REGULATIONS-2022

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Vision and Mission of the Department

Vision:

- To excel in the field of Electronics and Communication Engineering to contribute to the knowledge economy and betterment of human life.

Mission:

- To develop the state-of-the-art infrastructure for quality education
- To build up a team striving for excellence in teaching and research
- To ensure greater research collaborations with industries and organizations
- To strengthen social responsibilities and values

Mapping of Programme Educational Objectives with Department Mission:

Mission	PEO1	PEO2	PEO3	PEO4
To develop the state-of-the-art infrastructure for quality education	2	2	2	1
To build up a team striving for excellence in teaching and research	3	3	2	2
To ensure greater research collaborations with industries and organizations	3	3	3	2
To strengthen social responsibilities and values	1	2	1	1

Contribution 1: Reasonable 2: Significant 3: Strong

PROGRAMME EDUCATIONAL OBJECTIVES:

Graduates of Electronics and Communication Engineering program will

PEO1: excel in their professional and technical career and pursue higher education to be globally competent

PEO2: evaluate the real world problems and provide with technically feasible and economically viable solutions

PEO3: continuously update technologies through lifelong learning

PEO4: exhibit effective communication skills and professionalism in diverse environment

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

a) **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

b) **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.

c) **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.

d) **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.

e) **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**.**

f) **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.

g) **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.

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

i) **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

j) **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.

k) **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.

l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

The Electronics and Communication Engineering Graduates should be able to

a) Develop and test electronic systems for given specifications.

b) Design and analyze the signal processing systems as per the requirements.

c) Apply appropriate technology for the implementation of modern communication systems.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Educational objectives and the Programme outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	✓	✓	✓	✓	✓					✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓		✓			✓		✓
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS-2022
CHOICE BASED CREDIT SYSTEM
MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

A broad relation between the Course Outcomes and Programme Outcomes is given in the table

COURSE COUTCOMES		PROGRAMME OUTCOMES											
Sem	COURSE NAME	a	b	c	d	e	f	g	h	i	j	k	l
I	Matrices and Calculus	✓	✓	✓	✓	✓	✓	✓					✓
	Physics for Electronics Engineering	✓	✓	✓	✓							✓	✓
	Problem Solving usingC++	✓	✓	✓					✓	✓	✓		✓
	Software Development Practices	✓	✓	✓		✓	✓		✓	✓	✓		✓
	Digital Principles and System Design	✓	✓	✓					✓	✓	✓		✓
	Professional Communication	✓								✓	✓		✓
	Product Development Lab–1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Environmental Sciences and Sustainability(Non Credit)	✓	✓	✓	✓	✓						✓	✓
	Induction Program(Non Credit)							✓	✓	✓	✓	✓	✓
II	Transforms and Numerical Methods	✓	✓	✓	✓	✓	✓						✓
	Electron Devices and Circuit Theory	✓	✓	✓	✓	✓	✓					✓	✓
	Engineering Chemistry	✓	✓				✓	✓					✓
	Data Structures	✓	✓	✓	✓	✓	✓					✓	✓
	Java Programming	✓	✓	✓		✓			✓	✓	✓		✓
	Heritage for Tamils												
	Computer Aided Engineering Graphics	✓		✓		✓					✓		
	Product Development Lab-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Yoga for Stress Management												
III	Statistics and Linear Algebra	✓	✓	✓	✓					✓	✓		
	Signals and Systems	✓	✓	✓	✓	✓	✓	✓	✓				✓
	Analog electronics	✓	✓	✓	✓	✓	✓	✓	✓				✓
	Problem solving and python programming	✓	✓	✓		✓			✓	✓	✓		✓
	Electromagnetic fields and Transmission lines	✓	✓	✓	✓	✓		✓					✓
	Aptitude and Coding Skills I	✓	✓						✓	✓			
	Product Development Lab - 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Value Education (Non Credit)	✓	✓							✓	✓		
IV	Universal Human Values II: Understanding Harmony	✓	✓	✓	✓								✓
	Probability and Random Processes	✓	✓	✓	✓	✓							✓
	Control Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

	Linear Integrated Circuits	✓	✓	✓	✓	✓		✓					✓
	Analog and Digital Communication	✓	✓	✓	✓	✓							✓
	Aptitude and Coding Skills II	✓	✓							✓	✓		
	Product Development Lab -4	✓	✓	✓	✓	✓	✓	✓	✓				✓
	Testing of sensors and actuators	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
	Yoga for Personality Development												
V	Database Management Systems	✓	✓	✓	✓	✓	✓					✓	✓
	Digital VLSI Design	✓	✓	✓	✓	✓	✓					✓	✓
	Microcontroller and Interfacing	✓	✓	✓	✓	✓	✓					✓	✓
	Advanced Aptitude and Coding Skills I	✓	✓							✓	✓		
	Product Development Lab - 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Professional Elective I												
	Professional Elective II												
	Indian Constitution (Non Credit)	✓	✓	✓						✓	✓		
VI	Digital Signal Processing	✓	✓	✓	✓	✓	✓					✓	✓
	Embedded Systems &IoT Design	✓	✓	✓	✓	✓	✓					✓	✓
	Advanced Aptitude and Coding Skills II	✓	✓	✓	✓	✓	✓					✓	✓
	Product Development Lab - 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Management Elective												
	Professional Elective III												
	Professional Elective IV												
	Open Elective I												
VII	Microwave and Antennas	✓	✓	✓	✓	✓	✓						✓
	Optical Communication and Networking	✓	✓	✓	✓	✓				✓	✓	✓	✓
	Professional Ethics in Engineering						✓	✓	✓	✓	✓	✓	✓
	Essence of Indian Knowledge Tradition (Non Credit)	✓	✓	✓								✓	✓
	Professional Elective V												
	Open Elective II (MOOC / SWAYAM)												
	Project Work - Phase I and Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VIII	Project Work-Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS–2022

CHOICE BASED CREDIT SYSTEM

I-II SEMESTER CURRICULUM

SEMESTER–I								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORYCOURSESWITHLABORATORY COMPONENT								
1	22MA101	Matrices and Calculus	BSC	5	3	0	2	4
2	22PH101	Physics for Electronics Engineering	BSC	5	3	0	2	4
3	22CS101	Problem Solving using C++	ESC	5	3	0	2	4
4	22CS102	Software Development Practices	ESC	5	3	0	2	4
5	22EC101	Digital Principles and System Design	PCC	5	3	0	2	4
6	22HS101	Professional Communication	HSMC	4	2	0	2	3
LABORATORYCOURSES								
7	22GE111	Product Development Lab -1	EEC	2	0	0	2	1
MANDATORYCOURSES								
8	22CH102	Environmental Sciences and Sustainability(Non Credit)	MC	2	2	0	0	0
		Induction Program (Non Credit)	MC	3Weeks				
			TOTAL	**33**	**19**	**0**	**14**	**24**

SEMESTER–II								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORYCOURSESWITHLABORATORY COMPONENT								
1	22MA201	Transforms and Numerical Methods	BSC	5	3	0	2	4
2	22EC201	Electron Devices and Circuit Theory	PCC	5	3	0	2	4
3	22CH101	Engineering Chemistry	BSC	5	3	0	2	4
4	22CS201	Data Structures	ESC	5	3	0	2	4
5	22CS202	Java Programming	ESC	5	3	0	2	4
THEORY COURSE								
6	22GE201	Heritage of Tamils	HSMC	1	1	0	0	1
LABORATORY COURSES WITH THEORY COMPONENT								
7	22GE202	Computer Aided Engineering Graphics	ESC	3	1	0	2	2
LABORATORYCOURSES								
8	22GE211	Product Development Lab -2	EEC	2	0	0	2	1
AUDIT COURSES								
9		Yoga for Stress Management	AC	1	1	0	0	0
TOTAL				**32**	**18**	**0**	**14**	**24**

SEMESTER–III								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES WITH LABORATORY COMPONENT								
1	22MA302	Statistics and Linear Algebra	BSC	5	3	0	2	4
2	22EC301	Signals and Systems	PCC	5	3	0	2	4
3	22EC302	Analog electronics	PCC	5	3	0	2	4
4	22 EC304	Problem solving and Python Programming	ESC	5	3	0	2	4
THEORY COURSE								
5	22GE301	Tamils and Technology	HSMC	1	1	0	0	1
6	22EC303	Electromagnetic fields and Transmission lines	PCC	5	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	22CS311	Aptitude and Coding Skills I	EEC	2	0	0	2	1
8	22EC311	Product Development Lab - 3	EEC	2	0	0	2	1
AUDIT COURSES								
9		Value Education (Non Credit)	MC	1	1	0	0	0
TOTAL				**29**	**17**	**0**	**12**	**22**

SEMESTER–IV								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSE								
1	22GE302	Universal Human Values II: Understanding	HSMC	3	3	0	0	3
THEORY COURSESWITH LABORATORY COMPONENT								
2	22MA402	Probability and Random Processes	BSC	5	3	0	2	4
3	22EC401	Control Engineering	PCC	5	3	0	2	4
4	22EC402	Linear Integrated Circuits	PCC	5	3	0	2	4
5	22EC403	Analog and Digital Communication	PCC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
6	22CS411	Aptitude and Coding Skills II	EEC	2	0	0	2	1
7	22EC411	Product Development Lab -4	EEC	2	0	0	2	1
8	22EC412	Testing of sensors and actuators	EEC	2	0	0	2	1
AUDIT COURSES								
9		Yoga for Personality Development	AC	1	1	0	0	0
TOTAL				**30**	**16**	**0**	**14**	**22**

SEMESTER–V								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSE								
1		Professional Elective I	PEC	3	3	0	0	3
2		Professional Elective II	PEC	3	3	0	0	3
THEORY COURSESWITH LABORATORY COMPONENT								
3	22CS501	Database Management Systems	ESC	5	3	0	2	4
4	22EC501	Digital VLSI Design	PCC	5	3	0	2	4
5	22EC502	Microcontroller and Interfacing	PCC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
6	22CS511	Advanced Aptitude and Coding Skills I	EEC	2	0	0	2	1
7	22EC511	Product Development Lab- 5	EEC	2	0	0	2	1
AUDIT COURSES								
8		Indian Constitution (Non Credit)	MC	1	1	0	0	0
TOTAL				**26**	**16**	**0**	**10**	**20**

SEMESTER–VI								
Sl. No.	**Course Code**	**CourseTitle**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSE								
1		Management Elective	HSMC	3	3	0	0	3
2		Professional Elective III	PEC	3	3	0	0	3
3		Professional Elective IV	PEC	3	3	0	0	3
4		Open Elective I	OEC	3	3	0	0	3
THEORY COURSESWITH LABORATORY COMPONENT								
5	22EC601	Digital Signal Processing	PCC	5	3	0	2	4
6	22EC602	Embedded Systems &IoT Design	PCC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
6	22CS611	Advanced Aptitude and Coding Skills II	EEC	2	0	0	2	1
7	22EC611	Product Development Lab - 6	EEC	2	0	0	2	1
TOTAL				26	18	0	8	22

SEMESTER–VII								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSE								
1		Professional Ethics in Engineering	HSMC	3	3	0	0	3
2		Professional Elective V	PEC	3	3	0	0	3
3		Open Elective II (MOOC / SWAYAM)	OEC	3	3	0	0	3
THEORY COURSESWITH LABORATORY COMPONENT								
4	22EC701	Microwave and Antennas	PCC	5	3	0	2	4
5	22EC702	Optical Communication and Networking	PCC	5	3	0	2	4
MANDATORY COURSE								
6		Essence of Indian Knowledge Tradition (Non Credit)	MC	1	1	0	0	0
EMPLOYABILITY ENHANCEMENT COURSES								
7	22EC711	Project Work - Phase I and Internship	EEC	6	0	0	6	3
TOTAL				26	16	0	10	20

SEMESTER–VIII								
Sl. No.	**Course Code**	**CourseTitle**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSE								
1	22EC811	Project Work	EEC	16	0	0	16	8
TOTAL				16	0	0	16	8

CREDIT DISTRIBUTION

S. No.	Subject Area	CREDITS AS PER SEMESTER								Total Credits	% OF Distribution	Anna University
		I	II	III	IV	V	VI	VII	VIII			
1	HSMC	3	1	1	3	-	3	3	-	14	8.64	12
2	BSC	8	8	4	4	-	-	-	-	24	14.81	25
3	ESC	8	10	4	-	4	-	-	-	26	16.06	21
4	PCC	4	4	11	12	8	8	8	-	55	33.95	58
5	PEC	-	-	-	-	6	6	3	-	15	9.26	18
6	OEC	-	-	-	-	-	3	3	-	6	3.7	12
7	EEC	1	1	2	3	2	2	3	8	22	13.58	16
8	MC											
TOTAL		24	24	22	22	20	22	20	8	162	100	162

PROFESSIONAL ELECTIVE I SEMESTER V								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	22EC901	Introduction to Internet of things	PE	3	3	0	0	3
2	22EC902	FPGA Architecture and Applications	PE	3	3	0	0	3
3	22EC903	Computer Networks	PE	3	3	0	0	3
4	22EC904	Medical Electronics	PE	3	3	0	0	3
5	22EC905	Digital Image and Video Processing	PE	3	3	0	0	3
6	22EC906	Soft Computing	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE II SEMESTER V								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22EC907	Sensors and Actuator Devices	PE	3	3	0	0	3
2	22EC908	RTL Design with VHDL/Verilog HDL	PE	3	3	0	0	3
3	22EC909	Wireless Communication	PE	3	3	0	0	3
4	22EC910	Human Assist Devices	PE	3	3	0	0	3
5	22EC911	Multimedia Compression and Communication	PE	3	3	0	0	3
6	22EC912	Quantum Computing	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE III SEMESTER VI								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22EC913	Artificial Intelligence and Machine Learning	PE	3	3	0	0	3
2	22EC914	Low Power VLSI Design	PE	3	3	0	0	3
3	22EC915	4G / 5G Communication Networks	PE	3	3	0	0	3
4	22EC916	Wearable Devices	PE	3	3	0	0	3
5	22EC917	Wireless Sensor Networks	PE	3	3	0	0	3
6	22EC918	Robotics and Applications	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE IV SEMESTER VI								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22EC919	Application of IoT in Robotics	PE	3	3	0	0	3
2	22EC920	Design verification and Debugging	PE	3	3	0	0	3
3	22EC921	Massive MIMO Networks	PE	3	3	0	0	3
4	22EC922	Body Area Networks	PE	3	3	0	0	3
5	22EC923	Wireless Networks	PE	3	3	0	0	3
6	22EC924	Augmented Reality/Virtual Reality	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE V SEMESTER VII								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1	22EC925	UAV and Drone Technology	PE	3	3	0	0	3
2	22EC926	Design Optimization and Timing Analysis	PE	3	3	0	0	3
3	22EC927	Wireless Adhoc Networks	PE	3	3	0	0	3
4	22EC928	Cyber Security	PE	3	3	0	0	3
5	22EC929	Data Analytics	PE	3	3	0	0	3
6	22EC930	Satellite Communication	PE	3	3	0	0	3

MANAGEMENT ELECTIVES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	21CS939	Principles of Management	HSMC	3	3	0	0	3
2	21CS938	Professional Ethics in Engineering	HSMC	3	3	0	0	3
3	21EC919	Total Quality Management	HSMC	3	3	0	0	3
4	21CS917	Introduction to Innovation, IP Management and Entrepreneurship	HSMC	3	3	0	0	3

R2022 (2022-23)

CURRICULUM OF B.E (HONOURS) IN ELECTRONICS AND COMMUNICATION AND ENGINEERING

WITH SPECIALIZATION IN

INTERNET OF THINGS/VLSI/HIGH SPEED COMMUNICATION

INTERNET OF THINGS

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	22EC941	Industrial and Medical IoT	PE	3	3	0	0	3
2	22EC942	Programming and Web Technologies for IoT	PE	3	3	0	0	3
3	22EC943	Deep Learning and Its Applications	PE	3	3	0	0	3
4	22EC944	Robot Operating Systems	PE	3	3	0	0	3
5	22EC945	Design of Smart Cities	PE	3	3	0	0	3
6	22EC946	Image and Video Analytics	PE	3	3	0	0	3

VLSI

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	22EC947	Semiconductor Devices and Fabrication Processes	PE	3	3	0	0	3
2	22EC948	RFIC Design	PE	3	3	0	0	3
3	22EC949	VLSI Algorithms and Architectures	PE	3	3	0	0	3
4	22EC950	VLSI Design Testing and Verification	PE	3	3	0	0	3
5	22EC951	SOC and Low Power VLSI Design	PE	3	3	0	0	3
6	22EC952	Reconfigurable Architectures	PE	3	3	0	0	3

HIGH SPEED COMMUNICATION

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	22EC953	Advanced Wireless Communication	PE	3	3	0	0	3
2	22EC954	Advanced Wireless Networks	PE	3	3	0	0	3
3	22EC955	Software-defined networks	PE	3	3	0	0	3
4	22EC956	Satellite Communication & Navigation Systems	PE	3	3	0	0	3
5	22EC957	Information Storage and Cloud Computing	PE	3	3	0	0	3
6	22EC958	Cryptography and Network Security	PE	3	3	0	0	3

BIO MEDICAL TECHNOLOGY

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1		Biometric Systems	PE	3	3	0	0	3
2		Bio-signal Processing	PE	3	3	0	0	3
3		Therapeutic Equipment	PE	3	3	0	0	3
4		Medical Imaging Techniques	PE	3	3	0	0	3
5		Brain Computer Interface and Applications	PE	3	3	0	0	3
6		Bio Informatics	PE	3	3	0	0	3

SIGNAL & IMAGE PROCESSING

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1		Computer Vision	PE	3	3	0	0	3
2		Big Data Analytics	PE	3	3	0	0	3
3		Image Processing with Python	PE	3	3	0	0	3
4		Underwater Imaging systems and Image Processing	PE	3	3	0	0	3
5		Advanced Digital Signal Processing	PE	3	3	0	0	3
6		Pattern Recognition	PE	3	3	0	0	3

ROBOTICS & AUTOMATION

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1		Concepts in Mobile Robotics	PE	3	3	0	0	3
2		Sensors and Actuators for Robotics	PE	3	3	0	0	3
3		Microcontrollers for Robotics	PE	3	3	0	0	3
4		Process Control Automation	PE	3	3	0	0	3
5		AI and ML for Robotics	PE	3	3	0	0	3
6		Autonomous Robot Systems	PE	3	3	0	0	3

R2022 (2022-23)

B. E. (HONOURS) IN ELECTRONICS AND COMMUNICATION ENGINEERING

Additional 18 credits to be completed from the courses offered in the Professional Elective Verticals.

R2022 (2022-23)

MINOR DEGREE CURRICULUM OFFERED BY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(FOR OTHER B.E. / B.TECH PROGRAMMES)

MINOR'S DEGREE IN INTERNET OF THINGS

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	22EC901	Introduction to Internet of Things	PE	3	3	0	0	3
2	22EC907	Sensors and Actuator Devices	PE	3	3	0	0	3
3	22EC959	Image and Video Analytics	PE	3	3	0	0	3
4	22EC960	Robotic Operating System	PE	3	3	0	0	3
5	22EC961	Capstone Project	EEC	12	0	0	12	6

OPEN ELECTIVES (Multidisciplinary)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	22EC001	PCB Design	OE	3	3	0	0	3
2	22EC002	Embedded Systems	OE	3	3	0	0	3
3	22EC003	Principles Of Analog And Digital Communication	OE	3	3	0	0	3
4	22EC004	Sensors and Instrumentation	OE	3	3	0	0	3
5	22EC005	Automotive Electronics	OE	3	3	0	0	3
6	22EC006	Robotic Systems	OE	3	3	0	0	3
7	22EC007	Consumer Electronics	OE	3	3	0	0	3
8	22EC008	Healthcare Electronics	OE	3	3	0	0	3
9	22EC009	Semiconductor Physics	OE	3	3	0	0	3
10	22EC010	Biomedical Instrumentation	OE	3	3	0	0	3
11	22EC011	MATLAB Programming	OE	3	3	0	0	3
12	22EC012	Industrial IoT Applications	OE	3	3	0	0	3

SEMESTER I

COURSE CODE	COURSE TITLE	L	T	P	C
22MA101	**Matrices & Calculus** (Theory course with laboratory component) (Common to all Branches except CSBS)	3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- Explain the concepts of matrix algebra techniques needed for practical applications.
- Determine the curvature of the curves.
- Illustrate the simple applications of multivariable calculus and vector calculus.
- Elaborate the concept and application of multiple integrals.

UNIT I	MATRICES	15

Eigen values and Eigenvectors of a real matrix – Properties of Eigen values and Eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms

Experiments using SCILAB:

1. Introduction to SCILAB through matrices and general syntax.
2. Finding the Eigen values and Eigenvectors.
3. Plotting the graph of a quadratic form.

UNIT II	SINGLE VARIABLE CALCULUS	15

Curvature in Cartesian and Polar Co-ordinates – Centre and radius of curvature – Circle of curvature– Evolutes.

Experiments using SCILAB:

1. Evaluating the radius of curvature.
2. Finding the coordinates of the center of curvature.
3. Tracing of Curves.

UNIT III	MULTI VARIABLE CALCULUS	15

Partial derivatives (excluding Euler's theorem) – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables.

Experiments using SCILAB:

1. Evaluating the maxima of functions of several variables.
2. Evaluating the minima of functions of several variables.
3. Evaluation of Jacobians

UNIT IV	MULTIPLE INTEGRALS	15

Double integrals – Change of order of integration – Area enclosed by plane curves – Triple integrals – Volume of solids.

Experiments using SCILAB:

1. Evaluating area under a curve.
2. Evaluating area using double integral.
3. Evaluation of volume by integrals.

UNIT V	VECTOR CALCULUS	15

Gradient, divergence and curl (excluding vector identities) – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane and Gauss divergence theorem (Statement only) – Simple applications involving cubes and rectangular parallelopipeds.

Experiments using SCILAB:

1. Evaluating gradient.
2. Evaluating directional derivative.
3. Evaluating divergent and curl.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Use the matrix algebra methods to diagonalize the matrix.

CO2: Determine the evolute of the curve.

CO3: Apply differential calculus ideas on the function of several variables.

CO4: Evaluate the area and volume by applying the concept of multiple integration.

CO5: Utilize the concept of vector calculus in evaluating integrals.

TEXT BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:

1. M. K. Venkataraman, Engineering Mathematics, Volume I, 4th Edition, The National Publication Company, Chennai, 2003.
2. Sivaramakrishna Dass, C. Vijayakumari, Engineering Mathematics, Pearson Education India, 4th Edition, 2019.
3. H. K. Dass, and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Private Limited, 3rd Edition, 2014.

4. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.
5. S. S. Sastry, "Engineering Mathematics", Vol. I & II, PHI Learning Private Limited, 4th Edition, New Delhi, 2014.
6. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

LIST OF EQUIPMENTS:

SCILAB : Open Source

COURSE CODE	COURSE TITLE	L	T	P	C
22PH101	PHYSICS FOR ELECTRONICS ENGINEERING (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

The course will enable the learners to:

- Educate the fundamental important concepts in Physics and to apply the knowledge in solving scientific and engineering problems.
- Impart the basic concepts of light propagation in waveguides, conducting materials, semiconducting materials, opto and nano electronic devices and photovoltaic technology.

UNIT I	LASER AND FIBRE OPTICS	15

Population of energy levels – Einstein's A and B coefficients derivation - Resonant cavity - Optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction- Engineering applications of lasers in data storage (qualitative).

Fibre optics: Principle and propagation of light through optical fibre - V-number - Types of optical fibres (Material, refractive index and mode) - Losses in optical fibre - Fibre optic communication - Fibre optic sensors (pressure and displacement).

1. Determination of divergence of laser beam
2. Determination of acceptance angle and numerical aperture of an optical fibre

UNIT II	ELECTRON THEORIES OF MATERIALS	15

Introduction to Classical, Quantum and Zone theories - Classical free electron theory - Expressions for electrical conductivity and thermal conductivity - Wiedemann-Franz law - Success and failures of CFT- Effect of temperature on Fermi function- Density of energy states and average energy of electron at 0 K

- Energy bands in solids.

1. Determination of thermal conductivity of a bad conductor by Lee's disc method.
2. Measurement of the internal resistance using potentiometer.

UNIT III	SEMICONDUCTING MATERIALS	15

Intrinsic Semiconductors – E-k diagram -Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors- Band gap determination-Extrinsic semiconductors - Carrier concentration in n-type and p-type semiconductors -Electrical conductivity of intrinsic and extrinsic semiconductors -Variation of Fermi level with temperature and impurity concentration - Hall effect and its applications.

1. Bandgap determination of intrinsic semiconductor.
2. Determination of wavelength of semiconductor laser

UNIT IV	OPTO AND NANO ELECTRONIC DEVICES	15

Carrier generation and recombination processes in semiconductors (concepts only) –LED- Organic LED- Photodetectors– Electron density in bulk material (qualitative) -Size dependence of Fermi energy- Band gap of nanomaterial -Quantum confinement-Quantum Structures-Density of states in quantum well, quantum wire and quantum dot structures - Quantum dot lasers.

1. Synthesis of nanoparticles by sol-gel method
2. Determination of particle size using laser source
3. Determination of bandgap of an LED

UNIT V PHOTOVOLTAICS 15

Photovoltaic effect- Solar Cell-Parameters of Solar Cells -Solar Cell Technology - Effect of Conversion Efficiency-Input Light- Solar Cell Area, Angle of Light Falling on Solar Cell-Solar Cell Operating Temperature, photovoltaic thermal collectors, organic solar cells - dye sensitized solar cell.

1. Solar cell characteristics

TOTAL: 75 PERIODS

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1: Discuss the basic principles of working of laser and their applications in fibre optic communication.

CO2: Summarize the classical and quantum electron theories and energy band structures.

CO3: Describe the conductivity in intrinsic and extrinsic semiconductors and importance of Hall effectmeasurements.

CO4: Associate the properties of nanoscale materials and their applications in quantum computing.CO5: Explain the concepts of photovoltaic technology and its applications.

TEXT BOOKS:

1. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, 2014.
2. Kasap, S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
3. Wahab, M.A. Solid State Physics: Structure and Properties of Materials‖. Narosa Publishing House,2009.
4. Nelson, J, The physics of Solar Cells, Imperial College Press, 2003.
5. Jui Sheng Hsieh, Solar Energy Engineering, Prentice Hall, 2007

REFERENCES:

1. R.K. Gaur and S.L. Gupta, Engineering Physics, Dhanpat Rai Publications (P) Ltd., Eighth Edition., New Delhi, 2001.
2. Hanson, G.W., Fundamentals of Nanoelectronics, Pearson Education, 2009.

3. R. A. Serway and J.W. Jewett, Physics for Scientists and Engineers, Ninth Edition. Cengage Learning, 2014.
4. Rogers, B., Adams, J. & Pennathur, S. Nanotechnology: Understanding Small Systems‖. CRC Press, 2014.
5. A. Marikani, Materials Science, PHI Learning Private Limited, Eastern Economy Edition, 2017.
6. R. Wolfson, Essential University Physics, Volume 1 and 2 with Mastering Physics, Global Edition, 3rd Edition, Pearson 2017.
7. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India, 2012.
8. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc., 1995.
9. Garg, H.P., Treatise on Solar Energy, John Wiley & Sons, 2006.

LIST OF EQUIPMENT:

1. Semiconductor Laser
2. Determination of optical fibre parameters
3. Lee's disc apparatus
4. Potentiometer
5. Bandgap determination set up
6. Synthesis of Nanoparticles
7. Bandgap of an LED
8. Solar cell characteristics

COURSE CODE	COURSE TITLE	L	T	P	C
22CS101	PROBLEM SOLVING USING C++ (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs using exceptions.

UNIT I	PROBLEM SOLVING AND PROGRAMMING FUNDAMENTALS	15

General Problem Solving concepts: Algorithm for problem solving with Sequential Logic Structure, Decisions and Loops. Overview of C – Data types – Identifiers – Variables – Storage Class Specifiers – Constants – Operators - Expressions – Statements – Arrays and Strings – Single-Dimensional – Two Dimensional Arrays – Arrays of Strings – Multidimensional Arrays.

List of Exercise/Experiments:

1. Write C/C++ programs for the following:
    a. Find the sum of individual digits of a positive integer.
    b. Compute the GCD of two numbers.
    c. Find the roots of a number (Newton‘s method)
2. Write C/C++ programs using arrays:
    a. Find the maximum of an array of numbers.
    b. Remove duplicates from an array of numbers.
    c. Print the numbers in an array after removing even numbers.
3. Write C/C++ programs using strings:
    a. Checking for palindrome.
    b. Count the occurrences of each character in a given word.

UNIT II	POINTERS AND FUNCTIONS	15

Pointers -Variables – Operators – Expressions – Pointers and Arrays – Functions - Scope Rules – Function Arguments – return Statement – Recursion – Structures – Unions – Enumerations.

List of Exercise/Experiments:

1. Generate salary slip of employees using structures and pointers. Create a structure Employee withthe following members:
    EID, E name, Designation, DOB, DOJ, Basic pay
    Note that DOB and DOJ should be implemented using structure within structure.
2. Compute internal marks of students for five different subjects using structures and functions.

UNIT III	CLASSES AND OBJECTS	15

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program - Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory Allocation for Objects - Static Data Members - Static Member functions Array of Objects - Objects as function arguments - Returning objects - friend functions – Const Memberfunctions - Constructors – Destructors.

List of Exercise/Experiments:

1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

UNIT IV	OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM	15

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes. Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – Pure Virtual Functions – Polymorphism.

List of Exercise/Experiments:

1. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance are supported: Single inheritance b)Multiple inheritance c)Multi level inheritance d)Hierarchical inheritance.

UNIT V	I/O, FILES AND EXCEPTIONS	15

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

List of Exercise/Experiments:

1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.
4. Mini project.

TOTAL: 45+30 = 75 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:CO1:

Solve problems using basic constructs in C.

CO2: Implement C programs using pointers and functions.

CO3: Apply object-oriented concepts and solve real world problems.

CO4: Develop C++ programs using operator overloading and polymorphism.

CO5: Implement C++ programs using Files and exceptions.

TEXT BOOKS:

1. Herbert Schildt, The Complete Reference C++, 4th Edition, MH, 2015.
2. E Balagurusamy, Object Oriented Programming with C++, 4th Edition, Tata McGraw-Hill Education, 2008.

REFERENCES:

1. Karl Beecher, Computational Thinking: A beginner's guide to problem-solving and programming,BCS Learning & Development Ltd, 2017.
2. Nell Dale, Chip Weems, Programming and Problem Solving with C++, 5th Edition, Jones and Barklett Publishers, 2010.
3. John Hubbard, Schaum's Outline of Programming with C++, MH, 2016.
4. Yashavant P. Kanetkar, Let us C++, BPB Publications, 2020
5. ISRD Group, Introduction to Object-oriented Programming and C++, Tata McGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, C++ Programming: From Problem Analysis to Program Design, 3rd Edition, Thomson Course Technology, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0129720024067 1948837_shared/overview

LIST OF EQUIPMENTS:

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler

COURSE CODE	COURSE TITLE	L	T	P	C
22CS102	SOFTWARE DEVELOPMENT PRACTICES (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

UNIT I	AGILE SOFTWARE DEVELOPMENT AND Git and GitHub	15

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

Introduction to Git –Setting up 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 - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

List of Exercise/Experiments:

1. Form a Team, Decide on a project:
    a) Create a repository in GitHub for the team.
    b) Choose and follow a Git workflow
        - Each team member can create a StudentName.txt file with contents about themselvesand the team project
        - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.

- Team members can now create a Pull request to merge the branch to master branch or main development branch.
- The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
- Once pull request is reviewed and merged, the master or main development branch willhave files created by all team members.

2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

3. Form a Team, Decide on a project:
   c) Create a repository in GitHub for the team.
   d) Choose and follow a Git workflow
      - Each team member can create a StudentName.txt file with contents about themselvesand the team project
      - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
      - Team members can now create a Pull request to merge the branch to master branch or main development branch.
      - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updation.
4. Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
5. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

UNIT II	**HTML**	**15**

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and data list Elements Page-Structure Elements.

List of Exercise/Experiments:

1. Create web pages using the following:

a. Tables and Lists

b. Image map

c. Forms and Form elements

d. Frames

UNIT III	CSS	15

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients – Multiple Background Images Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module –Multicolumn Layout.

List of Exercise/Experiments:

1. Apply Cascading style sheets for the web pages created.

UNIT IV	JAVASCRIPT BASICS	15

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

List of Exercise/Experiments:

1. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.

UNIT V	JAVASCRIPT OBJECTS	15

Objects – Math, String, and Date, Boolean and Number, document Object – Using JSON to Represent objects – DOM: Objects and Collections – Event Handling.

List of Exercise/Experiments:

1. Implement Event Handling in the web pages.

Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.

a. Online assessment system

b. Ticket reservation system

c. Online shopping

d. Student management system

e. Student result management system

f. Library management

g. Hospital management

h. Attendance management system

i. Examination automation system

j. Web based chat application

TOTAL: 75 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply agile development methods in software development practices.

CO2: Set up and create a GitHub repository.

CO3: Develop static and dynamic webpages using HTML.

CO4: Design interactive personal or professional webpages using CSS.

CO5: Develop web pages using Java script with event-handling mechanism.

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill International Edition, 9th Edition, 2020.
2. Scott Chacon, Ben Straub, Pro GIT, Apress Publisher, 3rd Edition, 2014.
3. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Pearson, 5th Edition, 2018.

REFERENCES:

1. Roman Pichler, Agile Product Management with Scrum Creating Products that Customers Love, Pearson Education, 1st Edition, 2010.
2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, Running a Perfect Website, QUE, 2nd Edition, 1999.
4. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
5. Gopalan N.P. and Akilandeswari J., Web Technology, 2nd Edition, Prentice Hall of India, 2014.
6. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01338269041100 3904735_shared/overview
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01309442142747 03362099_shared/overview

LIST OF EQUIPMENTS:

Systems with either Netbeans or Eclipse

Java/JSP/ISP Webserver/Apache Tomcat /

MySQL / Dreamweaver or **Equivalent/**

Eclipse, WAMP/XAMP

COURSE CODE	COURSE TITLE	L	T	P	C
22EC101	DIGITAL PRINCIPLES AND SYSTEMS DESIGN (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To acquire the knowledge in Digital fundamentals and its simplification methods.
- To familiarize the design of various combinational digital circuits using logic gates.
- To realize various sequential circuits using flip flops.
- To interpret various clocked sequential circuits.
- To elucidate various semiconductor memories and related technology.
- To build various logic functions using Programmable Logic Devices.

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES	09+06

Review of number systems-representation-conversions, Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms, min term and max term, Simplification of Boolean expressions- Karnaugh map, Implementation of Boolean expressions using logic gates and universal gates.

Experiment

1. Implementation of Boolean expression using logic gates

UNIT II	COMBINATIONAL LOGIC CIRCUITS	09+06

Design of combinational circuits - Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/De-mux, Parity Generator/Checker

Experiments

1. Design of adders
2. Design of subtractors.
3. Design of binary adder using IC7483
4. Design of Multiplexers & Demultiplexers.
5. Design of Encoders and Decoders.
6. Implementation of a Boolean function using a multiplexer.

UNIT III	SEQUENTIAL CIRCUITS	09+06

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Asynchronous and Synchronous Counters Design - Shift registers, Universal Shift Register.

Experiments

1. Design and implementation of 3 bit ripple counters.
2. Design and implementation of 3 bit synchronous counter
3. Design and implementation of shift registers.

UNIT IV	SYNCHRONOUS SEQUENTIAL CIRCUITS DESIGN	09+06

Design of clocked sequential circuits - Moore/Mealy models, state minimization, state assignment, circuit implementation

UNIT V	MEMORY AND PROGRAMMABLE LOGIC DEVICES	09+06

Basic memory structure ROM: PROM – EPROM – EEPROM –RAM – Static and dynamic RAM – Programmable Logic Devices: Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.

TOTAL : 45 Theory + 30 Lab = 75 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Implement digital circuits using simplified Boolean functions.

CO2: Realize Combinational circuits for a given function using logic gates.

CO3: Demonstrate the operation of various counters and shift registers using Flip Flops.

CO4: Analyze Synchronous Sequential circuits.

CO5: Summarize the various types of memory devices.

CO6: Design the Combinational circuits using Programmable Logic Devices.

CO7: Perform practical exercises as an individual and / or team member to manage the task in time.

CO8: Express the experimental results with effective presentation and report.

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson, 2018.
2. S.Salivahanan and S.Arivazhagan, Digital Circuits and Design, 5th Edition, Oxford University Press, 2018.

REFERENCES:

1. A.Anandkumar, Fundamental of digital circuits, 4th Edition, PHI Publication,2016.
2. William Kleitz, Digital Electronics-A Practical approach to VHDL, Prentice Hall International Inc, 2012.

3. Charles H.Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design, 7th Edition, Thomson Learning, 2014.
4. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education Inc, 2017.
5. John.M Yarbrough, Digital Logic: Applications and Design, 1st Edition, Cengage India, 2006.

NPTEL LINK:

https://nptel.ac.in/courses/108/105/108105132/

LIST OF EQUIPMENTS:

IC Trainer Kit	-15 Nos
ICs each 7400/ 7404 / 7486 / 7408 / 7432 / 7483 / 7473 / 7411/ 7474	- 30 Nos

COURSE CODE	COURSE TITLE	L	T	P	C
22HS101	**PROFESSIONAL COMMUNICATION** (Theory course with laboratory component)	2	0	2	3

COURSE OBJECTIVES:

- Strengthen basic reading and writing skills.
- Comprehend listening contexts competently.
- Inculcate reading habit and develop effective reading skills.
- Improve active and passive vocabulary.
- Acquire speech clarity with right pronunciation.
- Develop vocabulary of a general kind and enhance grammatical accuracy.
- Imbibe Content and Language Integrated Learning (CLIL).

UNIT I	FORMAL AND INFORMAL COMMUNICATION	12

Listening: Short Texts, Short Formal and Informal Conversations

Speaking: Self-Introduction, Exchanging Personal Information

Reading: Practice in Skimming, Scanning and Predicting, Reading Comprehension

Writing: Free Writing, Hints Development

Grammar: Parts of Speech, Prepositions.

Vocabulary: Compound Nouns, Technical Words. (Theory 6)

List of Exercise/Experiments

1. Familiarization of Vowel Sounds-Monophthongs, Diphthongs and Consonant Sounds
2. Listening to Formal Conversations in British and American Accents
3. Guided Writing (Laboratory 6)

UNIT II	GRAMMAR AND LANGUAGE DEVELOPMENT	12

Listening: Telephonic Conversations.

Speaking: Sharing information of a personal kind - Greetings – Taking leave.

Reading: Short comprehension passages - Pre-reading and Post-reading (multiple choice questions, short questions / open and close ended questions)

Writing: Instructions, Recommendations, Checklists

Grammar: Tenses, Framing 'Wh' & 'Yes' or 'No' questions

Vocabulary: Numerical Adjectives, Collocations (Theory 6)

List of Exercise/Experiments

1. Communication Etiquettes
2. Self -Introduction using SWOT Analysis (Laboratory 6)

UNIT III	BASIC TECHNICAL WRITING AND STUDY SKILLS	12

Listening: Listening to longer texts and filling up the tables **Speaking:** Asking about routine actions and expressing opinions **Reading:** Short texts (Cloze Test)

Writing: Formal letters, E-mail writing, Interpretation of Charts and Graphs

Grammar: Cause and Effect expressions**,** Conditional Clauses

Vocabulary: Often misspelled and confusing words (Theory 6)

List of Exercise/Experiments

1. Mechanics of Reading Skills
2. News Reading–Cloze Tests (Laboratory 6)

UNIT IV	GROUP DISCUSSION AND JOB APPLICATIONS	12

Listening: Listening to recorded dialogues of conversations and completing exercises based on them

Speaking: Discussion on Social issues.

Reading: Reading text from magazines

Writing: Purpose Expressions, Letter of Application, Minutes of Meeting.

Grammar: Modal Verbs, Subject-Verb agreement

Vocabulary : Sequence Words (Theory 6)

List of Exercise/Experiments

1. Group Presentation, Group Discussion: Do's and Don'ts of Group Discussion
2. Discussions on failure and success in interviews of famous personalities
3. Spotting Errors (Laboratory)

UNIT V	ART OF REPORTING	12

Listening: Listening to TED talks

Speaking: Debate & Presentations

Reading: Biographies

Writing: Definitions (Single line & Extended), Report Writing (Industrial visit, Accident and Feasibility reports)

Grammar: Reported speech

Vocabulary: Verbal Analogies (Theory 6)

List of Exercise/Experiments

1. Writing based on listening to academic lectures and discussions

2. Leadership skills, Negotiation skills

3. Mechanics of Report Writing (Laboratory 6).

List of Projects

1. Create a podcast on a topic that will be interesting to college students
2. Read and Review (Movie/Book/Technical Article)
3. Presentation on Social Issues
4. Submit a report on "Global English: A study"

TOTAL : 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Comprehend conversations and short talks delivered in English.

CO2: Participate efficiently in informal conversations and develop an awareness of the self and apply well-defined techniques.

CO3: Read articles of a general kind in magazines and newspapers efficiently.

CO4: Write short general essays, personal letters and E-mails in English.

CO5: Develop vocabulary of a general kind by enriching reading skills.

TEXT BOOKS:

1. Kumar, Suresh E, & Sreehari, P. Communicative English. Orient Black Swan, 2007.
2. Richards, Jack C. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Dhanavel, S P. English and Soft Skills, Volume Two, Orient Black Swan.
3. Elbow, Peter. Writing Without Teachers. London: Oxford University Press, 1973.
4. Larsen, Kristine. Stephen Hawking: A Biography, Greenwood: Publishing Group, 2005.
5. Redston, Chris & Gillies Cunningham.Face2Face (Pre- intermediate Students' Book & Workbook) Cambridge University Press, New Delhi: 2005.
6. Lewis, Norman. Word Power Made Easy, Latest Edition: Penguin Random House India: 2015

WEB REFERENCES:

1. Basics of Business Communication: https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012688768083632128308_shared/ overview
2. Communicating to Succeed: https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012686653619175424640_shared/ overview
3. Business English: https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012683227498151936279_shared/ overview https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013267708367904768573/ overview (lab support)
4. Business Writing: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126894776010096643 3_shared/

overview

5. Email Etiquettes:
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013294623865561088176 82_shared/ overview
6. Email Writing Skills:
https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01268954363013529666_shared/ overview
7. Time Management:
https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012985921210736640721_shared/ overview
8. Understanding Body Language:
https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0129797376514457602 4689_shared/ overview

ONLINE RESOURCES:

https://infyspringboard.onwingspan.com/web/en/page/home

COURSE CODE	COURSE TITLE	L	T	P	C
22GE111	PRODUCT DEVELOPMENT LAB –1 (Common to all Branches)	0	0	2	1

The students may be grouped into 3 to 4 and work under a project supervisor. The device/system/component/prototype Idea to be developed by the students and a final presentation to be done by the students about the idea generated at the end of the semester

COURSE OBJECTIVES:

Students completing this course are expected to

- Understand the functionalities and limitation of various machine/equipment.
- Demonstrate various operations that can be performed to machines.
- Summarize the basic principles of machines to convert their ideas into products

LIST OF EXPERIMENTS

I 1. Study of Manufacturing Processes (Carpentry, Plumbing, Machines and Welding).
2. Study of fundamental operations of 3D Printer and Scanner with Software.
3. Study of Smart Machining (CNC and Laser cutting) and Engraving Techniques.

II 1. Study of Fundamental of Circuit Design.
2. Study of PCB Milling Machine.
3. Study of Soldering and Desoldering.

III 1. Study of Computer Peripheral Devices (Processing Information Devices)

IV 1. Present the Product Idea Presentation - Phase – I

TOTAL: 30 PERIODS

Note: The students can select the prototype to be made of their choice after learning the above exercises.

COURSE OUTCOMES:

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

CO1: Understand the concept of manufacturing processes.

CO2: Describe the working of the machine element.

CO3: Discuss the various applications of engineering materials.

CO4: Summarize the basics of core engineering concepts.

CO5:Describe the process for converting ideas into products.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:		
S. No	**Equipment Name**	**Quantity**
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Centre lathe	2 Nos
6	Arc welding transformer with cables and holders	2 Nos
7	Plumbing tools	2 Sets
8	Carpentry tools	2 Sets
9	Multimeter	10 Nos
10	Drilling Machine	1 No
11	Solder Stations	5 Sets
12	Desoldering Machine	1 No
13	PCB Milling Machine	1 No
14	Variable Power Supply	1 No
15	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	10 Sets
16	Personal Desktop Computers	30 Nos

COURSE CODE	COURSE TITLE	L	T	P	C
22CH104	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to all the Branches)	2	0	0	MC

COURSE OBJECTIVES:

The Course will enable learners to:

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment

UNIT I	NATURAL RESOURCES	07

Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - Types - Forest resources: Use and over-exploitation, deforestation and its impacts, Food resources: effects of modern agriculture, organic farming, Renewable energy sources - Solar, Wind, Geothermal, Tidal, OTE and Biomass.

1. **Field activity -Tree plantation**

UNIT II	POLLUTION AND WASTE MANAGEMENT	07

Pollution - Definition –causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards - nuclear accidents and holocaust - Role of an individual in prevention of pollution –Case studies. Waste management- Municipal solid wastes, e- waste, plastic waste.

1. **Field study – Solid waste management of the institution**

UNIT III	BIODIVERSITY AND ITS CONSERVATION	06

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: In-situ and ex-situ method.

1. **Field study – Biodiversity of the institution**

UNIT IV	SUSTAINABILITY AND MANAGEMENT	05

Sustainability-concept, needs and challenges- Circular economy - Sustainable Development Goals- Concept of Carbon footprint, Environmental Impact Assessment, Clean Development Mechanism, solutions.

1. **Field study – Carbon footprint of the institution**

UNIT V	**HUMAN POPULATION**	**05**

Introduction - Population growth, variation among nations, population explosion, Environment and human health – endemic/epidemic/pandemic – Role of information technology in environment and human health.

1. **Case Study – Pandemics of 21st century**

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Investigate and use conservational practices to protect natural resources.

CO2: Identify thecauses of pollutants and illustrate suitable methods for pollution abatement.

CO3: Adapt the values of biodiversity and its conservation methods.

CO4: Recognize suitable sustainable development practices and apply it in day-to-day life.

CO5: Assess theimpacts of human population and suggest suitable solutions

TEXT BOOKS:

1. Anubha Kaushik and C.P. Kaushik, Perspectives in environmental studies, New Age International Publishers, 2nd edition, 2021.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, 1st edition, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, PearsonEducation, 3rd edition, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Universities Press(I) Pvt. Ltd., Hyderabad, 3rd Edition, 2021.

REFERENCES:

1. William P. Cunningham & Mary Ann Cunningham Environmental Science: A GlobalConcern, McGraw Hill, 14th edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 3rd edition,2015.

3. G. Tyler Miller and Scott E. Spoolman, ―Environmental Science, Cengage Learning India Pvt, Ltd., Delhi, 14th edition, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 1st edition, 2012.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning, 1st edition, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022.

LIST OF EQUIPMENTS:

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler

SEMESTER II

COURSE CODE	COURSE TITLE	L	T	P	C
22MA201	TRANSFORMS AND NUMERICAL METHODS (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- Introduce the concepts of Laplace transforms and Z-transforms.
- Illustrate the application of transforms in solving differential and difference equations.
- Explain the Numerical methods for handling algebraic and transcendental equations.
- Introduce the numerical techniques for interpolation, differentiation and integration.

UNIT I	LAPLACE TRANSFORMS	15

Laplace transforms – Sufficient condition for existence – Transform of elementary functions Basic properties – Transforms of derivatives and integrals of functions – Derivatives and integrals of transforms –Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (Statement only).

Experiments using SCILAB:

1. Finding Laplace transform of a function.
2. Finding inverse Laplace Transforms.
3. Determine the input for given output function of Laplace Transform.

UNIT II	Z – TRANSFORMS	15

Z-transforms – Elementary properties – Inverse Z-transforms – partial fractions method – residues method – Convolution theorem.

Experiments using SCILAB:

1. Finding Z –transform of a sequence.
2. Finding convolution of two sequences.
3. Plotting the input and output function of Z transform.

UNIT III	SOLUTION OF DIFFERENTIAL AND DIFFERENCE EQUATIONS	15

Solution of linear ordinary differential equation of second order with constant coefficientsand first order simultaneous equations with constant coefficients using Laplace transform.

Formation of difference equations – Solution of first and second order difference equations with constant coefficients using Z-transform.

Experiments using SCILAB:

1. Solving second order Ordinary Differential Equation.
2. Finding the Laplace transform and its inverse of a function numerically.
3. Finding the Z-transform numerically

UNIT IV	**SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**	**15**

Solution of algebraic and transcendental equations by Newton Raphson method - Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Gauss Seidel Iterative method–Eigenvalues of a matrix by Power method.

Experiments using SCILAB:

1. Finding the real roots of algebraic and transcendental equations using Newton Raphson method.
2. Finding the largest Eigenvalue by power method.
3. Solving system of linear equations using Gauss Seidel Method.

UNIT V	**NUMERICAL DIFFERENTIATION AND INTEGRATION**	**15**

Finite differences – Forward and Backward differences – Interpolation – Newton's forward and backward interpolation formulae - Lagrange's interpolation for unequal intervals - Numerical Differentiation - Newton's and Lagrange's formulae - Numerical integration using Trapezoidal and Simpson's 1/3 rules – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

Experiments using SCILAB:

1. Finding approximately the missing value using Lagrange interpolation.
2. Evaluating line integrals by trapezoidal rule.
3. Evaluating line integrals by Simpson's rule

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Determine Laplace transform and inverse transform of simple functions.CO2:
Determine Z-transform and inverse transform of simple functions.

CO3: Solve ordinary differential equations using Laplace transform and difference equation using Z-transform.

CO4: Compute the solutions of algebraic, transcendental and the system of equations.

CO5: Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

TEXT BOOKS:

1. Bali N., Goyal M. and Watkins C., Advanced Engineering Mathematics, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Grewal, B.S., and Grewal, J.S., Numerical Methods in Engineering and Science, Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES:

1. Erwin. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Jain R.K. and Iyengar S. R. K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Wylie, R.C. and Barrett, L.C., Advanced Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
4. Mathews, J.H. Numerical Methods for Mathematics, Science and Engineering, 2nd Edition, Prentice Hall, 1992.
5. Sastry S.S, Introductory Methods of Numerical Analysis, PHI Learning Pvt. Ltd, 5th Edition, 2015.

SOFTWARE:

SCILAB : Open Source

COURSE CODE	COURSE TITLE	L	T	P	C
22EC201	**ELECTRON DEVICES AND CIRCUIT THEORY** (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To discuss the behavior of semiconductor diodes in various applications.
- To familiarize the operation of BJT and FET.
- To construct simple electronic circuits using special semiconductor devices.
- To understand the fundamental laws of electric circuits.
- To analyze the response of electric circuits using network theorems.

UNIT I	SEMICONDUCTOR DIODES	9+6

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes, Zener diode and its applications.

Experiments

1. VI characteristics of PN diode
2. VI characteristics of Zener diode.

UNIT II	TRANSISTORS	9+6

Bipolar Junction Transistor - NPN -PNP – Operations - Early effect – Current Equations - Input and Output characteristics of CE, CB, CC – Field Effect Transistors - JFET, MOSFET- D-MOSFET, E-MOSFET- Characteristics.

Experiments

3. Input and output characteristics of CE Configuration.
4. Characteristics of JFET.

UNIT III	SPECIAL SEMICONDUCTOR DEVICES AND APPLICATIONS	9+6

Tunnel diode,Varactor diode, UJT, SCR, DIAC, TRIAC, Power BJT- Power MOSFET- MOS-VMOS. LED, Photo transistor, Opto Coupler.

Experiments

5. VI characteristics of UJT.
6. VI characteristics of SCR

UNIT IV	BASIC CIRCUIT ANALYSIS	9+6

Resistive elements - Ohms Law- Kirchhoff's current and voltage laws - series and parallel connection of independent sources - R, L and C, source transformation, Mesh current and Node voltage with AC and DC Analysis - methods of analysis, star delta conversion. Transient response of RL, RC and RLC circuits using Laplace Transform for DC input and AC sinusoidal input.

Experiments

7(a). Verification of Kirchhoff's current law.

7(b).Verification of Kirchhoff's voltage law..

UNIT V	NETWORK THEOREMS	9+6

Thevenin and Norton Theorems - Superposition Theorem - Maximum power transfer theorem - Reciprocity Theorem - Millman's theorem.

Experiments

1. Verification of superposition theorem.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.

TOTAL: 45 Theory + 30 Lab = 75 PERIODS

COURSE OUTCOMES:

OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Examine the performance of electronic circuits using PN junction diode and Zener diode.

CO2: Construct electronic circuits using BJT and FET to sketch the input and output characteristics.

CO3: Demonstrate the behavior of special semiconductor devices in various applications.

CO4: Comprehend the impact of voltage and current in electric circuits using Mesh & Nodal methods.

CO5: Relate various network theorems to determine the response of the electric circuits.

CO6: Perform practical exercises as an individual and / or team member to manage the task in time.

CO7: Express the experimental results with effective presentation and report.

TEXT BOOKS:

1. Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of Electric Circuits, 7th Edition, McGraw Hill, 2022.
2. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, 2017

REFERENCES:

1. W.H.Hayt, J.E.Kemmerly &S.M.Durbin, Engineering Circuit Analysis, 9th Edition, McGraw Hill Education, New Delhi, India,2019.
2. Joseph Edminister and MahmoodNahvi, ―Electric Circuits, Schaum's Outline Series, 5th Edition Reprint,Tata McGraw Hill Publishing Company, New Delhi, 2016.
3. David A Bell, Electric Circuits and Electronic Devices, Oxford University Press, 2010
4. Thomas L.Floyd, Electronic Devices,9th Edition, Pearson,2017
5. Donald A Neaman, Semiconductor Physics and Devices, 4th Edition, McGraw Hill, 2017
6. Dr.R.S. Sedha, A Textbook of Applied Electronics, S Chand and company limited, 2019

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc22_ee93/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee64/preview

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

BC 107, BC 148,2N2646, BFW10	- 25 each
1N4007, Zener diodes	- 25 each
Bread Boards	-15 Nos
CRO (30MHz)	- 10 Nos
Signal Generator /Function Generators (3 MHz)	- 15 Nos
Transistor/FET/SCR/UJT (BJT-NPN-PNP and NMOS/PMOS)	- 25 Nos Dual
power supply/ single mode power supply	- 15 Nos
Multimeter	-15 Nos
Ammeter(0-50)mA	-15 Nos
Voltmeter(0-30)V	-15 Nos

COURSE CODE	COURSE TITLE	L	T	P	C
22CH101	ENGINEERING CHEMISTRY (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- To understand the water quality criteria and interpret its applications in water purification.
- To gain insights into the basic concepts of electrochemistry and implement its applications in chemical sensors.
- To acquire knowledge on the fundamental principle of energy storage devices and relate it to electric vehicles.
- To identify the different types of smart materials and explore their applications inEngineering and Technology.
- To assimilate the preparation, properties and applications of nanomaterials in various fields.

UNIT I	WATER TECHNOLOGY	15

Sources of water – Impurities - Drinking water quality parameters – Hardness and its types, problems - Municipal water treatment and disinfection (chlorination - break-point chlorination, UV, Ozonation). Boiler troubles - Scales and sludges, Boiler feed water: Requirements - Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning). External treatment – Ion exchange demineralization - Principle, process and fouling. Desalination of brackish water: Reverse osmosis – principle -types of membranes, process and fouling.

List of Experiments

1. Determination of total, temporary and permanent hardness of water by EDTA method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of alkalinity in water sample.
4. Estimation of iron content of the water sample using spectrophotometer (1,10-phenanthroline/thiocyanate method)

UNIT II	ELECTROCHEMISTRY AND SENSORS	15

Introduction- Conductance- factors affecting conductance – Electrodes – origin of electrode potential – single electrode potential, standard electrode potential – measurement of single electrode potential –over voltage - reference electrodes (standard hydrogen electrode, calomel electrode)-ion selective electrode- glass electrode - Nernst equation (derivation), numerical problems, Electrochemical series and its applications.

Chemical sensors – Principle of chemical sensors – Breath analyzer – Gas sensors – CO_2 sensors- Sensor for health care – Glucose sensor.

List of Experiments

1. Determination of the amount of NaOH using a conductivity meter.
2. Determination of the amount of acids in a mixture using a conductivity meter.
3. Determination of the amount of given hydrochloric acid using a pH meter.

UNIT III	ENERGY STORAGE DEVICES AND ENERGY SOURCES	15

Batteries – Primary alkaline battery - Secondary battery - Pb-acid battery, Fuel cell - H_2 – O_2 fuel cell. Batteries used in E- vehicle: Ni-metal hydride battery, Li-ion Battery, Li-air Battery Nuclear Energy – Nuclear fission, fusion, differences, characteristics – nuclear chain reactions – light water nuclear reactor – breeder reactor.

List of Experiments

1. Determination of single electrode potential of the given electrode.
2. Estimation of the iron content of the given solution using a potentiometer.
3. Determination of electrochemical cell potential (using different electrodes/ different concentrations of electrolytes)

UNIT IV	SMART MATERIALS FOR ENGINEERING APPLICATIONS	15

Polymers – Definition – Classification – smart polymeric materials - Preparation, properties and applications of Piezoelectric polymer - Polyvinylidene fluoride (PVDF), Electroactive polymer- Polyaniline (PANI) and Biodegradable polymer - Polylactic acid (PLA). Polymer composites: Definition, Classification – FRP's – Kevlar. Shape Memory Alloys: Introduction, Shape memory effect – Functional properties of SMAs – Types of SMA - Nitinol (Ni-Ti) alloys - applications. Chromogenic materials: Introduction – Types - applications.

List of Experiments

1. Determination of the molecular weight of polymer using Ostwald viscometer.
2. Application of polymeric fibers in 3D printing.

UNIT V	NANOCHEMISTRY	15

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) – properties of nanomaterials - types – nanotubes -carbon nanotubes, applications of CNT - nanocomposites – General applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

List of Experiments

1. Determination of concentration of $BaSO_4$ nanoparticles by conductometric titrations.
2. Preparation of ZnO nanocrystal by precipitation method.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Interpret the water quality parameters and explain the various water treatment methods.

CO2: Construct the electrochemical cells and sensors.

CO3: Compare different energy storage devices and predict their relevance in electric vehicles.

CO4: Classify different types of smart materials, their properties and applications in Engineering and Technology.

CO5: Integrate the concepts of nanochemistry and enumerate its applications in various fields.

TEXT BOOKS:

1. P. C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 17th Edition, 2022.
2. Sivasankar B., Engineering Chemistry, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Second reprint, 2012

REFERENCES:

1. S.S. Dara and S.S. Umare, A Textbook of Engineering Chemistry, S. Chand & Company, New Delhi, 12th Edition, 2013.
2. V.R. Gowarikar, Polymer Science, New Age International Publishers, 2nd edition, 2021.
3. J. C. Kuriacose and J. Rajaram, Chemistry in Engineering and Technology, Volume -1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.

4. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, Nanochemistry: A Chemical Approach to Nanomaterials, 2nd Edition, RSC publishers, 2015.
5. Prasanna Chandrasekhar, Conducting polymers, fundamentals and applications–Including Carbon Nanotubes and Graphene, Springer Science &Business Media, New York, 2nd Edition, 2019.
6. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, Vogel's Quantitative Chemical Analysis, Pearson Education Pvt. Ltd., 6th edition, 2019.

LIST OF EQUIPMENTS:

1. Conductivity meter
2. pH meter
3. Potentiometer

COURSE CODE	COURSE TITLE	L	T	P	C
22CS201	**DATA STRUCTURES** (Theory course with laboratory component) **(Common to CSE, CSD, EEE, ECE, IT and ADS)**	3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- To understand the concepts of List ADT.
- To learn linear data structures – stacks and queues ADTs.
- To understand and apply Tree data structures.
- To understand and apply Graph structures.
- To analyze sorting, searching and hashing algorithms.

UNIT I	LINEAR DATA STRUCTURES – LIST	15

Algorithm analysis - running time calculations - Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists - circularly linked lists - doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

List of Exercise/Experiments:

1. Array implementation of List, Stack and Queue ADTs.
2. Linked list implementation of List, Stack and Queue ADTs.
    a. Applications of List – Polynomial manipulations

UNIT II	LINEAR DATA STRUCTURES – STACKS, QUEUES	15

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT – Queue Model - Implementations: Array and Linked list - applications of queues - Priority Queues – Binary Heap Applications of Priority Queues.

List of Exercise/Experiments:

3. Array implementation of Stack and Queue ADTs.
4. Linked list implementation of Stack and Queue ADTs.
5. Applications of List – Polynomial manipulations
6. Applications of Stack – Infix to postfix conversion and expression evaluation

UNIT III	NON-LINEAR DATA STRUCTURES – TREES	15

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary searchtree ADT– AVL Tree.

List of Exercise/Experiments:

7. Implementation of Binary Trees and operations of Binary Trees.
8. Implementation of Binary Search Trees.
9. Implementation of Heaps using Priority Queues.

UNIT IV	NON-LINEAR DATA STRUCTURES - GRAPHS	15

Definition – Representation of Graph – Types of graph - Breadth-first traversal – Depth first traversal – Topological Sort – Applications of graphs – Bi Connectivity – Euler circuits.

List of Exercise/Experiments:

10. Graph representation and Traversal algorithms.

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	15

Searching- Linear Search - Binary Search - Sorting - Bubble sort - Selection sort - Insertion sort – Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

List of Exercise/Experiments:

11. Implement searching and sorting algorithms.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Implement abstract data types for list.

CO2: Solve real world problems using appropriate linear data structures.

CO3: Apply appropriate tree data structures in problem solving.

CO4: Implement appropriate Graph representations and solve real-world applications.

CO5: Implement various searching and sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Pearson Education, 2014.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.

REFERENCES:

1. Rajesh K. Shukla, Data Structures using C and C++, Wiley India Publications, 2009.
2. Narasimha Karumanchi, Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles, CareerMonk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, An Introduction to Data Structures with Application, McGraw-Hill, 2017.

4. Mark Allen Weiss, Data Structures and Algorithm Analysis in Java, Third Edition, Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, Fundamentals of Data Structures in C++, Second Edition, Silicon Press, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/

LIST OF REQUIREMENTS:

Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler

COURSE CODE	COURSE TITLE	L	T	P	C
22CS202	**JAVA PROGRAMMING** (Theory course with laboratory component) (Common to CSE, CSD, EEE, ECE, ME, IT, ADS and CSBS)	3	0	2	4

COURSE OBJECTIVES:

- To help students understand universal technical drawing standards.
- To explain object oriented programming concepts and fundamentals of Java.
- To apply the principles of packages, interfaces and exceptions.
- To develop a Java application with I/O streams, threads and generic programming.
- To build applications using strings and collections.
- To apply the JDBC concepts.

UNIT I	JAVA FUNDAMENTALS	15

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – this keyword - Overloading methods - Overloading constructors - Access Control – Static – Final.

List of Exercise/Experiments:

1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariffIf the type of the EB connection is domestic, calculate the amount to be paid as follows:

   First 100 units - Rs. 1 per unit

   101-200units - Rs. 2.50 per unit

   201 -500 units -Rs. 4 per unit

   > 501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows:

   First 100 units - Rs. 2 per unit

   101-200units - Rs. 4.50 per unit

   201 -500 units -Rs. 6 per unit

   > 501 units - Rs. 7 per unit

2. Arrays Manipulations: (Use Methods for implementing these in a Class)
   a. Find kth smallestelement in an unsorted array
   b. Find the sub array with given sum
   c. Matrix manipulations – Addition, Subtraction, Multiplication
   d. Remove duplicate elements in an Array
   e. Accept an integer value N and print the N^{th} digit in the integer sequence 1, 2, 3, 4, 5, 6, 7, 8,9, 10, 11, 12, 13, 14, 15 and so on till infinity.
   f. Example: The 11th digit in the sequence 12345678910111213…. is 0.

UNIT II	INHERITANCE, INTERFACES AND EXCEPTION HANDLING	15

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

List of Exercise/Experiments:

3. Develop a Java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.

4. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

5. Design a Java interface for ADT Stack. Implement this interface using array and built-in classes. Provide necessary exception handling in both the implementations.

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the area of the given shape and Number of sides() that prints the number of sides of the given shape.

7. Write a Java program to apply built-in and user defined exceptions.

UNIT III	MULTITHREADING, I/O AND GENERIC PROGRAMMING	15

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

List of Exercise/Experiments:

8. Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

UNIT IV	STRING HANDLING AND COLLECTIONS	15

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

List of Exercise/Experiments:

9. String Manipulation:
    - Reversing a set of words and count the frequency of each letter in the string.
    - Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should not be any other characterexcept 0 in the [0] sequence in a given binary string.
    - Remove all the occurrences of string S2 in string S1 and print the remaining.
    - Find the longest repeating sequence in a string
    - Print the number of unique string values that can be formed by rearranging the letters in the string S.
10. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
11. Collections:

    a) Write a program to perform string operations using Array List. Write functions for the following

    - Append - add at end
    - Insert – add at particular index
    - Search
    - List all string starts with given letter

    b) Find the frequency of words in a given text.

UNIT V	JDBC CONNECTIVITY	15

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update, Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

List of Exercise/Experiments:

12. Mini Project (using JDBC)

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the object oriented programming concepts and fundamentals of Java.

CO2: Develop Java programs with the packages, interfaces and exceptions.

CO3: Build Java applications with I/O streams, threads and generics programming.

CO4: Apply strings and collections in developing applications.

CO5: Implement the concepts of JDBC.

TEXT BOOKS:

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, McGraw Hill Education, 2019.

REFERENCES:

1. Cay S. Horstmann, Gary Cornell, Core Java Volume – I Fundamentals, 11th Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, 3rd Edition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_299594739473672 70000_shared/overview.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1.Systems with either Netbeans or Eclipse, JDK 1.7 and above, Linux and MySQL

COURSE CODE	COURSE TITLE	L	T	P	C
22GE201	HERITAGE OF TAMILS	1	0	0	1

COURSE OBJECTIVES:

The course is designed to

- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thinai in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture

UNIT I	LANGUAGE AND LITERATURE	3

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

UNIT II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3

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.

UNIT III	FOLK AND MARTIAL ARTS	3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV	THINAI CONCEPT OF TAMILS	3

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.

UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3

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: 15 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the students will be able to

- State the role of Tamil literature in shaping Tamil Cultural roots.
- Express the cultural and religious significance of Tamil art and sculptures.
- Identify and describe the techniques of folk and martial arts.
- Classify the role of Thinai concept in Tamil culture and literature.
- Compare the idea of cultural and intellectual contributions of Tamils

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 ofArchaeology & 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) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

COURSE CODE	COURSE TITLE	L	T	P	C
22GE101	**COMPUTER AIDED ENGINEERING GRAPHICS** Laboratory Course with Theory Component (Common to I Semester CSE, CSE (CS), ADS and II Semester ECE)	1	0	2	2

COURSE OBJECTIVES:

To help students understand universal technical drawing standards.

- To provide training on drafting software to draw part models.
- To demonstrate the concepts of orthographic and isometric projections.
- To use drawing skills for communicating concepts, ideas for engineering product design.
- Use pictorial views to visualize and draw the isometric view of the objects

UNIT I	INTRODUCTION TO CONVENTIONS IN ENGINEERING DRAWING AND CONIC SECTIONS	09

Introduction to Engineering Drawing - Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Conic curves - Ellipse, Parabola and Hyperbola by Eccentricity method. (Theory - 3)

Experiments Using CAD Software:

1. Drawing of a title block with necessary text, projection symbol and lettering using drafting software.
2. Drafting of Conic curves - Ellipse, Parabola and Hyperbola (Laboratory - 6)

UNIT II	ORTHOGRAPHIC PROJECTION	09

Visualization concepts and Orthographic Projection - Layout of views – Orthographic Projection Conversion of pictorial diagram into orthographic views. (Theory - 3)

Experiments Using CAD Software:

1. Drawing orthographic view of simple solids like Prism, Pyramids, Cylinder, Cone, etc, and dimensioning.
2. Drawing of orthographic views from the given pictorial diagram. (Laboratory -6)

UNIT III	PROJECTION OF PLANES	09

Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating objectmethod. (Theory - 3)

Experiments Using CAD Software:

1. Drawing of plane Surface inclined to HP.
2. Drawing of plane Surface inclined to VP. (Laboratory -6)

UNIT IV	PROJECTION OF SOLIDS	09

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis is inclined to HP by rotating object method. (Theory - 3)

Experiments Using CAD Software:

1. Drawing of simple solids like prism and pyramids when the axis is inclined to HP.
2. Drawing of simple solids like cylinder and cone when the axis is inclined to HP.

(Laboratory -6)

UNIT V	ISOMETRIC DRAWING	09

Principles of isometric view – Isometric view of simple solids – Prism, Pyramid, Cylinder and

Cone. (Theory - 3)

Experiments Using CAD Software:

1. Drawing isometric projection of simple solids.
2. Modeling of 2D to 3D objects using drafting software. (Laboratory -6)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain the various engineering standards required for drafting and explore knowledge in conic sections.CO2 Draw the orthographic views of 3Dprimitive objects.

CO3 Describe the projection of plane surfaces by the rotating plane method.

CO4 Apply the projection concepts and drafting tools to draw projections of solids.CO5 Sketch the pictorial views of the objects using CAD tools

TEXT BOOKS:

1. Natarajan K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 33rd Edition,2020.
2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, 15th Edition, 2019

REFERENCES:

1. Bhatt N.D. ,Engineering Drawing, Charotar Publishing House, 53rd edition ,2019.
2. BasantAgarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2019.
3. Engineering Drawing Practice for Schools and Colleges BIS SP46:2003 , Bureau of Indian Standards(BIS), 2008.
4. Parthasarathy. N.S and Vela Murali, Engineering Graphics, Oxford University, Press, New Delhi, 2019.
5. Gopalakrishna. K.R., Engineering Drawing Vol. 1 & 2, Subhas Publications, 27th Edition, 2017.
6. R.S Khurmi and J K Gupta, Textbook of Refrigeration and Air-conditioning (M.E.), S Chand & Co,2006

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity
1	Computer nodes or systems with suitable graphics facility	30 No
2.	Software for Drafting and Modelling	30 No
3.	Laser Printer or Plotter to print / plot drawings	1 No

COURSE CODE	COURSE TITLE	L	T	P	C
22GE211	PRODUCT DEVELOPMENT LAB –2 (Common to all Branches)	0	0	2	1

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The student batches should study the device/system/component and will do literature review todevelop prototype idea. Further at the end of the semester they will make a final presentation to exhibit the conceptual design skills and the process to develop a product.

COURSE OBJECTIVES:

Students completing this course are expected to

1. Use the innovative design methodology to articulate the product concepts.
2. Summarize the requisite Engineering Principles for transforming concepts into products.
3. Conduct basic tests to extract the qualitative and quantitative performance factors.

EXERCISES:

1. Study of Basic Engineering Design Concepts.
2. Conduct a literature survey on the implementation of the design concepts.
3. Prepare the design concepts for an identified literature gap**.**
4. Present the Product Idea Presentation –Phase II.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the working and capacity of various engineering systems.

CO2: Infer the outcomes in the product development process.

CO3: Perform basic engineering and material characterization tests.

CO4: Demonstrate the ability to provide conceptual design strategies for a product.

CO5: Implement the Science, Engineering, Technology and Mathematics (STEM) for product design.

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
22EC303	ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES	3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on static electric field, electric potential, static magnetic field, magnetic potential and their associated laws.
- To give insight into coupling between electric and magnetic fields through Faraday's law,displacement current and Maxwell's equations.
- To introduce the various types of transmission lines and its characteristics.
- To provide thorough understanding about high frequency line, power and impedance measurements.
- To solve different transmission line problems using smith chart.

UNIT I	ELECTROSTATICS	9

Coulomb's Law – Electric Field Intensity – Electric Field due to discrete charges and continuous charge distributions - Electric Field due to finite, infinite line and circular disc, Potential due to Electrical Dipole, Gauss Law and its Applications. Capacitance of various geometries using Laplace equation - Boundary conditions.

UNIT II	MAGNETOSTATICS	9

Biot-Savart Law– Magnetic Field Intensity due to finite and infinite wire, circular and rectangular loop – Ampere's Circuital Law and its applications. Lorentz Force Equation – Force and Torque on a closed loop, Magnetic Vector Potential. Inductance of loops and Solenoid- Boundary conditions.

UNIT III	TIME VARYING FIELDS AND MAXWELL'S EQUATIONS	9

Faraday's law, Displacement Current – Ampere's Circuital Law – Maxwell's Equation in Integral and Differential form - Maxwell's equation in Phasor form. Poynting Theorem.

UNIT IV	TRANSMISSION LINE THEORY	9

Transmission lines – general solution – The infinite line, Wavelength, velocity of propagation, Waveform distortion – the distortion-less line – Loading of Lines – Line not terminated in Z_o – Reflection coefficient, Calculation of current, voltage, power delivered and efficiency of transmission, Open and short circuited lines.

UNIT V	HIGH FREQUENCY TRANSMISSION LINES & IMPEDANCE MATCHING	9

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line - Standing Waves, Nodes, Standing Wave Ratio- Input impedance of the dissipation-less line, Quarter wave transformer – Single and double stub matching using Smith chart.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Compute electric fields and potentials due to static charges.

CO2: Illustrate static magnetic fields, magnetic potential and its applications.

CO3: Interpret Maxwell's equations in integral, differential and phasor forms and explain their physical meaning.

CO4: Solve transmission line equations and its parameters.

CO5: Explain standing wave ratio and input impedance in high frequency transmission lines.

CO6: Analyze impedance matching by stubs using smith charts and MATLABprogramming.

TEXT BOOKS:

1. W.H.Hayt & J.A. Buck, Engineering Electromagnetics, TMH,9th Edition, 2020.
2. John D Ryder, Networks lines and fields, Pearson, 2nd Edition, 2015.

REFERENCES:

1. Matthew N.O.Sadiku, Elements of Engineering Electromagnetics, Oxford University Press,7th Edition, 2018.
2. David K. Cheng, Field and Wave Electromagnetics, Pearson, 2nd Edition, 2014.
3. Umesh Sinha, Transmission Lines and Networks, Filters & Transmission Lines, Sathya Prakash, 2010.
4. G.S.N. Raju, Electromagnetic Field Theory & Transmission Lines, Pearson Education, 2006.
5. Joseph Edminister, Mahmood Nahvi, Schaum's Outline of Electromagnetics, McGraw-Hill Education, 5th Edition, 2019.

NPTEL LINK:

https://nptel.ac.in/courses/108106073

https://archive.nptel.ac.in/courses/117/101/117101056/#

COURSE CODE	COURSE TITLE	L	T	P	C
22GE301	TAMILS AND TECHNOLOGY	1	0	0	1

COURSE OBJECTIVES:

The course is designed to

- Recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- Highlight the concepts of design and construction technology during the Sangam age.
- Provide an overview of manufacturing technology and its role in Tamil society.
- Illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- Promote scientific Tamil and Tamil computing.

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

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

UNIT III	MANUFACTURING TECHNOLOGY	3

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.

UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3

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.

UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3

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: 15 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the students will be able to

CO1: Identify the role of weaving and ceramic technology in ancient Tamil Culture.

CO2: Assess the design and construction technology ideas in the current Tamil society.

CO3: Identify the different types of manufacturing technology used in Tamil society and their significance.

CO4: Classify agricultural and irrigation technologies in ancient Tamil society and its current relevance.

CO5: Discuss the fundamentals of scientific Tamil and Tamil computing.

TEXT-CUM-REFERENCE 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)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book

COURSE CODE	COURSE TITLE	L	T	P	C
22MA302	STATISTICS AND LINEAR ALGEBRA (Theory Course with Laboratory Component)	3	0	2	4

COURSE OBJECTIVES:

The course is designed to:

- Test the hypothesis for small and large samples.
- Introduce the concept of analysis of variance.
- Understand the concept of statistical quality control.
- Define vectors space and linear transformations.

UNIT I	TESTING OF HYPOTHESIS	15

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, F distributions for mean and variance- Chi-square test - Goodness of fit and Contingency table (test for independent).

List of Exercise/Experiments using R Programming:

1. Testing of hypothesis for given data using Z - test.
2. Testing of hypothesis for given data using t - test.

UNIT II	DESIGN OF EXPERIMENTS	15

One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design

List of Exercise/Experiments using R Programming:

1. Perform one way ANOVA test for the given data.
2. Perform two way ANOVA test for the given data.

UNIT III	STATISTICAL QUALITY CONTROL	15

Control charts for measurements $\bar{X}$ and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits.

List of Exercise/Experiments using R Programming:

1. Interpret the results for $\bar{X}$-Chart for variable data.
2. Interpret the results for R-Chart for variable data.

UNIT IV	VECTOR SPACES	15

Vector spaces - Subspaces - Linear combinations and linear system of equations - Linear independence and linear dependence - Bases and dimensions.

List of Exercise/Experiments using R Programming:

1. Plot the vector subspace in 3-dimensional space.
2. Compute the null space of the matrix.

UNIT V	LINEAR TRANSFORMATION AND DIAGONALIZATION	15

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of linear Transformations - Eigenvalues and eigenvectors - Diagonalizability.

List of Exercise/Experiments using R Programming:

1.Write Matrix representation of linear transformations

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Apply the concept of testing of hypothesis.

CO2: Demonstrate the different types of experimental designs.

CO3: Interpret the control charts for variables and attributes.

CO4: Identify the bases and dimensions.

CO5:Find the eigenvalues and eigenvectors using linear transformations

TEXT BOOKS:

1. R.A. Johnson, I. Miller and J. Freund, Miller and Freund's Probability and Statistics for Engineers, Pearson Education, Asia, 8th Edition, 2015
2. Friedberg, A.H., Insel, A.J. and Spence, L., Linear Algebra :A Matrix Approach 2nd Edition Prentice Hall of India, New Delhi, 2019.

REFERENCES:

1. J.L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 8th Edition, 2014.
2. S.M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Elsevier, 2014.
3. M.R. Spiegel, J. Schiller and R.A. Srinivasan, Schaum's Outline of Theory and Problems of Probability and Statistics, Tata McGraw Hill Edition, 2004.
4. R.E.Walpole, R.H.Myers, S.L. Myers and K.Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, 9th Edition, 2012.
5. J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, Tata McGraw Hill, 4th Edition, 2007.
6. Howard Anton, Anton Kaul, Elementary Linear Algebra, Wiley, 12th Edition, 2019.

COURSE CODE	COURSE TITLE	L	T	P	C
22EC301	SIGNALS AND SYSTEMS (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To summarize the basic properties of Signals and Systems and their classification.
- To demonstrate Continuous Time signals using Fourier series, Laplace transform and Fourier transform.
- To examine Continuous Time LTI systems using Laplace transform and Fourier transform.
- To analyze Discrete Time signals using DTFT and Z transform.
- To characterize Discrete Time LTI systems using DTFT and Z transform.

UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9+6

Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Operations on Signals, Classification of CT and DT signals - Periodic & Aperiodic signals, Deterministic & Random signals, Even & Odd, Causal & Non-Causal, Energy & Power signals - Continuous time systems and Discrete time systems - Classification of CT systems and DT systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

LIST OF EXPERIMENTS

1. Generation of Continuous time and Discrete Time signals.
2. Perform amplitude-scaling and time-shifting on a given signal.
3. Compute the even and odd parts of a given signal

UNIT II	ANALYSIS OF CONTINUOUS TIME SIGNALS	9+6

Fourier series analysis-Spectrum of Continuous Time (CT) signals- Fourier and Laplace transforms of CT Signals - Properties.

LIST OF EXPERIMENTS

4. Compute the Fourier transform of CT signals.
5. Compute the Laplace transform of CT signals.

UNIT III	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	9+6

Differential Equation - Impulse response, Convolution integrals, Fourier and Laplace transforms in analysis of Continuous Time systems.

LIST OF EXPERIMENTS

6. Perform convolution of signals using Fourier transform.

UNIT IV	ANALYSIS OF DISCRETE TIME SIGNALS	9+6

Discrete Time Fourier Transform (DTFT) – Properties of DTFT - Z transform – Properties of Z transform.

LIST OF EXPERIMENTS

7. Compute the Z transform of causal signals.

UNIT V	LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS	9+6

Difference Equations-Block diagram representation -Impulse response - Convolution sum- Discrete Fourier transform and Z transform analysis of Discrete Time systems

LIST OF EXPERIMENTS

8. Compute Linear convolution (Convolution Sum) of the given two sequences.

9. Simulate the impulse response of a system from its difference equation.
10. Find poles and zeros of Z domain signals and sketch the pole zero plot.

TOTAL: 45 PERIODS(THEORY) +30 PERIODS (LAB)=75 PERIODS

COURSE OUTCOMES:

CO1: Interpret the properties of Signals and Systems.

CO2: Determine Fourier series, Fourier transform and Laplace transform of Continuous Time signals.

CO3: Examine Continuous Time LTI systems using Fourier and Laplace transforms.CO4: Employ DTFT and Z transform in Discrete Time signal analysis.

CO5: Examine the Discrete time LTI systems using DTFT and Z transform.

CO6: Demonstrate Convolution operation for Continuous and Discrete time systems.

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, 2nd Edition, Pearson, 2015.
2. Simon Haykin and Barry Van Veen, Signals & Systems, 2nd Edition, Wiley, 2018.

REFERENCES:

1. B. P. Lathi, Principles of Linear Systems and Signals, 3rd Edition, Oxford, 2017.
2. M.J.Roberts, Signals & Systems Analysis using Transform Methods & MATLAB, 3rd Edition, Tata McGraw Hill, 2019.
3. R.E.Zeimer, W.H.Tranter and R.D.Fannin, Signals & Systems - Continuous and Discrete, 4th Edition, Pearson, 2014.
4. A. Nagoor Kani, Signals and Systems, 1st Edition, McGraw Hill, 2018.
5. A. Anand Kumar, Signals and Systems, 3rd Edition, PHI Learning Private Limited, 2013.

NPTEL LINKS:

https://nptel.ac.in/courses/108/106/108106163/
https://nptel.ac.in/courses/108104100

LIST OF EQUIPMENTS:

Requirements for a batch of 30 students

Sl. No.	Equipment	Quantity
1	SciLab / MATLAB / On Ramp	30
2	Personal Computers	30

COURSE CODE	COURSE TITLE	L	T	P	C
22EC302	ANALOG ELECTRONICS (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To analyze the various biasing methods of transistorized amplifiers.
- To analyze the effect of capacitances in the frequency response of BJT and MOSFET
- To discuss the effects of negative feedback on amplifier circuits and study the different types of oscillator circuits.
- To understand the operation of various classes of power amplifier circuits.
- To design the hardware implementation of analog circuits using discrete components.

UNIT I	BJT AND BJT AMPLIFIERS	9+6

Load line, Q-point, Biasing methods for BJT, Analysis of CE, CB and CC amplifiers using hybrid- pi equivalent circuit, BJT Differential amplifier – CMRR, Multistage amplifiers - Cascade amplifier, Darlington amplifier, Cascode amplifier.

LIST OF EXPERIMENTS

1. Analysis of Fixed Bias and Self Bias circuit
2. Darlington Amplifier
3. BJT Cascode/Cascade amplifiers using PSPICE

UNIT II	MOSFET AND MOSFET AMPLIFIERS	9+6

Load line, Q-point, Biasing methods for MOSFET, Analysis of CS, CD and CG MOSFET amplifiers using hybrid-pi equivalent circuits, Multistage Amplifiers - Cascade amplifier, Cascode amplifier

LIST OF EXPERIMENTS

4. MOSFET characteristics using PSPICE

UNIT III	FREQUENCY RESPONSE OF BJT AND MOSFET	9+6

Frequency response of BJT– Transistor amplifier with circuit capacitors, Short circuit current gain, Miller effect and Miller capacitance, High frequency analysis of CE amplifier, Frequency response of MOSFET – High frequency MOSFET model, Unit gain bandwidth, Miller effect and Miller capacitance, High frequency analysis of MOSFET CS amplifier.

LIST OF EXPERIMENTS

5. Frequency response of CE amplifier
6. Frequency response of CS amplifier using PSPICE

UNIT IV	FEEDBACK AMPLIFIERS AND OSCILLATORS	9+6

Feedback Concepts – gain with feedback – effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers – analysis of series-series, shunt-shunt and shunt-series feedback amplifiers. Barkhausen criterion, Colpitts, Hartley's, Clapp Oscillator, Phase shift, Wien bridge and crystal oscillators.

LIST OF EXPERIMENTS

7. Feedback Amplifier

8. Oscillator using PSPICE

UNIT V	**POWER AMPLIFIERS**	**9+6**

Classification of large signal amplifiers, Class A, B, AB, C, D, Conversion efficiency, Class C Tuned amplifier.

LIST OF EXPERIMENTS

9. Class B and Class C Tuned Amplifier
10. Class A Amplifier using PSPICE

TOTAL: 45 PERIODS(THEORY) +30 PERIODS (LAB)=75 PERIODS

COURSE OUTCOMES:

CO1: Design simple electronic circuits based on transistors

CO2: Design a BJT and MOSFET amplifier for the given specifications and analyze its frequency response.

CO3: Construction of feedback amplifier and oscillator circuit for the given specifications

CO4: Distinguish different classes of power amplifiers and employ it.

CO5: Understand the contemporary issues related to analog electronic circuits.

CO6: Design, simulation, modelling and hardware implementation of analog circuits with discrete components

TEXT BOOKS:

1. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, Mc Graw Hill Education (India) Private Ltd., 2010.
2. Robert L. Boylestad and Louis Nasheresky,―Electronic Devices and Circuit Theory‖, 11th Edition, Pearson Education, 2008.

REFERENCES:

1. David A Bell , Electronic Devices and circuits, Fifth edition, Oxford 2008.
2. Millman J. and Taub H.,―Pulse Digital and Switching Waveforms, TMH, 2000.
3. Millman J, Halkias.C and SathyabradaJit, Electronic Devices and Circuits, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
4. Sedra and Smith, ―Micro Electronic Circuits; Sixth Edition, Oxford University Press, 2011.
5. Floyd, Electronic Devices, Ninth Edition, Pearson Education, 2012.

NPTEL LINKS:

https://nptel.ac.in/courses/117/101/117101106/

https://archive.nptel.ac.in/courses/108/105/108105158/

LIST OF EQUIPMENTS:

Requirements for a batch of 30 students

Sl. No.	Equipment	Quantity
1	CRO(30MHz)	15
2	Signal Generator /Function Generator (3MHz)	15

3	Dual Regulated Power Supply (0-30V)	15
4	Transistor/FET(BJT-NPN-PNP and NMOS/PMOS)	50
5	Power Transistor	20
6	Resistors, Capacitors	50
7	Decade Inductance Box	10
8	Decade Capacitance Box	10
9	Bread Boards	15
10	Multimeter	15
11	Digital LCR Meter	2
12	Desktop PC with PSPICE Circuit Simulation Software	15

COURSE CODE	COURSE TITLE	L	T	P	C
22EC304	**PROBLEM SOLVING AND PYTHON PROGRAMMING** (Theory Course with Laboratory Component)	3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- To understand and write simple Python programs.
- To write Python programs using functions and understand recursion
- To solve problems using Python data structures –- lists, tuples, dictionaries.
- To understand files, modules and packages in Python.
- To use Exceptions, Standard Libraries and IDE for application development.

UNIT I	INTRODUCTION TO PYTHON	9+6

Introduction to Python programming – Arithmetic Operators - values and types - variables, expressions, statements – Functions – Conditionals and Recursion –Iteration.

List of Exercise/Experiments

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. First n prime numbers

UNIT II	FUNCTIONS	9+6

Fruitful functions: Return Values, Incremental Development, Composition, Boolean functions, Recursion, Example, Checking Types – Strings: len, Traversal with a for loop, String slices, Immutable, Searching, Looping and Counting, String Methods, in Operator, String Comparison – Case Study: Word Play.

List of Exercise/Experiments

1. String manipulation

a. Get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself

b. Python function that takes a list of words and returns the length of the longest one

c. Python program to remove the characters which have odd index values of a given string

d. Python program to count the occurrences of each word in a given sentence.

e. Python program that accepts a comma separated sequence of words as input and prints the unique words in sorted form

f. Python function to reverses a string if it's length is a multiple of 4

UNIT III	LISTS, DICTIONARIES, TUPLES	9+6

Lists: Sequence, Mutable, Traversing, Operations, list slices, list methods, Map, Filter and Reduce, Deleting elements, Lists and Strings, Objects and Values, Aliasing, List Arguments.

Dictionaries: Mapping, Collection of Counters, Looping and Dictionaries, Reverse Lookup, Dictionaries and Lists, Memos, Global Variables

Tuples: Immutable, Tuple Assignment, Tuple as Return Values, Variable-length Argument Tuples, Lists and Tuples, dictionaries and Tuples, Sequences of Sequences. Case Study: Data Structure Selection.

List of Exercise/Experiments

1. Operations on Tuples:
    a. finding repeated elements
    b. slice a tuple
    c. reverse a tuple
    d. replace last value of a tuple
2. List operations
    a. Find the maximum of a list of numbers
    b. Python program to remove duplicates from a list.
    c. Python program to get the smallest number from a list.
    d. Python program to print a specified list after removing the 0th, 4th and 5th elements.
    e. Python program to print the numbers of a specified list after removing even numbers from it.
    f. Python program to find the second smallest number in a list.
3. Linear search and Binary search
4. Selection sort, Insertion sort
5. Merge sort
6. Multiply matrices

UNIT IV	**FILES, MODULES, PACKAGES**	**9+6**

Files: Persistence, Reading and Writing, Format Operator, Filenames and Paths, Catching Exceptions - Modules: Importing a module, Packages, Creating a module.

List of Exercise/Experiments

1. Programs that take command line arguments (word count)
2. Find the most frequent words in a text read from a file

UNIT V	**EXCEPTIONS, LIBRARIES**	**9+6**

Exception Handling – Built-in Exceptions – Application Development with Python: Integrated Development Environment, Python Standard Library.

List of Exercise/Experiments

1. Simulate elliptical orbits in Pygame
2. Simulate bouncing ball using Pygame

TOTAL: 45+30=75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

CO1: Implement simple Python programs.

CO2: Develop Python programs using functions.

CO3: Represent and solve compound data using Python lists, tuples, dictionaries.

CO4: Implement and perform operations on files, modules and packages..

CO5: Apply Exceptions, Standard Libraries and IDE for application development.

TEXT BOOKS:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Martin C. Brown, Python: The Complete Reference, Mc-Graw Hill, (Unit 4 – Chapter 5, Unit 5 – Chapter 7, 17)

REFERENCES:

1. David Beazley, Brian K. Jones, Python Cookbook, O’Reilly , 3rd Edition, 2013.
2. ReemaThareja, “Problem Solving and Programming with Python”, 2nd Edition, Oxford University Press 2019.
3. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
4. John V Guttag, ―Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press , 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, ―Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
7. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
8. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
9. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

LIST OF EQUIPMENTS:

1. Systems with Linux Operating System

2.Python Interpreter

COURSE CODE	COURSE TITLE	L	T	P	C
22CS311	APTITUDE AND CODING SKILLS – I	0	0	2	1

COURSE OBJECTIVES:

- To develop vocabulary for effective communication and reading skills.
- To build the logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.

List of Exercises:

1. **English – Phase I**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering.

2. **Logical Reasoning – Phase I**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency.

3. **Quantitative Ability - Phase I**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability.

4. **Automata Fix – Phase I**

Logical, Compilation and Code reuse.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop vocabulary for effective communication and reading skills.

CO2: Build the logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

COURSE CODE	COURSE TITLE	L	T	P	C
22EC311	PRODUCT DEVELOPMENT LAB - 3	0	0	2	1

COURSE OBJECTIVES:

- To provide adequate understanding of project/product concepts and creative design process.
- To create a methodology for developing solutions to the complex systems.

S.NO.	LIST OF EXPERIMENTS
1.	Implementation of Design Process.
2.	Present the product idea.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1: Develop their intellectual skills for understanding the concepts, rules or procedures.

CO2: Develop their cognitive strategy to think, organize, learn and behave.

CO3: Demonstrate the ability to provide conceptual design strategies for a product.

CO4: Describe procedure for designing a prototype.

CO5: Recognize interdisciplinary strategies for solving complex problems.

CO6: Apply integrative strategies for solving complex problems.

LIST OF EQUIPMENTS:

Sl. No.	Equipment	Quantity
1.	CNC Router	1
2.	3D Printer	1
3.	3D Scanner	1
4.	Laser Cutting Machine	1
5.	Centre lathe	2
6.	Arc Welding transformer with cables and holders	2
7.	Plumbing tools	2 Sets
8.	Carpentry Tools	2 Sets
9.	Multimeter	10
10.	Drilling Machine	1
11.	Solder Stations	5 Sets
12.	Desoldering Machine	1
13.	PCB Milling Machine	1
14.	Variable Power Supply	1
15.	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitors, IC etc.,	10 Sets
16.	Personal Desktop Computers	30

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
22GE301	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	2	2	0	3

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT I	COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION	12

Purpose and motivation for the course, recapitulation from Universal Human Values-I- Self-Exploration–Its content and process-Natural Acceptance and Experiential Validation-as the process for self-exploration - Continuous Happiness and Prosperity-A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility-The basic requirements for fulfillment of aspirations of every human being with correct priority-Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario. Methods to fulfill the human aspirations: Understanding and living in harmony at various levels.

Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT II	UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF!	12

Understanding human beings as a co-existence of the sentient 'I' and the material 'Body' - Understanding the needs of Self ('I') and 'Body' - happiness and physical facility -Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Understanding the characteristics and activities of 'I' and harmony in 'I' - 'Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, the meaning of Prosperity in detail - Programs to ensure Sanyam and Health.

Practice sessions: To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with the disease.

UNIT III	UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP	12

Understanding values in a human-human relationship - the meaning of Justice (nine universal values in relationships) and the program for its fulfillment to ensure mutual happiness -Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in a relationship - Understanding the harmony in the society (society being an extension of the family) - Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Practice sessions: To reflect on relationships in family, hostel and institute as extended family, real-life examples, teacher-student relationship, the goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

UNIT IV	**UNDERSTANDING HARMONY IN NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE**	**12**

Understanding the harmony in Nature - Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as the Co-existence of mutually interacting units in all-pervasive Space - Holistic perception of harmony at all levels of existence.

Practice sessions: To discuss human beings as the cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V	**IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY IN PROFESSIONAL ETHICS**	**12**

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems - Case studies of typical holistic technologies, management models and production systems - Strategy for the transition from the present state to Universal Human Order: a. At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers b. At the level of society: as mutually enriching institutions and organizations - Sum up.

Practice Sessions / Exercises: Case Studies To discuss the conduct as an engineer or scientist etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students:

CO1: Would become more aware of themselves, and their surroundings (family, society, nature).

CO2: Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: Would have better critical ability.

CO4: Would become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).

CO5: Would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, Second Edition 2019.

REFERENCES:

1. Nagaraj A, Jeevan Vidya: Ek Parichaya Jeevan Vidya Prakashan, Amarkantak, 1999.
2. E.F Schumacher, Small is Beautiful, Vintage classics, London, 1993.
3. A. N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, Third Edition 2020.
4. Maulana Abdul Kalam Azad, India Wins Freedom, Oriental blackswan private limited, Hyderabad, 2020.
5. Mahatma Gandhi, Hind Swaraj or Indian Home Rule, Maheswari Publications, Delhi 2020.
6. Romain Rolland, The life of Vivekananda and the universal gospel, Publication house of Ramakrishna Math, Kolkata, Thirty second edition 2018.
7. Romain Rolland, Mahatma Gandhi: The man who become one with the universal being, Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.
8. Dennis P Heaton, The story of stuff. (2010): 553-556.
9. Mohandas Karamchand Gandhi, The story of my experiments with truth: An auto biography, Om Books International, 2018.
10. Cecile Andrews, Slow is beautiful: new visions of community, leisure, and joie de vivre, New society publishers, 2006.
11. Joseph Cornelius Kumarappa, The economy of permanence. CP, All India Village Industries Assn., 1946.

COURSE CODE	COURSE TITLE	L	T	P	C
22MA402	PROBABILITY AND RANDOM PROCESSES (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

The course is designed to:

- Provide the necessary basic concepts of random variables and to introduce some standard distributions.
- Understand the classification of random processes.
- Introduce the concept of auto correlation, cross correlation, and its spectral densities.
- Acquire the knowledge of linear system with random inputs.

UNIT I	ONE-DIMENSIONAL RANDOM VARIABLES	15

Basic probability definitions- Independent events- Conditional probability (revisit) - Random variable - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

List of Exercise/Experiments using MATLAB/ R Programming:

1. Finding probability of DRV and CRV.
2. Finding mean, variance and MGF.
3. Using distributions to find probability value.

UNIT II	TWO-DIMENSIONAL RANDOM VARIABLES	15

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and linear regression - Transformation of random variables.

List of Exercise/Experiments using MATLAB/ R Programming:

1. Determine mean values using regression.
2. Solving correlation problems
3. Finding covariance.

UNIT III	RANDOM PROCESSES	15

Classification - Stationary process - Poisson process - Markov process -Discrete time Markov chain- Random telegraph process.

List of Exercise/Experiments using MATLAB/ R Programming:

1. Determine asymptotic behaviour of Markov chain.
2. Solving Poisson process problems.
3. To test the stationary of a random process

UNIT IV	CORRELATION AND SPECTRAL DENSITIES	15

Auto correlation functions - Cross correlation functions - Properties - Power spectral density (continuous)- Cross spectral density (continuous) - Properties.

List of Exercise/Experiments using MATLAB/ R Programming:

1. Calculating auto correlation.
2. Finding PSD of a signal.
3. To estimate cross spectral density.

UNIT V	LINEAR SYSTEMS WITH RANDOM INPUTS	15

Linear time invariant system - System transfer function - Linear systems with random inputs - Auto correlation and cross correlation functions of input and output.

List of Exercise/Experiments using MATLAB/ R Programming:

1. Construct linear time invariant models.
2. Problem with phase of a transfer function.
3. Create random input signal.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:
CO1: Calculate the statistical measures of standard distributions.

CO2: Compute the correlation & regression for two dimensional random variables.

CO3: Find the steady state probabilities of the Markov chain.

CO4: Estimate the auto correlation and its power spectral densities of the random processes.

CO5: Determine the output power spectral density of linear system with random inputs.

TEXT BOOKS:

1. R.D. Yates and D.J. Goodman, Probability and Stochastic Processes, Wiley India Pvt. Ltd., 3rd Edition, 2021.
2. O.C. Ibe, Fundamentals of Applied Probability and Random Processes, 2nd Edition, Elsevier, 2019.

REFERENCES:

1. G.R. Cooper and C.D. McGillem, Probabilistic Methods of Signal and System Analysis, Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2. Hwei Hsu, Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes, Tata McGraw Hill Edition, New Delhi, 2004.
3. S.L. Miller and D.G. Childers, Probability and Random Processes with Applications to Signal Processing and Communications, Academic Press, 2nd Edition 2012.
4. H. Stark. and J.W. Woods, Probability and Random Processes with Applications to Signal Processing, Pearson Education, Asia, 3rd Edition, 2002.
5. P.Z. Peebles,Probability, Random Variables and Random Signal Principles, Tata McGraw Hill, 4th Edition, New Delhi, 2002.

COURSE CODE	COURSE TITLE	L	T	P	C
22EC401	CONTROL ENGINEERING (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To determine the transfer function models of mechanical and electrical systems
- To develop adequate knowledge in the time response of systems and steady state error analysis
- To analyze the open loop and closed loop frequency response of linear systems
- To design the compensators for Linear Systems
- To estimate stability for Linear Systems
- To make use of state variable representation of physical systems

UNIT I	MATHEMATICAL MODEL OF PHYSICAL SYSTEMS	9+6

Basic elements in control systems: Open and closed loop systems – Mathematical model and Electrical analogy of mechanical systems – Transfer function – Block diagram reduction techniques – Signal flow graphs - Applications of Control system.

LIST OF EXPERIMENTS

1. Determine the transfer function of the given closed loop system using MATLAB
2. Implement unity and non-unity feedback system using MATLAB.

UNIT II	TIME RESPONSE ANALYSIS	9+6

Time response: Time domain specifications – Types of test input – I and II order system response - Error coefficients – Generalized error series – Steady state error – Effects of P, PI, PID modes of feedback control

LIST OF EXPERIMENTS

3. Estimate the unit step response of the given transfer function and determine its time domain parameters using MATLAB.
4. Determine the steady state error of the given transfer function using MATLAB.
5. Simulate P, PD, PI, PID controller and verify by using hardware.

UNIT III	FREQUENCY RESPONSE ANALYSIS	9+6

Frequency response analysis – Bode plot – Polar plot. Determination of closed loop response from open loop response –M and N circles. Correlation between frequency domain and time domain specifications.

LIST OF EXPERIMENTS

6. Perform stability analysis of a given transfer function using gain and phase margins estimated by the Bode plot using MATLAB.
7. Estimate the relative stability of a given transfer function using gain and phase margins estimated by the Polar plot using MATLAB.

UNIT IV	STABILITY AND COMPENSATOR DESIGN	9+6

Characteristics equation – Routh Hurwitz criterion- Root locus construction – Effect of Lag, lead and lag-lead compensation on frequency response - Design of Lag, lead and lag lead compensator using bode plots.

LIST OF EXPERIMENTS

8. Sketch the root locus of the given transfer function and locate the closed loop poles for different values of open loop gain (K) using MATLAB.

UNIT V	STATE VARIABLE AND STATE SPACE MODELLING	9+6

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

LIST OF EXPERIMENTS

9. Construct the State space model for the classical transfer function using MATLAB.
10. Perform analytical study of water flow measurement using flow meter.

TOTAL: 45 PERIODS(THEORY) +30 PERIODS (LAB)=75 PERIODS

COURSE OUTCOMES:

CO1: Develop mathematical model of linear mechanical and electrical systems

CO2: Model the time response analysis of first and second order systems

CO3: Analyze the frequency response of open and closed loop systems

CO4: Design the compensators for Linear Systems

CO5: Analyze stability methods for Linear Systems

CO6: Examine the state variables, controllability and observability of linear and time invariant systems

TEXT BOOKS:

1. Nagarath,I.J. and Gopal,M., Control Systems Engineering, Sixth Edition, New Age International Publishers, 2017.
2. Benjamin C.Kuo, Automatic Control Systems, Ninth Edition, Wiley, 2014.

REFERENCES:

1. M.Gopal, Control System: Principle and Design, Fourth Edition, McGraw Hill Education, 2018.
2. Katsuhiko Ogata, Modern Control Engineering, Fifth Edition, Pearson, 2015.
3. Prof.S.D.Agashe, NPTEL Video Lecture Notes on Control Engineering, IIT Bombay.
4. S.K.Bhattacharya ,Control Systems Engineering, First Edition, Pearson, 2018.
5. Houpis C H and Sheldon S N ,Linear Control System Analysis and Design with MATLAB , Fifth Edition, CRC Press Taylor and Francis, 2014.

NPTEL LINKS:

https://nptel.ac.in/courses/107106081

https://onlinecourses.nptel.ac.in/noc19_ee42

LIST OF EQUIPMENTS:

Requirements for a batch of 30 students

Sl. No.	Equipment	Quantity
1	P,PI and PID controller Learner Kit	1
2	Water flow Measurement Kit	1
3	CRO 30MHz	10
4	Personal Computer	15
5	MATLAB	15 Users

COURSE CODE	COURSE TITLE	L	T	P	C
22EC402	**LINEAR INTEGRATED CIRCUITS** (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To describe the characteristics of operational amplifiers.
- To design Op–amp circuits for linear and nonlinear applications.
- To comprehend the working principles of ADC and DAC.
- To investigate the functions and applications of analog multipliers and PLLs.
- To construct different waveform generators and voltage regulators.

UNIT I	OPERATIONAL AMPLIFIER CHARACTERISTICS	9+6

Advantages of ICs over discrete components, Classification, Basic information about Op-amps – Ideal Op-amp Characteristics, Equivalent Circuit, Internal circuit diagrams of IC 741, Open and Closed loop configurations of IC 741, DC and AC performance characteristics and its compensation techniques, Slew Rate.

LIST OF EXPERIMENTS

Design and Testing of

1. Inverting, Non inverting amplifier, Differential amplifiers.

UNIT II	APPLICATIONS OF OPERATIONAL AMPLIFIERS	9+6

Linear Applications: Adder, Subtractor, Instrumentation Amplifier, Integrator, Differentiator, Non-linear Applications: Logarithmic Amplifier, Antilogarithmic Amplifier, Comparators, Schmitt trigger, Active Filters: First order and Higher order Low- Pass, High-Pass and Band-Pass Butterworth Filters.

LIST OF EXPERIMENTS

Design and Testing of

2. Integrator, Differentiator, Schmitt Trigger using Op-amp.
3. Instrumentation amplifier using Op-amp - PSPICE
4. Active low-pass, High-pass and band-pass filters - PSPICE

UNIT III	ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS	9+6

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R- 2R Ladder type, Voltage Mode and Current Mode R-2R Ladder types -A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope and Dual Slope.

LIST OF EXPERIMENTS

Design and Testing of

5. R-2R Ladder Type D-A Converter using Op-amp - PSPICE

UNIT IV	ANALOG MULTIPLIER AND PLL	9+6

Analog Multiplier ICs and their applications, PLL: Operation of the basic PLL, closed loop analysis, Voltage Controlled Oscillator IC 566, Monolithic PLL IC 565, application of PLL:FM Demodulator, FSK Demodulator, Frequency synthesizing and clock synchronization.

LIST OF EXPERIMENTS

Design and Testing of

6. PLL Characteristics IC565.
7. Frequency Synthesizer using IC 565.

UNIT V	WAVEFORM GENERATORS AND VOLTAGE REGULATORS	9+6

Waveform generators: Sine-wave generators – RC phase shift and Wien Bridge Oscillator- Triangular wave generator, IC 555 Timer and its modes of operation, Fixed voltage regulator– LM317 Adjustable voltage regulator- IC723 general purpose regulator

LIST OF EXPERIMENTS

Design and Testing of

8. Phase shift and Wien bridge oscillators using Op-amp.
9. Voltage regulator-IC723
10. Astable and Monostable multivibrators using NE555 Timer - PSPICE

TOTAL: 45 PERIODS(THEORY) +30 PERIODS (LAB) = 75 PERIODS

COURSE OUTCOMES:

CO1: Express the AC and DC characteristics of Op-amp with its compensation techniques.

CO2: Elucidate the functions of Op-amp in linear and nonlinear applications.CO3:

Classify and comprehend the working principle of data converters.

CO4: Illustrate the function of application specific ICs such as, Analog Multiplier, PLLand its applications.

CO5: Comprehend the effect of voltage regulators in power supply.

CO6: Design and evaluate various waveform generator circuits using Op-amp.

TEXT BOOKS:

1. D.Roy Choudhry, Shail B Jain, Linear Integrated Circuits, 5th Edition, New Age International Pvt. Ltd., 2020.
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 4th Edition, TMH, 2016.

REFERENCES:

1. Ramakant A. Gayakwad, Op-amp and Linear ICs, 4th Edition, Prentice Hall /Pearson Education, 2015.
2. Robert F.Coughlin, Frederick F.Driscoll, Operational Amplifiers and LinearIntegrated Circuits, 6th Edition, PHI, 2015.
3. Gray and Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition,Wiley International, 2009.
4. William D.Stanley, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004.
5. Salivahanan S and Kanchana Bhaaskaran V S, Linear Integrated Circuits, 3rdEdition, McGraw Hill Education, 2018.

NPTEL LINKS:
https://nptel.ac.in/courses/108/108/108108111/
LIST OF EQUIPMENT:

Requirements for a batch of 30 students

Sl. No.	Equipment	Quantity
1	CRO/DSO (Min 30MHz)	15
2	Signal Generator /Function Generators (3 MHz)	15
3	Dual Regulated Power Supplies (0 – 30V)	15
4	Digital Multimeter	15
5	IC Tester	5
6	Standalone desktops PC with SPICE	15
7	Components and Accessories	50

Components and Accessories:
Transistors, Resistors, Capacitors, Diodes, Bread Boards and wires,
Note: Op-Amps uA741, LM723, LM317, LM 555, LM 565, LM 566 may be used.

COURSE CODE	COURSE TITLE	L	T	P	C
22EC403	ANALOG AND DIGITAL COMMUNICATION (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To discuss the concepts of various AM modulation schemes and their spectral characteristics
- To describe the Generation and Detection of Frequency Modulation.
- To explain the performance of various Pulse coding Techniques.
- To learn principles of different pass band transmission schemes
- To calculate required parameters of Source and channel coding Techniques
- To visualize the effects of sampling and Digital Modulations Schemes

UNIT I	AMPLITUDE MODULATION	9+6

Need for Modulation, Amplitude modulation – frequency spectrum of AM– Power and current in AM wave – Generation of AM signal – AM Emitter Modulator and Collector Modulator, AM demodulation - Envelope, DSB-SC, SSB-SC & VSB generation and demodulation modulation, Synchronous detection, Comparison of AM modulation systems.

LIST OF EXPERIMENTS

1. AM Modulator and Demodulator

UNIT II	ANGLE MODULATION	9+6

Principle of frequency and phase modulation – Relation between FM and PM waves — Narrow band and wide band FM, Carson's rule, Frequency deviation, Bandwidth of FM – Direct and Indirect Methods of FM Generation - FM detectors – slope detectors, Phase discriminators, Ratio detectors, PLL Demodulators . Pre-emphasis and De-emphasis, Comparison of AM and FM. Super-heterodyne receiver (AM and FM)

LIST OF EXPERIMENTS

2. FM Modulator and Demodulator.

UNIT III	PULSE MODULATION SYSTEMS	9+6

Block Diagram of digital communication system, Sampling – Quantization – Uniform & nonuniform quantization. – Quantization noise- Companding (A law and μ law) – Pulse Code Modulation (PCM), Differential pulse code modulation-Delta modulation and Adaptive Delta Modulation.

LIST OF EXPERIMENTS

3. Signal Sampling and reconstruction
4. Pulse Code Modulation and Demodulation
5. Delta Modulation and Demodulation

UNIT IV	DIGITAL MODULATION TECHNIQUES	9+6

Geometric Representation of signals - Generation and detection of coherent systems -BASK, BFSK, BPSK, QPSK, QAM, and Comparison of all digital Modulation Techniques.

LIST OF EXPERIMENTS

6. Simulation of ASK, FSK, and BPSK generation schemes
7. Simulation of ASK, FSK and BPSK detection schemes
8. Simulation of QPSK and QAM generation schemes
9. Simulation of signal constellations of BPSK, QPSK and QAM

UNIT V	SOURCE AND CHANNEL CODING	9+6

Definition of - Discrete Memoryless source, Information, Entropy, Channel Capacity -Hartley law, Shannon law, Source coding theorem -Shannon Fano & Huffman codes. Channel coding theorem -Linear Block codes.

LIST OF EXPERIMENTS

10. Simulation of Linear Block

TOTAL: 45 PERIODS(THEORY) +30 PERIODS (LAB)=75 PERIODS

COURSE OUTCOMES:

CO1: Compare the Spectral efficiency of various Amplitude Modulation Schemes.

CO2: Summarize the concepts of Generation and Detection of Frequency Modulation

CO3: Demonstrate the performance of various Pulse coding Techniques.

CO4: Differentiate the different pass band transmission schemes

CO5: Construct different Source and Error control codes

CO6: Implement different Digital modulation schemes and coding techniques using simulation software

TEXT BOOKS:

1. Wayne Tomasi, Advanced Electronic Communications Systems, 6th Edition, Pearson New International Edition, Noida, India, 2014.
2. Simon Haykin, Communication Systems,5th Edition, Wiley, 2021.

REFERENCES:

1. Sanjay Sharma, Communication Systems (Analog and digital), 7th Edition, S.K. Kataria & Sons, 2022.
2. Roddy and Coolen, Electronic Communication, 4th Edition, Pearson Education, Noida, India, 2014.
3. Herbert Taub and Donald Schilling, Principles of Communication Systems, 4th Edition, McGraw Hill, 2017.
4. HweiKsu and Debjani Mitra, Analog and Digital Communication: Schaum's Outline Series, 3rd Edition, McGraw Hill Education, New Delhi, India., 2017.

NPTEL LINKS:

https://nptel.ac.in/courses/108104091
https://nptel.ac.in/courses/108104098

LIST OF EQUIPMENTS:

Requirements for a batch of 30 students

Sl. No.	Equipment	Quantity
1	Kits for Signal Sampling, AM, FM, PCM,DM	02
2	CROs/DSO	15
3	Function Generators	15
4	MATLAB or equivalent software package for simulation experiments	15
5	Personal Computers	15

Note: 2 Students per experiment

COURSE CODE	COURSE TITLE	L	T	P	C
22CS414	APTITUDE AND CODING SKILLS – II	0	0	2	1

COURSE OBJECTIVES:

- To develop advanced vocabulary for effective communication and reading skills.
- To build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

List of Exercises:

1. **English – Phase II**

   Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase II**

   Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase II**

   Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase II**

   Logical, Compilation and Code reuse

5. **Automata - Phase II**

   Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching

   Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop advanced vocabulary for effective communication and reading skills.

CO2: Build an enhanced level of logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

CO4: Apply data structures and algorithms in problem solving.

COURSE CODE	COURSE TITLE	L	T	P	C
22EC411	PRODUCT DEVELOPMENT LAB - 4	0	0	2	1

COURSE OBJECTIVES:

- Develop comprehensive report on the engineering facts applied to a specific problem.
- Analyze the real time problems during project/product development in engineering perspective.
- Evaluate the effectiveness of the product or a system through the knowledge acquired.
- Synthesize the business opportunities for a new product with novel design.

LIST OF EXPERIMENTS

1. Develop a prototype.
2. Demonstration of the project/product and submission of report.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1: Understand and explain the real time problems through literatures.

CO2: Analyze the methods to develop solution to the systems.

CO3: Classify, compare and analyze business opportunities for a new product.

CO4: Summarize and prepare reports for the experimental determinations.

CO5**:** Evaluate the performance and effectiveness of the existing problems.CO6:

Develop life-long learning skills for a productive career.

LIST OF EQUIPMENTS

S.NO	EQUIPMENT NAME	QUANTITY
1.	CNC Router	1
2.	3D Printer	1
3.	3D Scanner	1
4.	Laser Cutting Machine	1
5.	Centre lathe	2
6.	Arc Welding transformer with cables and holders	2
7.	Plumbing tools	2 Sets
8.	Carpentry Tools	2 Sets

9.	Multimeter	10
10.	Drilling Machine	1
11.	Solder Stations	5 Sets
12.	Desoldering Machine	1
13.	PCB Milling Machine	1
14.	Variable Power Supply	1
15.	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitors, IC etc.,	10 Sets
16.	Personal Desktop Computers	30

COURSE CODE	COURSE TITLE	L	T	P	C
22EC412	TESTING OF SENSORS AND ACTUATORS	0	0	2	1

OBJECTIVES:

- To develop the diagnostic skill
- To understand the behaviour of sensors and actuators in Engine

LIST OF EXPERIMENTS

1. Manifold Pressure Sensor
2. Pressure sensor testing
3. Injector testing
4. Fuel (Petrol or diesel) Supply Pump testing
5. Mass Air Flow Sensor
6. Throttle Position Sensor
7. Lamda Sensor
8. Rail Pressure Sensor
9. Accelerator Pedal Sensor
10. Knock Sensor
11. Nox Sensor
12. Particulate matters Sensors.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Describe the fundamental principles and features of the sensors.

CO2: Test the sensors functionality with the Sensor Diagnostic tool.

CO3: Validate the effect of failed sensors and actuators in engine.

CO4: Grade the effective use of the tools.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No	Model	Quantity
1	KTS 590	1
2	Vehicle Diagnostics Software-ESI Tronic	1

3	Multimeter	1
4	Mass Air flow sensor	3
5	Throttle position sensor	3
6	Lamda Sensor	3
7	Rail Pressure sensor	3
8	Accelerator pedal sensor	3
9	Knock sensor	3
10	Nox sensor	3