your stress triggers and find was tomanage them.	[AP]
C107.3	Develop proactive responses to stressful situations	[AN]
C107.4	Develop a long term action plan to minimize and better manage stress	[AP]

Course Contents:

Module 1 **10**

Scientific Foundations of Stress: What is stress? – Sources of Stress – Types of Stress – Personality Factors and stress – Stress and the college student. Stress Psychophysiology: Stress and nervous system – Hypothalamic – Pituitary – Adrenal (HPA) Axis – Effect of Stress on Immune system – Health risk associated with chronic stress – Stress and Major Psychiatric disorders.

Module 2 **10**

Developing Resilience to Stress: Understanding you stress level – Role of personality pattern, Self-esteem, Locus of control – Role of Thoughts Beliefs and Emotions – I & II – Life situation Intrapersonal: (Assertiveness, Time Management).

Module 3 **10**

Strategies for Relieving Stress: Developing cognitive coping skills – Autogenic training, imagery and progressive relaxation – Other relaxation techniques – Exercise and Health – DIY strategies stress management.

Total Hours	**30**

Reference Books:

1	Jonathan C. Smith; (2011), “Stress Management: A Comprehensive Handbook ofTechniques and Strategies”, First Edition; Springer Publishing Company.
2	Bob Stahl, Elisha Goldstein, Jon Kabat-Zinn (2019); “A mindfulness–based stress reduction workbook”; Second Edition; New Harbinger Publications.
3	Ryan M. Niemiec (2019), “ The Strengths-based workbook for stress relief”, First edition, New Harbinger Publications.

Web References:	
1	https://thiswayup.org.au/courses/coping-with-stress-course/
2	https://www.classcentral.com/course/swayam-stress-management-14309

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
C107.1	Remember	Quiz	**20**
C107.2	Apply	Group Discussion	**30**
C107.3	Apply	Class Presentation	**30**
C107.4	Understand	Assignment	**20**

23MC108	CONSTITUTION OF INDIA	1/0/0/0

Nature of Course	Theory
Pre Requisites	NIL

Course Objectives:

1	To familiarize with basic information about Indian constitution
2	To understand the fundamental rights and duties as citizens of India

Course Outcomes:
Upon completion of the course, students shall have ability to

C108.1	Explain the objectives of the Constitution of India and its formation	[U]
C108.2	Recall state and central policies (Union and State Executive), fundamentalRights and their duties.	[R]
C108.3	Make use of legal directions in developing solutions to societal issues	[AP]
C108.4	Utilized for competitive exams that requires knowledge of Indian Constitution	[AP]

Course Contents:

Module 1 **10**

Historical perspective, The making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights, Directive Principles of State Policy, Fundamental Duties, Citizenship Article 5-11.

Module 2 **10**

Federal structure, Powers of the Union and the states, Centre-State Relations, Union Executive - President, Prime Minister, Union Cabinet, Parliament, Supreme Court of India, State Executives - Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Elections, Electoral Process, and Election Commission of India, Election Laws. Powers and Functions of Municipalities and Panchayat

Module 3 **10**

Amendments - Methods, Emergency Provisions, National Emergency, President Rule, Financial Emergency, Provisions for SC & ST, OBC, women, children and backward classes, Right to Property, Freedom of Trade and Commerce. Agricultural Law

Total Hours:	**30**

Text Books:

1	Dr.D.D.Basu, “Introduction to the Constitution of India”, LexisNexis, New Delhi, 22nd Edition, 2016.
2	“Bare act-constitution of India”, The universal Publications, LexisNexis 2020, New Delhi, India.

Reference Books:

1	Subhash.C.Kashyap, “Our Constitution: An Introduction to India’s Constitution and Constitutional Law”, National Book Trust, India, 5th edition, 2019.
2	M. Laxmikanth, “Constitution of India”, Cengage Learning India. 1st edition 2018.

Web References:

1	https://unacademy.com/course/the-indian-constitution/NSKQ8XXQ
2	https://unacademy.com/goal/upsc-civil-services-examination-ias-preparation/KSCGY

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:100)

Course Outcome	Bloom’sLevel	Assessment Component	Marks
C108.1	Remember	Test	**20**
C108.4	Understand	Quiz	**40**
C108.3	Apply	Presentation	**20**
C108.2	Apply	Group Assignment	**20**

VALUE ADDED COURSE

23VA403	THE AGRICULTURE IN INDUSTRY 4.0	1/0/0/1

Nature of Course	:G (Theory & Analytical)

Course Objectives:

1	Introduce the basics of Agricultural Industry
2	Impart the challenges and opportunities of Agriculture Industry
3	Gain knowledge on Industry 4.0
4	Knowledge on Cyber Physical system and limitations
5	Imparting the knowledge on barriers and drives of implementing Industry 4.0.

Course Outcomes:
Upon completion of the course, students shall have ability to

C403.1	Understand the basics Agricultural Industry.
C403.2	Analyzing various challenges and opportunities of Agricultural Industry
C403.3	Understanding the concept of Industry 4.0.
C403.4	Understand Cyber Physical Systems with its limitations
C403.5	Analyze the barriers of implementing Industry 4.0

Course Contents:

Agriculture – Industry 4.0

Understand the Agriculture Industry and its role in Society, Challenges of the Agriculture Industry , Opportunities for Innovation in the Agriculture Industry, Industry 4.0 and the Industry 4.0 Environment, Cyber Physical Systems (CPS) and its benefits and drawbacks of CPS, Impact of Industry 4.0 on the Agriculture Industry, Barriers for Implementing Industry 4.0, Drivers of Implementing Industry 4.0.

Total Hours:	**15**

Reference Books:

1	Alasdair Gilchrist , “Industry 4.0: The Industrial Internet of Things” Apress, 2017.
2	Stella Despoudi, Konstantina Spanaki, Oscar Rodriguez-Espindola and Efpraxia D. Zamani, “Agricultural Supply Chains and Industry 4.0” : Technological Advance for Sustainability Springer , 2021.
3	Vítor João Pereira DominguesMartinho, “Trends of the Agricultural Sector in Era 4.0” Springer Cham,2022

Web References:

1	https://www.newfoodmagazine.com/article/162994/food-industry-automation-a-silver-lining-of-the-pandemic/
2	https://new.siemens.com/in/en/company/topic-areas/digital-enterprise.html?gclid=CjwKCAjwuYWSBhByEiwAKd_n_i5lwcG_Xsq_hys_f3G0cb6I-jVjuY4WQHE7Jh_oFjMO2063y_vgfxoC5joQAvD_BwE
3	https://prepr.org/resource-hub/webinar/ifc-workshop/manufacturing-request/?gclid=CjwKCAjwuYWSBhByEiwAKd_n_m3jXktk_Yf0VEn6ju5jcYpccR6-UGGaGeHJMX0pLnZ4SciHbWZo9hoCiMcQAvD_BwE
4	https://ati.ec.europa.eu/sites/default/files/202007/Industry%204.0%20in%20Agriculture%20-%20Focus%20on%20IoT%20aspects%20%28v1%29.pdf

23VA404	CONNECTING TECHNOLOGIES WITH REAL WORLD	1/0/0/1
Nature of Course	:Theory	
Course Objectives:		
1	Introduce the basics of connectivity technologies	
2	Familiarize the basics of modern technologies for realistic applications	
3	Gain knowledge of various sensors interface	
4	Impart knowledge on different user interface assistant devices	
5	Introduce concepts on behavioural analysis of connecting technologies	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C404.1	Understand the basics of connectivity Technologies	
C404.2	Analyze the various connectivity technologies in the real world	
C404.3	Analyze the different sensors suitable for real time applications.	
C404.4	Design the real time system which connect the modern connecting technology	
C404.5	Construction of IoT based design which is realistic and feasible for application	
C404.6	Analyzing the various user interface assistant devices for realtime applications	
Course Contents:		
Introduction to connectivity technologies-6LoWPAN-wireless HART-Z-wave –Mobile sensor Networks-UAV Networks, connectivity of different sensors- behavioural analysis of connecting technologies- user interface assistant devices. Connectivity of sensors modules with IoT		
	Total Hours:	**15**
Reference Books:		
1	Zach Shelby andCarsten Bormann, “6LoWPAN: The Wireless Embedded Internet”, Publisher: John Wiley & Sons, 1st edition,2019.	
2	Feng Zhao and Leonidas J. Guibas, “Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2nd edition, 2018.	
3	Holger Karl and Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks”, John Wiley, 3rd edition, 2019.	
Web References:		
1	https://onlinecourses.nptel.ac.in/noc22_ee50	
2	https://alison.com/course/introduction-to-connectivity-technologies-and-sensornetworks	
3	www.ist.hokudai.ac.jp/eng/divisions/mednet/	

23VA405	ARDUINO PROGRAMMING MODEL	1/0/0/1

Nature of Course	Theory & Practical

Course Objectives:

1	Introduce the hardware of Arduino board and the development of software in Integrated Development Environment
2	Familiarize with Arduino Coding
3	Gain knowledge on Arduino shields and libraries
4	To learn the interfacing of Arduino with Input/Output devices
5	Introduce concepts of real time interfacing using Arduino

Course Outcomes:
Upon completion of the course, students shall have ability to

C405.1	Understand various hardware features of the Arduino UNO board
C405.2	Understand various features of Integrated Development Environment (IDE) software used for the development of software
C405.3	Understand how to download and use the Arduino IDE for the development of software
C405.4	Understand the structure and functions of the Arduino program
C405.5	Demonstrate the interfacing and programming of Temperature Sensor (LM35), Humidity and Temperature Sensor (DHT11), Light Dependent Register, Touch Sensor, Optical Sensor with Arduino UNO board
C405.6	Demonstrate the interfacing and programming of Switch, Keypad Matrix, and Potentiometer with Arduino UNO board.

Course Contents:

Introduction to Arduino platform board, IDE, Sheilds and libraries, Arduino sketches, sketch structure, basic program flow and control, analog and digital, basic serial communication, variables and memory and inputs, outputs. Integration of sensors and actuators, memory with Arduino.

Total Hours:	15

Reference Books:

1	Simon Monk, “Programming Arduino: Getting started with sketches”, Publisher: Mcgrawhill , 2nd edition, 2016.
2	Brain Evans, “ Beginning Programming Arduino” Publisher: Technologyin action , 2nd edition, 2012
3	Ryan Turner, “Arduino Programming ” Publisher: KDS print, 1nd edition, 2019

Web References:

1	https://www.halvorsen.blog/documents/technology/resources/resources/Arduino/Programming%20with%20Arduino.pdf
2	https://bastiaanvanhengel.files.wordpress.com/2016/06/arduino_projects_book.pdf
3	https://www.coursera.org/learn/interface-with-arduino
4	https://www.tutorialspoint.com/arduino/arduino_tutorial.pdf

23VA406	PCB DESIGN FOR ELECTRONIC CIRCUITS	1/0/0/1
Nature of Course:	~~G~~(Theory + Practical)	
Course Objectives:		
1	Introduce the basics of PCB design	
2	Impart the knowledge on types of PCB packages	
3	Gain knowledge on tool usage	
4	Familiarize the rules for PCB design	
5	Gain the skills of designing PCB through CAD packages and documentation.	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C406.1	Acquire the basic level knowledge.	
C406.2	Understand the packages of Electronic components.	
C406.3	Know the types of PCBs.	
C406.4	Understand different tool usage.	
C406.5	Understand the rules before PCB Designing.	
C406.6	Understandthe flow of computer aided design packages and will Acquire the importance of manufacturing documents.	
Course Contents:		
What is PCB - Types of PCBs: Single Sided (Single Layer),Multi-Layer (Double Layer) - PCB Materials, Brief History of EDA - Latest Trends in Market - Different EDA tools - Introduction to SPICE and PSPICE Environment.Through Hole Packages - Axial lead - Radial Lead - Single Inline Package (SIP) - Dual Inline Package(DIP) - Transistor Outline(TO) - Pin Grid Array(PGA) - Through Hole Packages - Metal ElectrodeFace(MELF) - Leadless Chip Carrier(LCC) - Small Outline Integrated Circuit(SOIC) - Quad FlatPack(QPF) and Thin QFP (TQFP) - Ball Grid Array(BGA) - Plastic Leaded Chip Carrier(PLCC).Designing Flow Chart - Schematic Entry - Net listing - PCB Layout Designing – PrototypeDesigning - Design Rule Check(DRC) - Design For Manufacturing(DFM) - PCB Making - Printing,Etching - Drilling - Assembly of components, Description of PCB Layers - Electrical Layers – TopLayer - Mid Layer - Bottom Layer - Mechanical Layers - Board Outlines and Cutouts - Drill Details -Documentation Layers - Components Outlines - Reference Designation – Text.		
	Total Hours:	**15**
Reference Books:		
1	Walter C Bosshart, “Printed Circuit Boards: Design and Technology”, Tata McGraw-hill	
2	R S Khandpur, “Printed Circuit Boards: Design, Fabrication, Assembly & Testing”, Tata McGraw-hill	
3	Ronals A. Reis, “Electronics Project Design And Fabrication”, Merrill Publishing	
4	Darryl Lindsey,” The Design & Drafting of Printed Circuits”, The Design & Drafting of Printed Circuits	
Web References:		
1	https://componentsearchengine.com/	
2	https://upverter.com/	
3	https://nptel.ac.in/courses/108108031	

23VA407	ENERGY HARVESTING AND SECURITY ISSUES IN COGNITIVE NETWORKS	1/0/0/1

Nature of Course:	~~G~~(Theory)

Course Objectives:	
1	Introduce the basics and architecture of cognitive radio networks
2	Impart the knowledge on spectrum management and it's challenges
3	Gain knowledge on Energy Harvesting and it's Techniques
4	Familiarize the concept of cooperative relay
5	Impart the knowledge on energy efficient Techniques in Next generation networks.

Course Outcomes: **Upon completion of the course, students shall have ability to**	
C407.1	Understand the basics of cognitive radio networks and its architecture.
C407.2	Analyze the various spectrum management framework.
C407.3	Understand the Energy Harvesting and it's Techniques.
C407.4	Apply the cooperative relay in Cognitive Radio Network
C407.5	Analyze the SWIPT based CoR protocol.
C407.6	Understand the energy efficient Techniques in Next generation networks.

Course Contents:

Cognitive Networks, Cognitive Radio Network Architecture, Cognitive Wireless Sensor Networks, Cooperative Cognitive Wireless Communication Networks, Spectrum Management,Cognitive Radio Paradigms and Challenges - Security Measures of Cooperative Cognitive Wireless Communication Networks, Energy Harvesting, Power Management Schemes - Two-phase Method, Energy Harvesting Models and Constraints, RF-EH Network, Energy Supply and Demand of Cellular Systems, Energy cooperation, Communication cooperation, Cooperative Relay, Benefits of CoR, SWIPT Procedure, Architecture of SWIPT, SWIPT based CoR protocol, SWIPT CoR based CRN, 5G Technology, 5G Architecture, SWIPT and Cognitive Radio in 5G, Massive MIMO systems in EH CRNs.

Total Hours:	**15**

Reference Books:	
1	Prabhat Thakur, Ghanshyam singh, "Spectrum Sharing in Cognitive Radio Networks – Towards Highly Connected Environment", John Wiley and Sons.
2	Chuan Huang, Sheng zhou, Jie Xu, ZhixengNiu, Rui Zhang, Shuguang Cui, "Energy Harvesting Wireless Communications", IEEE Press, Wiley
3	Dushantha Nalin K.Jayakody, John Thompson, SymeonChatzinotas, Salman Durrani, "Wireless Information and Power Transfer: A new paradigm for Green Communications", Springer

Web References:	
1	https://ieeexplore.ieee.org/document/8628978
2	https://www.coursera.org/learn/smart-device-mobile-emerging-technologies
3	https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1093&context