S.A.ENGINEERING COLLEGE, CHENNAI-77
B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS – 2020A

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: Our graduate Engineers will have diversified professional competency in Electronics and Communication Engineering and allied technologies with good foundation in Mathematics and basic sciences.

PEO2: Our graduates will possess lifelong learning process and augment their engineering skills for new challenges with sustainability.

PEO3: Our graduates will have effective communication skills and work in Multidisciplinary team with critical thinking.

PEO4: Our graduates will practice the profession with ethics, integrity, leadership and social responsibility.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

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

2. **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.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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

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

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

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

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

PROGRAM SPECIFIC OBJECTIVES (PSOs)

1. To inculcate the ability to design quality products and to develop solutions which suits the real time societal needs by applying modern tools and the best universal practices.
2. To define and adhere the communication standards leading towards green communication.
3. To adapt to emerging Information and Communication Technologies (ICT) and to innovate ideas and solutions for the existing/novel problems.

Contribution 1: Reasonable 2: Significant 3: Strong

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	3	2	3	2	1	1	2	1	1	3	1
2	3	3	3	3	3	1	1	1	1	1	1	2
3	3	3	3	3	3	2	2	3	1	2	2	2
4	3	3	3	3	3	2	2	3	1	2	2	2

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAM SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	3	2	3	2	1	1	1	1	1	1	2
2	3	3	3	3	3	2	2	3	1	3	3	3
3	3	3	3	3	3	3	3	2	1	1	1	3

S.A.ENGINEERING COLLEGE

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS – 2020A

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 following table

COURSE OUTCOMES		PROGRAMME OUTCOMES											
Sem	**Course Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
I	Technical English	√	√							√	√	√	√
	Calculus and its Applications	√	√	√	√							√	√
	Applied Physics	√	√	√	√							√	√
	Engineering Chemistry	√	√	√	√	√	√	√	√			√	√
	Problem Solving and Python Programming	√	√	√	√	√	√					√	√
	Engineering Graphics	√	√	√	√							√	√
	Problem Solving and Python Programming Laboratory	√	√	√	√	√	√					√	√
	Physics and Chemistry Laboratory	√	√	√	√							√	√
	Indian Constitution						√	√		√	√	√	√
	தமிழர் மரபு /Heritage of Tamils												
II	English for Communication	√	√							√	√	√	√
	Complex Variables and Transforms	√	√	√	√							√	√
	Material Science	√	√	√	√							√	√
	Basic Electrical and Instrumentation Engineering	√	√	√	√	√	√					√	√
	Network Analysis and Synthesis	√	√	√	√	√	√	√	√		√		√
	Programming in C	√	√	√	√								√
	Environmental Science and Engineering	√	√	√	√							√	√
	Programming in C Laboratory	√	√	√	√	√						√	√
	Engineering Practices Laboratory	√	√	√									√
	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology												
III	Linear Algebra and Partial Differential Equations	√	√	√	√	√						√	√
	Object Oriented Programming	√	√	√	√	√							√
	Electronic Devices and Circuits	√	√	√	√	√	√	√				√	√
	Signals and Systems	√	√	√	√	√	√					√	√
	Digital System Design	√	√	√									
	Control Systems	√	√	√			√						√
	Object Oriented Programming Laboratory	√	√	√	√	√	√						√
	Analog and Digital Circuits Laboratory	√	√	√	√	√	√	√					√
	Interpersonal Skills/Listening &Speaking						√		√	√	√	√	√
IV	Probability and Random Processes	√	√	√	√							√	√
	Electronic Circuits Design	√	√	√	√							√	√
	Electromagnetic Fields	√	√	√	√	√	√	√	√				√
	Linear Integrated Circuits	√	√	√	√							√	√
	Data Structures and Algorithms	√	√	√	√	√							√
	Universal Human Values						√	√	√				√

COURSE OUTCOMES		PROGRAMME OUTCOMES											
Sem	**Course Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Circuits Design and Simulation Laboratory	√	√	√	√	√	√					√	√
	Linear Integrated Circuits Laboratory	√	√	√	√	√	√					√	√
	Technical Seminar/Mini Project	√	√	√	√	√	√	√	√	√	√	√	√
V	Communication Systems	√	√	√									
	Discrete-Time Signal Processing	√	√	√	√	√	√					√	√
	Microprocessors and Microcontrollers	√	√	√	√	√	√			√		√	√
	Waveguides and Antenna Theory	√	√	√	√	√	√					√	√
	Professional Elective I												
	Open Elective I												
	Digital Signal Processing Laboratory	√	√	√	√	√	√					√	√
	Communication Systems Laboratory	√	√	√	√	√	√					√	√
	Microprocessors and Microcontrollers Laboratory	√	√	√	√	√	√					√	√
VI	Communication Networks	√	√	√	√								√
	VLSI Design	√	√	√	√								√
	Industrial Automation	√	√	√	√		√	√					√
	Principles of Management	√	√	√	√	√	√					√	√
	Adhoc and Wireless Sensor Networks	√	√	√	√								√
	Communication Networks Laboratory	√	√	√	√	√							√
	VLSI Design Laboratory	√	√	√	√	√							√
	Technical Seminar/ Mini project		√		√	√	√		√	√	√	√	√
VII	RF System Design	√	√	√	√		√		√			√	√
	Fiber Optic Communication	√	√	√	√		√					√	√
	Embedded and Real Time Systems	√	√	√	√	√	√	√					√
	Internet of Things based system design	√	√	√	√	√	√			√	√	√	√
	Professional Elective -II												
	Open Elective - II												
	Embedded Lab for Product Development	√	√	√	√	√	√	√	√				√
	Microwave and Optical Communication Laboratory	√	√	√	√	√	√	√		√			√
	Project Phase I	√	√	√	√	√	√	√	√	√	√	√	√
VIII	Professional Elective - III												
	Professional Elective - IV												
	Project Work	√	√	√	√	√	√		√	√	√	√	√

S.A.ENGINEERING COLLEGE
B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS – 2020A
CHOICE BASED CREDIT SYSTEM
I - VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS1101A	Technical English	HS	3	3	0	0	3
2.	MA1101A	Calculus and its Applications	BS	4	3	1	0	4
3.	PH1101A	Applied Physics	BS	3	3	0	0	3
4.	CY1101A	Engineering Chemistry	BS	3	3	0	0	3
5.	CS1101A	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	ME1101A	Engineering Graphics	ES	4	2	0	2	3
7.	CI1101A	Indian Constitution	MC	2	2	0	0	0
8.	TA1101A	Heritage of Tamils	MC	1	1	0	0	1
PRACTICALS								
9.	CS1102A	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
10.	BS1101A	Physics and Chemistry Laboratory	BS	4	0	0	4	2
			TOTAL	**30**	**20**	**1**	**10**	**24**

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS1201A	English for Communication	HS	3	3	0	0	3
2.	MA1201A	Complex Variables And Transforms	BS	4	3	1	0	4
3.	PH1201A	Materials Science	BS	3	3	0	0	3
4.	EE1203A	Basic Electrical and Instrumentation Engineering	ES	3	3	0	0	3
5.	EC1201A	Network Analysis And Synthesis	PC	3	3	0	0	3
6.	CS1201A	Programming in C	ES	3	3	0	0	3
7.	CY1201A	Environmental Science and Engineering	MC	2	2	0	0	0
8.	TA1201A	Tamils and Technology	MC	1	1	0	0	1
PRACTICALS								
9.	CS1203A	Programming in C Laboratory	ES	4	0	0	4	2
10.	CE1202A	Engineering Practices Laboratory	ES	4	0	0	4	2
			TOTAL	**29**	**20**	**01**	**8**	**24**

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA1301A	Linear Algebra & Partial Diff Equations	BS	4	3	1	0	4
2.	IT1301A	Object Oriented Programming	ES	3	3	0	0	3
3.	EC1301A	Electronic Devices and Circuits	PC	3	3	0	0	3
4.	EC1302A	Signals And Systems	PC	3	3	0	0	3
5.	EC1303A	Digital System Design	PC	3	3	0	0	3
6.	EC1304A	Control Systems	PC	3	3	0	0	3
PRACTICALS								
7.	EC1305A	Analog And Digital Circuits Laboratory	PC	4	0	0	4	2
8.	HS1301A	Interpersonal Skills / Listening & Speaking	EEC	2	0	0	2	1
9.	IT1302A	Object Oriented Programming Laboratory	ES	4	0	0	4	2
			TOTAL	**29**	**18**	**1**	**10**	**24**

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EC1401A	Electronic Circuits Design	PC	3	3	0	0	3
2.	EC1402A	Electromagnetic Fields	PC	4	3	1	0	4
3.	EC1403A	Linear Integrated Circuits	PC	3	3	0	0	3
4.	MA1401A	Probability and Random Processes	BS	4	3	1	0	4
5.	CS1405A	Data Structures and Algorithms	ES	3	3	0	0	3
6.	HV1401A	Universal Human Values	MC	3	3	0	0	3
PRACTICALS								
7.	EC1404A	Circuits Design and Simulation Laboratory	PC	4	0	0	4	2
8.	EC1405A	Linear Integrated Circuits Lab	PC	4	0	0	4	2
9.	EC1406A	Technical Seminar/Mini Project	EEC	2	0	0	2	2
			TOTAL	**30**	**18**	**2**	**10**	**26**

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EC1501A	Communication Systems	PC	3	3	0	0	3
2.	EC1502A	Discrete Time Signal Processing	PC	4	3	1	0	4
3.	EC1503A	Microprocessors And Microcontrollers	PC	3	3	0	0	3
4.	EC1504A	Wave Guides and Antenna Theory	PC	4	3	1	0	4
5.		Elective-I(PE)	PE	3	3	0	0	3
6.		Elective –II (Open Elective)	OE	3	3	0	0	3
PRACTICALS								
7.	EC1505A	Communication Systems Laboratory	PC	4	0	0	4	2
8.	EC1506A	Discrete Time Signal Processing Laboratory	PC	4	0	0	4	2
9.	EC1507A	Microprocessor And Microcontrollers Laboratory	PC	4	0	0	4	2
			TOTAL	**32**	**18**	**2**	**12**	**26**

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MG1601A	Principles of Management	BS	3	3	0	0	3
2.	EC1601A	VLSI Design	PC	3	3	0	0	3
3.	EC1602A	Communication Networks	PC	3	3	0	0	3
4.	EC1603A	Industrial Automation	PC	3	3	0	0	3
5.	EC1604A	Adhoc and Wireless Sensor Networks	PC	3	3	0	0	3
PRACTICALS								
7.	EC1605A	VLSI Design Laboratory	PC	4	0	0	4	2
8.	EC1606A	Communication Networks Laboratory	PC	4	0	0	4	2
			TOTAL	**23**	**15**	**0**	**8**	**19**

SEMESTER VII

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EC1701A	RF System Design	PC	3	3	0	0	3
2.	EC1702A	Fiber Optic Communication	PC	3	3	0	0	3
3.	EC1703A	Embedded and Real Time Systems	PC	3	3	0	0	3
4.	EC1704A	Internet of Things based system design	PC	3	3	0	0	3
5.		Elective -II(PE)	PE	3	3	0	0	3
6.		Elective –II(OE)	OE	3	3	0	0	3
PRACTICALS								
7.	EC1705A	Microwave and Optical Communication Laboratory	PC	4	0	0	4	2
8.	EC1706A	Embedded Lab for Product Development	PC	4	0	0	4	2
9.	EC1712A	Project Work phase I	EEC	6	0	0	6	3
			TOTAL	**32**	**18**	**0**	**14**	**25**

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Professional Elective III	PE	3	3	0	0	3
2.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
3.	EC1801A	Project Work	EEC	20	0	0	20	10
			TOTAL	**26**	**6**	**0**	**20**	**16**

TOTAL NO. OF CREDITS: 184

HUMANITIES AND SOCIALSCIENCES (HS)

Sl.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS1101A	Technical English	HS	3	3	0	0	3
2.	HS1201A	English for Communication	HS	3	3	0	0	3

BASIC SCIENCES (BS)

Sl.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA1101A	Calculus And Its Applications	BS	4	3	1	0	4
2.	PH1101A	Applied Physics	BS	3	3	0	0	3
3.	CY1101A	Engineering Chemistry	BS	3	3	0	0	3
	BS1101A	Physics And Chemistry Laboratory	BS	4	0	0	4	2
4.	MA1201A	Complex Variables And Transforms	BS	4	3	1	0	4
5.	PH1201A	Materials Science	BS	3	3	0	0	3
6.	MA1301A	Linear Algebra & Partial Diff. Equations	BS	4	3	1	0	4
7.	MA1401A	Probability and Random Processes	BS	4	3	1	0	4
8.	MG1601A	Principles of Management	BS	3	3	0	0	3

ENGINEERING SCIENCES (ES)

Sl. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS1101A	Problem Solving And Python Programming	ES	3	3	0	0	3
2.	ME1101A	Engineering Graphics	ES	4	2	0	2	3
3.	CS1102A	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	CS1201A	Programming in C	ES	3	3	0	0	3
5.	CS1202A	C Programming Laboratory	ES	4	0	0	4	2
6.	EE1203A	Basic Electrical and Instrumentation Engineering	ES	3	3	0	0	3
7.	CE1202A	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	IT1301A	Object Oriented Programming	ES	3	3	0	0	3
9.	IT1302A	Object Oriented Programming Laboratory	ES	4	0	0	4	2
10.	CS1405A	Data Structures and Algorithms	ES	3	3	0	0	3

PROFESSIONAL CORE (PC)

SI.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC1201A	Network Analysis And Synthesis	PC	3	3	0	0	3
2.	EC1301A	Electronic Devices and Circuits	PC	3	3	0	0	3
3.	EC1302A	Signals And Systems	PC	3	3	0	0	3
4.	EC1303A	Digital System Design	PC	3	3	0	0	3
5.	EC1304A	Control Systems	PC	3	3	0	0	3
6.	EC1305A	Analog And Digital Circuits Laboratory	PC	4	0	0	4	2
7.	EC1401A	Electronic Circuits Design	PC	3	3	0	0	3
8.	EC1402A	Electromagnetic Fields	PC	4	3	1	0	4
9.	EC1403A	Linear Integrated Circuits	PC	3	3	0	0	3
10.	EC1404A	Circuits Design and Simulation Laboratory	PC	4	0	0	4	2
11.	EC1405A	Linear Integrated Circuits Lab	PC	4	0	0	4	2
12.	EC1501A	Communication Systems	PC	3	3	0	0	3
13.	EC1502A	Discrete Time Signal Processing	PC	4	3	1	0	4
14.	EC1503A	Microprocessors And Microcontrollers	PC	3	3	0	0	3
15.	EC1504A	Wave Guides and Antenna Theory	PC	4	3	1	0	4
16.	EC1506A	Discrete Time Signal Processing Laboratory	PC	4	0	0	4	2
17.	EC1505A	Communication Systems Laboratory	PC	4	0	0	4	2
18.	EC1507A	Microprocessor And Microcontrollers Laboratory	PC	4	0	0	4	2
19.	EC1601A	VLSI Design	PC	3	3	0	0	3
20.	EC1602A	Communication Networks	PC	3	3	0	0	3
21.	EC1603A	Industrial Automation	PC	3	3	0	0	3
22.	EC1604A	Adhoc and Wireless Sensor Networks	PC	3	3	0	0	3
23.	EC1605A	VLSI Design Laboratory	PC	4	0	0	4	2
24.	EC1606A	Communication Networks Laboratory	PC	4	0	0	4	2

27.	EC1701A	RF System Design	PC	3	3	0	0	3
28.	EC1702A	Fiber Optic Communication	PC	3	3	0	0	3
29.	EC1703A	Embedded and Real Time Systems	PC	3	3	0	0	3
30.	EC1704A	Internet of Things based system design	PC	3	3	0	0	3
31.	EC1705A	Microwave and Optical Communication Laboratory	PC	4	0	0	4	2
32.	EC1706A	Embedded Lab for Product Development	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)*
SEMESTER V
ELECTIVE I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC1508A	Medical Electronics	PE	3	3	0	0	3
2.	EC1509A	Advanced Digital System Design	PE	3	3	0	0	3
3.	EC1510A	Computer Architecture and Organization	PE	3	3	0	0	3
4.	EC1511A	Multimedia Communication & Information Theory	PE	3	3	0	0	3
5.	EC1512A	Mixed Signal IC Design	PE	3	3	0	0	3
6.	EC1513A	Digital Image Processing	PE	3	3	0	0	3

SEMESTER VII
ELECTIVE II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC1707A	Wireless Networks	PE	3	3	0	0	3
2.	EC1708A	Radar Signal Processing	PE	3	3	0	0	3
3.	EC1709A	Advanced Computer Architecture	PE	3	3	0	0	3
4.	EC1710A	Satellite Communication	PE	3	3	0	0	3
5.	EC1711A	Cognitive Radio	PE	3	3	0	0	3

SEMESTER VIII
ELECTIVE III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC1801A	Microwave Integrated Circuits	PE	3	3	0	0	3
2.	EC1802A	Deep Learning	PE	3	3	0	0	3
3.	EC1803A	Nano Electronics	PE	3	3	0	0	3
4.	GE1801A	Professional Ethics in Engineering	PE	3	3	0	0	3
5.	EC1805A	Neural Networks and Fuzzy Logic	PE	3	3	0	0	3

SEMESTER VIII
ELECTIVE IV

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC1806A	5G Communication and its applications	PE	3	3	0	0	3
2.	EC1807A	MEMS and NEMS	PE	3	3	0	0	3
3.	EC1808A	Network Routing Algorithm	PE	3	3	0	0	3
4.	EC1809A	WDM and Photonics Networks	PE	3	3	0	0	3
5.	EC1810A	Intellectual Property Rights	PE	3	3	0	0	3

***Professional Electives are grouped according to elective number as was done previously.**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS1301A	Interpersonal Skills / Listening & Speaking	EEC	2	0	0	2	1
2.	EC1406A	Technical Seminar/Mini Project	EEC	2	0	0	2	2
3.	EC1707A	Project Phase I	EEC	6	0	0	6	3
4.	EC1801A	Project Work	EEC	20	0	0	20	10

MANDATORY COURSES (MC)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CI1101A	Indian Constitution	EEC	2	0	0	2	1
2.	CY1201A	Environmental science & Engineering	EEC	2	0	0	2	2
3.	HV1401A	Universal Human Values	EEC	6	0	0	6	3

SUMMARY

S.NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	3	3							6	3.26%
2.	BS	12	7	4	4		3			30	16.30%
3.	ES	8	10	5	3					26	14.13%
4.	PC		3	14	14	20	16	16		83	45.10%
5.	PE					3		3	6	12	6.52%
6.	OE					3		3		6	3.20%
7.	EEC			1	2			3	10	16	8.60%
8.	Non Credit / Mandatory-MC	1	1		3					5	2.70%
	Total	24	24	24	26	26	19	25	16	184	

HS1101A	TECHNICAL ENGLISH	L	T	P	C
Prerequisites: Basic Language Proficiency.		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Nurture their ability in technical writing like to prepare professional job applications and effective reports.
- Develop their speaking skills by participating in various speaking activities.
- Strengthen their listening skill to comprehend lectures and talks in their areas of specialization.
- Improve their ability to explicit their excellence in all modes of technical communication.

UNIT I **9**

Reading - Reading short texts **Listening** - Listening to different formal / informal conversations **Writing-** Instructions, Jumbled sentences **Speaking** - Self introduction **Language development** - Parts of speech, Prepositions **Vocabulary development -** Word formation - root words from foreign language and their use in English.

UNIT II **9**

Reading - Skimming and Scanning to find specific information **Listening** - Listening to INK talks **Writing** - Job Application – cover letter, resume writing **Speaking** - Asking and Giving directions **Language development** - Conjunctions, Types of Nouns **Vocabulary development -** Prefixes and Suffixes.

UNIT III **9**

Reading - Reading for predicting the content **Listening** - Listening to situational short talks **Writing** - Types of paragraphs- Descriptive/Analytical/compare and contrast **Speaking** - Mini presentations, Expressing greeting and thanks **Language development** - Adjectives, Numerical Adjectives, Conditional Clauses **Vocabulary development -** Homophones, Homonyms.

UNIT IV **9**

Reading - Practice in speed reading **Listening** - Listening to short texts and fill the data **Writing**- Interpretation of Graphics/Information, Note making **Speaking** - Contributing for Group Discussion **Language development** - Active, Passive, Impersonal passive voice **Vocabulary development -** Definitions, Nominal Compounds.

UNIT V **9**

Reading - Reading short stories **Listening** - Listening for note taking **Writing** - Report writing, E-mail Writing **Speaking** - Picture descriptions, Speaking in familiar situations **Language development** - Tenses **Vocabulary development -** British and American Vocabulary.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Read technical texts and write area- specific texts effortlessly.

CO2: Listen and comprehend lectures and talks in their area of specialization successfully.

CO3: Speak appropriately and effectively in varied formal and informal contexts.

CO4: Write correctly, clearly and concisely with coherence and cohesion.

CO5: Prepare job applications and resume in an inspiring manner.

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1							2	3	2	2
CO2	2	1							2	3	2	2
CO3	2	1							2	3	2	2
CO4	2	1							2	3	2	2
CO5	2	1							2	3	2	2

TEXTBOOKS:

1. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.
2. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.

Extensive Reading

- Khera, Shiv. You can Win, Macmillan, 2000.

REFERNCES:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
3. Darlene Smith-Worthington, Sue Jefferson, Technical writing for Success, South-Western Cengage Learning, USA-2011.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.
5. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice Oxford University Press: New Delhi, 2014.
6. Swan Michael, Practical English Usage. Oxford University Press, Eighth impression 2002.

Recommended Websites

bbc.co.uk/1learning english
oxfordonlineenglish.com/
cambridgeenglish.org
inktalks.com/talks/
manageyourwriting.com

MA1101A	CALCULUS AND ITS APPLICATIONS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To understand the concepts of limits, continuity, differentiation and use it to find maxima and minima of functions of one variable.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations of first and second order that model in various engineering problems.
- To familiarize the student with functions of several variables that is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS **12**

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules – Maxima and Minima of functions of one variable.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER WITH APPLICATIONS: **12**

Basic concepts - Separable differential equations - Exact differential equations - Integrating factors - Linear differential equations - Bernoulli's equation - Geometric Applications - Orthogonal trajectories - Physical Applications - Simple electronic circuits - Newton law of cooling - Heat flow - Rate of decay of radioactive materials - Chemical reaction and solutions.

UNIT III DIFFERENTIAL EQUATIONS **12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS **12**

Double integrals – Change of order of integration – Double integrals in polar co-ordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Use both the limit definition and rules of differentiation to differentiate functions.

CO2: Helps the students to develop the fundamentals and basic concepts in ODE.

CO3: Apply various techniques in solving differential equations.

CO4: Apply differentiation to solve maxima and minima problems.

CO5:.Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	0	0	0	0	0	0	3	3
CO2	3	3	3	3	0	0	0	0	0	0	3	3
CO3	3	3	3	3	0	0	0	0	0	0	3	3
CO4	3	3	3	3	0	0	0	0	0	0	3	3
CO5	3	3	3	3	0	0	0	0	0	0	3	3

TEXTBOOKS:

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

REFERNCES:

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited.
2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. O'Neil. P. V., "Advanced Engineering Mathematics", 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
4. T. Veerarajan, Engineering Mathematics, Mc Grawhill Publications, New Delhi 2017.

PH1101A	APPLIED PHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER **9**

Elasticity - plasticity – Different Types of Stress and Strain - concept of stress-strain diagram and its application - three types of modulus of elasticity - Poisson's Ratio – Bending of beams - Expression for bending moment - young's modulus uniform and Non uniform bending: Theory and Experiment – I Shape girders – Torsional oscillation Theory and Experiment **-** Application of Elastic Materials.

UNIT II APPLIED OPTICS **9**

Laser : characteristics of laser – Principle of spontaneous mission and stimulated emission – Laser action – Einstein A & B coefficients - Population inversion - Pumping – Basic requirement of laser – Types of laser : Nd-YAG and CO_2 – Applications : Welding , Drilling & Cutting – Medical field **Fiber optics**: Introduction- Principle and propagation of light – Numerical aperture and acceptance angle – classification of optical fibers – Losses in optical fibers (Qualitative) **–** Fiber optics communication system (Block Diagram) – Advantages with fiber optic communication system.

UNIT III THERMAL PHYSICS **9**

Modes of heat transfer - thermal conduction, convection and radiation – Specific heat capacity- thermal conductivity – Newton's law of cooling - Searle's and Lee's disc methods: theory and experiment - conduction through compound media (series and parallel) – thermal expansion of solids, liquids and gases - Applications: heat exchangers, refrigerators and solar water heaters.

UNIT IV WAVE AND PARTICLE PHYSICS **9**

Inadequacy of Classical Mechanics - Development of quantum theory- Planck's Black body radiation and Distribution Laws(Qualitative) – Compton Effect (Derivation) - De Broglie wavelength – properties of matter waves – Experimental Verification (G.P Thomson experiment) – Heisenberg's uncertainty principle - Schrodinger's wave equation – time dependent – time independent wave equations – physical significance of Wave function – applications: particle in a one dimensional potential box.

UNIT V CRYSTALOGRAPHY **9**

Single crystalline, polycrystalline and amorphous materials Lattice - unit cell- Crystal systems-Bravais lattices- Lattice planes - Miller indices- Interplanar- d- Spacing in cubic Lattice - calculation of number of atoms per unit cell – atomic radius – packing factor for SC, BCC, FCC and HCP structures - Crystal Defects – types.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Gain knowledge on the basics of properties of matter and its applications.

CO2: Use the concepts of waves and optical devices and their applications in Laser and fiber optics.

CO3: Understand the properties of thermal materials and its applications.

CO4: Get knowledge on advanced physics concepts of quantum theory and its application in one dimensional box.

CO5: Understand the different types of crystals structures and different crystal growth

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	0	0	0	0	0	0	3	3
CO2	3	3	3	3	0	0	0	0	0	0	3	3
CO3	3	3	3	3	0	0	0	0	0	0	3	3
CO4	3	3	3	3	0	0	0	0	0	0	3	3
CO5	3	3	3	3	0	0	0	0	0	0	3	3

TEXTBOOKS:

1. GuptaS.L. and Sanjeev Gupta, Modern Engineering Physics, Dhanpat Rai Publishers, 2015.
2. R.K.Gaurand S. C. Gupta, Engineering Physics, Dhanpat Rai Publication(P)Ltd, New Delhi, 2014.
3. Bhattacharya, D.K. and Poonam, T. Engineering Physics, Oxford University Press, 2015.

REFERNCES:

1. C. Kittel, Introduction to Solid State Physics 8th Edition, Wiley Eastern Ltd, 2004.
2. Halliday,D., Resnick, R. and Walker, J. Principles of Physics. Wiley, 2015.
3. Tipler, P.A. and Mosca, G. Physics for Scientists and Engineers with Modern Physics, W.H.Freeman, 2007.
4. Einstein coefficient calculation, https://youtu.be/TvfiZHXUtXg (Video lecture).
5. Lattice structures, https://youtu.be/Rm-i1c7zr6Q (Video lecture).

CY1101A	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- It enables the students to gain information about Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- It deals with the information about the types of fuels, calorific value calculations and manufacture of solid, liquid and gaseous fuels.
- To impart knowledge about the nanomaterials synthesis, properties and applications.

UNIT I WATER TREATMENT AND TECHNOLOGY **9**

Introduction – characteristics, Water quality parameters – hardness – types, Determination - EDTA method, Alkalinity, boiler feed water requirements - boiler troubles – scale & sludge - Caustic Embrittlement, boiler explosion - softening of hard water - external treatment process - demineralization and zeolite, internal treatment - boiler compounds (phosphate, calgon, carbonate and colloidal conditioning methods) – desalination of brackish water – reverse osmosis.

UNIT II PHASE RULE AND ALLOYS **9**

Phase rule: Introduction, definition of terms with examples, One Component System - water system, Sulphur, CO_2 system, Thermal Analysis and cooling curves, Reduced phase rule - Two Component Systems - classification – lead-silver system - problems. Alloys: Introduction – Definition - Properties of alloys - Significance of alloying, Functions and effect of alloying elements - Ferrous alloys - Nichrome and Stainless steel – heat treatment of steel.

UNIT III ENERGY SOURCES AND STORAGE DEVICES **9**

Energy – Types – Non-renewable energy - Nuclear energy - renewable energy - solar energy conversion - solar cells. Introduction to Electrochemistry, Nernst Equation - Electrochemical cells – reversible and irreversible cells - Cell construction and representation - Batteries -types of batteries – characteristics – construction and working of primary battery (dry cell) - secondary battery (lithium-ion-battery) - fuel cells (H_2-O_2).

UNIT IV FUELS AND COMBUSTION **9**

Fuel: Introduction - classification of fuels- calorific value - higher and lower calorific values – coal - analysis of coal (proximate and ultimate) – carbonization - manufacture of metallurgical coke (Otto Hoffmann method) – petroleum - manufacture of synthetic petrol (Bergius process) - knocking- octane number – diesel oil - cetane number – natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - producer gas - water gas. Power alcohol and bio diesel. Combustion of fuels: introduction - theoretical calculation of calorific value - ignition temperature - explosive range – flue gas analysis (ORSAT Method).

UNIT V NANOCHEMISTRY **9**

Basics - distinction between nanoparticles and bulk materials; size-dependent properties, nano cluster, nano rod, nanotube (CNT) - Types of CNT and nanowire. Synthesis: precipitation, thermolysis, chemical vapour deposition, Properties, Characterisation and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Gain the knowledge on water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

CO2: Understand the various phase diagrams and able to predict the low melting alloys.

CO3: Get knowledge about various fuels and its applications based on its calorific value.

CO4: Understand about conventional and non-conventional energy sources and its applications.

CO5: Gain an insight about the recent trends in nano materials.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	0	1	1	0	0	0	3	3
CO2	3	3	3	3	1	0	1	0	0	0	3	3
CO3	3	3	3	3	1	2	0	0	0	0	3	3
CO4	3	3	3	3	0	0	1	1	0	0	3	3
CO5	3	3	3	3	1	0	0	1	0	0	3	3

TEXTBOOKS:

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010.

REFERNCES:

1. Dara S.S, Umare S.S, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Ozin G. A. and Arsenault A. C., “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005.

CS1101A PROBLEM SOLVING AND PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS **9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES & TURTLE **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file - **Case study: Simple Graphics using Turtle**: Draw a Random Pattern of Circle, Square and Rectangle; Draw a Pattern of Straight Lines, **Plotting Graphs in Python**: Menu Driven Program to Create Mathematical 3D Objects.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Read, write, execute by hand simple Python programs.

CO3: Decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, dictionaries.

CO5: Read and write data from/to files in Python Programs.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	0	0	0	0	3	3
CO2	3	3	3	3	3	2	0	0	0	0	3	3
CO3	3	3	3	3	3	2	0	0	0	0	3	3
CO4	3	3	3	3	3	2	0	0	0	0	3	3
CO5	3	3	3	3	3	2	0	0	0	0	3	3

TEXTBOOKS:

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. Reema Thareja, 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.

REFERNCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press, 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 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.

ME1101A	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

UNIT I PLANE CURVES ANDORTHOGRAPHICPROJECTIONS **12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization principles – Layout of views - Orthographic projection of multiple views (Free Hand Sketching) from pictorial views of objects - Principal planes - Projection of points - Demo using CAD software for above topics.

UNIT II PROJECTION OF POINTS STRAIGHT LINES ANDPLANE SURFACES **12**

Orthographic projections – principles - Principal planes - First angle projection - Projection of points - Projection of straight lines (only First angle projections) inclined to one of the principal planes - Determination of true lengths and true inclinations - Projection of planes (polygonal and circular surfaces) inclined to one of the principal planes - Demo using CAD software for above topics.

UNIT III PROJECTIONOFSOLIDS **12**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method - Demo using CAD software for above topics.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENTOF SURFACES **12**

Sectioning of above solids in simple vertical position - the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones - Demo using CAD software for above topics.

UNIT V ISOMETRIC ANDPERSPECTIVEPROJECTIONS **12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions – Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method - Demo using CAD software for above topics.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Familiarize with the fundamentals and standards of Engineering graphics

CO2: Perform freehand sketching of basic geometrical constructions and multiple views of objects.

CO3: Project orthographic projections of lines and plane surfaces.

CO4: Draw projections of solids and development of surfaces.

CO5: Visualize and to project isometric and perspective sections of simple solids.

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	0	0	0	0	0	0	1	1
CO2	3	2	2	1	0	0	0	0	0	0	1	1
CO3	3	2	2	1	0	0	0	0	0	0	1	1
CO4	3	2	2	1	0	0	0	0	0	0	1	1
CO5	3	2	2	1	0	0	0	0	0	0	1	1

TEXTBOOKS:

1. NatrajanK. V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

REFERNCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi,2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi,2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

CI1101A	INDIAN CONSTITUTION	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court, controller and auditor general of India and election commission of India.
- To understand the central and state relation, financial and administrative.

1.. Meaning of the constitution law and constitutionalism

2. Historical perspective of the Constitution of India

3. Salient features and characteristics of the Constitution of India

4. Scheme of the fundamental rights

5. The scheme of the Fundamental Duties and its legal status

6. The Directive Principles of State Policy – Its importance and implementation

7. Federal structure and distribution of legislative and financial powers between the Union and the States

8. Parliamentary Form of Government in India – The constitution powers and status of the President of India

9. Amendment of the Constitutional Powers and Procedure

10. The historical perspectives of the constitutional amendments in India

11. Emergency Provisions: National Emergency, President Rule, Financial Emergency

12. Local Self Government – Constitutional Scheme in India

13. Scheme of the Fundamental Right to Equality

14. Scheme of the Fundamental Right to certain Freedom under Article 19

15. Scope of the Right to Life and Personal Liberty under Article 21

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the emergence and evolution of Indian Constitution.

CO2: Understand the structure and composition of Indian Constitution.

CO3: Understand and analyse federalism in the Indian context.

CO4: Analyse Panchayat Raj institutions as a medium of decentralization

.

CO5: Understand and analyse the three organs of the state in the contemporary scenario

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	0	0	0	0	3	3	0	3	3	1	3
CO2	0	0	0	0	0	3	3	0	3	3	1	3
CO3	0	0	0	0	0	3	3	0	3	3	1	3
CO4	0	0	0	0	0	3	3	0	3	3	1	3
CO5	0	0	0	0	0	3	3	0	3	3	1	3

TA1101A	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

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

TEXTBOOKS:

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. 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)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

REFERNCES:

1. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

CS1102A	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To study python programs with conditionals and loops
- To use functions for python structured programs.
- Use strings for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- To read and write data from and to files in python.

LIST OF EXPERIMENTS:

1. Write a program to display the largest number among three numbers.
2. Write a program to display the Fibonacci series by using looping constructs.
3. Write a function to compute the GCD of two numbers.
4. Explore String Functions
5. With the help of strings, array or list, display a simple calendar in python program without using the calendar module.
6. With the help of list perform Linear search and Binary search.
7. Write a program to perform Selection sort, Insertion sort, Merge sort
8. Create a text file using python file I/O. Read the content of the file and change them from lower to upper case characters.
9. Programs that take command line arguments (wordcount)
10. Find the most frequent words in a text read from a file
11. Simulate bouncing ball using Py game.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Design simple programs using conditionals and loops.

CO2: Write functions to solve mathematical problems

CO3: Use strings for structuring Python programs.

CO4: Represent compound data using Python lists, tuples, dictionaries.

CO5: Identify to read and write data from and to files in python.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	0	0	0	0	3	3
CO2	3	3	3	3	3	2	0	0	0	0	3	3
CO3	3	3	3	3	3	2	0	0	0	0	3	3
CO4	3	3	3	3	3	2	0	0	0	0	3	3
CO5	3	3	3	3	3	2	0	0	0	0	3	3

BS1101A	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.

LIST OF EXPERIMENTS:

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method.

TOTAL: 30 PERIODS

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of TDS of water sample.
5. Determination of strength of acids in a mixture of acids using conductivity meter.
6. Estimation of iron content of the given solution using potentiometer.
7. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Apply principles of optics, sound and thermal properties for engineering.

CO2: Apply principles of elasticity for engineering applications.

CO3: Analyse the viscosity of a liquid.

CO4: Apply hands-on knowledge in the quantitative chemical analysis of water.

CO5: Carryout the basics if instrumental analysis-conductivity meter, potentiometer, pH meter.

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	0	0	0	0	0	0	3	3
CO2	3	3	3	3	0	0	0	0	0	0	3	3
CO3	3	3	3	3	0	0	0	0	0	0	3	3
CO4	3	3	3	3	0	0	0	0	0	0	3	3
CO5	3	3	3	3	0	0	0	0	0	0	3	3

HS1201A	ENGLISH FOR COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

The Course enables the second semester Engineering and Technology students to:

- Improve their language ability to improve the four basic skills of communication (LSRW).
- Enhance the skills and methods to enrich their reading and comprehending ability.
- Strengthen their skills to listen to the lectures and talks related to their fields of studies.
- Foster their ability to write effectively in all contexts.
- Cultivate their oral presentation skills through technical presentations and contribution in group discussions.

UNIT I **9**

Reading- Reading for detailed comparison **Listening**- Listening to interviews **Writing**- Developing hints, summarizing **Speaking**- Talk about future plans, arrangements intensions **Language development**- Sentence structures **Vocabulary development**- Synonyms, Antonyms, Adverbs.

UNIT II **9**

Reading - Extended reading **Listening**- Listening to telephonic conversations **Writing**- Formal Letter Writing - Letters for bona fide certificate - to the principal for permission for in plant training, industrial visit, paper presentations, inter college events, Letter to the Editor, Recommendations **Speaking**- Formal conversation **Language development**-Use of Punctuation, Modal verbs **Vocabulary development**- One word substitutes, Common Phrasal verbs.

UNIT III **9**

Reading - Identify topic sentences by reading a short story **Listening** - Listening to TED talks **Writing** - Process/product description **Speaking** - Formal Conversations **Language development** - Relative Clauses, Concord, Error correction **Vocabulary development**- Idioms & Phrases, Minimal pairs.

UNIT IV **9**

Reading - Reading newspaper articles **Listening** - Listening to inspirational speeches **Writing** - Essays, Checklist **Speaking** - Technical Presentations **Language development** - Degrees of Comparison **Vocabulary development** - Articles, Cause and Effect Expressions.

UNIT V **9**

Reading - Close reading **Listening**- Listening for summarizing **Writing** - Dialogue conversations **Speaking** - Movie/ Book Review **Language development** - Wh Questions, Yes/ no Questions **Vocabulary development** - Foreign Expressions and its applications, Reference words.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Read for comprehending and responding in general and professional settings.

CO2: Demonstrate the communication skills (LSRW) in academic, professional and social Environment.

CO3: Participate effectively in formal and informal conversations and express findings and opinions with proper language ability.

CO4: Comprehend conversations and short talks delivered in English.

CO5: Use the language effectively to write with clarity and accuracy in general and technical contexts.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1							2	3	2	2
CO2	2	1							2	3	2	2
CO3	2	1							2	3	2	2
CO4	2	1							2	3	2	2
CO5	2	1							2	3	2	2

TEXTBOOK:

1. Kalam, Abdul Dr. A.P.J. - The Wings of Fire, Universities press: 1999.

REFERENCES:

1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007.
3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad, 2015.
4. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013.
5. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning, USA: 2007.

Recommended websites:

- TED.com
- learningenglish.voanews.com
- islcollective.com
- examenglish.com
- englishclass101.com

MA1201A COMPLEX VARIABLES AND TRANSFORMS L T P C

3 1 0 4

COURSE OBJECTIVES:

- Understand the concept of Divergence and curl and use it in evaluating Line, Surface and Volume integrals.
- Understand C-R equations and use it in the construction of Analytic Functions.
- Understand the methods of Complex Integration using Cauchy's Integral Formula and Cauchy Residue theorem, finding Taylor's and Laurent's Series expansions.
- Find the Laplace Transforms of standard Functions and to find the Inverse Laplace Transform of a function and use it in solving Differential Equations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral – Area of a curved surface – Volume integral – Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals-simple applications involving cubes and rectangular parallelepipeds.

UNIT II ANALYTIC FUNCTIONS **12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions ($w = 1/z, w = z^2, w = e^z, w = \sinh z, w = \cosh z$) – Bilinear transformation.

UNIT III COMPLEX INTEGRATION **12**

Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT IV LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem –Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS **12**

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Solve problems using divergence and curl and evaluate line, Surface and Volume integrals.

CO2: Solve problems in Analytic functions and construction of analytic functions using C-R Equations.

CO3: Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.

CO4: Obtain the Laplace Transforms of standard functions.

CO5: Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	0	0	0	0	0	0	3	3
CO2	3	3	3	3	0	0	0	0	0	0	3	3
CO3	3	3	3	3	0	0	0	0	0	0	3	3
CO4	3	3	3	3	0	0	0	0	0	0	3	3
CO5	3	3	3	3	0	0	0	0	0	0	3	3

TEXTBOOKS:

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

REFERENCES:

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and Di Prima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. O'Neil. P. V. "Advanced Engineering Mathematics", 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
4. T. Veerarajan, Engineering Mathematics, Tata Mcgraw Hill publications co. ltd, New Delhi, 2017.

PH1201A	MATERIAL SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS **9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity –Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states –carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS **9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – Elemental and Compound Semiconductors – **N-type and P-type semiconductor (Qualitative)** – Hall effect – Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS **9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications. **Electro static Discharge (ESD)-**Superconductivity: properties – Type I and Type II superconductors–BCS theory of superconductivity (Qualitative) - High Tc superconductors – Electrical, medical, magnetic and computer application of superconductors.

UNIT IV DIELECTRIC MATERIALS **9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientation and space charge polarization – frequency and temperature dependence of polarisation – **Clausius mosotti relation -**dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer).

UNIT V ADVANCED ENGINEERING MATERIALS **9**

Metallic glasses - melt spinning process, applications - shape memory alloys: Ni-Ti alloy, applications – nanomaterials: preparation (bottom up and top down approaches), properties and applications - Bio materials – introduction - properties of bio materials-examples- medical applications- Ophthalmology- bio sensors- characteristics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: The students will gain knowledge of conducting materials and variation of its properties with temperature.

CO2: Acquire knowledge on basics of semiconductor physics and its applications in various devices.

CO3: Get knowledge on magnetic and superconducting materials properties and their various applications.

CO4: The students will understand the basics of dielectric materials, properties and applications of dielectric materials.

CO5: The students will get knowledge about new engineering materials and its applications in social applications.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	0	0	0	0	0	0	3	3
CO2	3	3	3	3	0	0	0	0	0	0	3	3
CO3	3	3	3	3	0	0	0	0	0	0	3	3
CO4	3	3	3	3	0	0	0	0	0	0	3	3
CO5	3	3	3	3	0	0	0	0	0	0	3	3

TEXTBOOKS:

1. S.Mohan, Principles of Materials Science, MJP Publishers, 2018.
2. Jasprit Singh, Semiconductor Devices, Basic Principles, Wiley 2012.
3. Umesh K Mishra and Jasprit Singh, Semiconductor Device Physics and Design, Springer, 2008.

REFERENCES:

1. Wahab, M.A. Solid State Physics: Structure and Properties of Materials‖, Narosa Publishing House, 2009.
2. William D.Callister Jr, David G. Rethwisch, Materials Science and Engineering, An Introduction, Wiley India (P) Ltd., 8th Edition, 2009.
3. Pillai S.O., Solid State Physics, New Age International (P) Ltd., Publishers, 2009.
4. Semiconductor Introduction, https://youtu.be/k6ZxP9Yr02E (Video lecture).
5. Superconductivity,https://youtu.be/D-9M3GWOBrw (Video lecture).

	L	T	P	C
EE1203A BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

To impart knowledge on

- Operation and working of transformer and their types.
- Construction, working principle and applications of AC and DC machines.
- Construction, working principle and applications of special electrical machines.
- Three phase electrical circuits and power measurement.
- Working principle of Various measuring instruments.

UNIT I TRANSFORMER **9**

Introduction - Ideal Transformer – Construction and working principle of single phase and three phase transformer, Auto Transformers, Instrument transformers, high frequency transformer, Voltage Regulation – Efficiency – All day efficiency – Applications.

UNIT II AC AND DCMACHINES **9**

Construction and working of three-phase induction motors, Single phase Induction motors, Alternator, Synchronous motors - Construction of DC machines - Motoring and generation principle - Emf And Torque equation – Applications of AC and DC machines.

UNIT III SPECIAL ELECTRICAL MACHINES **9**

Construction and working principle of Universal Motor - Stepper Motors – Brushless DC Motors- Permanent magnet DC motor -Permanent magnet synchronous motor - Linear Induction Motor – Applications of special electrical machines.

UNIT IV THREE PHASE CIRCUITS **9**

Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads-Power equation – Star Delta Conversion – power factor -Three Phase Power Measurement - Two wattmeter method.

UNIT V MEASUREMENT AND INSTRUMENTATION **9**

Principles of Electrical Instruments (PMMC and MI) – Multimeters, Oscilloscopes-Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect - Digital instruments (DSO and Power recorders).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the working principle of transformers and their applications.

CO2: Understand the working principle of AC and DC machines.

CO3: Understand the working principle of Special electrical machines.

CO4: Understand the concept of three phase power circuits and measurement.

CO5: Understand the use of measuring instruments for different applications.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	0	0	0	0	3	3
CO2	3	3	3	3	3	3	0	0	0	0	3	3
CO3	3	3	3	3	3	3	0	0	0	0	3	3
CO4	3	3	3	3	3	3	0	0	0	0	3	3
CO5	3	3	3	3	3	3	0	0	0	0	3	3

TEXTBOOKS:

1. D P Kothari and I.J Nagarath, ―Basic Electrical and Electronics Engineering, McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
2. Giorgio Rizzoni, ― Principles and Applications of Electrical Engineering, McGraw Hill Education (India) Private Limited, 2010.
3. S.K. Bhattacharya ― Basic Electrical and Electronics Engineering, Pearson India, 2011.

REFERENCES:

1. Del Toro, Electrical Engineering Fundamentals, Pearson Education, New Delhi, 2015.
2. Leonard S Bobrow, - Foundations of Electrical Engineering, Oxford University Press, 2013.
3. Rajendra Prasad, Fundamentals of Electrical engineering, Prentice Hall of India, 2006.

EC1201A	NETWORK ANALYSIS AND SYNTHESIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic concepts of DC and AC circuits behavior.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.
- To study the elements of network synthesis.

9

UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY

Ohm's Law – Kirchhoff's laws – Mesh current and node voltage method of analysis for D.Cand A.C. circuits - Network terminology - Graph of a network - Incidence and reduced incidence matrices; Trees – Cutsets - Fundamental cutsets - Cutset matrix – Tie sets - Link currents and Tie set schedules-Twig voltages and Cutset schedules, Duality and dual networks.

9

UNIT II NETWORK THEOREMS FOR DC ANDACCIRCUITS

Network theorems - Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem, application of Network theorems- Network reduction: voltage and current division, source transformation – star delta conversion.

9

UNIT III RESONANCE ANDCOUPLEDCIRCUITS

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency -Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor - Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multiwinding coupled circuits - Series, Parallel connection of coupled inductors.

9

UNIT IV TWOPORT NETWORKS

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid(H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.

9

UNIT V ELEMENTS OFNETWORKSYNTHESIS

Reliablility of one port network-Hurwitz polynomials - PR functions-Necessary and sufficient conditions of PR functions-Properties of driving point impedence - Synthesis of LC, RL and RC driving point impedence.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop the capacity to analyze electrical circuits,

CO2: Apply the circuit theorems in real time,

CO3: Analyse the frequency response of resonant circuits,

CO4: Analyse the frequency response of two port networks,

CO5: Analyse the elements of network synthesis.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	1	1	1	0	1	0	2
CO2	3	3	3	2	1	1	1	1	0	1	0	2
CO3	3	3	3	2	1	1	1	1	0	1	0	2
CO4	3	3	3	2	1	1	1	1	0	1	0	2
CO5	3	3	3	2	1	1	1	1	0	1	0	2

TEXTBOOKS:

1.William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, ―Engineering Circuit Analysis‖,McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016.

2.Joseph Edminister and Mahmood Nahvi, ―Electric Circuits‖, Schaum,,s Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES:

1. A.Bruce Carlson, ―Cicuits: Engineering Concepts and Analysis of Linear Electric Circuits‖,Cengage Learning, India Edition 2nd Indian Reprint 2009.
2. Allan H.Robbins, Wilhelm C.Miller, ―Circuit Analysis Theory and Practice‖,Cengage Learning, Fifth Edition, 1st Indian Reprint 2013
3. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.

CS1201A	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop applications in C using functions and functions.
- To develop applications in C using structures.
- To do input/output and file handling in C.

UNIT I BASICS OF C PROGRAMMING **9**

Introduction to programming paradigms - Structure of C program - C programming: Identifiers- Keywords-Data Types - Variables - Constants. Operators: Precedence and Associativity - Expressions – Input/ Output statements – Decision making statements – Switch statement – Looping statements – Pre-processor directives – Compilation process.

UNIT II ARRAYS AND STRINGS **8**

Introduction to Arrays: Declaration, Initialization - One dimensional array - Example Program: Computing Mean, Median and Mode - Two dimensional arrays - Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String- String operations – String Arrays.

UNIT III FUNCTIONS AND POINTERS **10**

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) - Recursion-Types of Recursion - Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions-Storage Classes - Pointers - Pointer operators - Null Pointers- Pointer arithmetic - Arrays and pointers - Array of pointers - Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference- Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT IV STRUCTURES **9**

Structures - Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure – Passing structures to functions – Array of structures – Pointers to structures – Union - Programs using structures and Unions, Enumerated data type - Dynamic Memory Allocation.

UNIT V FILE PROCESSING **9**

Files - Types of file processing: Sequential access, Random access - Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Payroll System and Transaction processing using random access files - Command line arguments.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop simple applications in C using basic constructs.

CO2: Design and implement applications using arrays and strings.

CO3: Develop and implement applications in C using functions and pointers.

CO4: Develop applications in C using structures.

CO5: Design applications using sequential and random access file Processing.

CO-PO Mapping

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

TEXTBOOKS:

1. Reema Thareja, "Programming in C", Oxford University Press Second Edition 2016.
2. Kernighan B. Wand Ritchie, D.M "The C Programming language", Second Edition, Pearson Education 2006.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition Pearson Publication.
2. Juneja ,B. L and Anita Seth," Programming in C",CENGAGE Learning India pvt. Ltd., 2011.
3. Pradip Dey Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press,2009.
4. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd.,Pearson Education in South Asia,2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education,1996.

CY1201A ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
2	0	0	0

COURSE OBJECTIVES:

- To understand nature and the facts about the environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY **14**

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of major ecosystem – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION **8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT III NATURAL RESOURCES **10**

Forest resources: Use and over-exploitation, deforestation, case studies- dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water – Mineral resources: environmental effects of extracting and using mineral resources, case studies – Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – 12 Principles of Green chemistry, role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies – environment protection act – Air

(Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act –- central and state pollution control boards.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the functions of ecosystems and appreciate the bio diversity.

CO2: Know the measures to control environmental pollution.

CO3: Understand the usage as well as the effects of over exploitation of natural resources.

CO4: Have knowledge about finding technological, economic and political solutions to environmental problems with various Environmental Protection Act in mind.

CO5: Understand the interrelationship between population explosion and the environment and also role of IT in environment and human health.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2							1	1
CO2	3	3	2	2							1	1
CO3	3	3	2	2							1	1
CO4	3	3	2	2							1	1
CO5	3	3	2	2							1	1

TEXTBOOK:

1. Environmental Science and Engineering by Anubha Kaushik and C.P.Kaushik-New Age International Publishers. New Delhi, 2017.

REFERENCES:

1. Benny Joseph, Environmental Studies, Tata mcgraw - Hill Publishing Company, Ltd., New Delhi, 2006.
2. Dr.B.S.Chauhan, Environmental Studies, University Science Press, New Delhi, 2011.

TA1201A	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

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

TEXTBOOKS:

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. 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)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

REFERENCES:

1. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

CS1203A	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To develop programs in C using basic constructs.
- To develop programs in C using control statements.
- To develop programs in C using arrays, strings, pointers.
- To develop programs in C using functions, structures.
- To develop programs in C using file processing.

1. Input and Output statements

2. Control statements – Branching & Looping

   a) Write a C program to generate Pascal's triangle.

   b) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*,/,% and use Switch Statement)

   c) Write a C program to find the sum of individual digits of a positive integer.

   d) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

   e) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

   f) Write a C program to swap Numbers Using Temporary Variables

3. Arrays

   a) Write a C program to search an array element using linear search.

   b) Write a C program to find both the larges and smallest number in a list of integers.

   c) Write a C program that uses functions to perform the following:
      i) Addition of Two Matrices
      ii)Multiplication of Two Matrices

   d) Write a C program to implement Bubblesort.

4. Strings

   a) Write a C program that uses functions to perform the following operations:
      i)To insert a sub-string in to given main string from a given position.
      ii)To delete n Characters from a given position in a given string.

   b) Write a C program to determine if the given string is a palindrome or not

5. Functions &Pointers:

Write C programs that use recursive functions

i) To find factorial of given number

ii) To solve Towers of Hanoi Problem.

iii) To swap the variables using call by value and call by reference.

6. a. Generate mark sheet of students using structures.

   b. Compute salary slip for five employees using structures and functions.

7. Insert, Update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop C programs for simple applications making use of basic constructs

CO2: Develop C programs for control statements.

CO3: Develop C programs involving arrays, strings and pointers.

CO4: Develop C programs involving functions, and structures.

CO5: Design applications using sequential and random access file processing.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1							2
CO2	3	2	2	1	1							2
CO3	3	2	2	1	1							2
CO4	3	2	2	1	1							2
CO5	3	2	2	1	1							2

CE1202A ENGINEERING PRACTICE LABORATORY L T P C

0 0 4 2

I ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

II ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Carry out basic home electrical works and appliances

CO2: Measure the electrical quantities

CO3: Elaborate on the components, gates, soldering practices.

CO4: Generate Clock signals

CO5: Measure ripple factor of rectifiers

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1									2
CO2	2	2	1									2
CO3	2	2	1									2
CO4	2	2	1									2
CO5	2	2	1									2

MA1301A LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic notions of groups, rings fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations.
- To give an integrated approach to number theory and abstract algebra and provide a firm basis for further reading and study in the subject

UNIT -I SYSTEM OF LINEAR EQUATION AND VECTOR SPACES **12**

Basic Definition-Equivalent system-Elementary operation systems in Triangular and Echelon form-Gauss elimination- Solution of linear equation and Linear combination of vectors-Vector spaces –Examples of vector space Subspaces–Linear independence and linear dependence–Basis and dimensions.

UNIT-II LINEAR TRANSFORMATION AND DIAGONALIZATION **12**

Linear transformation-Null spaces and ranges-Dimension theorem–Isomorphism-Matrix representation of a linear transformations–change of basis-Eigen values and eigenvectors-Diagonalizability.

UNIT-III INNER PRODUCT SPACES **12**

Inner product space-Examples of inner product space-Cauchy Schwartz inequality-Gram Schmidt orthogonalization process - Adjoint of linear operations –Self adjoint operator-Orthogonal and Unitaray operator-Least square approximation.

UNIT-IV PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagranges linear equation – Solution of linear equations of higher order with constant coefficients –Linear non-homogeneous partial differential equations.

UNIT-V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Dirichlet's conditions–General Fourier series–Half ranges in and cosine series-Method of separation of variables–Solutions of one dimensional wave equation and one-dimensional heat equation– Steady state solution of two-dimensional heat equation.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the fundamental concepts of advanced algebra and the irrolein modern mathematics and applied contexts

CO2: Demonstrate accurate and efficient use of advanced algebraic techniques

CO3: Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.

CO4: Able to solve various types of partial differential equations.

CO5: Able to solve engineering problems using Fourier series.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1						1	1
CO2	3	2	2	2	1						1	1
CO3	3	2	2	2	1						1	1
CO4	3	2	2	2	1						1	1
CO5	3	2	2	2	1						1	1

TEXTBOOKS:

1. Grewal B.S.,―Higher Engineering Mathematics, Khanna Publishers, New Delhi 43rdEdition, 2014.

2. Friedberg,A.H.,Insel,A.J.and Spence,L.,―Linear Algebra‖, Prentice Hall of India, New Delhi, 2004

REFERENCES:

1. Burden, R.L. and Faires ,J.D, "Numerical Analysis",9th Edition, Cengage Learning,2016.

2. James,G.―Advanced Modern Engineering Mathematics, Pearson Education,2007.

3. Kolman, B. Hill, D.R., ―Introductory Linear Algebra, Pearson Education, New Delhi, First Reprint,2009.

4. Kumaresan,S., ―Linear Algebra– A Geometric Approach, Prentice– Hall of India, New Delhi, Reprint,2010.

5. Lay,D.C.,―Linear Algebra and its Applications‖, 5thEdition,Pearson Education,2015.

6. O,,Neil,P.V.,―Advanced Engineering Mathematics‖, Cengage Learning,2007.

IT1301A OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS **10**

Object Oriented Programming-Abstraction–objects and classes-Encapsulation-Inheritance-Polymorphism-OOP in Java–Characteristics of Java–Fundamental Programming Structures in Java–Defining classes in Java–constructors, methods-access specifiers- static members Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages.

UNIT II INHERITANCE AND INTERFACES **9**

Inheritance –Super classes-sub classes –Protected members –constructors in sub classes-the Object class–abstract classes and methods -final methods and classes–Interfaces –defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning-inner classes, Array Lists-Strings

UNIT III EXCEPTION HANDLING AND I/O **9**

Exceptions - exception hierarchy - throwing and catching exceptions –built-in exceptions, creating own exceptions, Stack Trace Elements. Input/Output Basics–Streams–Byte streams and Character streams–Reading and Writing Console–Reading and Writing Files

UNITIV MULTI THREADING AND GENERIC PROGRAMMING **8**

Understanding Threads, Thread Priorities, Synchronizing Threads, Thread life cycle, Inter- thread communication. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations-Introduction to JDBC, JDBC Drivers and Architecture, Accessing Database with JDBC.

UNIT V EVENT DRIVEN PROGRAMMING **9**

Event-Driven Programming in Java, Event- Handling Process, Event Handling Mechanism, The Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners, Adapter Classes as Helper Classes in Event Handling. Introduction to Swing–Java Foundation Class-Swing GUI Components–Swing packages and Classes-Swing Control classes and Methods.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1. Develop Java programs using OOP principles

CO2.Develop Java programs with the concepts of in heritance and interfaces

CO3. Build Java applications using exceptions and I/O streams

CO4. Design problems solutions using Generic Collections and Exception Handling

CO5. Create a Database connectivity and manipulate database using JDBC

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

TEXTBOOKS:

1. Herbert Schildt, ―Java The complete reference, 8th Edition, McGraw Hill Education,2011.
2. CayS. Horstmann, Gary Cornell, ―Core Java Volume–I Fundamentals ,9th Edition, Prentice Hall, 2013.

REFERENCES:

1. Paul Deitel, Harvey Deitel, ―Java SE8 for programmers,3rd Edition,Pearson,2015.

2. Steven Holzner,―Java 2 Black Book, Dream tech press,2011.

EC1301A	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of semiconductor and special` semiconductor devices also the characteristics of various amplifiers
- To learn the biasing of BJT and FET circuits
- To understand and analyse the IC amplifier circuits
- To understand the power supply concept through LMPS and SMPS model

UNIT I- SEMICONDUCTOR DEVICES **9**

PN diode Current equations, Diffusion and drift current densities, Switching Characteristics, NPN -PNP -Operations-Early effect-Current equations- Input and Output characteristics of CE, CB, CC.

UNIT II- FET AND SPECIAL SEMICONDUCTOR DEVICES **9**

JFETs – Drain and Transfer characteristics, MOSFET- Characteristics- D-MOSFET, E-MOSFET- Characteristics, UJT, SCR, Diac, Triac, LDR- LED, LCD- Opto Coupler, CCD.

UNIT III- BJT AMPLIFIERS **9**

BJT– Need for biasing - DC Load Line and Bias Point – DC analysis of Transistor circuits – Various biasing methods of BJT – Bias Circuit Design - Thermal stability - Stability factors – Bias compensation techniques using Diode, thermistor and sensistor – BJT Amplifiers: CB, CE and CC amplifiers, h-parameter analysis of CE & CB amplifiers

UNIT IV- FET AMPLIFIERS **9**

JFET - DC Load Line and Bias Point -Various biasing methods of JFET - JFET Bias Circuit Design - MOSFET Biasing - Biasing FET Switching Circuits ,FET amplifiers: CS and CD amplifiers, Current Mirror and Current Steering Circuits, Differential Amplifier with resistive and Active loads

UNIT V- POWER SUPPLIES **9**

Linear mode power supply - Rectifiers - Filters - Half-Wave Rectifier Power Supply - Full- Wave Rectifier Power Supply-Voltage regulators:Voltage regulation -Linear series, shunt and switching Voltage Regulators- Over voltage protection - BJT and MOSFET – Switched mode power supply (SMPS) - Design of Regulated DC Power Supply.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understanding the concepts of semiconductor devices and characteristics of amplifiers

CO2: Analyse the concepts of special` semiconductor devices and evaluate the input, output and transfer characteristics

CO3: Analyse the biasing of BJT and FET circuits using biasing method and compensation method by finding the stability factors

CO4: Understand and analyse the IC amplifier circuits

CO5: Understand and analyse the power supply through LMPS and SMPS model by calculating voltage regulation parameter

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	1	0	0	0	1	3
CO2	3	3	3	3	1	2	1	0	0	0	1	3
CO3	3	3	3	3	1	2	1	0	0	0	1	3
CO4	3	3	3	3	1	2	1	0	0	0	1	3
CO5	3	3	3	3	1	2	1	0	0	0	1	3

TEXTBOOKS:

1. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, ―Electronic Devices and circuits‖, Third Edition, Tata McGraw- Hill, 2008.
2. Donald A Neaman, ―Semiconductor Physics and Devices‖, Fourth Edition, Tata Mc GrawHill Inc. 2012.

REFERENCES:

1. Robert Boylestad and Louis Nashelsky, ―Electron Devices and Circuit Theory‖ Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, ― A Text Book of Applied Electronics‖ S.Chand Publications, 2006.

EC1302A	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To understand the basic properties of signal & systems and the various methods of classification
- To learn Laplace Transform &Fourier transform and their properties
- To know Z transform & DTFT and their properties
- To characterize LTI systems in the Time domain and various Transform domains

UNIT I - CLASSIFICATION OF SIGNALS AND SYSTEMS **12**

Requirements of signal and system analysis in communication, Introduction to continuous and discrete time signals, Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Basic operation on the signals -Problems on signal operations, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy &Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable& Unstable.

UNIT II- ANALYSIS OFCONTINUOUS TIME SIGNALS **12**

Fourier series for periodic signals - Fourier Transform – properties- spectral analysis of CT signals-Laplace Transforms – properties -convergence of Laplace Transform.

UNIT III-LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS **12**

System modeling of CT system- LTI system-Impulse response - Differential Equation-Analysis of CT system using Fourier and Laplace transforms-convolution integrals-CT system connected in series /parallel.

UNIT IV- ANALYSIS OF DISCRETE TIME SIGNALS **12**

Baseband signal sampling (only definition)– Fourier Transform of discrete time signals (DTFT)–Properties of DTFT-spectral analysis of DT signals- Z-Transform-ROC and its properties-Properties of Z- Transform.

UNIT V- LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS **12**

System modeling of DT system -Impulse response –Difference equations-Analysis of DT system using Discrete Time Fourier Transform and Z Transform -Convolution sum-DT system connected in series and parallel.

TOTAL: 60PERIODS

CO1: Analyze the properties of signals and systems.

CO2: Apply Laplace transform, Fourier transform in signal analysis

CO3: Evaluate continuous time LTI systems using Fourier and Laplace Transforms

CO4: Apply Z transform and DTFT in signal analysis

CO5: Analyze discrete time LTI systems using Z transform and DTFT

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	0	0	0	0	3	3
CO2	3	3	3	3	3	3	0	0	0	0	3	3
CO3	3	3	3	3	3	3	0	0	0	0	3	3
CO4	3	3	3	3	3	3	0	0	0	0	3	3
CO5	3	3	3	3	3	3	0	0	0	0	3	3

TEXTBOOKS

1. Allan V.Oppenheim,S.Wilsky and S.H.Nawab,―Signals and Systems‖,Pearson,2015.(Unit 1-V)

2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, ―Signals & Systems - Continuous and Discrete‖, Pearson,2007.

REFERENCES

1. B.P. Lathi,―Principles of Linear Systems and Signals,Second Edition,Oxford,2009.

2. John Alan Stuller,―An Introduction to Signals and Systems‖,Thomson,2007.

EC1303A	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic Gates

UNIT I DIGITAL FUNDAMENTALS **9**

Number systems-decimal ,Binary ,Octal, Hexadecimal ,1"s and 2"s complements, Codes-Binary, BCD, Excess 3,Gray,Boolean theorems, Logic Gates, Universal gates, Sum of products and product of sums, Minterm and Maxterms, Karnaugh map minimization.

UNIT II COMBINATIONAL CIRCUIT DESIGN **9**

Design of Half adder and Full adder, Half and Subtractor, Binary Parallel adder-Carry look ahead adder, BCD adder, Multiplexer, De-multiplexer, Magnitude comparator, Decoder, Encoder, Priority Encoder, Parity generator &Parity checker**.**

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Flip Flops-SR,JK ,T,D, Master/Slave FF-operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits-Moore/Mealy models, State minimization, State assignment, circuit implementation-Design of counters-Ripple counters, Ring Counters, Shift register, Universal shift register.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Stable and Unstable states, output specifications, Cycles and Races, Race free assignments, State reduction, Fundamental and Pulse mode sequential circuits, Hazards, Design of Hazard free circuits.

UNIT V MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS **9**

Basic memory Structure-ROM-PROM-EPROM-EEPROM-EAPROM, RAM –Static and Dynamic RAM- Programmable Logic devices -Programmable Logic Array(PLA)-Programmable Array Logic(PAL)-Field Programmable Gated Arrays(FPGA)-Implementation of combinational logic circuits using ROM, PLA and PAL.

Digital Integrated circuits: Logic levels ,Propagation delay, Power dissipation, Fan–out and Fan-in ,noise margin, Logic families and their characteristics-TTL,CMOS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply digital electronics in the present contemporary world

CO2: Design various combinational digital circuits using logic gates

CO3: Analyze the synchronous sequential circuits

CO4: Analyze the Asynchronous sequential circuits

CO5: Classify different logical families, semiconductor memories and implementations of PLD devices using logic gates

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

TEXTBOOKS

1.M.Moris Mano and Michal D.Ciletti,"Digital Design",6th edition,Pearson2017

REFERENCES

1. Charles H.Roth." Fundamentals of Logic design",7th edition, Thomas learning,2019.

2. Thomas L.Floyd, "Digital fundamentals",11th edition, Pearson education Inc,2017.

3. S. Salivahanan and S.Arivazhagan "Digital Electronics",Ist edition, Vikas Publishing House pvt Ltd,2012
4. Anil K.Maini "Digital Electronics",Wiley,2014.

5. A. Anand Kumar" Fundamentals of Digital circuits",4th edition, PHI learning Private Limited,2016.
6. Soumitra Kumar Mandal " Digital Electronics", McGraw Hill Education Private Limited,2016.

EC1304A	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

• To introduce the elements of control system and their modeling using various techniques.

• To introduce methods for analyzing the time response, the frequency response and the stability of systems

• To introduce the state variable analysis method

UNIT I -SYSTEMS COMPONENTS AND THEIR REPRESENTATION **9**

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models.

UNIT II - TIME RESPONSE ANALYSIS **9**

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number- PID control-Analytical design for PD, PI, PID control systems

UNIT III- FREQUENCY RESPONSE AND SYSTEMANALYSIS **9**

Closed loop frequency response - Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT IV- CONCEPTS OF STABILITY ANALYSIS **9**

Concept of stability-Bounded - Input Bounded - Output stability- Routh stability criterion-Root locus concept- Guidelines for sketching root locus-Nyquist stability criterion & amp; Nyquist Plot.

UNIT V-CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS **9**

State variable representation-Conversion of state variable models to transfer functions-conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-State variabe analysis of digital control system- Digital control Design using state feedback.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand Control system components and use of transfer function models in physical systems.

CO2: Apply transient and steady state response for analysis of LTI systems

CO3: Apply Frequency domain analysis and compensation techniques for analysis of LTI systems and enhancing the system stability

CO4: Apply Routh Hurwitz, Root locus Technique and Nyquist plot for estimating the stability of linear systems

CO5: Determine controllability and observability using State Space analysis to control system

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-		1		-	-	-	-	2
CO2	3	3	2	-		1		-	-	-	-	2
CO3	3	3	2	-		1		-	-	-	-	2
CO4	3	3	2	-		1		-	-	-	-	2
CO5	3	3	3	-		1		-	-	-	-	2

TEXTBOOKS

1. M. Gopal," Control System –Principles and Design", Tata Mc Graw Hill,4th Edition,2012.

REFERENCES

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers,5th Edition,2007.
2. K.Ogata, "Modern Control Engineering",5th edition,PHI,2012.
3. S.K.Bhattacharya, Control System Engineering,3rd Edition,Pearson,2013.
4. Benjamin.C.Kuo,"Automatic Control Systems", Prentice Hall of India,7th Edition,1995.

EC1305A ANALOG AND DIGITAL CIRCUITS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- Study the characteristic of CE,CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristic of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of **E**lectronic **C**ircuits

LIST OF ANALOG EXPERIMENTS:

1. Half Wave and Full Wave Rectifiers, Filters, Power supplies

2. Frequency Response of CE,CB,CC and CS amplifiers

3. Darlington Amplifier

4. Differential Amplifiers-Transfer characteristic, CMRR Measurement

5. Bootstrap Amplifier

6. Determination of bandwidth of single stage and multistage amplifiers

7. Spice Simulation of Common Emitter and Common Source amplifiers

LIST OF DIGITAL EXPERIMENTS:

8. Design and implementation of code converters using logic gates
   i) BCD to excess-3code and vice versa (ii)Binary to gray and vice-versa
9. Design and implementation of 4 bit binary Adder/Subtraction and BCD adder using IC7483
10. Design and implementation of Multiplexer and De-multiplexer using logic gates

11. Design and implementation of encoder and decoder using logic gates

12. Construction and verification of4 bitripplecounterandMod-10 /Mod-12 Ripple counters

13. Design and implementation of 3-bit synchronous up/down counter

14. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip-flops.

15. Realize the Ring Counter and Johnson Counter using IC7476.

16. Design and verify the Truth Table of3-bit Parity Generator and 4-bit Parity Checker using basic logic gates with an even parity bit.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1. Analyze the frequency response of CE,CB and CC amplifier.

CO2. Analyze the limitation in bandwidth of single stage and multistage amplifier

CO3. Simulate amplifiers using Spice

CO4. Measure CMRR in differential amplifier

CO5: Gained the knowledge about digital circuits.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	0	0	0	0	2
CO2	3	3	3	3	3	3	3	0	0	0	0	2
CO3	3	3	3	3	3	3	3	0	0	0	0	2
CO4	3	3	3	3	3	3	3	0	0	0	0	2
CO5	3	3	3	3	3	3	3	0	0	0	0	2

HS1301A INTERPERSONAL SKILLS/ LISTENING & SPEAKING

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Equipe students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills.
- Make effective presentation.

UNIT I **6**

Listening as a key skill- its importance- Speaking- give personal information- ask for personal information-Improving pronunciation-pronunciation basics-Taking lecture notes-preparing to listen to a lecture-articulate a complete idea

UNIT II **6**

Interpersonal skills-nurturing-empathetic-self-control-patient-sociability-warmth-social skills-TeamWork-Work Ethic-willingto work-initiative-self-motivated - Integrity.

UNIT III **6**

Factors influence fluency- deliver a five-minute informal talk- greet- respond to greetings-describe health and symptoms-invite and offer-accept-decline-take leave-listen for and follow the gist-listen for detail.

UNIT IV **6**

Being an active listener: giving verbal and non-verbal feedback- participating in a group discussion- asking and getting clarifications- Summarizing academic readings and lectures- Conversational speech- listening to and participating in conversations-persuade

UNIT V **6**

Formal and informal talk- listen to follow and respond to explanations, directions and instructions in academic and business contexts-Strategies for formal presentations and interactive communication-group/pair presentations

TOTAL:30 PERIODS

COURSE OUTCOMES:

CO1. Listen and respond appropriately.

CO2. Participate in group discussions

CO3. Make effective presentations

CO4. Work in a team

CO5. Participate confidently and appropriately in conversations both formal and informal

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

TEXTBOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking Level4 Oxford University Press,Oxford :2011.
2. Richards,C.Jack.& David Bholke. Speak NowLeve l3.Oxford University Press,Oxford:2010

REFERENCES:

1.Bhatnagar,Nitin and Mamta Bhatnagar .Communicative English for Engineers and Professionals.Pearson:NewDelhi, 2010.
2.Hughes,Glyn and Josephine Moate. Practical English Classroom .Oxford University Press: Oxford,2014.
3.Ladousse, Gillian Porter. Role Play. OxfordUniversityPress:Oxford,2014

4.Richards C.Jack. Personto Person(Starter). Oxford University Press:Oxford,2 006.

5. Vargo ,Mari. Speak Now Level4. Oxford University Press: Oxford,2013

IT1302A OBJECT ORIENTED PROGRAMMING LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES:

- To builds software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing.
- To develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1. Develop a Java application to generate Electricity 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 tariff.
   If the type of the EB connection is domestic, calculate the amount to be paid as follows: First 100units-Rs.1perunit
   - 101-200 units-Rs.2.50peru nit201-500un its-Rs.4p erunit
   - 501units -Rs.6perunit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows: First 100units-Rs.2per unit
   - 101-200un its-Rs.4.50peru nit201-500un its-Rs.6p erunit
   - 501units -Rs.7perunit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yento INRand vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa)using packages.

3. 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.

4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations

5. Write a program to perform string operations using Array List. Write functions for the tfollowing

a. Append-add attend
b. Insert–add at particular index
c. Search
d. List all string starts with given letter.

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 only theme thod print Area() that prints the area of the given shape.

7. Write a Java program to implement user defined exception handling

8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.

9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every1 second and if the value is even, second thread computes the square of then number and prints. If the value is odd, the third thread will print the value of cube of the number

10. Write a java program to find the maximum value from the given type of elements using a generic function

11. Designacalculatorusingevent-drivenprogrammingparadigmofJavawiththefollowingoptions.

a) Decimal manipulations
b) Scientific manipulations

12. Develop a simple student database management system using event-driven and concurrent programming paradigms of Java. Use JDBC to connect a back-end database.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1. Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.

CO2. Develop and implement Java Programs with Array list.

CO3.Develop and implement Java programs with exception handling and multithreading.

CO4. Design applications using file processing, generic programming and event handling.

CO5. Ability to solve real world problems using features of Object Oriented Programming

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	1						2
CO2	3	2	2	1	2	1						2
CO3	3	2	2	1	2	1						2
CO4	3	2	2	1	2	1						2
CO5	3	2	2	1	2	1						2

EC1401A	ELECTRONIC CIRCUITS DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To give a comprehensive exposure to all types of amplifiers and oscillators constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To study about feedback amplifiers and oscillators principles
- To design oscillators.
- To study about turned amplifier.
- To design Multivibrators & Schmitt Trigger
-

UNIT I FEEDBACK AMPLIFIERS AND STABILITY **9**

Feedback Concepts –Properties of negative feedback-Four Feedback Topologies – analysis of series-series, shunt- shunt and shunt-series feedback amplifiers-stability problem-Gain and Phase-margins-Frequency compensation.

UNIT II OSCILLATORS **9**

Barkhausen criterion for oscillation –phase shift, Wien bridge -Hartley & Colpitt's oscillators –Clapp oscillator-Ring oscillators and crystal oscillators –oscillator amplitude stabilization. - Negative Resistance Oscillator-UJT Oscillator

UNIT III TUNED AMPLIFIERS **9**

Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier –double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stability of tuned amplifiers –Neutralization -Hazeltine neutralization method.

UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS **9**

Pulse circuits –RC integrator and differentiator circuits –diode clampers and clippers –Multivibrators –Collector coupled and Emitter Coupled Astable multivibrator- Monostable multivibrator- Bistable multivibrators -Triggering methods for Bistable Multivibrator, Schmitt Trigger

UNIT V POWER AMPLIFIERS **9**

Classification of large signal amplifiers-Class A, B, AB, D, Conversion efficiency, Class C tuned amplifier, cascode amplifiers

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1:Analyze different types of amplifier, oscillator and multivibrator circuits

CO2:Design BJT amplifier and oscillator circuits

CO3: Analyze transistorized amplifier and oscillator circuits

CO4: Design and analyze feedback amplifiers

CO5: Design of Power Amplifiers

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

TEXTBOOKS:

1. Sedra and Smith, ―Micro Electronic Circuits‖; Sixth Edition, Oxford University Press, 2011.(UNIT I, III,IV,V)

2. Jacob Millman, Microelectronics‘, McGraw Hill, 2nd Edition, Reprinted, 2009.(UNIT I,II,IV,V)

REFERENCES:

1.Robert L. Boylestad and Louis Nasheresky, ―Electronic Devices and Circuit Theory‖, 10th Edition, Pearson Education / PHI, 2008

2.David A. Bell, ―Electronic Devices and Circuits‖, Fifth Edition, Oxford University Press, 2008.

3.Millman J. and Taub H., ―Pulse Digital and Switching Waveforms‖, TMH, 2000

4. Millman and Halkias. C., Integrated Electronics, TMH, 2007.

EC1402A	ELECTROMAGNETIC FIELDS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To analyze fields potentials due to static changes
- To evaluate static magnetic fields
- To understand how materials affect electric and magnetic fields
- To understand the relation between the fields under time varying situations
- To understand principles of propagation of uniform plane waves.

UNIT I INTRODUCTION **9**

Introduction to Co-ordinate System–Rectangular–Cylindrical and Spherical Co-ordinate System–Introduction to line, Surface and Volume Integrals – Definition of Curl, Divergence and Gradient– Meaning of Stokes theorem and Divergence theorem. Helmholtz's theorem Coulomb's Law in Vector Form – Definition of Electric Field Intensity – Principle of Superposition – Electric Field due to discrete charges – Electric field due to continuous charge distribution - Electric Field due to charges distributed uniformly on an infinite and finite line – Electric Field on the axis of a uniformly charged circular disc –Electric Field due to an infinite uniformly charged sheet.

UNIT II STATIC ELECTRIC FIELDS **9**

Electric Scalar Potential–Relationship between potential and electric field-Potential due to infinite uniformly charged line – Potential due to electrical dipole - Electric Flux Density – Gauss Law – Proof of Gauss Law – Applications. Poisson's and Laplace's equation – Electric Polarization-Nature of dielectric materials-Definition of Capacitance–Capacitance of various geometries using Laplace's equation–Electrostatic energy and energy density – Boundary conditions for electric fields – Electric current – Current density– point form of ohm's law–continuity equation for current.

UNIT III STATIC MAGNETIC FIELDS **9**

The Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I – Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I –Ampere's circuital law and simple applications. Magnetic flux density –The Lorentz force equation for a moving charge and applications – Force on a wire carrying a current I placed in a magnetic field– Torque on a loop carrying a current I.

UNITIV STATIC MAGNETIC FIELDS IN MATERIALS **9**

Magnetic moment – Magnetic Vector Potential. Definition of Inductance – Inductance of loops and solenoids –Definition of mutual inductance – simple examples. Energy density in magnetic fields – Nature of magnetic materials –magnetization and permeability-magnetic boundary conditions. Applications of Magnetic Fields

UNIT V TIME VARYING FIELDS AND MAXWELL'S EQUATIONS **9**

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields. Poynting Vector and the flow of power — Instantaneous Average and Complex Poynting Vector. Derivation of Wave Equation – Uniform Plane Waves –Wave equation in Phasor form – Plane waves in free space and in a homogenous material. Wave equation for a conducting medium– Plane waves in lossy dielectrics– Skin effect.

TOTAL:45 PERIODS

COURSE OUTCOMES:
On the successful completion of the course, students will be able to:

CO1: Apply vector calculus to electric-magnetic fields in different engineering situations.

CO2: Compute electric field and potential for different configurations.

CO3: Solve problems requiring estimation of magnetic field quantities based on Amperes and Biot-Savart law.
CO4: Understand how materials affect electric and magnetic fields.

CO5: Examine the coupling between electric and magnetic fields through Maxwell's equations.

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	3	3	2	1	1	0	0	0	2
CO2	3	3	3	3	3	2	1	1	0	0	0	2
CO3	3	3	3	3	3	2	1	1	0	0	0	2
CO4	3	3	3	3	3	2	1	1	0	0	0	2
CO5	3	3	3	3	3	2	1	1	0	0	0	2

TEXTBOOKS:
1. W H.Hayt & J A Buck : "Engineering Electromagnetics" TATA McGraw-Hill, 7th Edition 2007 (Unit I,II,III).
2. E.C. Jordan &K.G. Balmain "Electromagnetic Waves and Radiating Systems."Pearson Education / PHI 4nd edition 2006. (Unit IV, V).

REFERENCES:
1.Matthew N.O.Sadiku:"Elements of Engineering Electromagnetics "Oxford University Press,4th edition, 2007
2.Narayana Rao,N: "Elements of Engineering Electromagnetics"6th edition,Pearson Education,New Delhi,2006.
3.Ramo,Whinnery and Van Duzer:"Fields and Waves in Communications Electronics" John Wiley&Sons,3rd edition 2003.
4.David K.Cheng:"Field and Wave Electromagnetics –Second Edition-Pearson Edition, 2004.

EC1403A LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT I BASICS OF OPERATIONAL AMPLIFIERS **9**

Current mirror and current sources, Current sources as active loads, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier –General operational amplifier stages-and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations .

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS **9**

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

UNIT III ANALOG MULTIPLIER AND PLL **9**

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

UNIT IVANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS **9**

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

UNIT V WAVEFORM GENERATORSANDSPECIALFUNCTIONICS **9**

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC555,ICVoltage regulators–Three terminal fixed and adjustable voltageregulators – IC 723 general purpose regulator – Monolithic switching regulator, Switched capacitor filter ICMF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto couplers and fibre optic IC.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Design linear and non linear applications of OP–AMPS and fabrication process

CO2: Design applications using analog multiplier and PLL

CO3: Design ADC and DAC using OP–AMPS

CO4: Generate waveforms using OP–AMP Circuits

CO5: Analyze special function ICs

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

TEXTBOOK:

1. D.Roy Choudhry, Shail Jain, ―Linear Integrated Circuits, New Age International Pvt. Ltd., 2018,Fifth Edition. (Unit I–V)

REFERNCES:

1. Ramakant A.Gayakwad,OP-AMP and Linear ICs,4th Edition, Prentice Hall / Pearson Education, 2015.
2. Gray and Meyer, Analysis and Design of Analog Integrated Circuits, Wiley International, 5th Edition, 2009.
3. S. Salivahanan &V.S. Kanchana Bhaskaran, Linear Integrated Circuits, TMH, 2nd Edition,4th Reprint, 2016.
4. Ramakant A.Gayakwad,OP-AMP and Linear ICs,4th Edition, Prentice Hall / Pearson Education, 2015.

MA1401A PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

UNIT-I PROBABILITY AND RANDOM VARIABLES **12**

Probability – Axioms of probability – Conditional probability – Total probability – Baye's theorem -Discrete and continuous random variables –Probability mass function-Probability density function-properties-MathematicalExpectations-conditionalexpectations-Moments–Momentgeneratingfunctions– characteristic function-Chebyshev's inequality

UNIT-II STANDARD DISTRIBUTION **12**

Discrete distribution-Bernauoli's trial-Binomial distribution-Poisson distribution-Geometric distribution-Negative Binomial Distribution- continuous distribution-Uniform distribution, Exponential distribution–Gamma distribution–Weibull distribution-Normal distributions

UNIT-III TWO-DIMENSIONAL RANDOM VARIABLES **12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression–Transformation of random variables–Central limit theorem(for independent and identically distributed random variables).

UNIT-IV CLASSIFICATION RANDOM PROCESSES **12**

Definition and Examples-First order and second order stationary process-strictly sense and wide sense stationary randomprocess-Ergodicprocess-Markovprocess-Markovchain-Poissonprocess–Binomial and normal process-Random telegraph process.

UNIT-V CORRELATION AND SPECTRAL DENSITIES **12**

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties. Linear time invariant system – System transfer function – Linear systems with random inputs–Auto correlation and cross correlation functions of input and output.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.

CO2: Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.

CO3: Apply the concept random processes in engineering disciplines.

CO4: Understand and apply the concept of correlation and spectral densities.

CO5: The students will have an exposure of various distribution functions and help in

acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

CO-PO Mapping

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

TEXTBOOKS:

1. Ibe, O.C.," Fundamentals of Applied Probability and Random Processes ", 1st Indian Reprint, Elsevier,2007.

2. Peebles,P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill,4th Edition, New Delhi, 2002.

REFERENCES:

1.Cooper.G.R.,McGillem.C.D.,"Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rdIndian Edition,2012.

2.Miller.S.L.and Childers.D.G.,-Probability and Random Processes with Applications to Signal Processing and Communications ",Academic Press,2004.

3. Stark. H. and Woods. J.W., -Probability and Random Processes with Applications to Signal Processing", Pearson Education, Asia, 3rdEdition,2002.

4.Yates.R.D.and Goodman.D.J.,-Probability and Stochastic Processes",Wiley India Pvt .Ltd., Bangalore, 2nd Edition, 2012.

CS1405A DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- Acquire basic knowledge of linear and non-linear data structures.
- Design and implement arrays, stacks, queues.
- Understand the complex data structures such as trees and graphs.
- Understand the various techniques of sorting and searching.
- Design and implement various programming paradigms and its complexity

UNIT I ALGORITHM ANALYSIS **9**

Mathematical background - Run time calculations - Logarithms in running time – List ADT- Linked lists–Doubly Linked Lists-Circularly Linked Lists – Operations-Applications.

UNIT II STACK ADT AND QUEUE ADT **9**

Stack model-Implementation of Stacks– Applications – Queue model-Implementation of Queue– Applications of Queues.

UNIT III TREES **9**

Binary trees – Tree Traversal with an application- Implementation- Expression trees - The Search Tree ADT-Binary Search Trees-AVL trees-Single Rotation-Double Rotation-B trees

UNIT IV SORTING AND SEARCHING **9**

Sorting – Insertion sort- Quick sort - Selection sort- Merge sorts - Radix sorts-Searching - Basic searchtechniques-Sequentialsearching-Binarysearch–Hashing-HashFunctions- Separate Chaining-Open Addressing-Rehashing.

UNITV GRAPHS ALGORITHMS **9**

Definitions- Representation of Graphs- Graph Traversal-Topological Sort - Shortest path algorithm- Dijkstra's algorithm-Minimum spanning tree-Prim's and Kruskal's algorithms-Applications of Depth-First search.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1:comprehend the basics in algorithms and data structures.

CO2: apply the knowledge of linear data structures to Engineering problems.

CO3:Gain the knowledge about Tree ADT and its Applications.

CO4:Technical know-how on the implementation of sorting searching algorithms

CO5:Implement graphs in real world scenarios

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

TEXTBOOKS:

1. Mark Allen Weiss, "Data StructuresandAlgorithmAnalysisinC",2nd Edition, Pearson Education,1997.
2. Reema Thareja,"DataStructuresUsingC",SecondEdition,OxfordUniversityPress,2011

REFERENCES:

1. ThomasH.Cormen,Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman,"Data Structures and Algorithms", Pearson Education,1983.

3. Stephen G. Kochan, "Programming in C",3rdedition, Pearson Education.

4. Ellis Horowitz, Sartaj Sahni,Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

HV1401A UNIVERSAL HUMAN VALUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), 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.

Module1: Course Introduction-Need, Basic Guidelines, Content and Process for Value Education 9

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it?- Its content and process;„Natural Acceptance‟ and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity-A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility-the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module2: Understanding Harmony in the Human Being-Harmony in Myself! 9

7. Understanding human being as a co-existence of the sentient„ I‟ and the material„ Body‟
8. Understanding the needs of Self(„I‟) and„ Body‟-happiness and physical facility
9. Understanding the Body as an instrument of „I‟ (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of „I‟ and harmony in„ I‟
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one‟s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship 9

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of

family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society-Undivided Society, Universal Order-from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from student's lives.

Module 4: Understanding Harmony in the Nature and Existence –Whole existence as Co existence 9

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all pervasive space
21. .Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in Nature (film "Home" can be used), pollution, depletion of resources and role of Technology etc.

Module5: Implications of the above Holistic Understanding of Harmony on Professional Ethics 9

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics:
    a. Ability to utilize the professional competence for augmenting universal human order
    b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
    c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order:
    a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.
    Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand and analyze the essentials of human values and skills, self-exploration, happiness and prosperity.

CO2: Evaluate harmony in human being.

CO3: Identify and evaluate the role of harmony in family, society and universal order.

CO4: Understand and associate the holistic perception of harmony at all levels of existence.

CO5: Develop appropriate technologies and management patterns to create harmony in professional and personal lives.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	-	3	-	-	-	3
CO2	-	-	-	-	-	1	-	1	-	-	-	1
CO3	-	-	-	-	-	2	1	1	-	-	-	1
CO4	-	-	-	-	-	2	3	1	-	-	-	3
CO5	-	-	-	-	-	2	2	3	-	-	-	3

TEXTBOOK:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi,2010

REFERENCES:

1.Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan,Amarkantak,1999.

2.Human Values, A.N. Tripathi, New Age Intl.Publishers,NewDelhi,2004.

3.The Story of Stuff (Book).

4.The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi

5.Small is Beautiful -E. F Schumacher.

6.Slow is Beautiful-Cecile Andrews

7.Economy of Permanence –J C Kumarappa

8.Bharat Mein Angreji Raj –Pandit Sunderlal

9.Rediscovering India- by Dharampal

10.Hind Swaraj or Indian Home Rule-by Mohandas K. Gandhi

11.India Wins Freedom-Maulana Abdul Kalam Azad

12.Vivekananda-Romain Rolland(English)

13. Gandhi-Romain Rolland(English)

EC1404A CIRCUITS DESIGN AND SIMULATION LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To gain hands on experience in designing electronic circuits
- To learn simulation software used in circuit design
- To learn the fundamental principles of amplifier circuits
- To differentiate feedback amplifiers and oscillators.
- To differentiate the operation of various multivibrators

DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitt's Oscillator
4. Single Tuned Amplifier
5. RC Integrator and Differentiator circuits
6. Astable and Monostable multivibrators
7. Clippers and Clampers
8. Cascode and Power Amplifier

SIMULATION USINGS PICE (USING TRANSISTOR):

1. Ring Oscillator
2. Wein Bridge Oscillator
3. Double and Stagger tuned Amplifiers
4. Bistable Multivibrator
5. Schmitt Trigger circuit with Predictable hysteresis
6. Analysis of power amplifier

TOTAL:60 PERIODS

COURSE OUTCOMES:
On the successful completion of the course, students will be able to:
CO1: Analyze various types of feedback amplifiers

CO2: Design oscillators

CO3: Design tuned amplifiers

CO5: Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave- shaping circuits and multivibrators using SPICE Tool.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	0	0	0	0	3	2
CO2	3	3	3	3	3	3	0	0	0	0	3	2
CO3	3	3	3	3	3	3	0	0	0	0	3	2
CO4	3	3	3	3	3	3	0	0	0	0	3	2
CO5	3	3	3	3	3	3	0	0	0	0	3	2

EC1405A LINEAR INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To understand the basics of linear integrated circuits and available ICs
- To understand the characteristics of the operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design

LIST OF EXPERIMENTS: DESIGN AND TESTING OF THE FOLLOWING CIRCUITS

1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable &Monostable multivibrators using op-amp.
6. Schmitt Trigger using op-amp.
7. Phase shift and Wien bridge oscillators using op-amp.
8. Astable and monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier, Clock synchronization
10. R-2R Ladder Type D-A Converter using Op-amp.
11. DC power supply using LM317and LM723.

SIMULATION USING SPICE (USING TRANSISTOR):

1. Active low-pass, High-pass and band-pass filters using Op-amp
2. Astable and Monostable multivibrators using NE555 Timer.
3. A/D converter
4. Analog multiplier

TOTAL PERIODS:60

COURSE OUTCOMES:

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

CO1: Design amplifiers, oscillators, D-A converters using operational amplifiers.

CO2: Design filters using op-amp and performs an experiment on frequency response.

CO3: Analyze the working of PLL and describe its application as a frequency multiplier.

CO4: Design DC power supply using ICs.

CO5: Analyze the performance of filters, multivibrators, A/D Converter oscillators and analog multiplier using PSPICE

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	0	0	0	0	3	2
CO2	3	3	3	3	3	3	0	0	0	0	3	2
CO3	3	3	3	3	3	3	0	0	0	0	3	2
CO4	3	3	3	3	3	3	0	0	0	0	3	2
CO5	3	3	3	3	3	3	0	0	0	0	3	2

EC1406A **TECHNICAL SEMINAR /MINI PROJECT** **L T P C**

0 0 4 2

COURSE OBJECTIVES:

- To gain hands on experience in designing power supply circuit
- To learn Eagle simulation software used for circuit design
- To design PN Diode application oriented circuits
- To sketch Inverting Operational Amplifier using Eagle software

LIST OF EXPERIMENTS:

1.Power Supply Circuit

2.Half Wave Rectifier

3.RC Filter

4.Clipper and Clamper Circuits using PN Diode

5.Inverting Operational-Amplifier

6. Mini Project

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Take international examination such as IELTS and TOEFL

CO2: Make presentations and Participate in Group Discussions.

CO3: Successfully answers questions in interviews.

CO4: Effectively communicate inside and outside the classroom.

CO5: Make them a flawless fearless proficient speaker and understand engineering ethics and to solve real time problems.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	3	3	3	1	3	3	3	3	3
CO2	0	3	0	3	3	3	0	3	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

EC1501A	COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of various analog modulation schemes.
- To understand the Noise performance of Receivers.
- To understand the principles Audio transducers.
- To know the principles of sampling &quantization
- To understand the various Digital Modulation schemes
- To learn the various baseband transmission schemes &fundamentals of channel coding.

UNIT I AMPLITUDE MODULATION **9**

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation –Filter Method,–comparison of different AM techniques, Super heterodyne Receiver, Noise performance of AM receiver using envelope detection.

UNIT II ANGLE MODULATION **9**

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth –FM modulation–Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator. Pre- emphasis and de-emphasis for FM. FM receiver model .Noise performance of FM receiver.

UNIT III AUDIO ENGINEERING **9**

Microphones-Introduction-Carbon Microphones-Crystal and Ceramic Microphones-dynamic Microphones- Capacitor Microphones- Capacitor Radio - Frequency, Frequency-Modulated Microphones-wireless microphones –Loudspeakers -Introduction-Components-Electrodynamic Transducers-Diaphragm Types- Electrostatic transducers. Sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform Quantization – quantization noise – PCM-Delta Modulation.

UNIT IV DIGITAL MODULATION SCHEME **9**

Geometric Representation of signals – Types of Digital Modulation schemes, Generation, detection, PSD&BER of Coherent BPSK, QPSK-QAM –GMSK , M-ary schemes.

UNIT V BASEBAND TRANSMISSION &RECEPTION **9**

Properties of Line codes- Line code presentation of Unipolar / Polar RZ & NRZ – Bipolar NRZ &RZ.–Manchester , Linear block codes –Hamming codes - Convolutional codes. ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding - Eye pattern – Receiving Filters-Matched Filter, Correlation receiver, Adaptive Equalization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand and evaluate AM generation techniques.

CO2: Analyze the FM communication systems and its Noise performance.

CO3: Evaluate and Analyze Electro acoustic devices using sampling process.

CO4: Apply various digital modulation schemes for Digital communication system.

CO5: Create and evaluate baseband transmission mechanisms**.**

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2									
CO2	3	3	2									
CO3	3	3	2									
CO4	3	3	2									
CO5	3	3	2									

TEXTBOOKS

1. S. Haykin,―Communication Systems, JohnWiley, 2005(Unit I–V)

2. Glen Ballou- Electroacoustic Devices: Microphones and Loudspeakers, Focal Press, Elsevier, 2009(Unit-III)

REFERENCES

1.B.Skla**r**,―Digital Communication Fundamentals and Applications,2nd Edition, Pearson Education,2009

2. P. Lathi,―Modern Digital and Analog Communication Systems‖3rd Edition, Oxford University Press 2007

3. HPH su, Schaum Outline Series-―Analog and Digital Communications‖,TMH2006

4. J.G. Proakis,―Digital Communication‖,4th Edition, Tata McGraw Hill Company,2001.

5. Glen M. Ballou- Handbook for Sound Engineers, Fourth Edition, Focal Press,Elsevier,2008

EC1502A	DISCRETE TIME SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and applications of digital signal processing

UNIT I DISCRETE FOURIER TRANSFORM **12**

Review of signals and systems, Basic block diagram of a DSP System, Discrete Fourier transform (DFT) -DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering – Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF), Fast Fourier transform (FFT).

UNIT II INFINITE IMPULSE RESPONSE FILTERS **12**

Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) -Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS **12**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures- linear phase structure, direct form realizations

UNIT IV FINITE WORD LENGTH EFFECTS **12**

Fixed point and floating point number representation- ADC- quantization- truncation and rounding -quantization noise - input / output quantization - coefficient quantization error - product quantization error -overflow error - limit cycle oscillations due to product quantization and summation- scaling to prevent overflow.

UNIT V MULTIRATE SIGNAL PROCESSING AND APPLICATIONS **12**

Architecture Sampling rate conversion–Interpolation, Decimation, Multistage implementation of Interpolation and Decimation -Applications of DSP- Voice processing: Analysis & Synthesis of Speech system, Sub-band coding, Musical Sound processing: Echo and Reverberation.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply DFT for the analysis of digital signals and systems.

CO2: Realize and implement IIR filters to meet the required constraints.

CO3: Design FIR filters with various realization methods.

CO4: Ability to characterize finite word length effects on digital filters.

CO5: Understand multirate filters and Apply digital signal processing systems in various applications.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	0	0	0	0	2	2
CO2	3	3	3	3	3	3	0	0	0	0	2	2
CO3	3	3	3	3	3	3	0	0	0	0	2	2
CO4	3	3	3	3	3	2	0	0	0	0	2	2
CO5	3	3	3	3	3	3	0	0	0	0	2	2

TEXTBOOKS

1. John G. Proakis & Dimitris G.Manolakis, Digital Signal Processing–Principles,Algorithms & Applications , Fourth Edition, Pearson Education/ Prentice Hall,2007. (UNIT I–V)
2. S.Salivahanan, A.Vallavaraj & C.Gnanapriya, Digital Signal Processing, Tata McGraw-Hill Publication, 2008

REFERENCES

1.Sanjit K.Mitra-Digital Signal Processing- A Computer Based Approach, Tata McGraw Hill,2007.

EC1503A MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the architecture of 8086 and 8051
- To study the addressing modes and instruction set of 8086and8051
- To introduce the need and use of interrupt structure in 8086and8051.
- To develop skill in simple program writing for 8086and8051applications.
- To introduce commonly used peripheral/interfacing ICs.

UNIT I THE 8086 MICROPROCESSOR **9**

Evolution of Microprocessors , Harvard and Von- Neumann architecture, RISC & CISC architectures, Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming –- Byte and String Manipulation.-Stacks - Interrupts and interrupt service routines– Modular programming using Macros and Procedures.

UNIT II 8086 SYSTEM BUS STRUCTURE **9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming –Introduction to Multiprogramming – System Bus Structure –Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations.

UNIT III I/O INTERFACING **9**

Memory Interfacing and I/O interfacing-Parallel communication interface–Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV MICROCONTROLLER **9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set –Addressing modes –Assembly language programming-Introduction to PIC Microcontroller.

UNIT V INTERFACING MICROCONTROLLER **9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the internal architecture, addressing modes, instructions sets and interrupts of 8086.

CO2: Illustrate about System Bus Structure for Multiprocessor Configuration.

CO3: Infer the functions of various interfacing integrated chips.

CO4: Understand the internal architecture, addressing modes and instruction sets of 8051.

CO5: Infer the functions of various interfacing IC's and real time applications with 8051

CO PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	0	0	0	0	0	0	0	1	1
CO2	3	2	3	2	0	2	0	0	0	0	1	1
CO3	3	1	0	0	0	0	0	0	0	0	0	1
CO4	3	2	2	0	0	2	0	0	0	0	2	1
CO5	3	3	3	2	3	2	0	0	2	0	2	1

TEXTBOOKS

1. Yu-Cheng Liu, Glenn A.Gibson,―MicrocomputerSystems:The8086/8088Family-Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007. (UNIT I-III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi,Rolin McKinlay,―The8051Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition, Pearson education, 2011.(UNIT IV-V)

REFERENCES

1. Doughlas V.Hall,―Microprocessors and Interfacing, Programming and Hardware, TMH, 2012
2. A.K.Ray,K.M.Bhurchandi,"Advanced Microprocessors and Peripherals" 3rd edition, Tata Mc Graw Hill, 2012

EC1504 A WAVEGUIDES AND ANTENNA THEORY

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To introduce the various types of transmission lines and its characteristics.
- To impart technical knowledge in impedance matching.
- To enhance the student knowledge in the area of waveguide components.
- To upgrade the student knowledge in the area of various antennas.
- To enable the student to understand the basic principles in antenna array.

UNIT I TRANSMISSION LINE THEORY

General theory of Transmission lines - transmission line equation - general solution - distortion-less line - Campbell's equation - Input and transfer impedance - Open and short circuited lines—reflection factor and reflection loss –Standing Waves, Nodes, Standing Wave Ratio. **12**

UNIT II IMPEDANCE MATCHING AND GUIDED WAVES

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching-TM and TE waves in rectangular waveguides. **12**

UNIT III WAVEGUIDE COMPONENTS

Introduction to S – Parameters – Properties – Directional Coupler – Power Divider - Waveguide Tees – attenuator – resonator – isolator – Circulator - Hybrid Ring. **12**

UNIT IV RADIATION MECHANISMS AND DESIGN ASPECTS

Physical concept of radiation – Near – and far – field regions –Antenna Pattern Characteristics - Introduction to Antenna Parameters - Half wave dipole - Parabolic Reflector - Cassegrain Feed – Rectangular patch Microstrip antenna and Log periodic antenna. **12**

UNIT V ANTENNA ARRAYS

Two - element array - N element linear array - Pattern multiplication – Broad side and End fire array – Binomial array - Smart antenna. **12**

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of transmission lines and its characteristics

CO2: Analyze the impedance matching network by Stubs using Smith Chart

CO3: Evaluate the S parameters of Waveguide Components

CO4: Understand the radiation mechanism of Antenna and its parameters

CO5: Categorize the radiation characteristics of Antenna Array

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	0	0	0	0	2	2
CO2	3	3	3	2	2	3	0	0	0	0	2	2
CO3	3	3	3	2	2	3	0	0	0	0	2	2
CO4	3	3	3	2	2	3	0	0	0	0	2	2
CO5	3	3	3	2	2	3	0	0	0	0	2	2

TEXTBOOKS

1. John D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2015.
2. Samuel Y. Liao," Microwave Devices and Circuits" Prentice Hall, 1990
3. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006.

REFERENCES

1. E.C.Jordanand K.G.Balmain,―Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.
2. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design–Theory and Applications", Pearson Education Asia, First Edition,2001.
3. David M.Pozar,"Microwave Engineering",Fourth Edition,Wiley India,2012.
4. Annapurna Das, Sisir K.Das, "Microwave Engineering", Tata McGraw-Hill Education, 2000

EC1505A COMMMUNICATION SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To Implement AM & FM modulation and demodulation
- To visualize the effects of sampling and TDM
- To implement PCM & DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

LIST OF EXPERIMENTS:

1. AM Modulator and Demodulator
2. FM Modulator and Demodulator
3. Signal Sampling and reconstruction
4. Pulse Code Modulation and Demodulation
5. Delta Modulation and Demodulation
6. Line coding schemes
7. Simulation of ASK, FSK, BPSK generation and detection schemes
8. Simulation of DPSK, QPSK and QAM generation schemes
9. Simulation of signal constellations of BPSK, QPSK and QAM
10. Simulation of Linear Block error control coding schemes
11. Simulation of Convolutional coding scheme
12. Communication link simulation- AWGN noise Analysis
13. Mini Project

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Simulate &validate the various functional modules of a communication system

CO2: Demonstrate their knowledge in baseband signaling schemes through Implementation of digital modulation schemes

CO3: To understand the basic concepts of A/D and D/A

CO4: Apply various channel coding schemes &demonstrate their capabilities towards the improvement of the noise performance of communication system.

CO5: Simulate end-to-end communication Link

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	0	0	0	0	1	2
CO2	3	3	3	3	3	1	0	0	0	0	1	2
CO3	3	3	3	3	3	1	0	0	0	0	1	2
CO4	3	3	3	3	3	1	0	0	0	0	1	2
CO5	3	3	3	3	3	1	0	0	0	0	1	2

EC1506A DISCRETE TIME SIGNAL PROCESSING LABORATORY **L T P C**

0 0 4 2

COURSE OBJECTIVES:

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts.

LIST OF EXPERIMENTS:

MATLAB SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF / HPF / BPF / BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF / HPF / BPF / BSF) and demonstrate the filtering operations
7. Implementation of Up-Sampling and Down-Sampling operation using Matlab

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor
2. Generation of various signals
3. Linear and Circular Convolution
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
5. Implementation of Up-sampling and Down-sampling operation in DSP Processor

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Carry out basic signal processing operations

CO2: Demonstrate their abilities towards MATLAB based implementation of various DSP systems

CO3: Analyze the architecture of a DSP Processor

CO4: Design and Implement the FIR Filters in DSP Processor for performing filtering operation over real-time signals

CO5: Design a DSP system for various applications of DSP

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	0	0	0	0	2
CO2	3	3	3	3	3	2	2	0	0	0	0	2
CO3	3	3	3	3	3	2	2	0	0	0	0	2
CO4	3	3	3	3	3	2	2	0	0	0	0	2
CO5	3	3	3	3	3	2	2	0	0	0	0	2

EC1507A MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To study introduce the programming language of 8086 and 8051.
- To develop skill in program writing for microprocessors and controllers.
- To introduce microprocessor and microcontroller based system design.
- To impart knowledge on embedded S/W development.

LIST OF EXPERIMENTS:

8086 based experiments and Interfacing:

1. Basic arithmetic and Logical operations.
2. Move a data block without overlap.
3. Conversion, decimal, arithmetic and Matrix operations.
4. String manipulations, sorting and searching Counters Programming
5. Traffic light controller
6. Stepper motor control
7. Digital clock
8. Keyboard and Display
9. Serial interface and Parallel interface
10. A/D and D/A interface and Waveform Generation

8051 Experiments

11. Basic arithmetic and Logical operations
12. Square and Cube program, Find 2's complement of a number
13. Unpacked BCD to ASCII

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Write ALP Programmes for Arithmetic and logical operation

CO2: Interface different I/Os with processor

CO3: Generate waveforms using Microprocessors

CO4: Execute Programs in 8051.

CO5: Explain the difference between simulator and Emulator.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	0	0	0	0	3	3
CO2	3	3	3	3	3	3	0	0	0	0	3	3
CO3	3	3	3	3	3	3	0	0	0	0	3	3
CO4	3	3	3	3	3	3	0	0	0	0	3	3
CO5	3	3	3	3	3	3	0	0	0	0	3	3

MG1601A PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To enable the students to study the evolution of Management, and

To study the functions and principles of management

To learn the application of the principles in an organization .

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS **9**

Definition of Management – Science or Art – Manager Vs Entrepreneur – types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Forms of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING AND STAFFING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the concept of evolution of management.

CO2: Understand the nature and purpose of planning.

CO3: Determine the performance of different types of organization, authority, centralization.

CO4: Demonstrate the ability to directing, leadership and communicate effectively.

CO5: Analysis of different international aspects of business.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	1					2	2
CO2	3	3	2	1	1	1					2	2
CO3	3	3	2	1	1	1					2	2
CO4	3	3	2	1	1	1					2	2
CO5	3	3	2	1	1	1					2	2

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, 10th Edition, Prentice Hall (India) Pvt. Ltd.,2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education,2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, “Fundamentals of Management” 7th Edition, Pearson Education, 2011.
2. Robert Kreitner&MamataMohapatra, “Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata Mc Graw Hill, 1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.

EC1601A VLSI DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Study the fundamentals of CMOS circuits and its characteristics
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
- Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR **9**

MOS Transistor, Ideal I-V Characteristics, Non ideal I-V Effects, C-V Characteristics, DC Transfer characteristics, Scaling, Layout Design Rules, Gate Layouts, Stick Diagrams, Delay Estimation - RC Delay Model, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS **9**

nMOS depletion load and Static CMOS design - Determination of Pull-up and Pull-down ratio-Design of Logic gates- Sizing of transistors -Stick diagrams-Lay out diagram for static CMOS - Pass transistor logic - Dynamic CMOS design - Noise considerations - Domino logic, np CMOS logic - Power consumption in CMOS gates - Multiplexers - Transmission gates design.

UNIT III SEQUENTIAL CIRCUIT DESIGN **9**

Static latches and Registers-BiStability Principles, - Static sequential circuits- CMOS static flip-flop-Dynamic sequential circuits – C^2MOS -Pseudo static latch- Dynamic two phase flip-flop - clocked CMOS logic - Pipelining - NORA CMOS logic -True single phase clocked logic - Realization of D-FF in TSPC logic.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM **9**

Introduction-Designing Static and Dynamic Adder circuits - The Array Multiplier - Multiplier structures- Wallace Tree Multiplier - Booth Multiplier - Barrel shifter - Memory structures - SRAM and DRAM design - Design approach of Programmable logic devices - PLA, PAL and FPGA,VLSI Testing.

UNIT V SPECIFICATION USING VERILOG HDL **9**

Basic Concepts: VLSI Design flow, structural gate level and switch level modeling, Design hierarchies, Behavioral and RTL modeling, Data flow modeling and RTL. Structural gate level description of digital circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Realize the concepts of digital building blocks using MOS transistor.

CO2: Design combinational MOS circuits and power strategies.

CO3: Design and construct Sequential Circuits and Timing systems.

CO4: Design arithmetic building blocks and memory subsystems.

CO5: Apply and implement FPGA design flow and testing

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	1	0	0	0	0	2	2
CO2	3	3	2	1	1	1	0	0	0	0	2	2
CO3	3	3	2	1	1	1	0	0	0	0	2	2
CO4	3	3	2	1	1	1	0	0	0	0	2	2
CO5	3	3	2	1	1	1	0	0	0	0	2	2

TEXTBOOKS:

1. Neil H.E.Weste, David Money Harris—CMOS VLSI Design: A Circuits and Systems Perspective, 4thEdition, Pearson, 2017(UNITI,II,V)
2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits: A Design perspective", Second Edition, Pearson, 2016.(UNIT III,IV)

REFERENCES:

1. M.J.Smith, "Application Specific Integrated Circuits",Addisson Wesley,1997.

2. Sung-Mokang,Yusufleblebici,ChulwooKim, "CMOS Digital Integrated Circuits:Analysis& Design", 4th edition McGraw Hill Education,2013.

3. Wayne Wolf,"Modern VLSI Design: System On Chip", Pearson Education,2007.

4. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005.

EC1602A COMMUNICATION NETWORKS L T P C

3 0 0 3

COURSE OBJECTIVES:

The student should be made to:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

UNIT I FUNDAMENTALS & LINK LAYER 9

Overview of Data Communications- Networks – Building Network and its types– Overview of Internet - Protocol Layering - OSI Mode - introduction to Data Link Layer - Link layer Addressing- Error Detection and Correction.

UNIT II MEDIA ACCESS & INTERNETWORKING 9

Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi –Low PAN –Zigbee - Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP)

UNIT III ROUTING 9

Routing - Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and interdomain protocols – Overview of IPv6 Addressing – Transition from IPv4 to IPv6.

UNIT IV TRANSPORT LAYER 9

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) –Services – Features – TCP Connection – State Transition Diagram – Flow, Error and Congestion Control - Congestion avoidance(DECbit, RED) - quality of service(QoS) – Application requirements

UNIT V APPLICATION LAYER 9

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP - DNS- - Electronic Mail (SMTP, POP3, IMAP, MIME).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the components required to build different types of networks

CO2: Understand the need of different functionality at each layer for given application

CO3: Trace the flow of information from one node to another node in the network

CO4: Choose the required functionality of transport layer and identify solution for each functionality.

CO5: Demonstrate various applications and their protocols.

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

TEXTBOOK:

1. Behrouz A. Forouzan, "Data communication and Networking", Fifth Edition, Tata McGraw– Hill, 2013 (UNIT I –V)

REFERENCES:

1. James F. Kurose, Keith W. Ross,"Computer Networking - A Top-Down Approach Featuring the Internet" Seventh Edition, Pearson Education,2016.
2. Nader. F. Mir,"Computer and Communication Networks", Pearson Prentice Hall Publishers, 2nd Edition, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher,2011.
4. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers,2011.

EC1603A	INDUSTRIAL AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the automation industries and Industries rely heavily on automation for
- economic viability and mass production.
- To understand the automation using relay logic
- To learn basic of automation, how system works and importance of PLC, SCADA and
- robots in automation
- To understand the opportunity to learn industrial automation techniques.
- To understand the basic and features of distribution control system.

UNIT I INTRODUCTION **9**

Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: Modbus & profibus.

UNIT II AUTOMATION USING RELAY LOGIC **9**

Relay Circuits: Construction & Principle of Operation, Types of Relays, Relay as a memory element, Contactor Circuits, Advantages of Contactors over Relay, DOL circuit implementation using contactor, Automation problems based on relays.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS **9**

Role of computers in measurement and control, Elements of computer aided measurement and control, man- machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, computer based data acquisition system, Internet of things (IoT) for plant automation.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER **9**

Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flowchart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V DISTRIBUTED CONTROL SYSTEM **9**

Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Understand the basic introduction of PLC and SCADA.

CO2: Understand the automation using relay logic.

CO3: Understand the role and elements of CAM and control systems.

CO4: Understand the automation of programmable logic controller.

CO5: Understand the basic and features of distribution control system.

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

TEXTBOOKS:

1. Process Control Instrumentation Technology By. C.D. Johnson, PHI
2. Industrial control handbook, Parr, Newnem

REFERENCES:

1. "Industrial Instrumentation and Control" By. S.K. Singh The McGraw Hill.
2. "Programmable logic controller", Dunning,Delmar.

EC1604A AD HOC AND WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Learn Ad hoc network and Sensor Network fundamentals
- Understand the different routing protocols
- Have an in-depth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks
- Have an exposure to mote programming platforms and tools

UNIT I AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS **9**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

UNIT II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES **9**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT III WSN NETWORKING CONCEPTS AND PROTOCOLS **9**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

UNIT IV SENSOR NETWORK SECURITY **9**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS **9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Know the basics of Ad hoc networks and Wireless Sensor Networks

CO2: Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement

CO3: Apply the knowledge to identify appropriate physical and MAC layer protocols

CO4: Understand the transport layer and security issues possible in Ad hoc and sensor networks.

CO5: Be familiar with the OS used in Wireless Sensor Networks and build basic module

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

TEXTBOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004. (UNIT I)
2. HolgerKarl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks",Johnwiley publication, Jan 2006.(UNIT II-V)

REFERENCES:

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004.
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422

EC1605A	VLSI DESIGN LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

To learn Hardware Descriptive Language (Verilog/VHDL)

To learn the fundamental principles of VLSI circuit design in digital and analog domain

To familiarize fusing of logical modules on FPGAs

To provide hands on design experience with professional design (EDA) platform

LIST OF EXPERIMENTS:

Part I: Digital System Design using HDL & FPGA (24 Periods)

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.

Requirements:

Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/ Altera/ equivalent FPGA Boards

Part-II Digital Circuit Design (24 Periods)

6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA Compare pre synthesis and post synthesis simulation for experiments 1 to 6.
7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates &Flip-Flops.

Requirements:

Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools

Part-III Analog Circuit Design (12 Periods)

9. Design and simulate a 4-bit synchronous counter using a Flip-Flops Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9 Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations.
10. Design and Simulate a CMOS InvertingAmplifier.
11. Design and Simulate Basic Common Source, Common Gate and Common Drain Amplifiers.Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11 by performing Schematic Simulations.
12. Design and simulate simple 5transistors differential amplifier. Analyze Gain,Bandwidth and CMRR by performing Schematic Simulations.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Write HDL code for basic as well as advanced digital integrated circuit

CO2: Import the logic modules into FPGA Boards

CO3: Synthesize Place and Route the digital IPs

CO4: Design, Simulate and Extract the layouts of Digital IC Blocks using EDA tools

CO5: Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools

CO-PO Mapping

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

EC1606 A COMMUNICATION NETWORKS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

The student should be made to:

- Learn to communicate between two desktop computers
- Learn to implement the different protocols
- Be familiar with IP Configuration
- Be familiar with the various routing algorithms
- Be familiar with simulation tools

LIST OF EXPERIMENTS:

1. Implementation of Stop and Wait Protocol and sliding window
2. Implementation and study of Go back-N and selective repeat protocols
3. Implementation of High Level Data Link Control
4. Implementation of IP Commands such as ping, Trace route, ns lookup.
5. Implementation of IP address configuration.
6. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
7. Network Topology - Star, Bus, Ring
8. Implementation of distance vector routing algorithm
9. Implementation of Link state routing algorithm
10. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
11. Implementation of Encryption and Decryption Algorithms using any programming language

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Communicate between two desktop computers

CO2: Implement the different protocols

CO3: Program using sockets.

CO4: Implement and compare the various routing algorithms operation over real-time signals

CO5: Use the simulation tool.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3							2
CO2	3	3	3	3	3							2

CO3	3	3	3	3	3							2
CO4	3	3	3	3	3							2
CO5	3	3	3	3	3							2

EC 1701A	RF SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Gain familiarity with RF transceiver system design for wireless communications.
- Explore design methods of receivers and transmitters used in communication systems.
- Develop understanding of RF LNAs (Low-Noise Amplifiers), Mixers, and Oscillators.
- Acquire knowledge of RF Power Amplifiers.

UNIT I RF BASICS & TRANSCEIVER ARCHITECTURE **9**

Non linearity and Time Variance, Intersymbol Interference, Noise, Sensitivity and Dynamic Range, Passive Impedance Transformation. Heterodyne Receivers, Homodyne receivers, Image Reject receivers, Digital- IF Receivers, Subsampling Receivers. Transmission Architectures— Direct Conversion transmitters, Two- step transmitters.

UNIT II LOW NOISE AMPLIFIER AND MIXER **9**

Low Noise Amplifiers—General Considerations, Input Matching, Bipolar LNAs, CMOS LNAs, Down conversion Mixers Passive and Active Mixers, Single-Balanced and Double-Balanced Mixers, Bipolar Mixers, CMOS Mixers, Noise in Mixers.

UNIT III OSCILLATORS **9**

Basic LC Oscillator Topologies, Voltage-controlled Oscillators, Phase Noise-Effect of phase noise, Q of an oscillator, Phase noise mechanisms, Noise-power Trade-off, Effect of frequency division and multiplication on phase noise, Oscillator pulling and pushing, Bipolar and CMOS LC Oscillators— Negative-Gm Oscillators, Interpolative Oscillators.

UNIT IV PLL AND FREQUENCY SYNTHESISERS **9**

Phase-Locked Loops, Basic PLL, Charge – Pump PLLs, Noise in PLLs, Phase noise at Input, Phase noise of VCO, RF Synthesizer Architectures, Integer-N Architecture, Fractional-N Architecture, Dual-Loop Architectures, Direct digital synthesis, frequency dividers.

UNIT V POWER AMPLIFIERS **9**

Linear and Non-linear Power amplifiers, Classification of PAs—Class A and Class B Pas, Class C Pas, High Frequency Power Amplifiers, Large Scale Impedance matching, Linearization techniques, Design Examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Enhance signal transmission quality through the practical implementation of passive impedance transformation techniques, aiming for improved impedance matching and minimized signal loss.

CO2: Evaluate CMOS mixers' performance by considering noise factors and optimization techniques.

CO3: Identify the fundamental role of oscillators in generating continuous periodic signals for RF communication system.

CO4: Analyse the operation and behaviour of PLL (Phase-Locked Loop) and Frequency Synthesizers.

CO5: Assess RF amplifier stability in practical applications.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	0	1	0	1	0	0	2	1
CO2	3	2	1	3	0	1	0	1	0	0	2	1
CO3	3	3	1	2	0	1	0	1	0	0	1	1
CO4	3	3	2	2	0	2	0	1	0	0	1	2
CO5	3	3	2	2	0	2	0	1	0	0	1	1

TEXTBOOKS

1. B.Razavi, “RF Microelectronics”, Pearson Education,1997.

2. Thomas Lee,” The Design of Radio Frequency CMOS Integrated Circuits”, Cambridge University Press, 2nd Edition, Cambridge,2004.

REFERENCES

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004.
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.

3. I.F. Akyildiz, W. Su, Sankara subramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422.

EC1702A	FIBER OPTIC COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study about the various optical fiber modes, configuration of optical fibers
- To explore various idea about optical fiber various coupling techniques
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

UNIT I INTRODUCTION TO OPTICAL FIBERS **9**

Introduction-general optical fiber communication system- basic optical laws and definitions- optical modes and configurations -mode analysis for optical propagation through fibers-modes in planar wave guide-modes in cylindrical optical fiber, over view of modes-Key modal concepts- Fiber optic cables-material dispersion- waveguide dispersion-classification of optical fiber-single mode fiber-graded index fiber.

UNIT II FIBER LENSING AND COUPLING **9**

Source to Fiber Power Launching- Lensing Schemes for Coupling Management- Fiber to Fiber Joints- LED Coupling to Single Mode Fibers- Fiber Splicing- Optical Fiber connectors.

UNIT III OPTICAL SOURCES AND DETECTORS **9**

Sources: Direct and indirect band gaps-LED structures-surface emitting LED-Edge emitting LED- quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes- Rate equations-external quantum efficiency-resonant frequencies-single mode laser-external modulation-temperature effort.

Detectors: Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time- Avalanche multiplication noise-temperature effects -comparisons of photo detectors.

UNIT IV OPTICAL RECEIVER AND MEASUREMENTS **9**

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error- Optical power measurement- attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements.

UNIT V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS **9**

System design consideration, Point – to –Point link design –Link power budget –rise time budget, WDM –Passive DWDM Components-SONET/SDH-Optical Interfaces-SONET/SDH Rings and Networks-Optical ETHERNET-Soliton.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Realize basic elements in optical fibers, different modes and configurations.

CO2: Analyze the transmission characteristics associated with dispersion and polarization Technique

C03: Understand the concept of various optical sources

CO5: Construct fiber optic receiver systems, measurements and coupling techniques.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	0	0	0	0	0	3	0	2
CO2	3	3	3	3	0	0	2	0	3	0	0	2
CO3	3	3	3	3	3	0	0	0	0	0	0	2
CO4	3	3	3	3	3	0	0	0	3	0	0	2
CO5	3	3	3	3	3	2	0	0	3	0	3	2

TEXTBOOKS

1. P Chakrabarti, "Optical Fiber Communication‖, McGraw Hill Education (India)Private Limited, 2016 (UNIT I, III)
2. Gred Keiser, "Optical Fiber Communication‖, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013. (UNIT I, II, IV, V)

REFERENCES

1. John M.Senior, "Optical fiber communication", Pearson Education, second edition.2007.

2. Rajiv Ramaswami, "Optical Networks", Second Edition, Elsevier , 2004.

3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

4. Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley & sons, 2004.

EC1703A	EMBEDDED AND REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems.

UNIT I - INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS **9**

Complex systems and microprocessors– Embedded system design process –Design example: Network Information Appliances- IVR Systems- Instruction sets preliminaries – ARM Processor– CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II - EMBEDDED COMPUTING PLATFORM DESIGN **9**

The CPU Bus-Memory devices and systems–Designing with computing platforms — platform- level performance analysis – Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III - PROCESSES AND OPERATING SYSTEMS **9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- UART-IEEE 1394-IRDA-USB-PCI development tools- EPROM ERASER, power optimization strategies for processes – Example Real time operating systems - POSIX – Windows CE.

UNIT IV - SYSTEM DESIGN TECHNIQUES AND NETWORKS **9**

Design methodologies- Design flows – Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors. – I2C; SPI; USB; CAN; Ethernet; Parallel Protocols – PCI; PCIx; AMBA bus.

UNIT V - CASE STUDY **9**

Data compressor – usage of JTAG adaptor for ARM and Embedded ICE-Alarm Clock – Audio player – Software modem-Digital still camera – Telephone answering machine-Engine control unit – Video accelerator.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the architecture and programming of ARM Processor

CO2: Illustrate the design and optimization of embedded computing platform

CO3: Interpret the different types of processes and real-time operating systems for embedded systems

CO4: Sketch the different system design methodologies for an embedded systems

CO5: Demonstrate real-time applications using embedded systems

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

TEXTBOOKS

1. Marilyn Wolf, "Computers as Components – Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

REFERENCES

1. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
2. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression,Addison-Wesley Professional, 2007.
3. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall,1999.
4. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc GrawHill 1997
5. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.
6. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc Graw Hill, 2004.

EC 1704 A	INTERNET OF THINGS BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications
- To create an IoT based Model

UNIT I FUNDAMENTALS OF IoT **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III IoT DEVELOPMENT BOARD **9**

Design Methodology - Embedded computing logic –STM Microcontroller, System on Chips - IoT system building blocks - Texas - Board details, IDE programming - Interfaces - Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES **9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS **9**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the concept of IoT

CO2: Analyze various protocols for IoT

CO3: Design a PoC of an IoT system usingRaspberry Pi/Arduino

CO4: Apply data analytics and use cloudofferings related to IoT

CO5: Analyze applications of IoT in realtime scenario.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	0	0	0	2	2	0	3
CO2	3	2	3	2	1	0	0	0	1	0	0	2
CO3	3	2	3	2	3	2	0	0	3	3	1	3
CO4	3	1	2	1	2	0	0	0	2	1	0	2
CO5	3	3	3	3	1	0	0	0	1	0	0	2

TEXTBOOKS

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERNCES

1. ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2 nd Edition, O'Reilly Media, 2011

EC1705A MICROWAVE AND OPTICAL COMMUNICATION LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To enable the students to verify the basic principles and design aspects involved in high frequency communication systems components.
- To expose the student to different high frequency components and conduct the experiments to analyze and interpret data to produce meaningful conclusion and match with theoretical concepts.
- To design and develop RF components using microstrip technology.

LIST OF EXPERIMENTS:

1. Mode characteristics of Reflex Klystron
2. VSWR and Impedance measurement and Impedance Matching
3. Gunn Diode Characteristics
4. Numerical Aperture and mode characteristics of Fiber
5. Fiber optic analog & digital link characterization
6. Measurement of connector, Bending& Fiber attenuation Losses
7. Characteristics of LED&PIN photo diode
8. Design and characterization of Microstrip Patch Antenna. (ADS/IE3D/CST or any similar/ equivalent tool may be used for the design)
9. Design of λ/2, λ/4 micro strip transmission line(ADS/IE3D/CST or any similar/ equivalent tool may be used for the design)
10. Analyzing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios
11. OFDM Signal Transmission and Reception using Software Defined Radios

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Analyze & plot the characteristics of microwave sources and impedance matching.

CO2: Analyze the performance of analog and digital optical link.

CO3: Measure the losses of fibers and analyze the mode characteristics of fiber.

CO4: Design and analyze the micro strip patch antenna and transmission line using the modern tool to extract the S parameter, Gain and Radiation pattern

CO5: Estimate the wireless channel characteristics and analyze the performance of wireless communication system using Software Defined Radios.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	0	1	0	0	3
CO2	3	3	3	3	3	2	2	0	1	0	0	3

CO3	3	3	3	3	3	2	2	0	1	0	0	3
CO4	3	3	3	3	3	2	2	0	1	0	0	3
CO5	3	3	3	3	3	2	2	0	1	0	0	3

EC 1706A EMBEDDED LAB FOR PRODUCT DEVELOPMENT L T P C

0 0 4 2

COURSE OBJECTIVES:

- Learn the working of STM32 microcontroller
- Understand the Building Blocks of Embedded Systems
- Learn the concept of memory map and memory interface
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

LIST OF EXPERIMENTS:

1. Study of STM32 evaluation system
2. Developing the system for Display board.
3. Developing the system for Automatic Announcement.
4. Developing the system for position tracking.
5. Developing the system for message passing using GSM module.
6. Developing the system for identifying the object using RFID.
7. Developing an embedded system for converting analog information to digital.
8. Developing an embedded system for converting digital data to analog.
9. Developing the system for adjusting the speed of the robot.
10. Study of SPI communication in STM32 microcontroller.
11. Implementing zigbee protocol with ARM.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Understand the basic building blocks od Embedded Systems and Write programs for a specific Application

CO2: Interface memory, A/D and D/A convertors with STM32 microcontroller system

CO3: Analyze the performance of interrupt

CO4: Write program for interfacing keyboard, display, motor and sensor.

CO5: Write programs to interface memory, I/Os with processor

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	1	2	1	0	0	0	2
CO2	3	3	3	3	3	1	2	1	0	0	0	2

CO3	3	3	3	3	3	1	2	1	0	0	0	2
CO4	3	3	3	3	3	1	2	1	0	0	0	2
CO5	3	3	3	3	3	3	3	1	0	0	0	2

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS (3 students per batch)

- STM32 microcontroller board 10 Nos
- Embedded trainer kits suitable for wireless communication 10 Nos
- Adequate quantities of Hardware, software and consumables

EC1508A MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To gain knowledge about the various physiological parameters both electrical and non-electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING **9**

Sources of biomedical signals, Bio-potentials, Bio-potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT **9**

pH,PO2,PCO2,Colorimeter,Bloodflowmeter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES **9**

Cardiac pacemakers, DCD fibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY **9**

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION **9**

Telemedicine, Insulin Pumps, Radio pill, Endo-microscopy, Brain machine interface, Lab on a chip.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Know the human body electro-physiological parameters and recording of bio-potentials

CO2: Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.

CO3: Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators.

CO4: Comprehend physical medicine methods eg. Ultrasonic, shortwave, microwave surgical diathermies, and bio-telemetry principles and methods.

CO5: Know about recent trends in medical instrumentation

CO-PO-MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	-	-	2	1	1
CO2	3	3	2	2	1	1	1	-	-	2	1	1
CO3	3	3	2	2	1	1	1	-	-	2	1	1
CO4	3	3	2	2	1	1	1	-	-	2	1	1

CO5	3	3	2	2	1	1	1	-	-	2	1	1

TEXTBOOKS

1. Leslie Cromwell,―Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi, 2007. (UNIT I–V)

REFERENCES

1. Khandpur, R.S., ―Handbook of Biomedical Instrumentation, TATA McGraw-Hill, NewDelhi, 2003.

2. JohnG.Webster,―Medical Instrumentation Application and Design, 3rd Edition, Wiley India Edition, 2007

3. Joseph J. Carr and John M. Brown, ―Introduction to Biomedical Equipment Technology, John Wiley and Sons, New York, 2004.

EC1509A ADVANCED DIGITAL SYSTEM DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce methods to analyze and design synchronous and asynchronous sequential circuits.
- To introduce the architectures of programmable devices.
- To introduced signal and implementation of digital circuits using programming tools.

UNIT I SEQUENTIAL CIRCUIT DESIGN **9**

Analysis of clocked synchronous sequential circuits and modeling- State diagram, state table, state table assignment and reduction-Design of synchronous sequential circuits design of iterative circuits-ASM chart and realization using ASM

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN **9**

Analysis of asynchronous sequential circuit–flow table reduction – races –state assignment-transition table and problems in transition table- design of asynchronous sequential circuit-Static, dynamic and essential hazards–data synchronizers–mixed operating mode asynchronous circuits–designing vending machine controller

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS **9**

Fault table method-path sensitization method–Boolean difference method-D algorithm-Tolerance techniques – The compact algorithm – Fault in PLA – Test generation-DFT schemes –Built in self-test.

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES **9**

Programming logic device families–Designing asynchronous sequential circuit using PLA/PAL–Realization of finite state machine using PLD–FPGA–Xilinx FPGA-Xilinx4000

UNIT V SYSTEM DESIGN USING VERILOG **9**

Hardware Modelling with Verilog HDL–Logic System, Data Types and Operators For Modelling in Verilog HDL - Behavioural Descriptions in Verilog HDL – HDL Based Synthesis –Synthesis of Finite State Machines– structural modeling – compilation and simulation of Verilog code–Test bench-Realization of combinational and sequential circuits using Verilog–Register counters–sequential machine–serial adder–Multiplier-Divider–Design of simple microprocessor.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Analyze the sequential digital circuit

CO2: Analyze the asynchronous sequential circuits

CO3: Diagnosis the fault by using testability algorithms

CO4: Design synchronous using programmable devices

CO5: Design a system using Verilog

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

TEXTBOOKS:

1. Charles H.Roth Jr "Fundamentals of Logic Design" Thomson Learning 2004.
2. M.D.Ciletti, Modeling, Synthesis and Rapid Prototyping with the Verilog HDL, Prentice Hall, 1999.

REFERENCES:

1. M.G.Arnold, Verilog Digital – Computer Design, Prentice Hall (PTR), 1999.
2. Nripendra N Biswas "Logic Design Theory" Prentice Hall of India, 2001.
3. Parag K.Lala " Digital system Design using PLD" B S Publications,2003.
4. Parag K.Lala" Fault Tolerant and Fault Testable Hardware Design" B S Publications, 2002.
5. S.Palnitkar, Verilog HDL–A Guide to Digital Design and Synthesis, Pearson, 2003.

EC1510A	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic structure and operation of digital computer
- To Analyze the implementation of fixed point and floating-point arithmetic operations
- To learn the design of data path unit and control unit for processor
- To understand the concept of various memories and interfacing
- To learn the parallel processing technique

UNIT I COMPUTER ORGANIZATION AND INSTRUCTIONS **9**

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uni-processors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

UNIT II ARITHMETIC **9**

Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Sub word parallelism

UNIT III THE PROCESSOR **9**

Introduction, Logic Design Conventions, Building a Data path - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Data path and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallel via Instructions.

UNIT IV MEMORY AND I/O ORGANIZATION **9**

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory, Bus Architectures, Communication Methodologies, Mass storage Devices.

UNIT V ADVANCED COMPUTER ARCHITECTURE **9**

Parallel processing architectures and challenges, Hardware multithreading, Multi-core and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the data representation, instruction formats and the operation of a digital computer.

CO2: Evaluate the fixed point and floating point arithmetic for ALU operation

CO3: Analyze the implementation schemes of control unit and pipeline performance

CO4: Understand the concept of various memories, interfacing and organization of multiple processors

CO5: Understand parallel processing technique and unconventional architectures

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	-	-	-	-	-	-	-	2
CO2	3	3	1	2	-	-	-	-	-	-	-	2
CO3	3	3	1	2	-	-	-	-	-	-	-	2
CO4	3	3	1	2	-	-	-	-	-	-	-	2
CO5	3	3	1	2	-	-	-	-	-	-	-	2

TEXTBOOKS

1. .David A. Patterson and JohnL.Hennessey,―Computer Organization and Design, Fifth edition, Morgan Kauffman / Elsevier,2014. (UNITI-V)
2. .MilesJ.Murdoccaand Vincent P. Heuring,―Computer Architecture and Organization: An Integrated approach, Second edition, Wiley India Pvt Ltd, 2015(UNIT IV,V)

REFERENCES

1. V.Carl Hamacher, Zvonko G.Varanesic and Safat G. Zaky, ―Computer Organization―,Fifth edition, McGraw-Hill Education India Pvt Ltd, 2014
2. William Stallings ―Computer Organization and Architecture‖, Seventh Edition, Pearson Education , 2006

EC1511A	MULTIMEDIA COMMUNICATION & INFORMATION THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the compression schemes for text, voice, image and video
- To know the broadcasting techniques for Multimedia Communication.
- To study the limits set by Information Theory

UNIT I AUDIO COMPRESSION **9**

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding(CELP)

UNIT II IMAGE AND VIDEO COMPRESSION **9**

Graphics Interchange format- Tagged image file format-Digitized documents- Digitized pictures JPEG-Video Encoding-Motion estimation –Overview of H.263 and MPEG-2

UNIT III TEXT COMPRESSION **7**

Static and Dynamic Huffman coding – Arithmetic coding –Lempel-Ziv coding – LZW coding

UNIT IV MULTIMEDIA COMMUNICATION **10**

Introduction-Multimedia Networking- Multimedia Conferencing- Multicasting-Technologies for e- Content-Digital Broadcasting-Digital Radio Broadcasting-Digital Video Broadcasting- DVB/ATSC System-DVB and Internet-Universal Multimedia Access-Middleware for Multimedia (Introduction only)

UNIT V INFORMATION THEORY **10**

Discrete Memoryless source, Information, Entropy, Mutual Information - Discrete Memoryless channels – Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - Source coding theorem - Shannon - Fano& Huffman codes

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Design audio compression techniques

CO2: Understand the image and video compression techniques

CO3: Apply the coding strategy for text compression

CO4: Understand the broadcasting techniques for multimedia communication

CO5: Apply source coding techniques for channel Information.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	1	3	2	0	1	0	3
CO2	3	3	3	3	1	1	1	2	0	1	0	3
CO3	3	3	3	3	1	1	1	2	0	1	0	3
CO4	3	3	3	3	1	1	3	2	0	1	0	3
CO5	3	3	3	3	1	1	1	2	0	1	0	3

TEXTBOOKS

1. Fred Halsall, ―Multimedia communication- Applications, Networks, Protocols and Standards, Pearson education, 2007.
2. S. Haykin, ―Digital Communications‖, John Wiley, 2005.

REFERENCES

1. Tay Vaughan, ―Multimedia making it work, McGraw-Hill Osborne Media, 2006.

2. Kurose and W. Ross, ―Computer Networking ―A Top Down Approach, Pearson education, 3rd ed, 2005.
3. KR. Rao,Z S Bojkovic, D A Milovanovic, ―Multimedia Communication Systems: Techniques, Standards, and Networks‖, Pearson Education 2007
4. R. Steimnetz, K. Nahrstedt, ―Multimedia Computing, Communications and Applications, Pearson Education, First ed, 1995.
5. Nalin K Sharda, Multimedia Information Networking', Prentice Hall of India, 1999

6. Aura Ganz, Zvi Ganz and KittiWongthawaravat, Multimedia Wireless Networks: Technologies, Standards and QoS', Prentice Hall, 2003.
7. Ellen Kayata Wesel, Wireless Multimedia Communications:Networking Video, Voice and Data', Addision Wesley, 1998
8. Ref.: Introduction to Multimedia Communications Applications, Middleware, Networking K. R.Rao University of Texas at Arlington Zoran S. Bojkovic Dragorad A. Milovanovic University of Belgrade, Serbia and Montenegro Published by John Wiley & Sons, Inc., Hoboken, New Jersey. Published simultaneously in Canada

EC1512A MIXED SIGNAL IC DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of mixed signal circuits.
- To enhance design thinking capability by inculcating the importance of parameters like non-linearity, mismatches, noise and jitter in mixed signal circuit design.
- To enrich the skills of computations by introducing modern engineering tools necessary

UNIT I- SIGNAL PROCESSING **9**

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform

UNIT II- SWITCHED CAPACITOR FILTERS **9**

Switched-capacitor filters- Non-idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

UNIT III- DATA CONVERTERS **9**

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

UNIT IV- MIXED SIGNAL **9**

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

UNIT-V- FREQUENCY SYNTHESIZERS **9**

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Analyze analog and discrete time signal processing

CO2: Understand switched capacitor filters

CO3: Identify suitable data converters

CO4: Realize voltage and current mode signalling and data transmission

CO5: Understand Frequency synthesizers

CO-PO Mapping

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

TEXTBOOKS:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.

2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw- Hill, 2003.

REFERENCES:

1. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.

2. Rudy V. de Plassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.

3. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.

4. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).

5. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008

EC1513A DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS **9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals- RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transform-DFT,DCT.

UNIT II IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform–Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION **9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV IMAGE SEGMENTATION **9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSIONAND RECOGNITION **9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors– Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Recall the basics and fundamentals of digital image processing and 2D-transforms.

CO2: Operate on images using the techniques of smoothing, sharpening for enhancement

CO3: Examine the causes for image degradation and reconstruct the images using various restoration filters

CO4: Interpret image segmentation and representation techniques.

CO5: Compare the various image compression schemes and recognize the image patterns.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	0	0	0	0	2	3
CO2	3	3	2	3	3	2	0	0	0	0	2	3
CO3	3	3	3	3	3	3	0	0	0	0	2	2
CO4	3	3	3	3	3	2	0	0	0	0	2	2
CO5	3	3	3	3	3	2	0	0	0	0	2	2

TEXTBOOKS

1. Rafael C. Gonzalez, Richard E. Woods, _Digital Image Processing‘, Pearson, Third Edition, 2010.
2. Anil K. Jain, _’Fundamentals of Digital Image Processing‘, Pearson, 2002.

REFERENCES

1. Kenneth R.Castleman,_DigitalImageProcessing‘,Pearson,2006.

2. William K. Pratt, Digital Image Processing‘, JohnWiley, NewYork, 2002.

EC1707A	NEXT GENERATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the concept about Wireless networks, protocol stack and standards.
- To study about fundamentals of 3G Services, its protocols and applications.
- To determine the performance of 4G Networks, its architecture and applications.
- To analyze 5G cellular network architecture
- To evaluate the performance of 5G NR

UNIT I WIRELESS LAN **9**

Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture,802.11b, 802.11a – Hiper LAN: Hiper LAN 1&2 – Bluetooth : Architecture, WPAN– IEEE 802.15.4.

UNIT II 3G OVERVIEW **9**

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA

UNIT III 4G **9**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, MVNO.

UNIT IV INTRODUCTION TO 5G **9**

Historical Trend of Wireless Communications - 5G Roadmap - Pillars of 5G – Global Initiatives– Standardization Activities – 5G System Concept – Spectrum for 5G – 5G Architecture – Functional Architecture and 5G Flexibility - 6G Network Architectures and Key Enabling Technologies

UNIT V 5G NR **9**

The Next Generation—5G/NR - Frequency Bands for NR - RF Exposure Above 6 GHz - Higher-Frequency Operation and Spectrum Flexibility - Transmission Scheme, Bandwidth Parts, and Frame Structure - Duplex Schemes - Scheduling and Data Transmission - Interworking and LTE Coexistence – 5G Core network – Radio Access Network – Radio Protocol Architecture – Radio link control - Hybrid ARQ With Soft Combining.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts of wireless networks, protocol stack and standards.

CO2: Understand the concepts of 3G Services, its protocol and application.

CO3: Determine the performance of 4G Networks, its architecture and applications

CO4: Analysis of 5G Cellular network architecture

CO5: Evaluate the performance of 5G NR.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	2	0	2	2	0	0	0	0	2
CO2	1	1	2	2	0	2	2	0	0	0	0	2
CO3	2	2	3	3	0	2	2	0	0	0	0	2
CO4	2	2	3	3	0	2	2	0	0	0	0	2
CO5	2	1	3	3	0	2	3	0	0	0	0	2

TEXTBOOKS

1. Jochen Schiller, Mobile Communications‖, Second Edition, Pearson Education 2012.

2. Vijay Garg, ―Wireless Communications and networking, First Edition, Elsevier 2007.

3. 5G Mobile and Wireless Communications Technology, Edited by: AfifOsseiran, Jose F. Monseeat and Patrick Marsch, 2016, Cambridge University Press.

4. Fundamentals oF 5G mobile networks, Edited by Jonathan Rodriguez, 2015 John Wiley & Sons, Ltd,

5. 5G NR: The Next Generation Wireless Access Technology, Erik Dahlman, Stefan Parkvall, Johan Sköld, 2018, Academic Press, an imprint of Elsevier

REFERENCES

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTEfor Mobile Broadband‖, Second Edition, Academic Press,2008.

2. Anurag Kumar, D.Manjunath, Joy kuri, ―Wireless Networking, First Edition, Elsevier2011.

EC1708A RADAR SIGNAL PROCESSING L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of Radar systems and Signal models.
- To illustrate the concepts of Sampling and Quantization of pulsed radar signals.
- To provide in-depth knowledge in Radar waveforms and Doppler processing.

UNIT I INTRODUCTION TO RADAR SYSTEMS **9**

Basic radar function, elements of pulsed radar, review of signal processing concepts and operations, A preview of basic radar signal processing, radar system components, advanced radar signal processing.

UNIT II SIGNAL MODELS **9**

Components of a radar signal, amplitude models, types of clutters, noise model and signal-to noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model.

UNIT III SAMPLING AND QUANTIZATION OF PULSED RADAR SIGNALS **9**

Domains and criteria for sampling radar signals, Sampling in the fast time dimension, Sampling in slow time: selecting the pulse repetition interval, sampling the doppler spectrum, Sampling in the spatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q.

UNIT IV RADAR WAVEFORMS **9**

Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range side lobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency codes.

UNIT V DOPPLER PROCESSING **9**

Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, dwell-to-dwell stagger, Pulse pair processing, additional Doppler processing issues, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phase center antenna processing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Explain the principles of elements involved in radar signal processing

CO2: Identify various signal models in radar signal processing

CO3: Analyze sampling and quantization of pulsed Radar signals

CO4: Describe different types of radar waveforms

CO5: Discuss on Doppler processing and its issues

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3							1	1

CO2	3	3	3	3							1	1
CO3	3	3	3	3							1	1
CO4	3	3	3	3							1	1
CO5	3	3	3	3							1	1

TEXTBOOKS:

1. Francois Le Chevalier, "Principles of Radar and Sonar Signal Processing", Artech House
2. Fred E. Nathanson, "Radar Design Principles-Signal Processing and the Environment",PHI

REFERENCES:

1. Mark A. Richards, "Fundamentals of Radar Signal Processing", McGraw-Hill, New York, 2005

EC1709A ADVANCED COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the micro-architectural design of processors.
- Learn about the various techniques used to obtain performance improvement and power savings in current processors.

UNIT I FUNDAMENTALS OF COMPUTER DESIGN

Review of Fundamentals of CPU, Memory and IO – Trends in technology, power, energy and cost, Dependability – Performance Evaluation. **9**

UNIT II INSTRUCTION LEVEL PARALLELISM

ILP concepts – Pipelining overview – Compiler Techniques for Exposing ILP – Dynamic Branch Prediction – Dynamic Scheduling –Multiple instruction Issue – Hardware Based Speculation – Static scheduling – Multi-threading– Limitations of ILP. **9**

UNIT III DATA-LEVEL PARALLELISM

Vector architecture – SIMD extensions – Graphics Processing units – Loop level parallelism. **9**

UNIT IV THREAD LEVEL PARALLELISM

Symmetric and Distributed Shared Memory Architectures- Performance Issues-Synchronization, Models of Memory Consistency. **9**

UNIT V MEMORY AND I/O

Cache performance-Reducing Cache Miss Penalty and Miss Rate-Reducing Hit Time-Memory and Performance-Memory Technology-.Types of Storage Devices-Buses-RAID-Reliability Availability and Dependability-I/O performance Measures . **9**

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the performance of different architectures with respect to various parameters.

CO2: Identify the performance of different ILP techniques.

CO3: Determine the performance of different architectures exploiting DLP techniques

CO4: Implement the performance of different architectures exploiting TLP techniques

CO5: Analyze cache and memory related issues in multi – processors.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	1	1	1	3
CO2	3	3	2	1	-	-	-	-	2	2	1	3
CO3	3	3	2	1	-	-	-	-	2	2	2	3
CO4	3	3	2	1	-	-	-	-	2	2	2	3
CO5	3	3	3	2	-	-	-	-	2	2	2	3

TEXTBOOKS

1. John L Hennessey and David A Patterson, “Computer Architecture A Quantitative Approach”, Morgan Kaufmann/ Elsevier, Fifth Edition, 2012.

REFERENCES

1. Kai Hwang and Faye Briggs, “Computer Architecture and Parallel Processing”, Mc GrawHill International Edition, 2000.
2. Sima D, Fountain T and Kacsuk P, “Advanced Computer Architectures: A Design Space Approach”, Addison Wesley, 2000.

EC1710A STATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

UNIT I SATELLITE ORBITS **9**

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geostationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility– eclipse-Sub satellite point–Sun transit outage-Launching Procedures-launch vehicles and propulsion.

UNIT II EARTH AND SPACE SEGMENTS **9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command- Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system – Transmit –Receive earth stations–Problems – Equivalent isotropic radiated power

UNIT III SATELLITE LINK DESIGN **9**

Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime. Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks– Overall system noise temperature– Carrier to-Noise ratio.

UNIT IV SATELLITE ACCESS **9**

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression–encryption.

UNIT V SATELLITE APPLICATIONS **9**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO,MEO,SatelliteNavigationalSystem.DirectBroadcastsatellites(DBS)-DirecttohomeBroadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT, Specialized services – E–mail, Video conferencing, Internet.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the Satellite orbital parameters using keplers law and Newton's law.

CO2: Analyze and update parameters of the Earth and Space Segment.

CO3: Evaluate the basic Satellite uplink and Downlink Design using mathematical model.

CO4: Analyze the performance of Satellite accessing methods using multiple access mechanism.

CO5: Analyze various Satellite Application and Specialized services.

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

TEXTBOOKS

1. Dennis Roddy,"Satellite Communication",4th Edition, McGraw Hill International, 2006.

REFERENCES

1. Wilbur L. Pritchard,Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N. Agarwal, "Design of Geosynchronous Space Craft",PrenticeHall,1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", HandBook, Artech House Bostan London, 1997.
4. TriT. Ha, "Digital Satellite Communication", IInd edition,1990.
5. Emanuel Fthenakis , "Manual of Satellite Communications",McGrawHillBookCo.,1984.
6. Robert G. Winch, "Telecommunication Trans Mission Systems", McGraw -Hill Book Co., 1983.
7. Brian Ackroyd, "World Satellite Communication and earthstation Design",BSP professional Books, 1990.
8. G.B.Bleazard,"Introducing Satellite communications",NCC Publication,1985.
9. M.Richharia,"Satellite Communication Systems-Design Principles",Macmillan 2003.

EC1711A	COGNITIVE RADIO	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Know the basics of the software defined radios.
- Learn the design of the wireless networks based on the cognitive radios
- Understand the concepts of wireless networks and next generation networks
- Understand architecture maps and design rules
- Learn about next generation networks

UNIT I - INTRODUCTION TO SOFTWARE DEFINED RADIO **9**

Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications..

UNIT II - INTRODUCTION TO COGNITIVE RADIOS **9**

Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

UNIT III - COGNITIVE RADIO ARCHITECTURE **9**

Basic SDR, hardware architecture, Computational processing resources, software architecture, Building the Cognitive Radio Architecture on Software defined Radio Architecture

UNIT IV - SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS **9**

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio

UNIT V - NEXT GENERATION WIRELESS NETWORKS **9**

The XG Network architecture- upper layer issues, cross – layer design. Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the architecture and evolution of software defined radio

CO2: Understand the cognitive techniques, position awareness and environment awareness in cognitive radios.

CO3: Analyze the cognitive radio architecture.

CO4: Analyze the spectrum sensing and dynamic spectrum access

CO5: Understand the architecture of next generation wireless networks

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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	0	0	0	0	0	0	0	0
CO2	2	2	2	1	0	0	0	0	0	0	0	0
CO3	3	3	2	3	0	0	0	0	0	0	0	0
CO4	3	3	2	3	0	0	0	0	0	0	0	0
CO5	3	3	2	2	0	0	0	0	0	0	0	0

TEXTBOOKS:

1. Joseph Mitola III,"Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
2. Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
3. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
4. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.

REFERENCES:

1. Simon Haykin, "Cognitive Radio: Brain –Empowere Wireless Communications",IEEE Journal on selected areas in communications, Feb 2005.
2. Hasari Celebi, Huseyin Arslan, "Enabling Location and Environment Awareness in Cognitive Radios", Elsevier Computer Communications , Jan 2008.
3. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
4. Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.
5. Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, "Cognitive Radio Communication and Networks", Elsevier, 2010.

EC1801A	MICROWAVE INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To enhance the knowledge in the area of planar microwave engineering and to make them understand the intricacies in the design of microwave circuits.
- To design impedance matching networks using distributed and lumped elements
- To impart knowledge about the various amplifiers and to design oscillator.
- To analyze about various microwave components and mixers
- To simulate and to test the microwave components under laboratory conditions.

UNIT I - INTRODUCTION TO MICROWAVE CIRCUITS **9**

Definitions – Conventional Frequency Bands – Lumped versus Distributed Circuits – Lumped and Distributed Regimes – Behavior of finite length transmission lines – Resonators - Combiners, Splitters and Couplers

UNIT II - MATCHING NETWORKS **9**

Circuit Representation of two port RF/Microwave Networks: Low Frequency Parameters, High Frequency Parameters, Transmission Matrix, Combined Impedance and Admittance Smith Chart, Design of Matching Circuits using Lumped Elements, Matching Network Design using Distributed Elements.

UNIT III - AMPLIFIERS AND MICROWAVE DIODES **9**

Amplifiers: Stability considerations in active networks – Gain Consideration in Amplifiers – Noise Consideration in active networks – Broadband Amplifier design – Low Noise Amplifier Design – Power amplifiers – Microwave Diodes.

UNIT IV- MIXERS AND OSCILLATOR DESIGN **9**

Mixers: Fundamentals, Conversion Gain – Design of Mixers: Single Ended Mixers – Single Balanced Mixers – Double Balanced Mixers. Oscillators: Basic Oscillator Model, Design Procedure – Quartz Oscillator – Dielectric Resonator Oscillator – Voltage Controlled Oscillator – Gunn Element Oscillator

UNIT V- MICROWAVE IC DESIGN AND MEASUREMENT TECHNIQUES **9**

Microwave Integrated Circuits – MIC Materials- Hybrid versus Monolithic MICs – Multichip Module Technology - Fabrication Techniques, Miniaturization techniques, Introduction to SOC, SOP, Test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of planar microwave engineering.

CO2 : Design impedance matching circuits using LC components and other elements.

CO3: Design Impart knowledge about the various amplifiers and oscillators.

CO4: Analyze microwave components and mixers

CO5: Simulate and to test the microwave components under laboratory conditions.

CO-PO Mapping:												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	2	1	1	0	0	0	2
CO2	3	3	3	3	3	2	1	1	0	0	0	2
CO3	3	3	3	3	3	2	1	1	0	0	0	2
CO4	3	3	3	3	3	2	1	1	0	0	0	2
CO5	3	3	3	3	3	3	1	1	0	0	0	2

TEXT BOOKS:

1. Thomas H.Lee, "Planar Microwave Engineering", Cambridge University Press, 2004. (Unit I, Unit II, Unit III & Unit V)
2. David M. Pozar, "Microwave Engineering", John Wiley & Sons, 4th edition 2012(Unit I, Unit II)
3. Behzad Razavi, "RF MicroElectronics", Prentice Hall Education, II Edition 2011.(Unit IV & Unit V)
4. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition,2001. (Unit III, Unit IV)

REFERENCES:

1. Hoffman R.K. "Handbook of Microwave Integrated Circuits", Artech House, Boston, 1987.
2. Ulrich L. Rohde and David P.N., "RF / Microwave Circuit Design for Wireless Applications", John Wiley, 2000.
3. C. Gentili, "Microwave Amplifiers and Oscillators", North Oxford Academic, 1986.
4. Matthew M. Radmanesh, "Radio Frequency and Microwave Electronics", Pearson Education, II Edition 2002.

EC1802A	DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of Deep Learning
- To understand Deep Learning Networks
- To Understand the concept of CNN and transfer learning techniques, to apply it in the classification problems
- To Learn how to use RNN for language modelling and time series prediction
- To Use auto encoder and deep generative models to solve problems with high dimensional data including text, image and speech.

UNIT 1- INTRODUCTION **9**

Motivation for deep learning - Machine learning Basics: Learning algorithms - Overfitting – Under fitting - Hyper parameters Estimators - Validation - Maximum Likelihood estimation - Bayesian Statistics - Challenges in Machine Learning

UNIT II- DEEP LEARNING NETWORKS **9**

Gradient based learning - Hidden Units - Architectural design - Back - propagation for MLP - Regularization - Parameter Regularization - Data Augmentation - Dropout - Optimization algorithms - Adaptive learning rates

UNIT III - CONVOLUTIONAL NEURAL NETWORK **9**

Architecture - Pooling - Convolution and its variants - CNN for Image classification and recognition, examples using MATLAB or Python

UNIT IV - SEQUENCE MODELING **9**

Recurrent Neural Networks(RNN) - Bi - directional RNN, Encoder Decoder Architecture - Recursive Nets - LSTM - Gated RNN - RNN for Sentiment Analysis

UNIT V - DEEP LEARNING MODELS **9**

Auto encoders - Deep Boltzmann Machine - Deep Belief Networks - Architecture - Greedy Learning – Speech Processing and Recognition using DBN

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basics of Deep Learning.

CO2: Understand the Deep Learning Networks

CO3: Understand the concept of CNN and transfer learning techniques, to Apply it in the classification problems

CO4: Learn how to use RNN for language modelling and time series prediction

CO5: Use auto encoder and deep generative models to solve problems with high dimensional data including text, image and speech.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	0	3	0	1	0	0	0	0	3	3
CO2	3	3	3	1	2	1	0	0	0	0	3	3
CO3	3	3	2	1	3	1	0	0	0	0	3	3
CO4	3	3	2	1	3	1	0	0	0	0	3	3
CO5	3	3	2	1	1	3	1	0	0	0	3	3

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville , "Deep Learning", MIT Press, USA, 2016. – (Unit I, Unit II, Unit III, Unit IV, Unit V)
2. Adam Gibson, Josh Patterson , "Deep Learning A practitioner's approach", O'Reilly, USA, 2016. – (Unit III, Unit V)

REFERENCES:

1. Yusuke Sugomori , "Deep Learning: Practical Neural Networks with Java", Packt Publisher, New York, 2016.
2. Jeff Heaton , "Artificial Intelligence for Humans: Deep Learning and Neural Networks", Lightning Source Inc, Tennessee, 2015.

EC1803A	NANO ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to Nano electronics, Nano devices, spintronics and molecular electronics.
- To identify quantum mechanics behind Nano electronics.
- To describe the principle and the operation of Nano electronic devices.
- To introduce the concept of carbon Nano tubes
- To describe the concept of molecular Electronics

UNIT I- INTRODUCTION TO NANOTECHNOLOGY **9**

Background to nanotechnology: Types of nanotechnology and nanomachines – Molecular Nanotechnology-Electron microscope – scanning electron microscope – atomic force microscope –scanning tunnelling microscope-nanomanipulator-atom manipulation- nanodots – Nanomaterials

UNIT II- FUNDAMENTALS OF NANOELECTRONICS **9**

Fundamentals of logic devices- physical limits to computations; concepts of logic devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer-performance of information processing systems

UNIT III - SILICON MOSFETs & QUANTUM TRANSPORT DEVICES **9**

Silicon MOSFETS - fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics-metal gates-junctions & contacts-advanced MOSFET concepts-Quantum transport devices based on resonant tunnelling-Electron tunnelling

UNIT IV- CARBON NANOTUBES **9**

Carbon Nanotube– formation of nanotubes-purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs –Nanotube for memory applications

UNIT V- MOLECULAR ELECTRONICS **9**

Electrodes & contacts – molecular electronic devices – simulation and circuit design – fabrication; Future applications- MEMS – robots – random access memory – mass storage devices.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental science and quantum mechanics behind Nano electronics

CO2: Apply the concepts of a quantum transport and tunnelling effects in nano electronics

CO3: Analyze the difference between microelectronics and Nano electronics

CO4: Understand the formation of carbon nanotubes

CO5: Understand about molecular electronics devices

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	1	0	0	0	1	2	2
CO2	2	3	2	2	1	1	0	0	0	1	2	2
CO3	3	2	2	2	3	1	0	0	0	1	2	2
CO4	3	2	2	3	1	1	0	0	0	1	2	2
CO5	3	2	2	3	1	1	0	0	0	1	2	2

TEXT BOOKS:

1. K.E. Drexler, Nano systems: Molecular Machinery, Manufacturing and Computation, Wiley India Pvt Ltd, (2013),3rd Edition (I,II,IV)

2.Cuevas & Juan Carlos, Molecular Electronics-An Introduction to Theory and Experiment, World Scientific,(2017) 2nd Edition,(III,V)

REFERENCES:

1. Charles P. Poole, Jr. and Frank, Introduction to Nanotechnology, John Wiley and sons, 2013, 2nd Edition.

2. Lynn E Foster, Nanotechnology, Pearson Education, 2007, 2nd Edition.

GE1801A PROFESSIONAL ETHICS IN ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I - INTRODUCTION **10**

Morals, values and Ethics- Integrity - Work ethic -Service learning -Civic virtue- Respect for others - Living peacefully - Caring - Sharing - Honesty - Courage - Valuing time - Cooperation - Commitment - Empathy – Self confidence - Character - Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II - ENGINEERING ETHICS **9**

Senses of ·Engineering Ethics·-Variety of moral issues –Types of inquiry -Mor.al dilemmas-Moral Autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Models of professional roles - Theories about right action - Self-interest - Customs and Religion -Uses of Ethical Theories.

UNIT III - ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation -Engineers as responsible Experimenters -Codes of Ethics-A Balanced Outlook on Law.

UNIT IV - SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk -Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk Respect for Authority - Collective Bargaining - Confidentiality – Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) -Discrimination.

UNIT V- GLOBAL ISSUES **8**

Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Code of Conduct - Corporate Social Responsibility.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Learnt the Basic morals and human values

CO2: Understood the ethics in various engineering disciplines

CO3: Learnt to implement the codes of ethics in engineering society

CO4: Realized the responsibilities and rights of engineer

CO5: Learnt to apply the professionalism & ethics in global issues

CO-PO Mapping

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

TEXT BOOKS:

1. l . Mike W. Martin and Roland Schinzinger, "Ethics in Engineering". Tata McGraw Hill, New Delhi. 2003.
2. 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi. 2004.

EC1805A NEURAL NETWORKS AND FUZZY LOGIC

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To obtain the fundamentals of Artificial Neural Networks
- To provide adequate knowledge about feed forward /feedback neural networks
- To apply the concept of fuzzy logic in various systems.
- To implement fuzzy inference system to solve scientific and engineering problems
- To introduce the concept of optimization and Neuro fuzzy approaches.

UNIT I- INTRODUCTION TO ARTIFICIAL NEURAL NETWORK **9**

Artificial neural networks and their biological motivation: Terminology, Models of neuron, Topology, characteristics of artificial neural networks, types of activation functions; learning methods: error correction learning, Hebbian learning, Perceptron: XOR Problem, Perception learning rule convergence theorem; Adaline.

UNIT II- FEEDFORWARD AND RECURRENT NEURAL NETWORKS **9**

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perceptron model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications; Recurrent neural networks: Linear auto associator – Bi-directional associative memory – Hopfield neural network.

UNIT III- FUZZY LOGIC & FUZZY SETS **9**

Introduction to Fuzzy Logic, Classical and Fuzzy Sets, Membership Function, Membership Grade, Universe of Discourse, Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions, Negation, Product, Difference, Properties of Classical set and Fuzzy sets, Fuzzy vs Probability, Fuzzy Arithmetic, Fuzzy Numbers.

UNIT- IV FUZZY RELATIONS AND AGGREGATIONS **9**

Essential Elements of Fuzzy Systems, Classical Inference Rule, Classical Implications and Fuzzy Implications, Crisp Relation and Fuzzy Relations, Composition of fuzzy relations, Cylindrical Extension and Projection. Fuzzy IF-THEN rules, Inference: Scaling and Clipping Method, Aggregation, Fuzzy rule based Model: Mamdani Model, TSK model, Fuzzy Propositions, Defuzzification: MOM, COA.

UNIT V- FUZZY OPTIMIZATION AND NEURO FUZZY SYSTEMS **9**

Fuzzy optimization –one-dimensional optimization. Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Translate biological motivations into various characteristics of artificial neural networks.

CO2: Learn and implement supervised and unsupervised learning algorithms for various applications and

to interpret associative memories for storing and recalling the input patterns.

CO3: Apply ANN models and Fuzzy logic principles for industrial and societal application.

CO4: Gain knowledge about fuzzification and de-fuzzification methods for developing fuzzy inference systems.

CO5: Apply and integrate various neuro - fuzzy techniques for designing intelligent systems.

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	1	2	1	2	1	1	1	1	1
CO2	2	2	2	1	2	1	2	1	1	1	1	1
CO3	2	2	2	1	2	1	2	1	1	1	1	1
CO4	2	2	3	2	3	1	2	1	1	1	1	2
CO5	2	2	3	2	3	1	2	1	1	1	1	2

TEXT BOOKS:

1. S. Rajasekaran,G. A. Vijayalakshmi Pai ,"Neural Networks , Fuzzy Systems and Evolutionary Algorithms - Synthesis And Application" PHI 2nd Edition – 2017 (Unit - I, II, III ,IV,V)
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, John Wiley and sons, 2010(Unit - IV,V)

REFERENCES:

1. Jacek. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 2007.
2. J.S.R. Jang, C.T. Sun, E. Mizutani, "Neuro Fuzzy and Soft Computing - A computational Approach to Learning and Machine Intelligence", Pearson Education Inc., 2007
3. Simon Haykin, "Neural Networks and Learning Machines", Mac Millen College Pub co., NewYork,2011.
4. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", PrenticeHall, 1995.
5. Laurene Fausett, Fundamentals of Neural Networks-Architectures, algorithms and applications,Pearson Education Inc., 2008 (reprint)

EC1806A 5G COMMUNICATION AND ITS APPLICATIONS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of 5G and its use cases
- To understand 5G Architecture and use of MIMO in 5G
- To understand Device to Device communication and standardization.
- To understand 5G Radio access techniques in.
- To understand interference and mobility management in 5G.

UNIT 1- INTRODUCTION TO 5G **9**

3G and 4G(LTE) overview- Introduction to 5G – Use Cases - Evolving LTE to 5G Capability-Pillars of 5G - 5G NR and 5G core network (5GCN) - 5G Standardization - 3GPP and IMT2020 - Spectrum for 5G – 5G deployment - Options, Challenges and Applications.

UNIT II- 5G CHANNEL MODELS AND MIMO SYSTEMS **9**

Modeling requirements and scenarios - Channel model requirements, Propagation scenarios, The 5G Architecture – IoT: relation to 5G. Millimeter Wave Communications: Spectrum and regulations, Channel propagations, Hardware technologies for mmW systems, Development scenario, Architecture and mobility , Beamforming, Physical layer techniques.

UNIT III- DEVICE TO DEVICE (D2D) COMMUNICATIONS **9**

D2D: from 4G to 5G, D2D standardization: 4G LTE D2D, D2D in 5G: research challenges, Radio resource management for mobile broadband D2D, RRM techniques for mobile broadband D2D, RRM and system design for D2D, 5G D2D RRM concept: an example, Multi-hop D2D communications for proximity and emergency, services, National security and public safety requirements in 3GPP and METIS, Device discovery without and with network assistance.

UNIT IV- RADIO ACCESS TECHNIQUES **9**

Access Design Principles for Multi-user Communications – Multi-carrier with Filtering – Non-orthogonal Schemes for Efficient Multiple Access – Radio Access for Dense Deployments – Radio Access for V2X Communication.

UNIT V- INTERFERENCE AND MOBILITY MANAGEMENT IN 5G **9**

Network deployment types, Ultra-dense network or densification, Moving networks, Heterogeneous networks, Interference management in 5G, Interference management in UDN, Interference management for moving relay nodes , Interference cancelation, mobility management in 5G, User equipment- controlled versus network-controlled handover, Mobility management in heterogeneous 5G networks

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand 4G-LTE and 5G cellular communication networks

CO2: Analyze use of MIMO in 5G and its techniques.

CO3: Apply 5G in device to device (D2D) communication and standardization.

CO4: Study the in-depth functioning of 5G radio access technologies.

CO5: Understand interference and mobility management in 5G.

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	0	3	0	1	0	0	0	0	3	3
CO2	3	3	3	1	2	1	0	0	0	0	3	3
CO3	3	3	2	1	3	1	0	0	0	0	3	3
CO4	3	3	2	1	3	1	0	0	0	0	3	3
CO5	3	3	2	1	1	3	1	0	0	0	3	3

TEXT BOOKS:

1. Asif Oseiran, Jose F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016. (UNIT I TO V)

REFERENCES:

1. Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley,2015.
2. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long Term Research",Wiley, 2018
3. 5G NR: The Next Generation Wireless Access Technology, Erik Dahlman, Stefan Parkvall, Johan Sköld, 2018, Academic Press, an imprint of Elsevier.

EC1807A	MEMS AND NEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of microsystems
- To know the design concepts of micro sensors and micro actuators
- To know the various RF MEMS components and Bio MEMS.
- To introduce the concepts of quantum, mechanics and nano systems

UNIT I - INTRODUCTION OF MEMS AND NEMS **9**

Introduction to design of MEMS and NEMS, Overview of Nano and Micro electro mechanical Systems, Applications of Micro and Nano electromechanical Systems, Materials for MEMS and NEMS: Silicon, Silicon compounds, polymers, metals.

UNIT II - MEMS FABRICATION TECHNOLOGIES **9**

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Thin film depositions: LPCVD, Sputtering, Evaporation, electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging Materials.

UNIT III - MICRO SENSORS & ACTUATORS **9**

Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor. Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Case study: RF switch.

UNIT IV - RF AND BIO MEMS **9**

Introduction to RF MEMS technologies: Need for RF MEMS components in communications, space and defence applications, Materials and fabrication technologies, Special considerations in RF MEMS design. Case studies: Micro-switches BioMEMS- Drug delivery, Electronic nose, Bio chip.

UNIT V - NANO DEVICES AND QUANTUM MECHANICS **9**

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Interpret the basics of micro/nano electromechanical systems including their applications and advantages

CO2: Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining.

CO3: Analyze the key performance aspects of electromechanical transducers including sensors and actuators.

CO4: Explore the fundamental working principle of bio-molecule sensing/sensors, and applying this knowledge to design solutions to probe biomedical and biology systems.
CO5: Comprehend the theoretical foundations of quantum mechanics and nano systems.

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	1	2	2	1	0	0	0	2
CO2	3	3	3	2	1	2	2	1	0	0	0	2
CO3	3	3	3	2	1	2	2	1	0	0	0	2
CO4	3	3	3	2	1	2	2	1	0	0	0	2
CO5	3	3	3	2	1	2	2	1	0	0	0	2

TEXT BOOKS:

1. Marc J Madou ‘Fundamentals of Micro Fabrication’, CRC Press, 2011.(Unit I & II)
2. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim, ‘Micro Sensors, MEMS and Smart devices’, John Wiley & son LTD,2002.(Unit III , IV & V)

REFERENCES:

1. Tai Ran Hsu ,”MEMS and Microsystems Design and Manufacture” ,Tata McGraw Hill,2002.
2. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006
3. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures” CRC Press, 2002.
4. A.M. Dirac," Principles of Quantum Mechanics", Oxford University Press, Oxford, 1978
5. Stephen D.Senturia ‘Microsystem Design’ Springer International Edition,2010.
6. Steeve P Beeby, G Ensel,’MEMS Mechanical Sensors’ Architect House.2004.

EC1808A NETWORK ROUTING ALGORITHM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To educate the students with the layered structure of communication networks and the unique features of the network layer.
- To be able to understand and customize Internet routing algorithms on routers.
- To modify mobile networking algorithm to satisfy the evolving demands in the mobile network.
- To enable the student for implementing Wireless Standards in network routing
- To educate the students about routing in Internet-based mobile ad-hoc networking Systems.

UNIT-I INTRODUCTION TO INTERNETWORKING **9**

Overview of Internetworking--LAN, MAN, WAN, TCP/IP Layer Architecture-Functions of network layer- Internet-Addressing-IP Addressing-Functions of Router-Protocol Stack Architecture-Network Topology and Management architectures, PSTN, Network Protocol Analyzer.

UNIT -II IP NETWORK ROUTING **9**

IP Routing – Static routes-RIPv1-RIPv2-IGRP-EIGRP, OSPF and integrated IS-IS, BGP- Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT-III MOBILE - IP NETWORKS **9**

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based: Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII), IoT: CoAP

UNIT-IV NEXT GENERATION ROUTING **9**

Quality of Service Routing-Adapting Shortest Path and Widest Path Routing-Update Frequency, Information Accuracy and Impact on Routing-Framework for Source-Based QoS Routing with Path Caching, Multiprotocol Label Switching, Generalized MPLS-MPLS VPN, VOIP Routing – PSTN Call routing using internet-PSTN Call Routing-IP-PSTN Internetworking for VOIP

UNIT-V MOBILE AD –HOC NETWORKS **9**

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the fundamentals of various network architecture for routing in internetworks.

CO2 :Design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.

CO3 :Modify mobile networking algorithm to satisfy the evolving demands in the mobile network.

CO4 : Acquire knowledge about the Wireless Standards

CO5 : Identify a suitable routing algorithm for Mobile adhoc networks

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	1	3	0	0	0	3	3	3	3
CO2	3	3	1	1	3	0	0	0	3	3	3	3
CO3	3	3	1	1	3	0	0	0	3	3	3	3
CO4	3	3	1	1	3	0	0	0	3	3	3	3
CO5	3	3	1	1	3	0	0	0	3	3	3	3

TEXT BOOKS:

1. D.Medhi and K.Ramasamy, Network Routing : Algorithms, Protocols and Architectures, Morgan Kaufmann Publishers, First Edition 2007. (Unit I, II & III)
2. Steen Strub M, Routing in Communication networks, Prentice Hall International, 1995
3.Steve Rackley, Wireless Networking Technology,Elsevier,2007 (Unit IV & Unit V)

REFERENCES:

1. William Stallings, ' High speed networks and Internets Performance and Quality of Service', IInd Edition, Pearson Education Asia. Reprint India 2002
2. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001

3. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, " A Survey of mobility Management in Next generation All IP-Based Wireless Systems", IEEE Wireless Communications Aug. 2004, pp 16-27.
4. A.T Campbell et al., "Comparison of IP Micromobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82.
5. C.Siva Rama Murthy and Mohan Gurusamy, " WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi –2002.

EC1809A	WDM AND PHOTONIC NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn about WDM technology and issues in Optical networks
- To understand and design virtual topology
- To understand Wavelength Routing Algorithms and Wavelength –Convertible Networks
- To learn about Photonics Integrated Circuits
- To understand Photonic Signal Processing

UNIT I -WDM TECHNOLOGY AND ISSUES IN WDM OPTICAL NETWORKS **9**

Introduction, optical networks, wavelength Division Multiplexing, WDM optical network architectures-Broadcast and select Networks, Wavelength Routed Networks, Linear Light wave Networks, Issues in Wavelength Routed Networks-Routing and Wavelength Assignment, Wavelength Convertible Networks, Multi fiber Networks, Wavelength Rerouting

UNIT II - VIRTUAL TOPOLOGY DESIGN **9**

Introduction, Virtual topology design problem-physical and virtual topology, Traffic Routing over Virtual Topology, Limitations on Virtual Topology, Virtual topology Design sub problems, Virtual topology Design Heuristics, Regular virtual topology Design-Single-Hop Traffic Maximization Heuristic, Propagation delay Minimization Heuristic, Simulated Annealing based Heuristic, Need for Virtual Topology Reconfiguration, Reconfiguration due to traffic changes, Reconfiguration for fault Restoration.

UNIT III-WAVELENGTH ROUTING ALGORITHMS AND WAVELENGTH –CONVERTIBLE NETWORKS **9**

Introduction, Classification of RWA Algorithm-Route selection Algorithm, Wavelength selection algorithm, RWA Algorithm, Fairness and Admission Control, Distributed Control protocol, Need for Wavelength Converters, Wavelength –convertible Switch Architectures, Routing in Convertible Networks, Performance Evaluation of Convertible Networks

UNIT IV-PHOTONICS INTEGRATED CIRCUITS – MATERIALS AND COMPONENTS **9**

Integrated Optics - Integrated Optical Circuits, the Rise of Si and Si-Based Systems, Materials for PICs, SiO_2-Based Materials, Single-Crystal $LiNbO_3$, GaAs/AlGaAs or InP/InGaAsP, Materials Properties of SOI, Optical Couplers, Two-Waveguide Directional Coupler, Integrated Optical Switches, The $\Delta\beta$ Directional Coupler Switch, Reversed $\Delta\beta$ Switch, Modal Interference Switches, Thermo-Optical Switches.

UNIT V-PHOTONIC SIGNAL PROCESSING **9**

Introduction - Incoherent Photonic Signal Processing, Coherent Integrated-Optic Signal Processing, Signal-Flow Graph Approach and Photonic Circuits - Signal-Flow graph theory, Rules of SFG, Derivation of the transfer Functions of the incoherent RFOSP, incoherent fiber-optic systolic array processors (FOSAPs), Elemental Optical signal processors - Optical splitter and combiner, Binary programmable incoherent fiber-optic transversal filter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand about WDM technology and issues in Optical networks

CO2 : Understand the concepts of virtual topology design

CO3: Understand about Wavelength Routing Algorithms and Wavelength –Convertible Networks

CO4: Gain knowledge about Photonics Integrated Circuits

CO5: Understand about Photonic Signal Processing

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	1	2	1	2	1	0	0	0	1
CO2	2	2	2	1	2	1	2	1	0	0	0	1
CO3	2	2	2	1	2	1	2	1	0	0	0	1
CO4	2	2	3	2	3	1	2	1	0	0	0	2
CO5	2	2	3	2	3	1	2	1	0	0	0	2

TEXT BOOKS:

1. WDM Optical Networks –Concepts, Design and Algorithm "C.Siva Ram Murthy and Mohan Gurusamy", 2002 (Unit I,II,III)
2. "Principles of Photonic Integrated Circuits - Materials, Device Physics, Guided Wave Design", Richard Osgood Jr. Xiang Meng,, Springer Nature Switzerland,2021 (Unit IV)
3. "Photonic Signal Processing", Second Edition, Le Nguyen Bin, CRC Press, Taylor & Francis Group, 2019 (Unit V)

REFERENCES:

1. Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006

2. Rajiv Ramaswami and Kumar N. Sivarajan,"Optical Networks: A Practical Perspective",Harcourt Asia Pvt Ltd., 3rd Edition, 2004.

EC1810A	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts about IPR
- To understand the registrations of IPR
- Analyze the agreements and legislations of IPRs
- Understand the applications of digital products
- Understand the basics of enforcements of IPRs

UNIT I-INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR

UNIT II - REGISTRATION OF IPRs **10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III - AGREEMENTS AND LEGISLATIONS **10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV - DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V- ENFORCEMENT OF IPRs **7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyse the introduction of IPR

CO2: Understand the registration of IPR

CO3:Analyze the agreements and legislations of IPR

CO4: Understand the applications of digital products

CO5: Understand the enforcements of IPR

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	2	1	0	2	2	0	0	2
CO2	3	3	3	3	2	1	0	2	2	0	0	2
CO3	3	3	3	3	2	1	0	2	2	0	0	2
CO4	3	3	2	3	3	0	0	2	2	0	0	2
CO5	3	3	3	3	3	1	0	2	2	0	0	2

TEXT BOOKS:

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012 (UNIT I &III)
2. S. V. Satakar, -Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.(UNIT II,IV & V)

REFERENCES:

1. Deborah E. Bouchoux, -Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.