P. A. COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai)
An ISO 9001:2015 Certified Institution - Accredited by NBA and NAAC with 'A' Grade
Pollachi – 642 002

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULA & SYLLABI

(I to VIII Semester)

REGULATIONS

2019

Vision and Mission of the Institute and Department

Vision of the Institute

To progress to become a center of excellence in Engineering and Technology through creative and innovative practices in teaching-learning process and promoting research and development to produce globally competitive and employable professionals who are psychologically strong and emotionally balanced with social perception and professional ethics.

Mission of the Institute

To offer academic programmes, in the emerging areas of Engineering and Technology, provide training and research facilities and opportunities to promote student and faculty research in collaboration with Industry and Government for sustainable growth.

Vision of the Department

To enrich the students, technical knowledge and practical skills in the field of Electronics and Communication Engineering and to nurture highly emulous communication engineers with the power to facilitate the society.

Mission of the Department

To provide quality education and promote research in the field of Electronics and Communication Engineering and thereby rendering continuous service to the society by imbibing leadership skills and moral values in the students.

Program Educational Objectives (PEO)

The objectives of the programme are to provide the following to the students:

PEO 1: To nourish the students with fundamentals of engineering and technology by excelling in the field of Electronics and Communication to envisage the emerging industrial needs and professional competence.

PEO 2: To impart skill based training program to design, analyze and create innovative solutions for technical challenges.

PEO 3: To instill strong zeal and elegant personality by imbibing ethical principles and modeling the prosocial behavior to inculcate values among future generation.

Program Specific Outcomes (PSO):

The following outcomes of the programme are provided to the students:

PSO 1: Ability to exploit the acquired knowledge of basic skills, mathematical concepts and electronic principles for the design of electronic and communication systems.

PSO 2: Be acquainted with the continuous learning in the field of Embedded systems, VLSI design, Communication and Signal Processing and hold expertise in the modern tools for quenching the techno-thirsty society.

PSO 3: Incorporate the socio-responsible electronics and communication engineer with leadership, teamwork skills and exhibit a commitment to the lifelong learning.

Program Outcomes (POs):

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.

SEMESTER I

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
		Induction Programme	0	0	0	0
THEORY						
1	19CAHS001	Communicative English	3	0	0	3
2	19CABS001	Engineering Mathematics - I	3	1	0	4
3	19CABS003	Engineering Physics	3	0	0	3
4	19CAES003	Programming for Problem Solving	3	0	0	3
PRACTICAL						
5	19CABS004	Physics Laboratory	0	0	3	1.5
6	19CAES005	Workshop Practice	0	0	4	2
7	19CAES006	Programming in C Laboratory	0	0	3	1.5
		Total	**12**	**1**	**10**	**18**

SEMESTER II

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CABS006	Engineering Chemistry	3	0	0	3
2	19CABS007	Engineering Mathematics - II	3	1	0	4
3	19ECES203	Principles of Electrical Engineering	3	0	0	3
4	19CAES007	Engineering Graphics	2	0	4	4
5	19CAPC001	Electric Circuit Analysis	3	1	0	4
PRACTICAL						
6	19CABS005	Chemistry Laboratory	0	0	3	1.5
7	19ECES207	Electrical Engineering Laboratory	0	0	3	1.5
		Total	**14**	**2**	**10**	**21**

SEMESTER III

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CABS008	Transforms and Partial Differential Equations	3	0	0	3
2	19ECES302	Data Structures and Algorithms	3	0	0	3
3	19ECPC303	Electronic Devices and Circuits	3	0	0	3
4	19ECPC304	Signals and Systems	3	0	0	3
5	19ECPC305	Digital System Design	3	0	0	3
6	19CAHS002	Environmental Science and Engineering	3	0	0	3
PRACTICAL						
7	19ECPC307	Electronics Devices and Circuits Laboratory	0	0	3	1.5
8	19ECPC308	Digital System Design Laboratory	0	0	3	1.5
		Total	**18**	**0**	**6**	**21**

SEMESTER IV

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19ECBS401	Probability and Random Processes	3	0	0	3
2	19ECPC402	Electromagnetic Fields	3	0	0	3
3	19ECPC403	Analog Circuits	3	0	0	3
4	19ECPC404	Linear Integrated Circuits	3	0	0	3
5	19ECPC405	Microprocessors and Microcontrollers	3	0	0	3
6	19ECES406	Control Systems	3	0	0	3
PRACTICAL						
7	19ECPC407	Analog Circuits and IC Laboratory	0	0	3	1.5
8	19ECPC408	Microprocessors and Microcontrollers Laboratory	0	0	3	1.5
		Total	**18**	**0**	**6**	**21**

SEMESTER V

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19ECPC501	Digital Signal Processing	3	0	0	3
2	19ECPC502	Computer System Architecture and Organization	3	0	0	3
3	19ECPC503	VLSI Design	3	0	0	3
4	19ECPC504	Analog Communication	3	0	0	3
5	19ECPE5XX	Professional Elective – I	3	0	0	3
6		Open Elective – I	3	0	0	3
7	19CAMC001	Constitution of India	3	0	0	–
PRACTICAL						
8	19ECPC506	Digital Signal Processing Laboratory	0	0	3	1.5
9	19ECEE507	VLSI Design Laboratory	0	0	3	1.5
		Total	**21**	**0**	**6**	**21**

SEMESTER VI

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19ECPC601	Transmission Lines and Antennas	3	0	0	3
2	19ECPC602	Digital Communication	3	0	0	3
3	19ECPC603	Computer Networks	3	0	0	3
4	19ECPE6XX	Professional Elective – II	3	0	0	3
5		Open Elective – II	3	0	0	3
6	19ECMC604	Management Theory and Youth Empowerment	3	0	0	-
PRACTICAL						
7	19ECPC605	Computer Networks Laboratory	0	0	3	1.5
8	19ECPC606	Analog and Digital Communication Laboratory	0	0	3	1.5
9	19CAHS003	Communication Skills Laboratory	0	0	2	1
		Total	**18**	**0**	**8**	**19**

SEMESTER – VII

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19ECPC701	RF and Microwave Engineering	3	0	0	3
2	19ECPC702	Embedded and Real Time Systems	3	0	0	3
3	19ECPE7XX	Professional Elective – III	3	0	0	3
4	19ECPE7XX	Professional Elective – IV	3	0	0	3
5		Open Elective – III	3	0	0	3
6	19CAHS004	Professional Ethics in Engineering	3	0	0	3
PRACTICAL						
7	19ECPC704	RF and Microwave Laboratory	0	0	3	1.5
8	19ECEE705	Embedded Systems Laboratory	0	0	3	1.5
9	19CAEE001	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3
		Total	**18**	**0**	**12**	**24**

SEMESTER – VIII

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19ECPE8XX	Professional Elective – V	3	0	0	3
2	19ECPE8XX	Professional Elective – VI	3	0	0	3
3		Open Elective– IV	3	0	0	3
PRACTICAL						
4	19ECEE801	Project Work	0	0	16	8
		Total	**9**	**0**	**16**	**17**

Total Credits: 161
Total Credits: 122 (III – VIII Semesters)

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

Sl.No.	Course Code	Course Title	L	T	P	C
1.	19CAHS001	Communicative English	3	0	0	3
2.	19CAHS002	Environmental Science and Engineering	3	0	0	3
3.	19CAHS003	Communication Skills Laboratory	0	0	2	1
4.	19CAHS004	Professional Ethics in Engineering	3	0	0	3

BASIC SCIENCES (BS)

Sl.No.	Course Code	Course Title	L	T	P	C
1.	19CABS001	Engineering Mathematics – I	3	1	0	4
2.	19CABS003	Engineering Physics	3	0	0	3
3.	19CABS004	Physics Laboratory	0	0	3	1.5
4.	19CABS006	Engineering Chemistry	3	0	0	3
5.	19CABS007	Engineering Mathematics – II	3	1	0	4
6.	19CABS005	Chemistry Laboratory	0	0	3	1.5
7.	19CABS008	Transforms and Partial Differential Equations	3	0	0	3
8.	19ECBS401	Probability and Random Processes	3	0	0	3

ENGINEERING SCIENCES (ES)

Sl.No.	Course Code	Course Title	L	T	P	C
1.	19CAES003	Programming for Problem Solving	3	0	0	3
2.	19CAES005	Workshop Practice	0	0	4	2
3.	19CAES006	Programming in C Laboratory	0	0	3	1.5
4.	19ECES203	Principles of Electrical Engineering	3	0	0	3

5.	19CAES007	Engineering Graphics	2	0	4	4
6.	19ECES207	Electrical Engineering Laboratory	0	0	3	1.5
7.	19ECES302	Data Structures and Algorithms	3	0	0	3
8.	19ECES406	Control Systems	3	0	0	3

PROFESSIONAL CORE (PC)

Sl.No.	Course Code	Course Title	L	T	P	C
1.	19CAPC001	Electric Circuit Analysis	3	1	0	4
2.	19ECPC303	Electronic Devices and Circuits	3	0	0	3
3.	19ECPC304	Signals and Systems	3	0	0	3
4.	19ECPC305	Digital System Design	3	0	0	3
5.	19ECPC307	Electronics Devices and Circuits Laboratory	0	0	3	1.5
6.	19ECPC308	Digital System Design Laboratory	0	0	3	1.5
7.	19ECPC402	Electromagnetic Fields	3	0	0	3
8.	19ECPC403	Analog Circuits	3	0	0	3
9.	19ECPC404	Linear Integrated Circuits	3	0	0	3
10.	19ECPC405	Microprocessors and Microcontrollers	3	0	0	3
11.	19ECPC407	Analog Circuits and IC Laboratory	0	0	3	1.5
12.	19ECPC408	Microprocessors and Microcontrollers Laboratory	0	0	3	1.5
13.	19ECPC501	Digital Signal Processing	3	0	0	3
14.	19ECPC502	Computer System Architecture and Organization	3	0	0	3
15.	19ECPC503	VLSI Design	3	0	0	3
16.	19ECPC504	Analog Communication	3	0	0	3
17.	19ECPC506	Digital Signal Processing Laboratory	0	0	3	1.5
18.	19ECPC601	Transmission Lines and Antennas	3	0	0	3
19.	19ECPC602	Digital Communication	3	0	0	3

20.	19ECPC603	Computer Networks	3	0	0	3
21.	19ECPC605	Computer Networks Laboratory	0	0	3	1.5
22.	19ECPC606	Analog and Digital Communication Laboratory	0	0	3	1.5
23.	19ECPC701	RF and Microwave Engineering	3	0	0	3
24.	19ECPC702	Embedded and Real Time Systems	3	0	0	3
25.	19ECPC704	RF and Microwave Laboratory	0	0	3	1.5

PROFESSIONAL ELECTIVES (PE) – I (SEMESTER V)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19ECPE501	Information Theory and Coding	3	0	0	3
2.	19ECPE502	Speech and Audio Processing	3	0	0	3
3.	19ECPE503	Measurements and Instrumentation	3	0	0	3
4.	19ECPE504	Bio– Medical Electronics	3	0	0	3
5.	19ECPE505	Consumer Electronics	3	0	0	3
6.	19ECPE506	Virtual Reality	3	0	0	3
7.	19ECPE507	Operating Systems	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – II (SEMESTER VI)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19ECPE601	Nanoelectronics	3	0	0	3
2.	19ECPE602	DSP Processors	3	0	0	3
3.	19ECPE603	Artificial Intelligence and Machine Learning	3	0	0	3
4.	19ECPE604	MEMS and NEMS	3	0	0	3
5.	19ECPE605	Low Power VLSI Design	3	0	0	3
6.	19ECPE606	High Speed Electronics	3	0	0	3
7.	19ECPE607	Power Electronics	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – III
(SEMESTER VII)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19ECPE701	CAD for VLSI Circuits	3	0	0	3
2.	19ECPE702	Fiber Optic Communication	3	0	0	3
3.	19ECPE703	Advanced Digital Signal Processing	3	0	0	3
4.	19ECPE704	Satellite Communication	3	0	0	3
5.	19ECPE705	Digital Image Processing	3	0	0	3
6.	19ECPE706	Green Communication	3	0	0	3
7.	19ECPE707	Electronics Packaging and Testing	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – IV
(SEMESTER VII)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19CAHS005	Total Quality Management	3	0	0	3
2.	19ECPE709	Opto Electronic Devices	3	0	0	3
3.	19CAPE001	Soft Computing	3	0	0	3
4.	19ECPE711	ASIC Design	3	0	0	3
5.	19ECPE712	Data Analytics	3	0	0	3
6.	19ECPE713	Photonic Networks	3	0	0	3
7.	19ECPE714	Compressive Sensing	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – V
(SEMESTER VIII)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19ECPE801	Mixed Signal Design	3	0	0	3
2.	19ECPE802	Electromagnetic Interference and Electromagnetic Compatibility (EMI & EMC)	3	0	0	3
3.	19ECPE803	Testing of VLSI Circuits	3	0	0	3
4.	19ECPE804	Wireless Communication	3	0	0	3

5.	19ECPE805	Real Time Operating Systems	3	0	0	3
6.	19ECPE806	Video Analytics	3	0	0	3
7.	19ECPE807	Fundamentals of Nanoscience	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – VI (SEMESTER VIII)

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19ECPE808	Cryptography and Forensics	3	0	0	3
2.	19ECPE809	Cognitive Radio	3	0	0	3
3.	19ECPE810	Blockchain Technology	3	0	0	3
4.	19ECPE811	Wireless Networks	3	0	0	3
5.	19ECPE812	VLSI Signal Processing	3	0	0	3
6.	19CAPE002	Intellectual Property Rights	3	0	0	3
7.	19ECPE814	Principles of Medical Imaging	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EE) – PRACTICAL COURSES AND PROJECT WORK

Sl. No.	Course Code	Course Title	L	T	P	C
1.	19ECEE507	VLSI Design Laboratory	0	0	3	1.5
2.	19ECEE705	Embedded Systems Laboratory	0	0	3	1.5
3.	19CAEE001	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3
4.	19ECEE801	Project Work	0	0	16	8

LIST OF OPEN ELECTIVES(OE)

Sl. No.	COURSE CODE	COURSE TITLE	Hours/Week			
			L	T	P	C
1.	19CEOE01	Geographical Information System	3	0	0	3
2.	19CEOE02	Green Buildings	3	0	0	3
3.	19CEOE03	Planning of Smart Cities	3	0	0	3
4.	19CEOE04	Vastu Science for Building Construction	3	0	0	3

5.	19CEOE05	Disaster Management and Mitigation	3	0	0	3
6.	19CSOE06	Open Source Technologies	3	0	0	3
7.	19CSOE07	Ethical Hacking	3	0	0	3
8.	19CSOE08	Internet of Things	3	0	0	3
9.	19CSOE09	Software Testing	3	0	0	3
10.	19CSOE10	User Interface Design	3	0	0	3
11.	19ECOE11	Automotive Electronics	3	0	0	3
12.	19ECOE12	Hardware Descriptive Language	3	0	0	3
13.	19ECOE13	Embedded System Design using ARM Processor	3	0	0	3
14.	19ECOE14	Bio - Inspired Computing Technologies	3	0	0	3
15.	19ECOE15	Vehicular Communication and Networking Technology	3	0	0	3
16	19EEOE16	Energy Efficient Lighting System	3	0	0	3
17	19EEOE17	Sensors and Transducers	3	0	0	3
18	19EEOE18	Electrical Safety	3	0	0	3
19	19EEOE19	Electric Vehicles	3	0	0	3
20	19EEOE20	SCADA System and Application Management	3	0	0	3
21	19MEOE21	Testing of Materials	3	0	0	3
22	19MEOE22	Robotics	3	0	0	3
23	19MEOE23	Industrial Engineering	3	0	0	3
24	19MEOE24	Marketing Management	3	0	0	3
25	19MEOE25	Energy Conservation and Management	3	0	0	3

MANDATORY COURSES (MC)

Sl.No.	Course Code	Course Title	L	T	P	C
1.	19ECMCx0x	Induction Program	0	0	0	0
2.	19CAMC001	Constitution of India	3	0	0	0

3.	19ECMC604	Management Theory and Youth Empowerment	3	0	0	0

VALUE ADDED COURSES (VAC)

Sl.No.	Course Code	Course Title	Credit
1.	19ECVAC01	Embedded System Design using MSP430 and TIVA C Series	1
2.	19ECVAC02	Introduction to Cadence Design Tool	1
3.	19ECVAC03	Signal and Image Processing using Raspberry Pi	1
4.	19ECVAC04	Mobile Phone Servicing	1
5.	19ECVAC05	Embedded System Design using PIC Microcontroller	1
6.	19ECVAC06	Programming using Arduino	1
7	19ECVAC07	PCB Designing & Fabrication	1
8.	19EEVAX08	Online Course (NPTEL)	1

CREDIT SUMMARY

Sl. No.	Subject Area	Credits per Semester								Total Credits	AICTE Suggested Credits
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	3		3			1	3		10	12
2	**BS**	8.5	8.5	3	3					23	25
3	**ES**	6.5	8.5	3	3					21	24
4	**PC**		4	12	15	13.5	12	7.5		64	48
5	**PE**					3	3	6	6	18	18
6	**OE**					3	3	3	3	12	18
7	**EE**					1.5		4.5	8	14	15
8	**MC**	0				0	0			–	0
	TOTAL	**18**	**21**	**21**	**21**	**21**	**19**	**24**	**17**	**162**	**160**

HS – Humanities and Social Sciences including Management
BS – Basic Sciences
ES – Engineering Sciences
PC – Professional Core
PE – Professional Electives
OE – Open Electives
EE – Employability Enhancement Courses
MC – Mandatory Courses

INDUCTION PROGRAMME

SEMESTER I

(Common to all branches)

Number of Days **21 Days**

Activities:

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

19CAHS001 COMMUNICATIVE ENGLISH SEMESTER I

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make learners acquire listening skills with correct pronunciation, stress and Intonation.
- To emphasize the development of speaking skills amongst the learners of Engineering.
- To inculcate the habit of reading for effective and efficient communication.
- To equip the learners with writing skills needed for academic as well as work place
- contexts.
- To enable learners to fine-tune their linguistic skills with appropriate grammatical usage.

UNIT-I: LISTENING 9

Listening Comprehension, Pronunciation, Intonation, Stress, Pause, Rhythm, Listening to Short & Long Conversations/Monologues- Note -Taking.

UNIT-II: SPEAKING 9

Self Introduction, Making Oral & Formal Presentation, Communication at Work Place, Mock Interviews, Role Play Activities, Group Discussions, Debates, Delivering Welcome Address, Proposing Vote of Thanks, Introducing the Chief Guest at a function.

UNIT-III: READING 9

Reading Comprehension, Speed Reading, Interpreting Visual Materials (Signs, Post Cards, Pictures, and Labels Etc), Reading for Specific Information, Reading to identify Stylistic Features (Syntax, Lexis and Sentence Structures), Cloze Test.

UNIT-IV: WRITING 9

Phrase, Clause and Sentence Structures, Punctuation, Discourse Markers, Coherence, Precision in Writing, Graph & Process Description, Definition, Writing E-mail, Paraphrasing, Note-making, Job Application with Resume, Writing Review of a Book/Movie, Creative Writing.

UNIT-V: GRAMMAR AND VOCABULARY 9

Word Formation with Prefix and Suffix, Synonyms and Antonyms, Tenses, Parts of Speech, Common Errors in English (Subject-Verb Agreement, Noun-Pronoun Agreement, Prepositions, Articles, Conditional statements, Redundancies, Clichés etc), Voices.

Contact periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Board of Editors, Using English, Orient Black Swan, 2015.
2. Practical English Usage, Michael Swan, OUP 1995.
3. Cambridge BEC Vantage Practice Tests, Self-study Edition, CUP, 2002.
4. Exercises in Spoken English. Parts 1-II, EFLC, Hyderabad, OUP, 2014.
5. Indlish. JyothiSanyal, Viva Books, 2006.
6. Communicative English. J. Anbazhagan Vijay, Global Publishers, Chennai 2018.

WEB REFERENCES:

1. www.cambridgeenglish.org/exams/
2. www.examenglish.com/BEC/BEC_Vantage.html
3. www.splendid-speaking.com/exams/bec_ speaking.html

COURSE OUTCOMES:

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

CO1: Listen and comprehend the contexts delivered in English.

CO2: Speak clearly, confidently, comprehensively and communicate with one or many listeners using appropriate communicative strategies.

CO3: Read different genres of texts adopting various reading strategies.

CO4: Write effectively and persuasively to enhance students' employability.

CO5: Communicate cohesively, coherently and flawlessly avoiding grammatical errors and using a wide vocabulary range in speaking and writing contexts.

19CABS001 **ENGINEERING MATHEMATICS - I** **SEMESTER I**

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To be familiarize with differentiation of single variable and its applications.
- To acquire knowledge of differentiation for more than one variable and its applications.
- To obtain the knowledge of definite and improper integration.
- To acquire the knowledge of multiple integration and related applications.
- To gain methods to solve differential equations with constant and variable coefficients.

UNIT-I: DIFFERENTIAL CALCULUS **9+3**

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

UNIT -II: FUNCTIONS OF SEVERAL VARIABLES **9+3**

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-III: INTEGRAL CALCULUS **9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT-IV: MULTIPLE INTEGRALS **9+3**

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

UNIT-V: DIFFERENTIAL EQUATIONS **9+3**

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.

Contact periods:
Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

REFERENCES:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publisher, 43rd Edition, 2010.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
3. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
4. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
5. Narayanan, S. and ManicavachagomPillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
6. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.

COURSE OUTCOMES:

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

CO1: Understand the limit definition and rules of differentiation to differentiate functions.
CO2: Apply differentiation to solve maxima and minima problems.
CO3: Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
CO4: Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
CO5: Apply various techniques in solving differential equations.

19CABS003 ENGINEERING PHYSICS SEMESTER I

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge on Wave optics phenomenon, Huygens' Principle and Interference of light.
- To understand the basic principles in lasers, characteristics, types of lasers and its applications.
- To accustom the student about origin of quantum physics, Schrodinger's equation and its applications.
- To know about free electron theory, density of states in metals, Intrinsic and Extrinsic properties.
- To acquaint the student with the concepts of Fiber optic principles and its applications.

UNIT-I: WAVE OPTICS 9

Huygens' Principle - superposition of waves and interference of light - Air wedge - Theory - Applications - Testing of flat surfaces - Thickness of a thin sheet of paper - Michelson interferometer - Theory - Applications - Determination of wavelength of monochromatic light.

UNIT-II: LASER OPTICS 9

Einstein's theory of matter - radiation interaction and A and B coefficients - amplification of light by population inversion - different types of lasers - gas laser - $C0_2$ - solid state laser - Neodymium Nd -YAG laser - dye laser - properties of laser beams - monochromaticity - coherence - directionality and brightness - Applications of lasers in cutting, welding and materials processing.

UNIT-III: INTRODUCTION TO QUANTUM MECHANICS 9

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation - Properties of matter waves - de Broglie wavelength in terms of voltage, energy, and temperature - Heisenberg's Uncertainty principle - verification - physical significance of wave function - Schrodinger's Time independent and Time dependent wave equations - Particle in a one dimensional potential well.

UNIT-IV: INTRODUCTION TO SOLIDS AND SEMICONDUCTORS 9

Quantum theory - Fermi distribution function - effect of temperature - density of energy states in metals - Semiconductors - Properties - elemental and compound semiconductors - Intrinsic and extrinsic semiconductors - properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature - extrinsic semiconductors - Carrier concentration in P type and N type semiconductors - variation of Fermi level with temperature and impurity concentration.

UNIT-V: FIBER OPTICS 9

Introduction - Basic Principles involved in fiber optics - Total internal reflection - Structure of optical fiber - Propagation of light through optical fiber - Derivation for Numerical Aperture and acceptance angle - fractional index change - Classification of optical fiber

based on materials, refractive index profile and Modes - Fiber optical communication links - Fiber optic sensors - Temperature and displacement.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Avadhanulu M. N. and Kshirsagar P. G, "A Textbook of Engineering Physics", S.Chand and Company Ltd, New Delhi, 2010.
2. Hecht E, "Optics", McGraw Hill Education, 2012.
3. Griffiths D.J, "Quantum mechanics", Pearson Education, 2014.
4. Neamen, D.A. "Semiconductor Physics and Devices, Times Mirror High Education Group Chicago, 1997.
5. Pain H.J, "The physics of vibrations and waves", Wiley, 2006.
6. Svelto O, "Principles of Lasers", Springer Science & Business Media, 2010.

COURSE OUTCOMES:

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

CO1: Understand waves and optics phenomena, and their applications.

CO2: Analyze the construction and working of gas lasers and solid-state lasers.

CO3: Be familiar with the dual nature of matter using de-Broglie matter wave, Heisenberg‘s uncertainty principle, Schrodinger’s time independent and dependent wave equations.

CO4: Know about the properties of conducting and semiconducting materials and devices.

CO5: Gain knowledge about fiber optics and classify fibers based on index profiles and modes.

19CAES003 PROGRAMMING FOR PROBLEM SOLVING SEMESTER I

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, pointers, structures and union.
- To perform file handling operations in C.
- To learn dynamically allocated memory techniques and file operations in C.

UNIT-I: BASICS OF PROGRAMMING 11

Generation and Organization of Computers – Number System – Binary – Decimal – Conversion - Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart. Introduction to programming paradigms: Structure of C program – Data Types – Constants – Enumeration Constants – Keywords – Operators and Expressions – Input / Output statements.

UNIT-II: ARRAYS AND STRINGS 9

Decision making statements – Switch statement – Looping statements – Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays – String : String operations – String Arrays – Simple programs : Sorting – Searching – Matrix operations.

UNIT-III: FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function definition, function declaration, function call, Built-in functions (string functions, math functions) – Recursion – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

UNIT-IV: STRUCTURES AND UNION 9

Structure – Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Self referential structures Union – Programs using structures and Unions – Enumeration types – Bit fields – typedefs – Dynamic memory allocation – Storage classes.

UNIT-V: FILE PROCESSING 7

Files: File opening modes – Types of file processing: Sequential access, Random access – Preprocessor directives – Command line arguments.

Contact Periods

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. ReemaTheraja "Fundamentals of Computing and Programming in C", Second Edition, Oxford University Press, 2016
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 15th revised edition, 2016.
4. Dawn Griffiths, David Griffiths, "Head First C", O'Reilly Publishers, 2012.
5. Paul J. Deitel and Harvey Deitel, "C How to Program", 7th edition, Pearson Education, 2013.

COURSE OUTCOMES:

Upon completion of this 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 and union.
CO5: Design applications using sequential and random-access file processing.

19CABS004 PHYSICS LABORATORY SEMESTER I

L T P C
0 0 3 1.5

COURSE OBJECTIVES:

- To understand the physical and thermal properties of matter.
- To calibrate the electrical devices, Laser diffraction and parameters of optical fibers.
- To determine the compressibility of liquids and viscosity of liquids.
- To analyze the band gap energy of semiconductors and thickness of paper.
- To determine the spectral wavelength and dispersive power of prism.

LIST OF EXPERIMENTS

1. Young's Modulus - Cantilever Bending - Koenig's Method
2. Torsional pendulum - Determination of Rigidity Modulus & Moment of Inertia
3. Young's Modulus - Non Uniform bending Method
4. Lee's Disc method - Thermal conductivity of a bad conductor
5. Ammeter and Voltmeter Calibration - Low Range
6. a) Laser - Particle size Determination
   b) Optical fiber - Determination of NA & Acceptance angle
7. Ultrasonic Interferometer - Velocity of sound & Compressibility of liquids
8. Poiseuille's method - Determination of Coefficient of viscosity of a liquid
9. Determination of Bandgap Energy of Semiconductor
10. Air Wedge - Determination thickness of a paper
11. Spectrometer - Diffraction Grating - Normal Incidence Method
12. Spectrometer - Determination of Dispersive power of a prism

Contact periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Determine the physical and thermal properties of matter.

CO2: Calibrate electrical measuring instruments and thereby effectively using it for electronic application and understanding the principle of Laser diffraction and propagation through optical fibers and determine its parameters.

CO3: Understand the ultrasonic wave propagation in liquids and determine the viscosity liquids for engineering applications.

CO4: Determine the band gap energy of semiconductor materials and thickness of paper.

CO5: Identify the spectral wavelength and determine the dispersive power of prism.

19CAES005 WORKSHOP PRACTICE SEMESTER I

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To provide exposure to the students with hands on various basic engineering practices in Civil, Mechanical and Electrical Engineering.
- To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon and Cross-Lap joint.
- To make various Welding joints and sand mould preparation for various patterns.
- To prepare electrical wirings.
- To fabricate various parts like tray, frustum of cone and square box in sheet metal

LIST OF EXPERIMENTS

1. Introduction to use of tools and equipment's in Carpentry, Welding, Foundry and Sheet Metal
2. Safety aspects in Carpentry, Welding and Foundry
3. Half lap Joint and Dove tail Joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of Sand mould for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal
7. Electrical wiring - simple house wiring
8. Plumbing
9. CNC Machines demonstration and lecture on working principle.
10. Additive manufacturing demonstration and lecture on working principle.

Contact periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 60 Periods

COURSE OUTCOMES:
Upon on completion of the course, the student will be able to

CO1: Use a variety of the tools and equipment used in sheet metal, welding, foundries, and carpentry.

CO2: Fabricate basic carpentry prototypes such as the lap joint, lap tee joint, dovetail joint, mortise and Tenon, and cross-lap joint.

CO3: Prepare various Welding joints and sand moulds for various patterns.

CO4: Carry out basic home electrical works and appliances and pipe connections including plumbing woks.

CO5: Sheet metal fabrication of various parts such as tray, frustum of cone, and square box

19CAES006 PROGRAMMING IN C LABORATORY SEMESTER I

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions:
   i. 5 if it is a perfect cube.
   ii. 4 if it is a multiple of 4 and divisible by 6.
   iii. 3 if it is a prime number.

   Sort the numbers based on the weight in the increasing order as shown below
   <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height.
8. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
9. Given a string ―a$bcd./fg‖ find its reverse without changing the position of special characters.
   (Example input:a@gh%;j and output:j@hg%;a)
10. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
11. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.
12. Solve towers of Hanoi using recursion.
13. Sort the list of numbers using pass by reference.
14. Generate salary slip of employees using structures and pointers.
15. Compute internal marks of students for five different subjects using structures and functions.
16. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
17. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

18. **Mini project**

Create a ―Railway reservation system‖ with the following modules

- Booking
- Availability checking
- Cancellation
- Prepare chart

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Develop C programs for simple applications making use of basic constructs, arrays and strings.

CO2: Develop C programs involving functions, recursion, pointers, and structures.

CO3: Design applications using sequential and random access file processing.

19CABS006 ENGINEERING CHEMISTRY SEMESTER II

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the principles of electrochemical reactions, electrode potential and applications of EMF measurements.
- To accustom the student about the principles and generation of energy in different types of batteries.
- To obtain the knowledge on concepts of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- To acquaint the student with the concepts of important photo physical and photochemical processes and elemental analysis using spectroscopy.
- To develop the advanced engineering materials by using silicon wafer techniques.

UNIT-I: ELECTROCHEMICAL CELLS 9

Galvanic cells - redox reactions - electrodes metal and metal ion, hydrogen electrode and calomel electrode - electrode potentials-standard oxidation and reduction potentials - Nernst equation and problems - EMF series and significance - Application of EMF measurements - pH measurement using glass electrode and fluoride measurement by ISE.

UNIT-II: BATTERIES 9

Batteries - components, characteristics - voltage, current, current capacity, power density, energy density, cycle life, shelf life and self discharge. Types of batteries - Primary - Zn/MnO_2, Zn/HgO, Zn/Ag_2O, $Li/SOCl_2$, construction, function and performance comparison - Secondary lead acid, nickel cadmium and lithium ion battery - construction, function and performance comparison.

UNIT-III: CORROSION 9

Corrosion - spontaneity - chemical corrosion - mechanism, nature of oxides - Pilling - Bedworth rule - electrochemical corrosion - mechanism-galvanic series and importance - prevention methods - design of materials, cathodic protection techniques(sacrificial anode and impressed current cathode), inhibitors - Protective coatings - inorganic coating - electroplating - surface preparation and plating method applied to Cr and Ni and galvanizing - organic coating - paints - constituents and functions.

UNIT-IV: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS 9

Beer-Lambert's law - UV Visible spectroscopy and IR spectroscopy - principles - instrumentation (block diagram only) - Flame photometry-principles - instrumentation (block diagram only) - estimation of sodium by flame photometry - atomic absorption spectroscopy - principles instrumentation(block diagram only)-estimation of Ni by atomic absorption spectroscopy.

UNIT-V: SILICON WAFER TECHNOLOGY 9

Silicon for IC chips - single crystal - preparation by czechralsky and float zone processes - wafer preparation, P-N junction formation - ion implantation, diffusion and epitaxial growth techniques - insulator layer by oxidation - printing of circuits by photolithography - masking and electron beam methods - etching by chemical and electrochemical methods.

Contact periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Jain P.C. and Monica Jain, "Engineering Chemistry", DhanpatRai Publications Pvt. Ltd, New Delhi, 16" Edition, 2017.
2. Dara S.S, Umarae, "Text book of Engineering Chemistry", S. Chand Publications, 2004.
3. Agarwal, C.V, "Chemistry of Engineering Materials", 9th Edition, B.S. Publications, 2006.
4. Kuriakose J.C, and Rajaram J, "Chemistry in Engineering and Technology", vol.1 & I, Tata McGraw Hill Publishing company Pvt. Ltd, New Delhi, 2001.
5. Sharma Y.R,"Elementary Organic Spectroscopy", S. Chand Publications, 2013.
6. Tyagi M.S., "Introduction to semiconductor materials and devices", Wiley India 2012.

COURSE OUTCOMES:

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

CO1: Understand the principles of electrochemical cells, EMF measurements and electrode potentials which makes them to apply in experimental instrumentation techniques.

CO2: Know the knowledge about different types of batteries with their functions which is useful for various engineering fields.

CO3: Be familiar with corrosion of the instruments and equipments they use in their field and also to learn the mechanisms and the preventive measures by various techniques.

CO4: Know about the different types of spectroscopic techniques and applications.

CO5: Gain the knowledge about the silicon chips and their fabrication methods and to apply in preparation of electrical and electronics instruments.

19CABS007 ENGINEERING MATHEMATICS - II SEMESTER II

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To obtain the knowledge of Eigen values and diagonalization of a matrix.
- To gain the knowledge of vector differentiation, integration and related applications.
- To be known about analytic functions with properties, construction of analytic function and the knowledge of conformal transformation.
- To obtain the knowledge of Cauchy's integral theorem, calculus of residues and complex integration around unit circle and semicircle.
- To be familiar with techniques of Laplace and Inverse Laplace transformation.

UNIT-I: MATRICES 9+3

Eigen values and Eigenvectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigenvectors - Cayley-Hamilton theorem - Diagonalization of matrices -Reduction of a quadratic form to canonical form by orthogonal transformation -Nature of quadratic forms.

UNIT-II: VECTOR CALCULUS 9+3

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.

UNIT-III:ANALYTIC FUNCTIONS 9+3

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= z + c, cz ,$\frac{1}{z}$, z^2 - Bilinear transformation.

UNIT-IV: COMPLEX INTEGRATION 9+3

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-V: LAPLACE TRANSFORMS 9+3

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.

Contact periods:
Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.
2. Erwinkreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2016.
3. Bali N.P , Manish Goyal v and Watkins C., "Advanced Engineering Mathematics", Firewall Media, New Delhi, 7th Edition, 2009.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi , 3rd Edition, 2007.
5. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
6. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.

COURSE OUTCOMES:

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

CO1: Understand the concept of Eigen values and eigenvectors, diagonalization of a matrix, symmetric matrices, positive definite matrices and similar matrices

CO2: Acquire knowledge in Gradient, divergence and curl of a vector point function and related identities

CO3: Understand the properties and formation of analytic function, mappings of standard functions and Bilinear transformation

CO4: Understand calculus of residues to evaluate contour integration

CO5: Understand Laplace transform and inverse transform of simple functions, various related theorems and application to differential equations with constant coefficients

19ECES203 PRINCIPLES OF ELECTRICAL ENGINEERING **SEMESTER II**

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of electric circuits, measurements techniques and instruments.
- To study the working principle of DC and AC machines.
- To introduce the components of Electrical installations and energy conservation.

UNIT-I: DC CIRCUITS **9**

Electrical circuit elements (R, L and C) - Voltage and current sources - Ohm's Law - Kirchhoff's law - R, RL, RC, RLC circuits with DC excitation - Time domain analysis of first order RL, RC and RLC circuits.

UNIT-II: AC CIRCUITS **9**

Representation of sinusoidal waveforms - Average, RMS and Peak values - Form factor and Peak factor - Phasor representation - Real, Reactive, Apparent power and power factor - Analysis of single phase AC circuits consisting of R, L, C, RL, RC, RLC combinations - Resonance - Three phase balanced circuits - Voltage and current relations in star-delta connections.

UNIT-III: ELECTRICAL MACHINES **9**

DC machines: Construction, Principle of operation, basic equations and types, Characteristics and Applications of DC generators, DC motors.

AC machines: Single phase Transformer - Equivalent circuit, losses, Regulation and Efficiency - Auto Transformer - Construction, Principle of operation, basic equations and types, Characteristics and Applications of Single phase and Three phase Induction motor - Synchronous motor – Alternator.

UNIT-IV: ELECTRICAL AND ELECTRONIC INSTRUMENTS **9**

Functional elements of an Instrument - Static and Dynamic Characteristics - Errors in Measurements - Types of instruments - Operating principle of Moving coil, Moving Iron instruments (Ammeter and voltmeter), Dynamometer type watt meters and Induction type Energy meters - Standards and calibrations - Cathode Ray Oscilloscope - Digital storage oscilloscope.

UNIT-V: ELECTRICAL INSTALLATIONS AND ENERGY CONSERVATION **9**

Single phase and three phase system - phase, neutral and earth, basic house wiring - tools and components, different types of wiring - basic safety measures at home and industry - Energy efficient lamps - Energy billing. Components of LT switchgear : Switch fuse unit, MCB, ELCB, MCCB, Types of wires and cables - Earthing - Batteries - Principle, characteristics, types and applications.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Mittle V.N and Aravind Mittal, "Basic Electrical Engineering", Tata McGraw Hill, Second Edition, New Delhi, 2005.
2. Kothari D.P, Nagrath I.J, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

3. Sawhney A.K, “A Course in Electrical & Electronic Measurements & Instrumentation”, DhanpatRai and Co, 2004.
4. Nagsarkar T.K and Sukhija M S,"Basic Electrical Engineering", Oxford Press, 2005.
5. Hughes.E, "Electrical and Electronics Technology" Pearson, 2010.
6. MahmoodNahvi and Joseph A. Edminister, "Electric Circuits", Schaum Outline series, McGraw Hill, Sixth edition, 2014.
7. Premkumar N. and Gnanavadivel J, “Basic Electrical and Electronics Engineering”, Anuradha Publishers, 4th Edition, 2008.

COURSE OUTCOMES:

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

CO1: Analyze the DC and AC circuits.
CO2: Explore the significance of Electrical machines.
CO3: Acquire the knowledge on Measurement techniques and Instruments.
CO4: Utilize the components of electrical installations.
CO5: Assembly of electrical wiring.

19CAES007 ENGINEERING GRAPHICS SEMESTER II

L T P C
2 0 4 4

COURSE OBJECTIVES:

- To know the geometrical construction in plane geometry used in engineering practice.
- To know how to draw orthographic projection from a pictorial view and to practice the projection of points, line and planes in first quadrant and projection of solids on different principle planes.
- To know about the section of solids and development of the same.
- To know how to draw Pictorial view of solids from the orthographic view.
- To demonstrate and familiarise of CAD packages.

UNIT-I: GEOMETRICAL CONSTRUCTIONS 6+12

Dimensioning - Lettering - Types of Lines - Scaling conventions - Dividing a given straight line in to any number of equal parts - Bisecting a given angle - Drawing a regular polygon given one side - Special methods of constructing a pentagon and hexagon.

UNIT-II: ORTHOGRAPHIC PROJECTIONS 6+12

Introduction to Orthographic projections - Projection of points - Projection of straight lines with traces - conversion of pictorial views to orthographic views - Projection of solids

UNIT-III: SECTION OF SOLIDS AND DEVELOPMENT 6+12

Sectioning of solids - Development of surfaces

UNIT-IV: PICTORIAL VIEW 6+12

Isometric Projections - Conversion of orthographic views to Pictorial views (simple objects)

UNIT-V: COMPUTER AIDED DRAFTING (NOT FOR EXAMINATION) 6+12

Introduction to computer aided drafting package to make 2-D Drawing. Object Construction - page layout – Layer and Line type - Creating, Editing and selecting the Geometric Objects - Mechanics - Viewing, Annotating, Hatching and Dimensioning the drawing - Creating Blocks and Attributes, Drafting - Create 2D drawing. A Number of chosen problems will be solved to illustrate the concepts clearly. (Demonstration purpose only)

Contact periods:
Lecture: 30 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 90 Periods

REFERENCES:

1. N.S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
2. 2. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50 th Edition, 2010.
3. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

5. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
6. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.

COURSE OUTCOMES:

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

CO1: Represent solids as per international standards.

CO2: Generate and interpret multiple views and projections of lines, planes and solids.

CO3: Generate and interpret sectional views and development of surfaces.

CO4: Generate and interpret pictorial views.

CO5: Towards the end of the course it is expected that the students would be matured to visualize the engineering components..

19CAPC001 ELECTRIC CIRCUIT ANALYSIS **SEMESTER II**

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To introduce electric circuits and its analysis.
- To impart knowledge on solving circuits using network theorems.
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce phasor diagrams and analysis of three phase circuits.

UNIT-I: BASIC CIRCUITS ANALYSIS **9+3**

Ohm's Law - Kirchoffs laws - DC and AC Circuits - Resistors in series and parallel circuits - Mesh current and node voltage method of analysis for D.C and A.C. circuits - Phasor diagram - Power, Power Factor and Energy.

UNIT-II: NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS **9+3**

Network reduction: voltage and current division, source transformation - star delta conversion. Thevenins and Norton & Theorem - Superposition Theorem - Maximum power transfer theorem - Reciprocity Theorem.

UNIT-III: RESONANCE AND COUPLED CIRCUITS **9+3**

Series and paralled resonance - their frequency response - Quality factor and Bandwidth - Self and mutual inductance - Coefficient of coupling - Tuned circuits - Single tuned circuits.

UNIT-IV: TRANSIENT RESPONSE FOR DC CIRCUITS **9+3**

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input - Characterization of two port networks in terms of Z, Y and h parameters.

UNIT-V: THREE PHASE CIRCUITS **9+3**

Three phase balanced / unbalanced voltage sources - analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced - phasor diagram of voltages and currents - power and power factor measurements in three phase circuits.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

REFERENCES:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",TataMcGraw Hill publishers, New Delhi (2013).
2. Joseph A. Edminister, MahmoodNahri, "Electric circuits", Schaum's series, Tata Mc Graw-Hill, New Delhi (2010).
3. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill (2015).

4. Chakrabati A, “Circuits Theory (Analysis and synthesis), DhanpathRai& Sons, New Delhi, Seventh - Revised edition (2018)
5. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill (2013).

COURSE OUTCOMES:

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

CO1: Analyze electrical circuits.
CO2: Apply circuit theorems.
CO3: Analyze resonance circuits.
CO4: Analyze transient response.
CO5: Analyze three phase circuits.

19CABS005 CHEMISTRY LABORATORY SEMESTER II

L T P C
0 0 3 1.5

COURSE OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis.
- To provide exposure to the students with hands on experience on the determination of chemical substances present in solution by conductometric and potentiometric experiments.
- To quantify the Copper content by Iodometric method.
- To expose the students to test the Saponification value of an oil.
- To equip the students with the principles of rate constant of a chemical reaction.

LIST OF EXPERIMENTS:

1. Estimation of hardness by EDTA method.
2. Estimation of chloride by Argentometric method.
3. Conductometric titration of mixture of acids and strong base.
4. Estimation of iron content of the given solution using Potentiometer.
5. Determination of Saponification value of oil.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of HCl by pH titration.
8. Determination of the rate constant of reaction.
9. Estimation of Dissolved Oxygen by Iodometry.
10. Conductometric titration of strong acid and strong base.
11. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
12. Estimation of copper content of the given solution by Iodometry.

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Outfit with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

CO2: Apply the EMF and conductometric measurements in quantitative analysis of Substances.

CO3: Equip with the methods and techniques involved in the Saponification process

CO4: Comprehend the rate constant of a chemical reaction with respect to time

CO5: Quantify the metal ion concentration of the given sample

19ECES207 ELECTRICAL ENGINEERING LABORATORY SEMESTER II

L T P C
0 0 3 1.5

COURSE OBJECTIVES:

- To understand the performance characteristics of DC and AC machines
- To calibrate and measuring capability of the DC AC meters
- To impart practical knowledge on Wiring.

LIST OF EXPERIMENTS

1. Verification of Ohm's Law and Kirchoff's law
2. Measurement of three phase power by two wattmeter method
3. Measurement of three phase power by three voltmeter, three ammeter method
4. Calibration of Ammeter, Voltmeter, Wattmeter and Single phase Energy meter
5. Measurement of voltage, current, power on primary and secondary side of single phase and three phase transformers
6. Measurement of AC signal parameters using CRO/DSO and Function generators
7. Demonstration of cut out sections of DC and AC machines
8. Open circuit characteristics and load test on DC shunt generator
9. Speed control of DC shunt motor
10. Load test on single phase transformer
11. Study of components o LT Switchgear
12. Fluorescent lamp wiring, Stair case wiring and Residential house wiring using fuse, indicator, lamp and energy meter
13. Study of battery characteristics during charging and discharging

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Verify Ohm's Law and Kirchoff's law on electrical circuits.

CO2: Performance characteristics of DC machines and transformers.

CO3: Performance measurements of DC and AC instruments.

CO4: Able to do domestic and industrial wiring.

CO5: Studying the characteristics of battery charging and discharging.

19CABS008 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT-I:PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of homogeneous and non-homogeneous types.

UNIT-II: FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT-III: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Classification of PDE – Method of separation of variables – Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT-IV: FOURIER TRANSFORMS 9

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT-V: Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9

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.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S, Manicavachagom Pillay T.K and Ramanaiah G., "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3. Andrews L.C and Shivamoggi B., "Integral Transforms for Engineers", SPIE Press, 1999.

4. Bali N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
5. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
6. James G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.

COURSE OUTCOMES:

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

CO1: Understand how to solve the given standard partial differential equations.

CO2: Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO3: Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

CO4: Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

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

19ECES302 DATA STRUCTURES AND ALGORITHMS SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the features of C.
- To learn the linear and non– linear data structures.
- To explore the applications of linear and non– linear data structures.
- To learn to represent data using graph data structure.
- To learn the basic sorting and searching algorithms.

UNIT-I: C PROGRAMMING BASICS 9

Structure of a C program – Compilation and linking processes – Constants, Variables – Data types – Expressions using operators in C – Managing Input and Output operations – Decision making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and two-dimensional arrays. Strings – String operations – String arrays. Simple programs – Sorting searching – matrix operations.

UNIT-II: FUNCTIONS, POINTERS, STRUCTURES AND UNIONS 9

Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and Unions – Definition – Structure within a structure – Union – Programs using structures and unions – Storage classes, pre-processor directives.

UNIT-III: LINEAR DATA STRUCTURES 9

Arrays and its representations – Stacks and Queues – Linked lists – Linked list – Based implementation of Stacks and Queues – Evaluation of expressions – Linked list based polynomial addition.

UNIT-IV: NON– LINEAR DATA STRUCTURES 9

Trees – Binary Trees – Binary tree representation and traversals – Binary search trees – Applications of trees. Set representations – Union – Find operations. Graph and its representations – Graph traversals.

UNIT-V: SEARCHING AND SORTING ALGORITHMS 9

Linear Search – Binary search – Bubble sort – Insertion sort – Merge sort – Quick sort – Hash tables – Overflow handling.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Pradip Dey and Manas Ghosh, "Programming in C", Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2008.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1996.
4. Alfred V,Aho, John E, Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
5. Robert Kruse, Tondo C.L, Bruce Leung and Shashi Mogalla, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2007.

6. Jean – Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw– Hill, 1991.

COURSE OUTCOMES:

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

CO1: Implement linear and non-linear data structure operations using C.

CO2: Suggest appropriate linear / non-linear data structure for any given data set.

CO3: Apply hashing concepts for a given problem.

CO4: Modify or suggest new data structure for an application.

CO5: Appropriately choose the sorting algorithm for an application.

19ECPC303 ELECTRONIC DEVICES AND CIRCUITS SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of Semiconductor devices.
- To investigate the different configurations of BJT.
- To learn the principles of JFET and MOSFET.
- To gain knowledge in the Special Diodes and Transistors.
- To understand the basics of power and display devices.

UNIT-I: FUNDAMENTALS OF SEMICONDUCTOR DIODES 9

Energy band structure for PN junction diode – Diffusion and Drift currents – PN junction diode – Current-Voltage characteristic – Diode current equation – Switching characteristics and effect of temperature on PN junction diodes – Zener diode – Breakdown in PN junction diodes – Diffusion capacitances and space charge capacitances. PN diode applications: Clippers – Clampers – Voltage regulators.

UNIT-II: FUNDAMENTALS OF BJT 9

BJT: Construction and working of NPN and PNP transistor – CB, CE and CC characteristics – Emitter and Voltage divider bias of BJT – Thermal runway – Early effect – Ebers-Moll mode – BJT applications: BJT as a switch – Amplifiers and LED drivers.

UNIT-III: FIELD EFFECT TRANSISTORS 9

JFET: Device characteristics – Current equation – Pinch off voltage, Biasing – MOSFET: Depletion and Enhancement mode MOSFET – Characteristics of n–MOS and p–MOS – Threshold Voltage – Current – Voltage characteristics – Biasing – FET applications: FET as a voltage variable resistor – Chopper – Analog switch.

UNIT-IV: SPECIAL DIODES AND TRANSISTORS 9

Special diodes: Schottky barrier diode – Varactor diode – Tunnel diode – Gallium Arsenide device – LASER diode – LDR – Special transistors: MESFET – Dual gate MOSFET – CNTFET – FINFET.

UNIT-V: FUNDAMENTALS OF POWER AND DISPLAY DEVICES 9

Power devices: SCR – DIAC – TRIAC – UJT – Display devices: Construction and characteristics of LED and LCD – Principle of photo emissivity and photo conductivity phototransistor – Solar cell – Opto coupler – CCD.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Donald A. Neaman, "Semiconductor Physics and Devices", 4th Edition, Tata Mc GrawHill Inc. 2012.
2. Salivahanan S, Suresh Kumar N and Vallavaraj A., "Electronic Devices and circuits", 2nd Edition , Tata McGraw– Hill, 2008.

3. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Prentice Hall, 10th edition, July 2008.
4. Sedha R.S., "A Text Book of Applied Electronics", S.Chand Publications, 2006.
5. Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.
6. Nandhitha Das Gupta and Amitava Das Gupta, "Semiconductor Devices: Modeling and Technology" Prentice Hall of India Pvt Ltd, 4th Edition, 2004.
7. Adel S. Sedra and Kenneth C.Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition, 2009.

COURSE OUTCOMES:

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

CO1: Operate the basic electronic devices such as PN junction diode.

CO2: Illustrate the different configuration of BJT.

CO3: Apply the fundamentals of FET and MOSFET in various applications.

CO4: Apply the knowledge of special diodes and transistors in various applications.

CO5: Apply the concepts of power devices and display devices.

19ECPC304 SIGNALS AND SYSTEMS SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the properties and representation of discrete and continuous signals and systems.
- To analyze the signal using Fourier and Laplace transforms.
- To analyze and synthesize continuous Time systems.
- To study the sampling process and analyze the signals using z– transforms.
- To analyze and synthesize discrete time systems.

UNIT-I: CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous Time signals (CT signals) – Discrete Time signals (DT signals) – Step, ramp, pulse, impulse, sinusoidal, exponential – Classification of CT and DT signals – Periodic & aperiodic signals, deterministic & random, energy & power, even & odd signals – CT systems and DT systems – Classification of systems – Static & dynamic, linear & nonlinear, time-variant & time-invariant, causal & non-causal, stable & unstable systems.

UNIT -II: ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series analysis – Spectrum of Continuous Time signals (CT signals) – Fourier transform and Laplace transform in signal analysis.

UNIT-III: LINEAR TIME INVARIANT – CONTINUOUS TIME SYSTEM 9

Differential equation – Block diagram representation – Impulse response – Convolution integral – Frequency response – Fourier and Laplace transforms in analysis.

UNIT-IV: ANALYSIS OF DISCRETE TIME SIGNALS 9

Sampling of CT signals and aliasing – DTFT and properties – Z-transform and its properties.

UNIT-V: LINEAR TIME INVARIANT – DISCRETE TIME SYSTEMS 9

Difference equations – Block diagram representation – Impulse response – Convolution sum – LTI systems analysis using DTFT and Z-transforms.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Allan V. Oppenheim, Wilsky S. and Nawab S.H., "Signals and Systems", Pearson Education, 2007.
2. Edward W. Kamen and Bonnie's Heck, "Fundamentals of Signals and Systems using web and MATLAB", Pearson Education, 2007.
3. Hsu H. P. and Rakesh Ranjan, "Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007.
4. Salivahanan S., Vallavaraj A. and Gnanapriya C., "Digital Signal Processing", McGraw Hill International/TMH, 2007.
5. Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley &sons, Inc, 2004.
6. Robert A. Gabel and Richard A. Roberts, "Signals & Linear Systems", John Wiley, III edition, 1987.
7. Rodger E. Ziemer, William H. Tranter and Ronald Fannin D., "Signals & systems", Fourth Edition, Pearson Education, 2002.

COURSE OUTCOMES:

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

CO1: Categorize the different types of signals and systems.

CO2: Determine the analysis of continuous time signals.

CO3: Analyze the LTI continuous time systems.

CO4: Determine the analysis of continuous time signals.

CO5: Analyze the discrete time systems using DTFT and Z Transform.

19ECPC305 DIGITAL SYSTEM DESIGN SEMESTER III

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 sequential circuits.
- To introduce the analysis and design procedures for Asynchronous sequential circuits.
- To explain the various semiconductor memories and related technology.

UNIT-I: NUMBER SYSTEM AND LOGIC SIMPLIFICATION 9

Decimal, binary, octal, hexadecimal – 1's and 2's complements – Codes – Binary, BCD, Excess 3, Gray, Logic gates – Boolean postulates and laws – De-Morgan's theorem – Simplification using Boolean algebra – Min terms – Max terms – Canonical forms – Sum of product and product of sum – Minimization using Karnaugh map and tabulation method with Don't cares.

UNIT -II: COMBINATIONAL LOGIC CIRCUIT 9

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Controlled inverter – Parallel binary adder/subtractor – Carry Look Ahead adder – BCD adder – Multiplexer – De-multiplexer – Decoder – Encoder – Code converters – Magnitude comparator.

UNIT-III: SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Latches – 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 – Modulo n counters – Up/down counters – Ripple counters, Ring counters, Johnson counters, Shift registers.

UNIT-IV: ASYNCHRONOUS SEQUENTIAL CIRCUITS 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.

UNIT-V: MEMORY DEVICES AND LOGIC FAMILIES 9

Classification of memories – ROM – ROM organization – PROM – EPROM – EEPROM – EAPROM – RAM – RAM organization, SRAM, DRAM – Introduction to PLDs – ROM – PAL – PLA – Architecture of PLDs – Implementation of digital functions using PLDs – Digital integrated circuits: logic levels, propagation delay, power dissipation, fan-out and fan- in, noise margin, logic families and their characteristics – TTL, CMOS.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Morris Mano M., "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Donald. D. Givone "Digital Principles and Design" 2nd Edition, Tata McGraw Hill Higher Education (Pvt). Ltd, 2003.

3. Charles H. Roth, “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.
4. Salivahanan S and Arivazhagan S., “Digital Electronics”, Ist Edition, Vikas Publishing House pvt Ltd, 2012.
5. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education, New Delhi, 2009.
6. Soumitra Kumar Mandal, “Digital Electronics”, McGraw Hill Education Pvt Ltd, 2016
7. Anand Kumar A., “Fundamentals of Digital Circuits”, 4th Edition, PHI Learning Private Limited, 2016.

COURSE OUTCOMES:

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

CO1: Apply the Boolean algebra and Karnaugh map for simplification.

CO2: Design various Combinational digital circuits using logic gates.

CO3: Design and analyze Counters, Shift registers and Finite state machines.

CO4: Design and analyze Asynchronous sequential circuit.

CO5: Implement digital circuit in Programmable Logic Devices.

19CAHS002 ENVIRONMENTAL SCIENCE AND ENGINEERING **SEMESTER III**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand what constitutes the environment.
- To conserve the natural resources.
- The role of a human being in maintaining a clean and useful environment for the future generations.
- To maintain ecological balance and preserve biodiversity.
- The role of government and non-government organization in environment 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 the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

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. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT-III: NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies – Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, 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 – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – River / forest / grassland / hill / mountain.

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, case studies – Role of non-governmental organization – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies – Wasteland reclamation – Consumerism and waste products – Environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Enforcement machinery involved in environmental legislation – Central and state pollution control boards – Public awareness.

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 – Case studies.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2004.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
5. Rajagopalan R., "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
6. Tyler Miller G and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

COURSE OUTCOMES:

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

CO1: Understand how to conserve the natural resources.

CO2: Understand what constitutes the environment and how to conserve biodiversity.

CO3: Create awareness about environmental pollution and disaster management.

CO4: Gain adequate knowledge about the social issues of the environment and the role of government and non-government organization in environment management..

CO5: Understand about human population and the environment and the role of information technology in environment and human health**.**

19ECPC307 ELECTRONIC DEVICES AND CIRCUITS LABORATORY SEMESTER III

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To study the characteristics of PN and Zener diodes.
- To gain the knowledge of CB, CC and CE transistor characteristics.
- To obtain the Drain and Transfer characteristics.
- To study the characteristics of Rectifiers.
- To obtain the characteristics of Power diodes.

LIST OF EXPERIMENTS

1. Characteristics of PN junction diode
2. Characteristics of Zener diode
3. CE, CB and CC transistor characteristics and parameters
4. Design of Emitter and Voltage divider bias circuits for BJT
5. JFET Characteristics and parameters
6. MOSFET Characteristics and parameters
7. Design of Biasing circuits for JFET
8. Design of Wave shaping Circuits
9. Half– wave & Full– wave rectifiers
10. Design of Regulated Power Supplies
11. SCR characteristics
12. Sawtooth waveform generation using UJT

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Draw the characteristics of PN and Zener diodes.
CO2: Verify the CB, CC and CE transistor characteristics.
CO3: Draw the Drain and Transfer characteristics.
CO4: Verify the characteristics of Power diodes.
CO5: Verify the characteristics of Rectifiers.

19ECPC308 DIGITAL SYSTEM DESIGN LABORATORY SEMESTER III

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand the combinational circuits using basic gates.
- To design and implement the various combinational circuits.
- To design implement combinational circuits using MSI devices.
- To design and implement sequential cells.
- To understand and code with HDL programing.

LIST OF EXPERIMENTS

1. Implementation of Adder and Subtractor using basic gates
2. Design and implementation of Binary to Gray and BCD to Excess 3 Code converter
3. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
4. Design and implementation of Multiplexer, De– multiplexer, Decoder and Encoder using logic gates
5. Design and implementation of 2 bit Magnitude Comparator using logic gates and 8 Bit Magnitude Comparator using IC 7485
6. Realization of one flips flop using other flip flops
7. Construction and verification of Mod– n Ripple counters
8. Design and implementation of Synchronous counter to count any desired sequence
9. Implementation of SISO, SIPO, PISO and PIPO shift registers using IC7474
10. Design and Implementation of Johnson Counter and Ring Counter
11. Simulation of experiments 1, 6, 9 and 11 using Verilog Hardware Description Language

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Implement simplified combinational circuits using basic gates.
CO2: Implement combinational using MSI devices.
CO3: Design and implement sequential circuits.
CO4: Simulate combinational circuit using HDL.
CO5: Simulate sequential circuit using HDL.

19ECBS401 PROBABILITY AND RANDOM PROCESSES SEMESTER IV

L	T	P	C
3	0	0	3

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 9

Probability – Axioms of probability – Conditional probability – Baye‘s theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT-II: TWO – DIMENSIONAL RANDOM VARIABLES 9

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-III: RANDOM PROCESSES 9

Classification – Stationary process – Markov process – Markov chain – Poisson process – Random telegraph process.

UNIT-IV: CORRELATION AND SPECTRAL DENSITIES 9

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT-V: LINEAR SYSTEMS WITH RANDOM INPUTS 9

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

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

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.
3. Cooper G. R and Mc Gillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
4. Hwei Hsu, "Schaum‘s Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
5. Miller S.L and Childers. D.G., “Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.

6. Stark H and Woods J.W., “Probability and Random Processes with Applications to Signal Processing", Pearson Education, Asia, 3rd Edition, 2002.
7. Yates R.D and Goodman. D. J., “Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

COURSE OUTCOMES:

Upon completion of this course, the 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.

19ECPC402 ELECTROMAGNETIC FIELDS SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts in vector algebra applied in the field of electromagnetics.
- To study the concepts and ideas in the field of static electric and magnetic fields.
- To learn the concepts of electric potential and capacitance in electrostatics.
- To analyze about inductance and applications of laws governing the magneto statics.
- To learn Maxwell's equations and solve problems based on the above concepts.

UNIT-I: BASICS OF ELECTROMAGNETICS 9

Electromagnetic model, review of vector algebra, rectangular, cylindrical and spherical coordinate systems, vector multiplication – Cross product, Dot product, types of integrals in electromagnetic theory, Gradient of a scalar, Divergence of a vector field, Divergence theorem, Curl of a vector, Stoke's theorem, Laplacian of a scalar.

UNIT-II: ELECTROSTATICS 9

Electric field, Coulomb's law and its vector form, applications of Coulomb's law, Electric flux density, Gauss's law and applications, Work done and electric potential, potential due to point charge, Potential gradient, Energy density, Electric dipole, Maxwell's first equation.

UNIT-III: CONDUCTORS, DIELECTRICS AND CAPACITANCE 9

Conductors, Current and current density, Continuity equation, Dielectrics in static electric field-Polarization, Properties, Dielectric strength, Boundary conditions – Conductor and free space, Perfect dielectrics, Capacitance – Parallel, Cylindrical and Spherical capacitors, Poisson's and Laplace's equations, Capacitance using Laplace's equation.

UNIT-IV: MAGNETOSTATICS 9

Magnetic fields intensity, Magnetic flux density, Properties, Biot-Savart law and its applications, Ampere's circuit law and its applications, Magnetic torque and Magnetic dipole Moment, Nature of magnetic materials, Magnetic boundary conditions, Inductance, Electric and magnetic circuits.

UNIT-V: TIME-VARYING FIELDS AND MAXWELL EQUATIONS 9

Faraday's law, Displacement current, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, General wave equations, Uniform plane waves – Free space, Good conductor, Lossless and Lossy dielectric, Pointing vector and theorem.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Cheng D.K., "Field and wave electromagnetics", 2nd Edition, Pearson (India), 1989.
2. Hayt W. H and Buck J. A., "Engineering electromagnetics", 7th Edition, McGraw-Hill (India), 2006.
3. Griffiths D.J., "Introduction to electrodynamics", 4th Edition, Pearson (India), 2013.
4. Notaros B. M., "Electromagnetics", Pearson: New Jersey, 2011.
5. Sadiku M.N.O and Kulkarni S.V., "Principles of electromagnetics", 6th Edition, Oxford (Asian Edition), 2015.
6. Salivahanan S and Karthie S., "Electromagnetic Field Theory", McGraw Hill Education, 2nd Edition, 2018.
7. Edward C. Jordon , Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", Pearson Education; 2nd Edition (2015).

COURSE OUTCOMES:

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

CO1: Analyze the electromagnetic field theory with vector algebra.

CO2: Display an understanding of fundamentals in electromagnetic laws and concepts.

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

CO4: Explain electromagnetic wave propagation in lossy and in lossless media.

CO5: Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws.

19ECPC403 **ANALOG CIRCUITS** **SEMESTER IV**

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.
- To analyze the frequency response of amplifier.
- To study about feedback amplifiers and oscillators principles.
- To learn about large signal and tuned amplifier.
- To understand the analysis and design of LC and RC oscillators, amplifiers and multi vibrators.

UNIT-I: ANALYSIS OF BJT and FET AMPLIFIERS 9

BJT: Analysis of single stage CE, CB and CC amplifiers – Low frequency analysis – Frequency limitations – High frequency model and analysis – Darlington pair connection – RC coupled CE amplifier – Multi stage frequency effects. FET: single stage CS, CG and CD amplifiers – Low frequency analysis – Miller effect capacitance – Miller's theorem – High frequency model and analysis.

UNIT-II: SMALL SIGNAL ANALYSIS OF TRANSISTORS 9

BJT: Equivalent circuit model – Hybrid Pi model – Complete hybrid equivalent model – Approximate hybrid equivalent circuit – Input resistance – Output resistance– Voltage gain – current gain calculations.FET: JFET small signal model – Transconductance– Input impedance – Output impedance– Voltage gain calculations – MOSFET small signal equivalent model.

UNIT-III: FEEDBACK AMPLIFIERS AND OSCILATORS 9

Feedback concepts – Gain with feedback – Effect of feedback on gain stability, distortion, bandwidth, input and output impedances – Topologies of feedback amplifiers – Analysis of Series - series, Shunt - shunt and Shunt - series feedback amplifiers. Barkhausen criterion for oscillation – Phase shift, Wien bridge – Hartley & Colpitt's oscillators – Crystal oscillators – Oscillator amplitude stabilization.

UNIT-IV: LARGE SIGNAL AND TUNED AMPLIFIERS 9

Classification of large signal amplifiers – Operation of Class A, B, C, D and AB amplifiers – Efficiency – Class A amplifier with load – Class B Push - pull amplifier – Distortion in amplifiers – Tuned amplifiers – Single, Double-Tuned and stagger tuned amplifiers.

UNIT-V: WAVE SHAPING AND MULTIVIBRATOR CIRCUITS 9

Pulse circuits – Attenuators – RC integrator and differentiator circuits – Diode clampers and clippers – Multivibrators – Astable, Monostable and Bistable multivibrators – Schmitt trigger – UJT oscillator.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Sedra and Smith, "Micro Electronic Circuits"; 6th Edition, Oxford University Press, 2011.
2. Salivahanan S and Suresh Kumar N., "Electronic Devices and Circuits", 4th Edition, TMH, 2007.
3. David A. Bell, "Electronic Devices and Circuits", 4th Edition, PHI, 2007.
4. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008.

5. Millman J and Taub H., “Pulse and Switching Waveforms”, TMH, 2000.
6. Millman and Halkias C., “Integrated Electronics”, TMH, 2007.
7. Donald A. Neamen, “Electronic Circuit Analysis and Design”, 2nd Edition, TMH 2009.

COURSE OUTCOMES:

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

CO1: Analyze different types of BJT and FET amplifiers.
CO2: Analyze frequency response of BJT and FET amplifiers.
CO3: Design and analyze feedback amplifiers and oscillators.
CO4: Analyze different types of large signal and tuned amplifiers.
CO5: Design wave shaping circuits and multivibrators.

19ECPC404 LINEAR INTEGRATED CIRCUITS SEMESTER IV

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 study the theory and applications of 555 Timer and PLL.
- To learn the theory of ADC and DAC.
- To understand the concepts of waveform generation and introduce some special function ICs.

UNIT-I: OPERATIONAL – AMPLIFIERS FUNDAMENTALS AND CHARACTERISTICS 9

Basic information about op-amps – Characteristics of an Ideal Operational Amplifier – Pin Configuration of μA741 – Current mirrors and Current sources – Building blocks of 741 Operational Amplifier – I/O stages, gain stage and level translator stage of 741 op-amp – DC characteristics – AC characteristics, Frequency response, Slew rate, and Compensation techniques.

UNIT-II: APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Inverting and Non inverting amplifier – Differential amplifier – Voltage follower – Summing amplifier – Instrumentation amplifier – Integrator and Differentiator – Comparator – Zero crossing detector – Regenerative comparator – Sample and Hold Circuit – Active Butterworth first & second order filters: Low pass and High Pass filters.

UNIT-III:555 TIMERS AND PHASE LOCKED LOOP 9

555 Timer functional block diagram and description – Monostable and astable operation, 566 Voltage controlled oscillator – Basic principles of PLL – Block schematic– Lock and capture range – PLL applications: Frequency multiplication, Frequency synthesis – Frequency translation – FM detection.d

UNIT-IV: DATA CONVERTERS 9

Digital to Analog converters – Binary weighed DAC, R – 2R Ladder type DAC, Inverted R-2R ladder type DAC, Switches in DAC. Analog to digital converters – Direct type ADCs: Successive approximation, Flash ADC – Integrating type ADCs: single, dual slope types –DAC/ADC specifications.

UNIT-V: WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS 9

Sine wave generators – Multivibrators and triangular wave generator – IC voltage regulators – Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator – IC VFC32 Voltage to frequency converter – Frequency to voltage converter.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Roy Choudhry D. and Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd.,5thEdition, 2018.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", fourth Edition, Tata Mc Graw– Hill, 2016.
3. Ramakant A.Gayakwad, "OP– AMP and Linear ICs", 4th Edition, Prentice Hall/ Pearson Education, 2015.

4. Gray and Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley International, 5th Edition, 2009.
5. Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, 6th Edition, 2001.
6. Salivahanan S. &Kanchana Bhaskaran V.S., “Linear Integrated Circuits”, TMH, 2nd Edition, 4th Reprint, 2016.
7. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education, 4th Edition, 2001.

COURSE OUTCOMES:

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

CO1: Analyze the Characteristics of OP-AMP.
CO2: Develop and analyze operational amplifier application circuits.
CO3: Design applications using 555 timer and PLL.
CO4: Design ADC and DAC using OP-AMPS.
CO5: Generate waveforms using OP-AMP Circuits and Analyze special function ICs.

19ECPC405 **MICROPROCESSORS AND MICROCONTROLLERS** **SEMESTER IV**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce hardware architecture, instruction set and programming of 8085 microprocessors.
- To study the BUS structure and operating modes of 8086.
- To learn the peripheral interfacing of microprocessors.
- To study the hardware architecture, instruction set, programming and interfacing of 8051 microcontrollers.
- Exposit case studies, the system design principles using 8085 and 8086.

UNIT-I: INTRODUCTION TO MICROPROCESSORS **9**

8085 – Architecture – Instruction set – Addressing mode – Programming – Memory and I/O interfacing – 8086 – Architecture – Instruction set and programming.

UNIT-II: 8086 SYSTEM BUS STRUCTURE **9**

8086 signals – Basic configurations – Minimum and Maximum mode configurations – System bus timing – System design using 8086 Multiprocessor configurations – Coprocessor, closely coupled and loosely Coupled configurations.

UNIT-III: PERIPHERALS AND INTERFACING USING 8086 **9**

Programmable Peripheral Interface (8255) – Keyboard display controller (8279) – ADC0808 and DAC0808 Interface – Programmable timer controller (8254) – Programmable interrupt controller (8259) – Serial communication interface (8251).

UNIT-IV: 8051 MICROCONTROLLER **9**

8051 – Architecture, Special Function Registers (SFRs), Instruction set, Addressing modes, Assembly language.

UNIT-V: APPLICATIONS OF MICROCONTROLLER **9**

Interfacing to: matrix display, (16x2) LCD – Traffic light control, Washing machine control, RTC Interfacing using I2C Standard – Motor control – Relay, PWM, DC &Stepper motor.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Penram International Publishing reprint, 6th Edition, 2017.
2. Douglas V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill, Revised 2nd Edition 2006, 11th reprint 2015.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051Microcontroller and Embedded Systems", 2nd Edition, Pearson Education 2008. 12th impression 2018.
4. Krishna Kant, "Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096", PHI, 2007, 7th Reprint, 2015.
5. Ray A.K and Bhurchandi K.M., "Advanced Microprocessor and Peripherals", Tata McGraw–Hill, 2nd Edition, 2010.

6. Barry B. Brey, "The Intel Microprocessors Architecture, Programming and Interfacing", Pearson Education, 2007, 2nd impression, 2010.

COURSE OUTCOMES:

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

CO1: To relate any architecture and assembly language for a processor.

CO2: To comprehend the architectural and pipelining concepts for Microprocessors.

CO3: To design and deploy the Interfacing peripherals in real time scenario.

CO4: To discriminate different microprocessor and microcontroller and its special function registers.

CO5: To design, develop and troubleshoot microcontroller– based system.

19ECES406 **CONTROL SYSTEMS** **SEMESTER IV**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

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 – DC and AC servo Systems – Synchronous – Multivariable control system.

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 SYSTEM ANALYSIS 9

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

UNIT-IV: CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability – Bounded – Input bounded – Output stability – Routh stability criterion – Relative stability – Root locus concept – Guidelines for sketching root locus – Nyquist stability criterion.

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 – Equivalence between transfer function and state variable representations – State variable analysis of digital control system – Digital control design using state feedback.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Gopal M., “Control System - Principles and Design‖”, Tata McGraw Hill, 4th Edition, 2012.
2. Nagrath J and Gopal M., “Control System Engineering”, New Age International Publishers, 5th Edition, 2007.
3. Ogata K., "Modern Control Engineering”, 5thEdition, PHI, 2012.
4. Bhattacharya S.K., “Control System Engineering”, 3rd Edition, Pearson, 2013.
5. Benjamin C.Kuo, “Automatic control systems”, Prentice Hall of India, 7th Edition, 1995.

COURSE OUTCOMES:

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

CO1: Identify the various control system components and their representations.

CO2: Analyze the various time domain parameters.

CO3: Analysis the various frequency response plots and its system.

CO4: Design various transfer functions of digital control system using state variable models.

CO5: Apply the concepts of various system stability criterions.

19ECPC407 ANALOG CIRCUITS AND IC LABORATORY SEMESTER IV

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Study the Frequency response of Amplifiers.
- Learn the fundamental principles of oscillator circuits.
- Analyze the characteristics of Op– Amp.
- Exposed to simple applications using Op– Amp.
- Learn to implement Filters.

LIST OF EXPERIMENTS

1. Frequency Response of CE and CB amplifiers
2. Frequency Response of CS and CD amplifiers
3. Frequency Response of Cascade amplifier
4. Design and analysis of feedback amplifiers
5. Design and testing of RC Phase shift oscillator and Wien Bridge Oscillator
6. Design and testing of Hartley Oscillator and Colpitts Oscillator
7. Design and testing of Astable and Monostable multivibrator circuit using transistors
8. Simple applications of op– amps(inverting and non– inverting amplifier, Adder, Integrator and Differentiator)
9. Design and testing of Magnitude comparator
10. Design of Schmitt trigger circuit

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Analyze the frequency response of different amplifier circuits.
CO2: Design oscillator circuits.
CO3: Inspect various types of feedback amplifiers.
CO4: Design simple circuits using Op– amp.
CO5: Implement Filters using Op– amp.

19ECPC408 **MICROPROCESSORS AND MICROCONTROLLERS LABORATORY** **SEMESTER IV**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Introduce ALP concepts and features.
- Write ALP for arithmetic and logical operations in 8086 and 8051.
- Control Traffic Light and Stepper Motor.
- Differentiate Serial and Parallel Interface.
- Interface different I/Os with Microprocessors.

LIST OF EXPERIMENTS

8086 Programs using kits

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion and decimal arithmetic
4. Sorting and searching
5. Password checking

Peripherals and Interfacing Experiments

6. Traffic light control
7. Stepper motor control
8. Digital clock
9. Key board and Display
10. Serial interface and Parallel interface
11. A/D and D/A interface and Waveform Generation

8051 Experiments using kits

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

Contact periods:

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES:

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

CO1: Write ALP Programs for fixed and Arithmetic operations.
CO2: Control external peripherals.
CO3: Interface different I/Os with processor.
CO4: Generate waveforms using Microprocessors.
CO5: Execute Programs in 8051.

19ECPC501 DIGITAL SIGNAL PROCESSING SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand convolution, Discrete Fourier Transform and its properties.
- To design, realize and understand the characteristics of IIR.
- To design and realize FIR Filters.
- To understand Finite word length effects and Multi rate DSP.
- To study and understand the DSP processors.

UNIT-I: DISCRETE FOURIER TRANSFORM 9

Review of Discrete signals and system, Convolution – Linear, Circular, Sectioned, Introduction to DFT – Properties of DFT – Circular convolution – Filtering methods based on DFT – FFT algorithms – Decimation in time algorithms, Decimation in frequency algorithms – Use of FFT in linear filtering.

UNIT-II: IIR FILTER DESIGN 9

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

UNIT-III: FIR FILTER DESIGN 9

Linear phase FIR filter – Fourier series, Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques, Realization of FIR filter.

UNIT-IV: FINITE WORD LENGTH EFFECTS 9

Fixed point and floating-point number representations, Quantization – Truncation and rounding errors – Steady state output, Noise power – Coefficient quantization error – Product quantization error, Limit cycle in recursive systems – Zero input, Overflow limit cycle and scaling.

UNIT-V: DIGITAL SIGNAL PROCESSORS 9

Introduction, Features, Architecture of TMS320C5x processor, Pin diagram, Addressing modes, Applications of DSP – Speech processing, Sound processing, Biomedical signal processing.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing – Principles, Algorithms and Applications”, 4th Edition, Pearson Education / Prentice Hall, 2007.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.
3. Emmanuel C. Ifeachor and Barrie. W. Jervis, “Digital Signal Processing”, 2nd Edition, Pearson Education / Prentice Hall, 2002.
4. Oppenheim A.V, Schafer R. W and Buck J. R., “Discrete – Time Signal Processing”, 8th Edition Indian Reprint, Pearson, 2004.
5. Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.
6. Schaums, “Outline of Digital Signal Processing", Monson H. Hayes, Tata Mc Graw Hill.

7. Nagoorkani A., “Digital Signal Processing”, McGraw Hill Education; 2nd Edition.

COURSE OUTCOMES:

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

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

CO2: Design and analyze IIR and FIR filters.

CO3: Illustrate finite Word length effect on filters.

CO4: Work with Digital signal processors.

CO5: Know the applications of DSP.

19ECPC502 COMPUTER SYSTEM ARCHITECTURE AND ORGANIZATION **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic structure and operation of a digital computer.
- To familiarize with implementation of fixed point and floating-point arithmetic operations.
- To gain knowledge about the design of data path unit and control unit for processor.
- To learn the hierarchical memory system including cache memories and virtual memory.
- To understand the micro– architectural design of processors.

UNIT-I: FUNDAMENTALS OF COMPUTER DESIGN **9**

Review of Fundamentals of CPU, Performance evaluation – Instructions – Operations and operands – Representing instructions – Logical operations – Control operations – Addressing mode.

UNIT-II: ARITHMETIC CIRCUITS **9**

Fixed point Addition, Subtraction, Multiplication and Division, Floating Point arithmetic, High performance arithmetic.

UNIT-III: THE PROCESSOR **9**

Introduction, Logic Design Conventions, Building a Datapath – A Simple Implementation scheme – An overview of Pipelining – Pipelined Datapath and Control, Data Hazards: Forwarding versus Stalling, Control Hazards.

UNIT-IV: MEMORY and I/O ORGANIZATION **9**

Cache and Virtual memory – Memory allocation – Associative memory – Memory technology – Bus Architectures- Internal Communication Methodologies.

UNIT-V: PARALLELISM PROCESSING METHODOLOGIES **9**

Dynamic branch prediction – Hardware based speculation – Multi-threading – Vector architecture – Loop level parallelism – Symmetric and distributed shared memory architectures.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. John L. Hennessey and David A. Patterson, “Computer Architecture A Quantitative Approach”, Morgan Kaufmann/ Elsevier, 5th Edition, 2012.
2. Kai Hwang and Faye Briggs, “Computer Architecture and Parallel Processing”, Mc Graw – Hill International Edition, 2000.
3. Sima D., Fountain T. and Karsuk P., “Advanced Computer Architectures: A Design Space Approach”, Addison Wesley, 2000.
4. Morris Mano, “Computer System Architecture”, Prentice– Hall of India, 2000.
5. Paraami, “Computer Architecture”, BEH R002, Oxford Press.
6. Pal P. Chaudhuri, “Computer organization and design”, 2nd Edition, Prentice Hall of India, 2007.

COURSE OUTCOMES:

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

CO1: Analyze the performance issues of a given processor.

CO2: Illustrate the fixed point and floating-point arithmetic for ALU operation.

CO3: Implement schemes of control unit and pipeline performance

CO4: Explain the concept of various memory technologies of a processor.

CO5: Discuss parallel processing technique and advanced architectures.

19ECPC503 **VLSI DESIGN** **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn various aspects of CMOS logic.
- To impart knowledge on various combinational.
- To learn the design and realization of sequential digital circuits.
- To exposed various aspects of arithmetic building blocks and memory subsystems.
- To be familiar with the basics of Verilog HDL.

UNIT-I: CMOS LOGIC DESIGN **9**

VLSI design flow – MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal I-V effects, DC transfer characteristics – CMOS technologies, Layout design Rules – Stick diagram.

UNIT-II: COMBINATIONAL CIRCUIT DESIGN **9**

Static CMOS – Ratioed circuits – Cascode voltage switch logic – Dynamic circuits – Domino logic – Dual – Rail domino logic – Pass-Transistor circuits – CMOS with transmission gates –Source of power dissipations.

UNIT-III: SEQUENTIAL CIRCUITS DESIGN **9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

Timing Issues: Timing Classification Of Digital System, Synchronous Design..

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

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

UNIT-V: SYSTEM DESIGN USING VERILOG HDL **9**

Basic concepts – Identifiers – Gate primitives – Gate delays – Operators, timing controls – Procedural assignments – Conditional statements – Design of combinational and sequential circuits using Data flow – Structural gate level – Switch level modeling and Behavioral modeling – Test benches.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Neil H.E, Weste and David Money Harris, "CMOS VLSI Design a Circuits and Systems Perspective", 4th Edition, Pearson, 2015.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 3rd Edition, Pearson Education Ltd., New Delhi, 2006.
3. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits a Design perspective", Pearson Education, 2nd Edition, 2016.
4. Uyemura J. P., "Introduction to VLSI Circuits and Systems", John Wiley and Sons (Asia), 2002.

5. Charles H. Roth and Jr., Lizy Kurian John, "Digital System Design using VHDL", 3rd Edition, Cengage, 2018.
6. Pucknell D.A and Eshraghian K., "Basic VLSI Design", 3rd Edition, PHI, 2003.
7. Wolf W.,"Modern VLSI Design – System on Chip design", 3rd Edition, Pearson Education, 2004.

COURSE OUTCOMES:

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

CO1: Derive the electrical characteristics of MOSFETs.
CO2: Design various combinational circuits.
CO3: Design and construct Sequential Circuits and Timing systems.
CO4: Design arithmetic building blocks and memory subsystems.
CO5: Develop Verilog programs for digital logic circuits.

19ECPC504 ANALOG COMMUNICATION SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of amplitude modulation.
- To exposed to the principles of angle modulation.
- To gain knowledge in effect of noise on communication systems.
- To be familiar the basics of receivers.
- To know the principles of sampling & quantization.

UNIT-I: AMPLITUDE MODULATION 9

Introduction to communication system, Need for modulation, Amplitude modulation, Phasor representations – Power relations in AM waves – Generation and Detection – AM – DSB Modulation, DSBSC, SSB modulated wave – Principles of Vestigial side band modulation.

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.

UNIT-III: NOISE IN COMMUNICATION SYSTEMS 9

Input SNR, Output SNR and Figure of Merit analysis: Amplitude Modulation, Double Side band Suppressed Carrier Modulation, Single side band Modulation, AM and FM Systems – Pre-emphasis & De-Emphasis in FM.

UNIT-IV: RADIO TRANSMITTER AND RECEIVERS 9

Transmitter types : AM transmitter , FM transmitter- Receiver types: Tuned radio frequency receiver, Super heterodyne receiver – AGC – FM receiver – Amplitude limiting.

UNIT-V: ANALOG PULSE MODULATION TECHNIQUES 9

Sampling - Natural sampling, Flat top sampling – Mathematical Representation – Spectrum – Reconstruction – Aliasing, Types of Pulse Modulation: PAM, PPM, PWM – Modulation and Demodulation – Time Division Multiplexing.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Simon Haykins John, "Communication Systems", Wiley and Sons, 5th Edition.
2. Dennis Roddy and John Coolen, "Electronic Communications", 4th Edition, PEA, 2004.
3. Lathi B.P., "Modern Digital and Analog Communication Systems", 4th Edition, BS Publication, 2004.
4. Robert J. Schoenbeck, "Electronic Communication Systems – Modulation and Transmission" 2nd Edition, PHI.
5. Simon Haykin, "Analog and Digital Communications", John Wiley, 2005.
6. Sam Shanmugam K., "Analog and Digital Communication", Wiley and Sons, 2006.
7. Wayne Tomasi, "Electronics Communication Systems: Fundamentals through Advanced", Prentice Hall, 2004.

COURSE OUTCOMES:

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

CO1: Design AM communication systems.

CO2: Illustrate and analyze Angle modulated communication systems

CO3: Analyze the noise performance of AM and FM systems.

CO4: Develop and analyze AM receivers.

CO5: Gain knowledge in sampling and quantization

19CAMC001 CONSTITUTION OF INDIA SEMESTER V

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

- To gain knowledge about Indian constitution.
- To study the growth of modern Indian intellectual's constitutional role.
- To understand the role of socialism in India.
- To be familiar about central and state government functionalities in India.
- To understand about Indian society.

UNIT-I: INTRODUCTION 9

Historical background – Constituent assembly of India – Philosophical foundations of the Indian constitution – Preamble – Fundamental rights – Directive principles of State policy – Fundamental duties – Citizenship – Role of the election commission.

UNIT-II: STRUCTURE AND FUNCTION OF CENTRAL & STATE GOVERNMENT 9

Union Government – Structures of the union Government and functions – President – Vice president – Prime minister – Cabinet – Parliament – Supreme court of India – Judicial review. State Government – Structure and functions – Governor – Chief minister – Cabinet – State legislature – Judicial system in States – High Courts and other subordinate courts.

UNIT-III: CONSTITUTION FUNCTIONS OF INDIA AND INDIAN SOCIETY 9

Indian federal system – Central – State relations – President's rule – Constitutional amendments – Constitutional functionaries – Assessment of working of the Parliamentary system in India. Society: Nature, Meaning and definition; Indian social structure; Caste, Religion, Language in India; Constitutional remedies for citizens – Political parties and pressure groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker sections.

UNIT-IV: POLICIES AND ACTS – GENERAL 9

Insurance and bonding – Laws governing sale, Purchase and use of Urban and Rural land – Land Revenue Codes – Tax laws – Income Tax, Sales Tax, Excise and Custom duties and their Influence on Construction cost – Legal requirements for planning – Property law – Agency law – Local Government laws for approval.

UNIT-V: POLICIES AND ACTS ON INFRASTRUCTURE DEVELOPMENT 9

A historical review of the Government Policies on Infrastructure – Current public policies on transportations – Power and telecom sector – Plans for infrastructure development – Legal framework for regulating private participation in roads and highways – Ports and airport and telecom.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2018.
2. Agarwal R.C., "Indian Political System", S. Chand and Company, New Delhi, 2004.
3. Laxmikanth M., "Indian Polity", McGraw Hill Education (India) Private limited, 2016.
4. Sharma and Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2018.

5. Maciver and Page, “Society: An Introduction Analysis”, Mac Milan India Ltd., New Delhi, 2007.
6. Sharma K.L., “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi, 2006.

COURSE OUTCOMES:

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

CO1: Realize and abide the rules of the Indian constitution.
CO2: Be aware of the functions of Central Government.
CO3: Illustrate the function of state Government.
CO4: Explain the various constitutional functions.
CO5: Identify different culture among the people of India.

19ECPC506 DIGITAL SIGNAL PROCESSING LABORATORY SEMESTER V

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To learn about the generation of sequences.
- To realize Linear and Circular Convolution.
- To design and realize FIR and IIR filters.
- To implement signal processing algorithms using digital signal processor.
- To design and realize FIR and IIR filters using digital signal processor.

LIST OF EXPERIMENTS

EXPERIMENTS USING MATLAB:

1. Generation of various discrete time signals
2. Linear and circular convolution
3. Auto correlation and Cross Correlation
4. Implementation of FFT algorithm.
5. Design of FIR filters using windowing techniques
6. Design of Butterworth and Chebyshev IIR filters
7. Implement an Up– sampling and Down– sampling operation

EXPERIMENTS USING DSP PROCESSOR:

8. Architecture of Digital Signal Processor - A study
9. MAC operation using various addressing modes
10. Implementation of Linear and Circular Convolution
11. Waveform generation
12. Implementation of FIR and IIR filters

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Write code to visualize signal processing operations.

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

CO3: Design and realize FIR and IIR filters using MATLAB.

CO4: Design and Implement the various DSP algorithms in processor.

CO5: Implement a DSP system for various digital filters.

19ECEE507 VLSI DESIGN LABORATORY SEMESTER V

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To Learn Hardware Descriptive Language (Verilog / VHDL).
- To exposed to the fundamental principles of VLSI circuit design in digital and analog domain.
- To be familiar with fusing of logical modules on FPGA.
- To provide hands on design experience with professional design (EDA) platforms.
- To learn to do power analysis of the circuits designed.

LIST OF EXPERIMENTS

Part I: Digital System Design using HDL & FPGA

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
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.

Part-II Digital Circuit Design

7. Design and simulate a CMOS inverter using digital flow.
8. Design and simulate a CMOS Basic Gates & Flips.
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops.

   Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7to9.

   Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations.

Part-III Analog Circuit Design

10. Design and Simulate a CMOS Inverting Amplifier.
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 5 transistor differential amplifier. Analyze Gain, Bandwidth and CMRR by performing Schematic Simulations.

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

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

CO2: Import the logic modules into FPGA Board.

CO3: Synthesize Place and Route the digital IPs.

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

CO5: Able to perform power analysis of the circuits.

19ECPC601 TRANSMISSION LINES AND ANTENNAS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand about transmission lines characteristics.
- To impart technical knowledge in impedance matching using smith chart.
- To get acquaintance with waveguides.
- To understand the basic principle of antennas.
- To enhance knowledge in various antenna designs.

UNIT-I: TRANSMISSION LINE THEORY AND LINE AT RADIO FREQUENCY 9

General theory of Transmission lines – General solution – Wavelength, Velocity of propagation – Waveform distortion – The distortion-less line – Loading and different methods of loading – Reflection coefficient – Reflection factor and reflection loss – Input and transfer impedance – Open and short circuited lines – Transmission line equations at radio frequencies – Line of Zero dissipation – Voltage and current on the dissipation-less line, Standing waves, Nodes, Standing wave ratio.

UNIT-II: IMPEDANCE MATCHING IN HIGH FREQUENCY LINES 9

Impedance matching: Quarter wave transformer – Impedance matching by stubs – Single stub and double stub matching – Smith chart – Solutions of problems using Smith chart – Single and double stub matching using Smith chart.

UNIT-III: WAVEGUIDES 9

General wave behavior along uniform guiding structures – Transverse electromagnetic waves, Transverse magnetic waves, Transverse electric waves – TM and TE waves between parallel plates. Field equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel functions, TM and TE waves in circular waveguides.

UNIT-IV: RADIATION PROPERTIES OF AN ANTENNA 9

Radiating fields of current element – Radiation from half wave dipole and Quarter wave monopole, folded dipole, Reciprocity principle. Broadside and End fire array – N-element linear array – Pattern multiplication – Binomial array – Concept of Phased arrays, Adaptive arrays and Microstrip antenna arrays – Antenna radiation hazards.

UNIT-V: ANTENNA TYPES AND ITS MEASUREMENTS 9

Antenna types: Loop antenna – Helical antenna – Spiral antenna – Slot antennas – Horn antenna – Parabolic reflector antenna. Modern Antennas – Embedded antennas – UWB – Plasma antenna – Smart antennas for Bluetooth applications – Antenna measurements: Antenna measurement range, Radiation pattern, Gain, Impedance, Directivity measurement, Polarization and efficiency measurements.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45Periods

REFERENCES:

1. John D. Ryder, "Networks, Lines and Fields", 2nd Edition, Prentice Hall of India, 2007.
2. John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and wave propagation", 4th Edition, McGraw–Hill Book Company, 2010.
3. Constantine A. Balanis, "Antenna Theory Analysis and Design", 4th Edition, John Wiley, 2016.

4. Rajeswari Chatterjee, “Antennas for Information Super Skyways”, PHI Leaning Private Limited, 2008.
5. Raju G.S.N., “Electromagnetic Field Theory and Transmission Lines”, Pearson Education, 2006.

COURSE OUTCOMES:

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

CO1: Compute the electrical parameters of transmission lines.
CO2: Solve the impedance matching by stub using smith chart.
CO3: Analyze the characteristics of TE and TM waves in waveguides.
CO4: Understand basic principle and design of antennas.
CO5: Enhance the knowledge on various antenna and parameters measurement.

19ECPC602 DIGITAL COMMUNICATION SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the principles of sampling and quantization.
- To study the various waveform coding schemes.
- To learn the various baseband transmission schemes.
- To understand the various Band pass signaling schemes.
- To know the fundamentals of channel coding.

UNIT-I: SAMPLING AND QUANTIZATION 9

Low pass sampling – Aliasing – Signal reconstruction – Quantization – Uniform and non-uniform quantization – Quantization noise – Logarithmic companding of speech signal – PCM – TDM.

UNIT-II: WAVEFORM CODING 9

Prediction filtering and DPCM – Delta modulation – ADPCM and ADM principles – Linear predictive coding.

UNIT-III: BASEBAND TRANSMISSION AND RECEPTION 9

Properties of Line codes – Power spectral density of Unipolar / Polar RZ and NRZ – Bipolar NRZ – Manchester – ISI – Nyquist criterion for distortionless transmission – Pulse shaping – Correlative coding – M-ary schemes – Eye pattern, Receiving Filters – Matched filter, Correlation receiver, Adaptive equalization.

UNIT-IV: DIGITAL MODULATION SCHEME 9

Geometric Representation of signals – Generation, detection, PSD and BER of Coherent BPSK, BFSK and QPSK – QAM – Carrier synchronization – Structure of non-coherent receivers – Principle of DPSK.

UNIT-V: ERROR CONTROL CODING 9

Channel coding theorem – Linear block codes – Hamming codes – Cyclic codes –Convolutional codes – Viterbi decoder.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Haykin S., "Digital Communications", John Wiley, 2005.
2. Sklar V., "Digital Communication Fundamentals and Applications", 2nd Edition, Pearson Education, 2009.
3. Lathi B.P., "Modern Digital and Analog Communication Systems" 3rd Edition, Oxford University Press 2007.
4. Hwei P. Hsu , Schaum Outline Series, "Analog and Digital Communications", TMH 2006.
5. Proakis J.G., "Digital Communication", 4th Edition, Tata Mc Graw Hill Company, 2001.

COURSE OUTCOMES:

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

CO1: Design PCM systems.

CO2: Design and implement base band transmission schemes.

CO3: Design and implement band pass signaling schemes.
CO4: Analyze the spectral characteristics of band pass signaling schemes and their noise performance.
CO5: Design error control coding schemes.

19ECPC603 COMPUTER NETWORKS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the Basic elements of a network, Issues in building a network, protocols, standards and models.
- To be exposed the functions of Data Link Layer, Wired and Wireless networks.
- To understand the function of Network Layer and to analyze routing algorithms in unicast and Multicast domain.
- To realize the transport layer protocols and understanding congestion control and avoidance mechanisms.
- To be familiar with application layer services and importance of security in data transfer.

UNIT-I: FUNDAMENTALS OF NETWORKING AND PHYSICAL LAYER 9

Introduction to networks – Topologies – Protocols and standards – Network models: ISO/OSI model – TCP/IP – Comparison of OSI model and TCP/IP – Physical layer: Transmission media – Connecting devices – Hubs, Switches, Routers, Gateways – Coding techniques (NRZ, NRZI, Manchester and 4B/5B).

UNIT-II: DATA LINK LAYER 9

Functions of DLL: Framing – Flow control – Error control – Media Access Control (MAC): Random access – Controlled access – Channelization – Working and standards of Ethernet protocol – Wireless technologies: Challenges – IEEE 802.11 – Bluetooth – Zigbee.

UNIT-III: NETWORK LAYER AND INTERNETWORKING 9

Purpose of Network Layer: Packet switching – Logical addressing (IPV4 and IPV6) – Routing: unicast (DVR and LSP) – Multicast (DVMRP and PIM) – Internetworking concepts: ARP, DHCP, ICMP, IGMP – Border Gateway Protocol – Basics of IoT.

UNIT-IV: TRANSPORT LAYER 9

Features of Transport Layer – UDP – An overview of TCP – TCP Connection Management – Congestion control mechanisms – Congestion avoidance (DECbit and RED) – Components and services of QoS – RSVP.

UNIT-V: APPLICATION LAYER 9

Conventional Applications: Client server paradigm and programming – WWW–HTTP – E-mail (MIME, SMTP, IMAP and POP3) – DNS – SNMP – Basics of Network security and cryptography (DES, AES, RSA and Diffie-Hellman algorithms).

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Behrouz A. Forouzan, “Data Communication and Networking”, Tata McGraw– Hill, New Delhi, 2013.
2. Kurose James F and Keith W. Ross, “Computer Networking: A Top – Down Approach”, Pearson Education, New Delhi, 2013.
3. Andrew S. Tanenbaum, “Computer networks”, Prentice Hall of India, New Delhi, 2011.
4. Comer D. E., “Internetworking with TCP/IP”, Prentice Hall of India, New Delhi, 2013.

5. William Stallings, “Data and Computer Communication”, Prentice Hall of India, New Delhi, 2014.
6. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kauffmann Publishers Inc., 2012.
7. William Stallings, “Cryptography and Network Security Principles and Practice”, Pearson Education, Fourth Edition, 2005.

COURSE OUTCOMES:

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

CO1: Identify the networking devices and differentiate the network architectures used in networking with their functions.

CO2: Illustrate the different protocols used in DLL and able to recognize the working of wireless network devices.

CO3: Analyze the routing algorithms and understanding the concept of World Wide Web and IoT.

CO4: Recognize the functions of TCP in controlling congestion and understanding the necessity of providing QoS.

CO5: Describe various application services and applying cryptography techniques on the data to be transferred.

19ECMC604 MANAGEMENT THEORY AND YOUTH EMPOWERMENT **SEMESTER VI**

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

- To Provide the Value Education to improve the students' good character.
- To develop Personality and learning of Introspection.
- To learn the Cultural values.
- To study the evolution of management.
- To study the functions and principles of management.

UNIT-I: PHILOSOPHY OF LIFE SCIENCE **9**

Life – Purpose of Life – Philosophy of life – Law of nature – Kindness towards living beings preserving natural resources.

UNIT-II: HUMAN VALUES AND SOCIAL VALUES **9**

Culture – Analysis of thought – Moralization of desire – Neutralization of anger – Eradication of worry – Blessings and benefits – Harmonious friendship – Love and compassion – Individual Peace. Family – Family peace – Society – Life style – World brotherhood – Greatness of women – Five duties – Economics – Hygiene and health care – Education – Politics – Responsibilities of people.

UNIT-III: DEVELOPMENT OF MENTAL PROSPERITY **9**

Prosperity of Mind – Life force – Bio-Magnetism and Mind – Functions of Mind – Mental frequency – Ten stages of Mind – Genetic centre – Meditation –Value of spirituality –Universal magnetism and Bio-Magnetism.

UNIT-IV: 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 – Types of Business organization – Sole proprietorship, partnership, company – Public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management.

UNIT-V: ORGANISING **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.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Vethathiri Maharishi, 2011, "Journey of Consciousness", Vethathiri Publications.
2. Iyankar B.K.S., "The path to Holistic Health", Dorling Kindusly Pvt. Ltd, London, 2014.
3. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
4. JAF Stoner, Freeman R.E and Daniel R. Gilbert, "Management", Pearson Education, 6th Edition, 2004.

5. Stephen A. Robbins, David A. Decenzo and Mary Coulter, "Fundamentals of Management", Pearson Education, 7th Edition, 2011.
6. Tripathy P.C. and Reddy P.N., "Principles of Management", Tata McGraw Hill, 1999.

COURSE OUTCOMES:

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

CO1: Enable the student to have good character.

CO2: Practice mental hygiene.

CO3: Possess emotional stability and Cultural values.

CO4: Acquire knowledge of evolution of management.

CO5: Aware the functions and principles of management.

19ECPC605 COMPUTER NETWORKS LABORATORY SEMESTER VI

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To transfer data between two computers.
- To implement the coding schemes, Flow control and MAC protocols.
- To familiar with IP Configuration.
- To know to implement various routing algorithms.
- To apply programming skills for securing data.

LIST OF EXPERIMENTS

1. Study of Network simulator (NS) and creation of two nodes to analyze the data transfer between them
2. Network Topology – Bus, Star and Ring
3. Coding schemes (NRZ, Manchester and 4B/5B)
4. Error Detection (Checksum and CRC) and Error Correction Techniques (Hamming)
5. Implementation of High-Level Data Link Control
6. Visualization of Stop and Wait Protocol and sliding window using NS
7. Go back– N and selective repeat protocols using NS
8. IP address configuration and transfer of files through IP
9. Simulation of CSMA / CD and CSMA/CA protocol
10. Routing algorithms (DVR and LSP)
11. Simulation of Congestion Control Algorithms using NS
12. Implementation of DES and RSA or given data using any programming language

Contact periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Connect and transfer data between two computers.
CO2: Implement different coding schemes and protocols.
CO3: Configure IP for internetworking.
CO4: Construct and analyze a network using simulation tool.
CO5: Implement different cryptography algorithms.

19ECPC606 ANALOG AND DIGITAL COMMUNICATION LABORATORY SEMESTER VI

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To implement analog modulation schemes.
- To implement digital modulation schemes.
- To visualize the effect of sampling, various line coding techniques and TDM.
- To simulate error control coding schemes.
- To gain the knowledge to implement Communication system.

LIST OF EXPERIMENTS

1. Amplitude Modulation and Demodulation
2. Frequency Modulation and Demodulation
3. Generation of DSB using Balanced Modulation
4. Pre-Emphasis and De-emphasis
5. Signal Sampling and reconstruction
6. ASK and FSK Modulation
7. Pulse Modulation–PPM, PCM
8. Delta Modulation and Adaptive Delta Modulation
9. Line coding schemes
10. Time Division Multiplexing
11. Simulation of Analog modulation schemes-AM and FM
12. Simulation of Digital Modulation schemes – ASK, FSK
13. Simulation of Error control coding schemes- Linear Block Codes and cyclic error control coding schemes
14. Simulation of signal constellations of BPSK, QPSK and QAM
15. Experiments using MATLAB Communication Tool Box
    - Analysis of Analog Modulation Schemes
    - Analysis of Digital Modulation Schemes

Contact periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Demonstrate analog modulation techniques.
CO2: Demonstrate digital modulation techniques.
CO3: Understand sampling effect on signal.
CO4: Measure and analyze the performance of receiver characteristics.
CO5: Simulate the various functional modules of a communication system.

19CAHS003 COMMUNICATION SKILLS LABORATORY SEMESTER VI

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- To provide guidance and practice in basic general and classroom conversation.
- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing.
- To develop effective communication skills.

UNIT-I: 9

Listening – Listening and answering – Listening to a lecture and pronunciation – **Speaking** – Giving and asking personal information – **Reading** – Strategies for effective reading and Reading comprehension – **Writing** – Develop a paragraph: topic sentence, supporting sentences and concluding sentence – Descriptive paragraph writing.

UNIT-II: 9

Listening – Listening to process information – Stress and intonation patterns – **Speaking** – small talk – Converse with reasonable accuracy over a wide range of everyday topics – **Reading** – Read for details – Use of graphic organizers to review and aid comprehension – **Writing** – State reasons and examples to support ideas in writing – Write a paragraph with reasons and examples – Opinion paragraph writing.

UNIT-III: 9

Listening – Lexical chunking for accuracy and fluency – Factors influence fluency – Listen for and follow the gist – Listen for details – **Speaking** – Informal talk – Describing health and symptoms – **Reading** – Connectors and Pronouns in a passage – Speed reading techniques – **Writing** – Elements of a good essay –Types of essays – Descriptive, Narrative, Issue-based, Argumentative and analytical.

UNIT-IV: 9

Listening – Active listening – **Speaking** – Giving verbal and non-verbal feedback – Listening and participating in conversations – Strategies for presentations: group/pair presentations – **Reading** – Genre and Organization of Ideas – **Writing** – Email writing – visumes – Job application – Project writing – Writing convincing proposals.

UNIT-V: 9

Listening – Listening and responding to explanations in academic and business contexts – Speaking – Participating in a group discussion – **Reading** – Critical reading and thinking – Understanding how the text positions the reader – **Writing** – Statement of Purpose – Letter of recommendation – Vision statement.

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30 Periods

REFERENCES:

1. Ladousse and Gillian Porter, "Role Play", Oxford University Press: Oxford, 2014.
2. Hughes, Glyn and Josephine Moate, "Practical English Classroom", Oxford University Press: Oxford, 2014.

3. Davis, Jason and Rhonda Liss, “Effective Academic Writing (Level 3)”, Oxford University Press: Oxford, 2006.
4. Debra Daise, CharlNorloff, and Paul Carne, “Reading and Writing (Level 4)” Oxford University Press: Oxford, 2011.
5. Withrow, Jeans and et al, “Inspired to write. Readings and Tasks to develop writing skills”, Cambridge University Press: Cambridge, 2004.
6. Robert M Sherfield and et al. “Developing Soft Skills” 4th edition, New Delhi: Pearson Education, 2009.

COURSE OUTCOMES:

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

CO1: Listen and respond appropriately.

CO2: Make effective presentations and participate in group discussions.

CO3: Read and evaluate texts critically.

CO4: Write winning job applications.

CO5: Display critical thinking in various professional contexts.

19ECPC701 RF AND MICROWAVE ENGINEERING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To inculcate understanding of the basics required for circuit representation of RF networks.
- To deal with the issues in the design of microwave amplifier.
- To instill knowledge on the properties of various microwave components.
- To deal with the microwave generation.
- To introduce the microwave measurement techniques.

UNIT-I: TWO PORT NETWORK THEORY 9

Review of low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnection of Two port networks, High frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors.

UNIT-II: RF AMPLIFIERS AND MATCHING NETWORKS 9

Characteristics of Amplifiers, Amplifier power relations, Stability considerations, Stabilization methods, Noise figure, Constant VSWR, Broadband, High power and multistage amplifiers, Impedance matching using discrete components, Two component matching networks, Frequency response and quality factor, T and Pi matching networks, Microstrip line matching networks.

UNIT-III: PASSIVE AND ACTIVE MICROWAVE DEVICES 9

Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal and Schottky diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode, Introduction to MIC.

UNIT-IV: MICROWAVE GENERATION 9

Review of conventional vacuum Triodes, Tetrodes and Pentodes, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons, Backward wave Crossed field amplifier and oscillator.

UNIT-V: MICROWAVE MEASUREMENTS 9

Measuring Instruments: Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design: Theory and Applications", Pearson Education Inc., 2011.
2. Robert E. Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, 2005.
3. David M. Pozar, "Microwave Engineering", Wiley India (P) Ltd, New Delhi, 2008.

4. Thomas H. Lee, “Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits”, Cambridge University Press, 2004.
5. Mathew M. Radmanesh, “RF and Microwave Electronics”, Prentice Hall, 2000.

COURSE OUTCOMES:

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

CO1: Analyze the multi- port RF networks and RF transistor amplifiers.

CO2: Generate Microwave signals and design microwave amplifiers.

CO3: Explain the active & passive microwave devices

CO4: Acquire knowledge on components used in Microwave communication systems

CO5: Measure and analyze Microwave signal and parameters.

19ECPC702 EMBEDDED AND REAL TIME SYSTEMS SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the architecture and programming of ARM processor.
- To be familiar with the embedded computing platform design and analysis.
- To be exposed to the basic concepts of Real time operating system.
- To learn the system design techniques and networks for embedded systems.
- To observe the different case studies.

UNIT-I: INTRODUCTION TO EMBEDDED COMPUTING AND ARM POCESSOR 9

Complex systems and microprocessors – Embedded system design process – Design example: Model train controller – 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 – Consumer electronics architecture – Platform – Level performance analysis – Components for embedded programs – Models of programs – Assembly, linking and loading – Compilation techniques – Program level performance analysis – Software performance optimization – Program level energy and power analysis and 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 – 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.

UNIT-V: CASE STUDY 9

Data compressor – Alarm clock – Audio player – Software modem – Digital still camera– Telephone answering machine – Engine control unit – Video accelerator.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2. Jonathan W. Valvano, "Embedded Microcomputer Systems Real Time Interfacing", 3rd Edition, Cengage Learning, 2012.
3. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
4. Raymond J.A. Buhr and Donald L.Bailey, "An Introduction to Real-Time Systems - From Design to Networking with C / C++", Prentice Hall, 1999.

5. Krishna C. M. and Kang G. Shin, “Real-Time Systems”, International Editions, McGraw Hill 1997.
6. Prasad K.V. K. K., “Embedded Real-Time Systems: Concepts, Design & Programming”, Dream Tech Press, 2005.
7. Sriram V. Lyer and Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata McGraw Hill, 2004.

COURSE OUTCOMES:

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

CO1: Describe the architecture and programming of ARM processor.

CO2: Explain the basic concepts of real time Operating system design.

CO3: Use the system design techniques to develop software for embedded systems.

CO4: Differentiate between the general purpose operating system and the real time operating system.

CO5: Model real-time applications using embedded-system concepts.

19CAHS004 PROFESSIONAL ETHICS IN ENGINEERING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of Values and Ethics in their professional careers.
- To know the different ideas of engineering ethics.
- To Infer moral judgment concerning the profession
- To inculcate the sense of social responsibility.
- To know the global issues of ethics.

UNIT-I: HUMAN VALUES 9

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 – Moral 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 9

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.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
2. Govindarajan M., Natarajan S. and Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
5. John R. Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

6. Edmund G. and Robert L. Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.

COURSE OUTCOMES:

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

CO1: Apply human values.

CO2: Apply ethical issues related to Engineering.

CO3: Realize the code of Ethics.

CO4: Realize the responsibilities and rights in the society.

CO5: Know Global Issues.

19ECPC704 RF AND MICROWAVE LABORATORY SEMESTER VII

L	T	P	C
0	0	3	2

COURSE OBJECTIVE:

- Understand the working principle of optical sources, detector, fibers and microwave components.
- Develop the understanding of simple optical communication link.
- Learn about the characteristics and measurements in optical fiber.
- Know about the behavior of microwave components.
- Practice the microwave measurement procedures.

LIST OF EXPERIMENTS

1. DC characteristics of LED and PIN Photo diode
2. Mode characteristics of Fibers
3. Measurement of connector and bending losses
4. Fiber optic Analog and Digital Link– eye diagram (digital)
5. Numerical aperture determination for Fibers
6. Attenuation measurement in Fibers
7. Reflex klystron and Gunn diode characteristics
8. Basic microwave parameter measurement such as VSWR, frequency, wavelength, Attenuation and power measurement
9. Radiation pattern of Horn Antenna
10. S - Parameter Measurements for Isolator, Circulator, E plane Tee, H Plane Tee, Magic Tee and Directional Coupler

Contact periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Analyze the performance of simple optical link.
CO2: Test microwave and optical components.
CO3: Analyze the mode characteristics of fiber.
CO4: Analyze the radiation pattern of antenna.
CO5: Analyze S parameters of microwave components.

19ECEE705 EMBEDDED SYSTEMS LABORATORY SEMESTER VII

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVE:

- Learn the working of ARM processor & understand the building blocks of Embedded systems.
- Learn the concept of memory map and memory interface.
- Know the characteristics of peripheral devices.
- Write programs to interface memory, I/Os with processor.
- Study the interrupt performance.

LIST OF EXPERIMENTS

1. Study of ARM evaluation system
2. Interfacing ADC and DAC
3. Interfacing LED and PWM
4. Interfacing real time clock and serial port
5. Interfacing keyboard and LCD
6. Interfacing EPROM and interrupt
7. Interrupt performance characteristics of ARM and FPGA
8. Flashing of LEDS
9. Interfacing stepper motor and temperature sensor
10. Implementing zigbee protocol with ARM

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Write programs in ARM for a specific application.

CO2: Interface memory and write programs related to memory operations.

CO3: A/D and D/A convertors with ARM system.

CO4: Analyze the performance of interrupt.

CO5: Write programs for interfacing keyboard, display, motor and sensor.

19CAEE001	PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP	SEMESTER VII L T P C 0 0 6 3

COURSE OBJECTIVES:

- To empower students with over all Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experimental learning to enhance the Enterpreneurship and employability skills of the students.

This course is a four months immersive program to keep up with the industry demand and to have critical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from industry and faculties. This is an EEC category course offered as an elective under the type, "Experimental Project Based Learning".

Highlights of this course:

- Students undergo training on emerging technologies
- Students develop solutions for real world use cases
- Students work with mentors to learn and use industry best practices
- Studnets access and use self-learning courses on various technologies, approaches and methodologies.
- Collabarate in teams with other students working on the same topic
- Have a dedicated mentor to guide

The Course will involve 40 – 50 hours of technical training and 40-50 hours of project Development. The activities involved in the project along with duration are given in Table 1.

Table 1 Activities

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team Members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2

Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform.	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, Project Document and demonstration video.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
Total		**16 Weeks**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

Table 2: Evaluation Schema

	Skills		Weightage
I	**Technical Skills**		
	1.	Technical Training & Assignment	20%
	2.	Project Planning	5%
	3.	Requirement Analysis	5%
	4.	Project Design	5%
	5.	Innovation	5%
	6.	Technology Stack (Utilization of various APIs, tools, techniques)	5%
	7.	Coding	15%
	8.	Acceptance Testing	5%
	9.	Performance	5%
II	**Soft Skills**		
	1.	Team Work	5%
	2.	Time management	10%
	3.	Attendance and Punctuality	5%
	4.	Project Documentation	5%
	5.	Project Demonstration	5%
Total Score			100%

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical:45 Periods Total: 45 Periods

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Upskill in emerging technologies and apply to real industry-level use cases
CO2: Understand agile development process
CO3: Develop career readiness competencies, Team Skills/ Leadership qualities
CO4: Develop time management, Project Management skills and communication skills
CO5: Use critical thinking for innovative problem solving
CO6: Develop entrepreneurship skills to independently work on products.

19ECEE801	PROJECT WORK	SEMESTER VIII

L	T	P	C
0	0	16	8

COURSE OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 60 Periods

COURSE OUTCOMES:

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

CO1: On completion of the project work students will be in a position to take up their project work to formulating proper model.

19ECPE501 INFORMATION THEORY AND CODING SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of probability.
- To describe and analyze the information source.
- To analyze the channel characteristics.
- To understand source coding techniques.
- To construct the various error coding.

UNIT-I: BASIC CONCEPTS OF PROBABILITY 9

Sets: Definition and operations, Probability – Joint and conditional probabilities, Baye's theorem, Random variables – Operations on single and multiple random variables – Random process concept – Stationarity – Ergodicity – First order Markov process – Correlation – Auto and cross correlation functions – Power spectral density.

UNIT-II: INFORMATION THEORY 9

Uncertainty – Information and it's property – Entropy and its property – Joint and Conditional Entropy – Mutual information and its property – Relationship between Entropy and Mutual information.

UNIT-III: CHANNEL CLASSIFICATION AND CAPACITY 9

Discrete Memoryless Channels – BSC, BEC – Channel capacity, Shannon limit, Channel representations – Noiseless Channel, Lossless channels, Deterministic Channel.

UNIT-IV: SOURCE CODING 9

Overview of source coding – Properties – Optimal codes – Source coding theorem – Shannon's first, second and third theorem – Shannon Binary Encoding, Shannon-Fano Encoding – Huffman codes – Adaptive Huffman coding.

UNIT-V: ERROR CODING TECHNIQUES 9

Types of errors – Types of codes – Hamming weight, Hamming distance, Hamming code **–** Linear block codes: Error detection and error correction capabilities of linear block codes– Binary cyclic codes: Syndrome calculation – Error detection and error correction – Minimum distance decoding – Single parity code.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Simon Haykin and Michael Moher, "Communication Systems", John Wiley and Sons, 5th Edition, 2012.
2. Thomas Cover and Joy Thomas, "Elements of Information theory", 2nd Edition, 2014.
3. Sam Shanmugam K., "Digital and Analog Communication Systems", John Wiley and Sons, 2012.
4. John G. Proakis, "Digital Communication" McGraw Hill 5th Edition, 2014.
5. Reza F.M., "An Introduction to information theory", McGraw Hill, New Delhi.1994.
6. Ranjan Bose, "Information Theory, Coding and Cryptography", Tata McGraw Hill, 2012.

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of information and its property.

CO2: Learn principle of information theory.

CO3: Interpret the concepts of discrete memory less sources.

CO4: Apply the fundamentals of information theory to source coding.

CO5: Know the concepts of error codes to the design of communication systems.

19ECPE502 **SPEECH AND AUDIO PROCESSING** **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To familiarize the basic mechanism of speech production.
- To learn the basic concepts of methods for speech analysis and parametric representation of speech.
- To give an overall picture about various applications of speech processing.
- To impart ideas of perception of sound, Psycho-acoustic analysis, Spatial audio perception and rendering.
- To introduce Audio Compression Schemes.

UNIT-I: FUNDAMENTALS OF SPEECH PRODUCTION **9**

Speech production: Acoustic theory of speech production, Speech analysis: Short – Time speech analysis, Time domain analysis (Short time energy, Short time zero crossing rate, ACF). Parametric representation of speech: AR model, ARMA model, LPC analysis (LPC model, Auto correlation method).

UNIT-II: SPEECH ANALYSIS METHODS **9**

Frequency domain analysis (Filter Banks, STFT, Spectrogram), Cepstral analysis, MFCC, Fundamentals of speech recognition and Text-to-speech conversion speech coding, Speech enhancement, Speaker verification, Language identification.

UNIT-III: AUDIO SIGNAL PROCESSING MODELS OF SOUND PERCEPTION **9**

Signal processing models of audio perception: Basic anatomy of hearing system, Auditory filter banks, Psycho – Acoustic analysis: Critical band structure, Absolute threshold of hearing, Simultaneous masking, Temporal masking, Quantization noise shaping, MPEG psycho – Acoustic model.

UNIT-IV: STANDARDS FOR AUDIO COMPRESION **9**

Audio compression methods: Sampling rate and bandwidth requirement for digital audio, Redundancy removal and perceptual irrelevancy removal, Transform coding of digital audio: MPEG2 – AAC coding standard, MDCT and its properties, Pre-echo and pre-echo suppression, Loss less coding methods.

UNIT-V: AUDIO QUALITY ANALYSIS **9**

Spatial audio perception and rendering: The physical and psycho – Acoustical basis of sound localization and space perception. Spatial audio standards. Audio quality analysis: Objective analysis methods – PEAQ, Subjective analysis methods – MOS score, MUSHRA score.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Douglas O'Shaughnessy, "Speech Communications: Human and Machine", IEEE Press, Hardcover 2nd Edition.
2. Nelson Morgan and Ben Gold, "Speech and Audio Signal Processing: Processing and Perception Speech and Music", John Wiley and Sons, July 1999.

3. Donald G. Childers, “Speech Processing and Synthesis Tool boxes”, John Wiley and Sons, September 1999.
4. Rabiner and Juang, “Fundamentals of Speech Recognition”, Prentice Hall, 1994.
5. Rabiner and Schafer, “Digital Processing of Speech Signals”, Prentice Hall, 1978.
6. Thomas F. Quatieri, Discrete, “Time Speech Signal Processing: Principles and Practice”, Prentice Hall; ISBN: 13242942X; 1st Edition.
7. Daniel Jurafsky and James H Martin, "Speech and Language Processing-An Introduction Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education.

COURSE OUTCOMES:

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

CO1: Understand basic concepts of speech production, speech analysis, speech coding.
CO2: Apply the parametric representation of speech and apply it in practical applications.
CO3: Develop systems for various applications of speech processing.
CO4: Learn signal processing models of sound perception and application of perception models in audio signal processing.
CO5: Implement audio compression algorithms and standards.

19ECPE503 MEASUREMENTS AND INSTRUMENTATION SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the purpose of measurement, Basic functional elements of instrumentation the methods of measurements, errors associated with measurements.
- To study about the meters used to measure voltage, current, power and energy.
- To learn about the different bridges for measurement.
- To understand the magnetic measurements and the usage of current and potential transformers.
- To know the different display and recording devices.

UNIT-I: MEASUREMENT CONCEPTS 9

Measurement System – Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Calibration – Primary and secondary standards.

UNIT-II: MEASUREMENT OF VOLTAGE, CURRENT, POWER AND ENERGY 9

Principle, construction, operation and types of analog & digital voltmeters, ammeters – Extension of range and calibration of voltmeter & ammeter – Errors and compensation, Single and three phase watt meters and energy meters – Calibration of wattmeter and Energy meter.

UNIT-III: DC and AC BRIDGES 9

Measurement of resistance – Wheatstone bridge – Kelvin double bridge; Measurement of inductance, capacitance: Q of coil – Maxwell's Bridge – Schering bridge – Anderson bridge – Hay Bridge – Wien bridge.

UNIT-IV: MAGNETIC MEASUREMENTS AND INSTRUMENT TRANSFORMERS 9

Determination of B-H curve and measurements of iron loss – Instrument transformers – Theory, operation and characteristics, Interference and screening – Multiple earth and earth loops – Electrostatic and Electromagnetic Interference – Grounding techniques.

UNIT-V: DISPLAY AND RECORDING DEVICES 9

Magnetic disk and tape Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD and Dot matrix display – Data Loggers.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Sawhney A.K., "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Co, New Delhi, 2010.
2. Kalsi H.S., "Electronic Instrumentation", McGraw– Hill Education, New Delhi, 2010.
3. Golding E.W and Widdis F.C., "Electrical Measurements and Measuring Instruments", A.H. Wheeler and Co, 2001.
4. Doebelin E.O., "Measurement Systems – Applications and Design", McGraw Hill Education Pvt. Ltd., 2007.
5. Gupta J.B., "A Course in Electronic and Electrical Measurements and Instrumentation", S.K. Kataria and Sons, Delhi, 2003.

6. David A. Bell, “Electronic Instrumentation and Measurements”, Oxford University Press, 2013.
7. Jones, B.E., “Instrumentation Measurement and Feedback”, Tata McGraw Hill, 1986.

COURSE OUTCOMES:

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

CO1: Get the knowledge on functional elements of measurement system and its concepts.
CO2: Measure the voltage, current, power and energy.
CO3: Understand the method of measurement using DC and AC bridges.
CO4: Use instrument transformers for the appropriate measurement.
CO5: Learning on various storage and display devices.

19ECPE504 BIO-MEDICAL ELECTRONICS SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To gain knowledge about the physiological parameters.
- To understand the bio-chemical and non-electrical parameters.
- To study about various assist devices.
- To gain knowledge about various equipment used in diagnosis and treatment.
- To study about the state of art technologies in medical field.

UNIT-I: ELECTRO-PHYSIOLGOGY AND BIO POTENTIAL RECORDING 9

Origin of Bio Potentials – Bio-Potential Electrodes – Biological amplifiers – ECG and PCG, EEG, EMG: Lead systems, recording methods, typical waveforms and signal characteristics.

UNIT-II: BIO-CHEMICAL AND NON-ELECTRICAL PARAMETER MEASUREMENT 9

Measurement of partial pressure – Auto Analyzer and Colorimeter – Blood flow meters – Cardiac and respiratory measurements – Measurement of temperature: skin and surface temperature, Measurement of pressure: Sphygmomanometer, Measurement of Pulse: Direct and indirect measurement – Coulter counter.

UNIT-III: ASSIST DEVICES 9

Cardiac Pacemakers: External and internal – Defibrillators: AC, DC and DC synchronized – Dialyzer: Hemo dialyzer and peritoneal dialyzer – Heart lung machine – Ventilators.

UNIT-IV: PHYSICAL MEDICINE AND BIO TELEMETRY 9

Diathermy: Shortwave, Microwave, Ultrasonic and Surgical types – Bio telemetry: Principles, Types, Applications, MRI, CT and CAT.

UNIT-V: RECENT TRENDS IN MEDICAL APPLICATIONS 9

Endoscopy: Principle and recording setup, Radio pill and pill cam, Computer axial Tomography – Virtual surgery.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Khandpur. R.S., "Biomedical Instrumentation: Technology and Applications", McGraw–Hill Education (India), 3rd Edition, 2014.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall (India), 2007.
3. Arumugam. M., "Biomedical Instrumentation", Anuradha Publications, 2017.
4. John G. Webster, "Medical Instrumentation Application and Design", 3rd Edition Wiley India, 2007.

COURSE OUTCOMES:

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

CO1: Know the knowledge about the physiological parameters.

CO2: Understand the bio potentials and recording setup of various equipments.

CO3: Interpret about various assist devices.

CO4: Interpret the knowledge about various equipments used in diagnosis and treatment.

CO5: Comprehend study about the state of art technologies in medical field.

19ECPE505 CONSUMER ELECTRONICS SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the working principles of loudspeakers and microphones.
- To impart knowledge on television standards and systems.
- To introduce the basic principle of optical recording and reproduction.
- To explore the various telecommunication systems.
- To give an integrated approach to home appliances.

UNIT-I: LOUDSPEAKERS AND MICROPHONES 9

Dynamic loudspeaker, Electrostatic loudspeaker, Permanent magnet loudspeaker, Woofers and tweeters – Microphone characteristics, Carbon microphones, Dynamic microphones and wireless microphones.

UNIT-II: TELEVISION STANDARDS AND SYSTEMS 9

Components of a TV system – Interlacing – Composite video signal. Color TV – Luminance and Chrominance signal; Monochrome and color picture tubes – Color TV systems – NTSC, PAL, SECAM – Components of a remote control.

UNIT-III: OPTICAL RECORDING AND REPRODUCTION 9

Audio Disc – Processing of the Audio signal – Read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats – Recording systems – Playback systems.

UNIT-IV: TELECOMMUNICATION SYSTEMS 9

Telephone services – Telephone networks – Switching system principles – PAPX switching – Circuit, Packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless local loop. VHF/UHF Radio systems, Limited range cordless phones; Cellular modems.

UNIT-V: HOME APPLIANCES 9

Basic principle and block diagram of microwave oven; Washing machine hardware and software; Components of air conditioning and refrigeration systems.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Bali S.P., "Consumer Electronics", Pearson Education, 2005.
2. Gupta R.G., "Audio and video systems", Tata Mc Gram Hill, 2004.
3. Chitode J.S., "Consumer Electronics", Technical Publications, Pune, 2007.
4. Dhake A.M., "Television and video Engineering" Tata Mc Gram Hill 2006.

COURSE OUTCOMES:

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

CO1: Demonstrate the working principles of loudspeakers and microphones.
CO2: Develop various Standards for television system.
CO3: Explain the basic principle of optical recording and reproduction.
CO4: Acquire knowledge about the various telecommunication systems.
CO5: Solve engineering problems using modern electronics.

19ECPE 506 **VIRTUAL REALITY** **SEMESTER V**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce virtual reality to Electronics Engineers.
- To understand the design considerations in content creation and interaction.
- To know about the adverse health effect of virtual reality.
- To design guidelines of a safe health system.
- To discuss about applications in various fields.

UNIT-I: INTRODUCTION TO VIRTUAL REALITY 9

The virtual reality triangle – History of VR – Components of VR system – Input devices: Trackers, Navigation and Gesture interfaces, Output devices: Graphic Display, Sound and haptic feedback.

UNIT-II: VR ARCHITECTURE AND MODELING PROCESS 9

VR System Architecture – Geometric modeling – Kinematic modeling – Physical modeling – Behaviour modeling – Model management.

UNIT-III: CONTENT CREATION AND INTERACTION DESIGN GUIDELINES 9

Content creation: Design guidelines – High-Level concepts of content creation – Environmental design – Affecting behavior – Transitioning to VR content creation – Human-centered interaction – VR Interaction concepts – Input devices – Interaction patterns and techniques.

UNIT-IV: ADVERSE HEALTH EFFECTS 9

Motion sickness – Eye strain, Seizures and after effects – Hardware challenges – Latency – Measuring sickness, Adverse Health effects: Design guidelines.

UNIT-V: VR APPLICATIONS 9

Military applications – Medical applications – Robotic applications – Real time tracking – Games – Movies – Simulations – Treatment and therapy.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Burdea C and Philippe Coiffet, "Virtual Reality Technology", 2nd Edition, Gregory, John Wiley and Sons, Inc., 2008.
2. Jason Jerald, "The VR Book: Human - Centred Design for Virtual Reality", Association for Computing Machinery and Morgan and Claypool, 2015.
3. Dieter Schmalstieg and Tobias Hollerer, "Augmented Reality: Principles and Practice (Usability)", Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
4. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)", Addison – Wesley Professional; 1st Edition, 2016.
5. Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", O 'Reilly Media; 1st Edition, 2015.
6. Tony Parisi, "Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages", O'Reilly Media; 1st Edition, 2014.

7. Robert Scoble and Shel Israel, “The Fourth Transformation: How Augmented Reality and Artificial Intelligence Will Change Everything”, Patrick Brewster Press, 1st Edition, 2016.

COURSE OUTCOMES:

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

CO1: Understand the basics of virtual reality system.

CO2: Identify problem statements and function as a member of an engineering design team.

CO3: Explain the concept of design interaction.

CO4: Understand the difficulties in health effects.

CO5: Analyze and Design a system or process to meet given specifications with realistic Engineering constraints.

19ECPE507 OPERATING SYSTEMS SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To learn processes and scheduling algorithms.
- To analyze various memory management schemes.
- To introduce the concepts of I/O management and file systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT-I: OPERATING SYSTEM OVERVIEW 9

Computer system overview – Basic elements, Instruction execution, Interrupts, Memory hierarchy, Cache memory, Direct Memory Access, Multiprocessor and multicore organization. Operating system overview – Objectives and functions, Evolution of operating system, Computer system organization operating system structure and operations – System calls, System programs, OS generation and system boot.

UNIT-II: PROCESS MANAGEMENT 9

Processes – Process concept, Process scheduling, Operations on Processes, Inter process Communication; CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads – Overview, Multithreading models, Threading issues; Process Synchronization – The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT-III: STORAGE MANAGEMENT 9

Main memory – Background, Swapping, Contiguous Memory allocation, Paging, segmentation, Segmentation with paging, 32 and 64bit architecture Examples; Virtual memory – Background, Demand paging, Page replacement, Allocation, Thrashing; Allocating Kernel memory, OS examples.

UNIT-IV: FILE SYSTEMS AND I/O SYSTEMS 9

Mass Storage system – Overview of Mass storage structure, Disk structure, Disk scheduling and management, Swap space management; File-System interface – File concept, Access methods, Directory structure, Directory organization, File system mounting, File sharing and protection; File system implementation- File system structure, Directory implementation, Allocation methods, Free space management, Efficiency and performance, Recovery; I/O systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, performance.

UNIT-V: CASE STUDY 9

Linux system – Design principles, Kernel modules, Process management, Scheduling, Memory management, Input-Output management, File system, Inter-process communication; Mobile OS - IOS and Android – Architecture and SDK framework, Media layer, Services layer, Core OS layer, File system.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2. Ramaz Elmasri, Gil Carrick A and David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
3. Achyut S. Godbole and AtulKahate, "Operating Systems", McGraw Hill Education, 2016.
4. Andrew S. Tanenbaum, "Modern Operating Systems", 2nd Edition, Pearson Education, 2004.
5. Gary Nutt, "Operating System", 3rd Edition, Pearson Education, 2004.
6. Harvey M. Deitel, "Operating Systems", 3rd Edition, Pearson Education, 2004.
7. Daniel P. Bovet and Marco Cesati, "Understanding the Linux kernel‖", 3rd Edition, 'Reilly, 2005.
8. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", 4th Edition, Payload media,2011.

COURSE OUTCOMES:

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

CO1: Describe the functions of operating systems.
CO2: Understand deadlock, prevention and avoidance algorithms.
CO3: Compare and contrast various memory management schemes.
CO4: Understand the functionality of file systems.
CO5: Characterize the phenomenon of Linux Operating System.

19ECPE601 NANOELECTRONICS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates.
- To explore the fabrication process.
- To introduce the nanostructure devices.
- To explore the basics of nanomaterial synthesis and characterization.
- To introduce the applications of nanotechnology.

UNIT-I: INTRODUCTION TO NANOTECHNOLOGY 9

Microelectronics towards bio molecule electronics – Particles and waves – Wave – Particle duality – Wave mechanics – Schrödinger wave equation – Wave mechanics of particles: Atoms and atomic orbitals – Materials for nanoelectronics – Semiconductors – Crystal lattices: Bonding in crystals – Electron energy bands–Semiconductor hetero structures – Lattice-Matched and pseudo-morphic hetero structures – Inorganic – Organic hetero structures – Carbon nanomaterials: nanotubes and fullerenes.

UNIT-II: FABRICATION AND MEASUREMENT TECHNIQUES 9

Growth, Fabrication and measurement techniques for nanostructures – Bulk crystal and hetero-structure growth – Nanolithography, etching and other means for fabrication of nanostructures and nano devices – Techniques for characterization of nanostructures – Spontaneous formation and ordering of nanostructures – Clusters and nanocrystals – Methods of nanotube growth – Chemical and biological methods for nanoscale fabrication – Fabrication of nanoelectro-mechanical systems.

UNIT-III: PROPERTIES OF NANOMATERIALS 9

Dielectrics – Ferroelectrics – Electronic properties and Quantum effects – Magneto electronics – Magnetism and magneto transport in layered structures – Organic molecules – Electronic structures, Properties and reactions – Neurons – The Molecular basis of their electrical excitability – Circuit and system design – Analysis by diffraction and fluorescence methods – Scanning probe techniques.

UNIT-IV: NANO STRUCTURE DEVICES 9

Electron transport in semiconductors and nanostructures – Time and length scales of the electrons in solids – Statistics of the electrons in solids and nanostructures – Density of states of electrons in nanostructures – Electron transport in nanostructures – Electrons in traditional Low-dimensional structures – Electrons in quantum wells – Electrons in quantum wires – Electrons in quantum dots – Nanostructure devices – Resonant-tunneling diodes – Field-effect transistors – Single-electron-transfer devices – Potential-effect transistors – Light-emitting diodes and lasers – Nano-electromechanical system devices – Quantum-dot cellular automata.

UNIT-V: LOGIC DEVICES AND ITS APPLICATIONS 9

Logic Devices– Silicon MOSFET's – Ferroelectric field effect transistors – Quantum transport Devices based on resonant tunneling – Single-Electron devices for logic applications – Superconductor digital electronics – Quantum computing using superconductors – Carbon nanotubes for data processing – Molecular electronics.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Vladimir V. Mitin, Viatcheslav A. Kochelap and Michael A. Stroscio, "Introduction to Nanoelectronics: Science, Nano technology, Engineering, and Applications", Cambridge University Press 2011.
2. Supriyo Datta, "Lessons from Nano electronics: A New Perspective on Transport", World Scientific 2012.
3. George W. Hanson, "Fundamentals of Nano electronics", Pearson 2009.
4. Korkin, Anatoli; Rosei, Federico (Eds.), "Nano electronics and Photonics", Springer 2008.
5. Mircea Dragoman and Daniela Dragoman, "Nano electronics: principles and devices", CRC Press 2006.
6. Karl Goser, Peter Glosekotter and Jan Dienstuhl, "Nano electronics and Nano systems: From Transistors to Molecular and Quantum Devices", Springer 2004.

COURSE OUTCOMES:

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

CO1: Understand the basics of nanotechnology.
CO2: Identify the different fabrication methods.
CO3: Understand the behavior of nanomaterials and related structures.
CO4: Analyze and design nanostructure devices and logic circuits.
CO5: Know the applications of nanotechnology.

19ECPE602 **DSP PROCESSORS** **SEMESTER VI**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce various techniques of digital signal processing that are fundamental to various industrial applications.
- To learn the basics of DSP systems, its theory and practical implementation of different kind of algorithms.
- To know third generation DSP architectures and interfacing of memory and I/O peripherals to the DSP processors.
- To learn the instruction set available for processors.
- To know interfaces available for programmable DSP processor.

UNIT-I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING 9

Sampling process, Discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time – Invariant systems. Architectures for programmable DSP devices: Basic Architectural features, DSP computational building blocks, Bus architecture and memory, Data addressing capabilities, Address generation unit, programmability and program execution, speed issues, features for external interfacing.

UNIT-II: PROGRAMMABLE DIGITAL SIGNAL PROCESSOR 9

Commercial Digital Signal Processing Devices, Architecture of TMS320C54XX, Data Addressing modes, memory space, program control, Instructions and programming, On-Chip peripherals, Interrupts Pipeline operation.

UNIT-III: ARCHITECTURE OF ARM PROCESSORS 9

Introduction to the architecture, Programmer's model – Operation modes and states, registers, special registers, floating point registers, Behavior of the Application Program Status Register(APSR) – Integer status flags, Q status flag, GE bits, Memory system – Memory system features, memory map, stack memory, Memory Protection Unit (MPU), Exceptions and Interrupts.

UNIT-IV: INSTRUCTION SETS 9

Background to the instruction set in ARM Cortex – M Processors, Comparison of the instruction set in ARM Cortex – M Processors, understanding the assembly language syntax, Use of a suffix in instructions, Unified Assembly Language (UAL), Instruction set, Cortex – M4 – Specific instructions, Barrel shifter, Accessing special instructions and special registers in programming.

UNIT-V: INTERFACING SERIAL CONVERTERS 9

Synchronous Serial Interface – Multichannel Buffered Serial Port (McBSP) – McBSP Programming – CODEC Interface – CODEC Programming – DSP Interface.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Avtar Singh and Srinivasan S., "Digital Signal Processing", CENGAGE Learning, 2004.
2. Joseph Yiu, "The Definitive Guide to ARM Cortex – M3 and Cortex – M4 Processors", Elsevier Publications, 3rd Edition.
3. Andrew N. Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier Publications, 2004.

4. Venkataramani B. and Bhaskar M., "Digital Signal Processors: Architecture, Programming and Applications", Tata McGraw Hill, New Delhi, 2002.
5. Texas Instruments Manuals for TMS 320C 54X Volumes 1 to 5.
6. User Manual and Technical Reference of TMS320C54xx processor, Vi Microsystems, Chennai.
7. John G. Proakis, "Digital Signal Processing Principles – Algorithms and Applications", PHI– 3rd Edition, 2002.

COURSE OUTCOMES:

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

CO1: Acquire in depth knowledge of DSP processors their architectures.
CO2: Know programming language techniques.
CO3: Integrate DSP programmable devices with memories and I/O peripherals.
CO4: Know about Instruction set available for processors.
CO5: Interface DSP processors to converters.

19ECPE603 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING **SEMESTER VI**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To be familiar with the Fundamental concepts of Artificial Intelligence.
- To study different search techniques used in real time applications.
- To expose the various methods to represent knowledge.
- To understand the concepts of Machine learning and its applications.
- To be familiar with the concepts of constructing graphical models for classification.

UNIT-I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Introduction to Artificial intelligence – AI applications – Problem definition – Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics – Specialized production system, Reasoning – Forward and Backward reasoning, AI Agents – Types – Structure – Behavior and environment.

UNIT-II: SEARCHING TECHNIQUES 9

Breadth first search – Depth first Search – Heuristics search – Iterative deepening – Hill climbing – Simulated annealing – Best first search, A* algorithm, AO* algorithm, Minmax& game trees, Refining minmax, Alpha-Beta pruning, Means end analysis and constraint satisfaction.

UNIT-III: REPRESENTATION OF KNOWLEDGE 9

Game playing – Knowledge representation, Knowledge representation using predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic – Structured representation of knowledge.

UNIT-IV: OVERVIEW OF MACHINE LEARNING 9

Introduction – Applications – Types of machine learning – Concept learning – Version spaces and candidate elimination algorithm – Machine learning tools, Supervised Learning : Linear regression – Classification – Support vector machines – Decision tree learning – K-nearest neighbor learning, Unsupervised Learning : Clustering – K- means clustering – Hierarchical clustering – Distributional clustering – Principal component analysis.

UNIT-V: BAYESIAN AND PROBABILISTIC GRAPHICAL MODELS 9

Bayes theorem – Maximum likelihood – Minimum description length principle – Bayes optimal classifier – Gibbs algorithm – Naive Bayes classifier – Bayesian belief network – EM algorithm – Graphical models – Directed and undirected graphical model – Conditional independence properties – Hidden Markov models.

Contact periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Russell and Norvig, "Artificial Intelligence, A Modern Approach", 3rd Edition, Pearson Prentice Hall, 2010.
2. Tom Mitchell, "Machine Learning", McGraw– Hill, 2013.
3. Elaine Rich, Kevin Knight and Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
4. Akerkar, "Introduction to Artificial Intelligence", Prentice – Hall of India, 2011.

5. Deepak Khemani, “A First Course in Artificial Intelligence”, Tata McGraw Hill Education, 2013.
6. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, 3rd Edition, 2014.
7. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

COURSE OUTCOMES:

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

CO1: Identify problems that are amenable to solution by AI methods.
CO2: Perform different searching techniques to real world problem.
CO3: Enlighten the methods used to represent the acquired knowledge.
CO4: Explain the concept and learning techniques used in Machine learning.
CO5: Characterize the working of classifiers used in real– time applications.

19ECPE604 **MEMS AND NEMS** **SEMESTER VI**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of micro electromechanical devices.
- To know the fabrication process of Microsystems.
- To familiarize the design concepts of micro sensors and micro actuators.
- To introduce concepts of quantum mechanics.
- To impart knowledge on nano-systems.

UNIT-I: OVERVIEW AND INTRODUCTION **9**

New trends in Engineering and Science: Micro and nanoscale systems Introduction to design of MEMS and NEMS, Overview of nano and micro-electromechanical systems, Applications of micro and nano-electromechanical systems, Micro-electromechanical systems, Devices and structures definitions, Materials for MEMS: Silicon, Silicon compounds, Polymers, Metals.

UNIT-II: MEMS FABRICATION TECHNOLOGIES **9**

Microsystem fabrication processes: Photolithography, Ion implantation, Diffusion and 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 **9**

MEMS Sensors: 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.

UNIT-IV: MICRO ACTUATORS **9**

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), Micromechanical motors and pumps. Case study: Comb drive actuators.

UNIT-V: NANOSYSTEMS AND QUANTUM MECHANICS **9**

Atomic structures and Quantum Mechanics, Molecular and nanostructure dynamics: Schrodinger equation and Wave function theory, Density functional theory, Nanostructures and molecular dynamics, Electromagnetic fields and their quantization, Molecular wires and molecular circuits.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Marc J. Madou, “Fundamentals of Microfabrication”, CRC press 1997.
2. Stephen D. Senturia, “Micro system Design”, Kluwer Academic Publishers, 2001.
3. Tai Ran Hsu, “MEMS and Microsystems Design and Manufacture”, Tata Mcraw Hill, 2002.
4. Chang Liu, “Foundations of MEMS”, Pearson Education India limited, 2006.
5. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures”, CRC Press, 2002.

COURSE OUTCOMES:

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

CO1: Explain the concepts of micro electromechanical devices.
CO2: Acquire knowledge on the fabrication process of Microsystems.
CO3: Understand the design concepts of micro sensors and micro actuators.
CO4: Know the concepts of quantum mechanics.
CO5: Acquire knowledge on nano-systems.

19ECPE605 LOW POWER VLSI DESIGN SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To identify sources of power in an IC.
- To identify the power reduction techniques based on technology independent and technology dependent.
- To power dissipation mechanism in various MOS logic style.
- To identify suitable techniques to reduce the power dissipation.
- To design memory circuits with low power dissipation.

UNIT-I: POWER DISSIPATION IN CMOS 9

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active power dissipation – Designing for low power, Circuit techniques for leakage power reduction – Basic principle of low power design.

UNIT-II: POWER OPTIMIZATION 9

Logic level power optimization – Circuit level low power design – Standard adder cells, CMOS adders architectures – BiCMOS adders – Low voltage low power design techniques, Current mode adders – Types of multiplier architectures, Braun, Booth and Wallace tree multipliers and their performance comparison.

UNIT-III: DESIGN OF LOW POWER CMOS CIRCUITS 9

Computer arithmetic techniques for low power system – Low voltage low power static Random access and dynamic random-access memories – Low power clock, Interconnect and layout design – Advanced techniques – Special techniques.

UNIT-IV: POWER ESTIMATION 9

Power estimation techniques – logic power estimation – Simulation power analysis –Probabilistic power analysis.

UNIT-V: SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER 9

Synthesis for low power – Behavioral level transform – Software design for low power.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Abdelatif Belaouar and Mohamed I.Elmasry, “Low Power Digital VLSI Design”, Kluwer, 1995.
2. Chandrasekaran A.P and Broadersen R.W., “Low Power Digital CMOS Design”, Kluwer, 1995.
3. Dimitrios Soudris, C.Pignet and Costas Goutis, “Designing CMOS Circuits for Low Power” Kluwer, 2002.
4. Gary Yeap, “Practical Low Power Digital VLSI Design”, Kluwer, 1998.
5. James B. Kulo and Shih-Chia Lin, “Low voltage SOI CMOS VLSI Devices and Circuits”, John Wiley and Sons, Inc. 2001.
6. Kulo J.B and Lou J.H., “Low Voltage CMOS VLSI Circuits”, Wiley 1999.
7. Kaushik Roy and Prasad S.C., “Low power CMOS VLSI Circuit Design”, Wiley, 2000.

COURSE OUTCOMES:

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

CO1: Know the basics and advanced techniques in low power design.
CO2: Acquire knowledge on reduction in power dissipation by an IC.
CO3: Understand the design concepts of computer arithmetic techniques for low power system.
CO4: Understand the concepts of Power estimation techniques.
CO5: Design Behavioral level transformation technique.

19ECPE606 HIGH SPEED ELECTRONICS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the requirement of high speed circuits.
- To know structure of metal semiconductor.
- To learn different types of MOS devices.
- To introduce the various advanced devices.
- To study the fabrication and characterization techniques.

UNIT-I: INTRODUCTION TO HIGH SPEED DEVICES AND CIRCUITS 9

Introduction to basic concepts requirement of high speed circuits, Devices and materials-classification and properties of semiconductor devices – Review of Crystal Structure: Crystal structure of important semiconductors (Si, GaAs, InP) – Electrons in periodic lattices – Energy band diagram – Carrier concentration and carrier transport phenomenon – Electrical – Optical – Thermal and high field properties of semiconductors.

UNIT-II: HOMOJUNCTION DEVICES 9

BJT and FET: Structure – Band diagram – Operation – I-V and C-V characteristics (analytical expressions) – Small signal switching models.

UNIT-III: MOS DEVICES 9

MOS Diode: Structure – Band diagram – Operation – C-V characteristics – Effects of oxide charges – Avalanche injection – High field effects and breakdown; Heterojunction based MOSFET: Band diagram – Structure – Operation – I-V and C-V characteristics (analytical expressions) – MOSFET breakdown and punch through – Subthreshold current – Scaling down; Alternate High k-dielectric Materials: HF-MOSFETs – SOI MOSFET – Buried channel MOSFET – Charge coupled devices.

UNIT-IV: ADVANCED DEVICES 9

HBT and HEMT Devices: AlGaAs / GaAs, InP and SiGe based HBT and HEMT structure – Band diagram – Operation – I-V and C-V characteristics (analytical expressions) – Small signal switching models – Benefits of heterojunction transistor for high speed applications – High frequency resonant – Tunneling devices – Resonant-tunneling hot electron transistors

UNIT-V: FABRICATION AND CHARACTERIZATION TECHNIQUES 9

Crystal growth and Wafer preparation: Epitaxy – Diffusion – Ion implantation – Dielectric film deposition and oxidization techniques – Masking and lithography techniques (optical, e-beam and other advanced lithography techniques) – Metallization – Bipolar and MOS integration techniques interface passivation techniques; Characterization techniques: Four probe and hall effect measurement – I-V and C-V for dopant profile characterization and DLTS.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Nandita Das Gupta and Amitava Das Gupta, “Semiconductor Devices: Modeling and Technology”, Prentice Hall of India, 2004.
2. Tyagi M. S., “Introduction to Semiconductor Materials and Devices”, John Wiley and Sons, 2008.
3. Sze S.M., “High Speed Semiconductor Devices”, Wiley, 1990.

4. Singh J., “Semiconductor Devices: Basic Principles”, John Wiley and Sons, 2007.
5. Richard A. Kiehl and Gerhard Sollner T.C.L., “High Speed Heterostructure Devices”, Academic Press, Inc, 1994.
6. Doering R and Nishi Y., “Handbook of Semiconductor Manufacturing Technology”, 2nd Edition, Boca Raton, FL: CRC Press, Taylor & Francis Group, 2008.

COURSE OUTCOMES:

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

CO1: Analyze the need of high speed semiconductor circuits.
CO2: Describe the homojunction devices.
CO3: Discuss different types of MOS devices.
CO4: Analyze the various advanced devices.
CO5: Exposure on fabrication and characterization techniques.

19ECPE607 POWER ELECTRONICS SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

UNIT-I: INTRODUCTION 9

Basic structure and switching characteristics of Power diode – Power transistor – SCR – TRIAC – GTO – MOSFET and IGBT – Ratings of SCR – di/dt and dv/dt protection – Introduction of ICT – SIT – SITH and MCT – IGCT – Gate driving circuits.

UNIT-II: CONTROLLED RECTIFIERS 9

Operation of single-phase Half Wave and Full Wave Rectifiers with R- RL and RLE load (Fully controlled and Half controlled) operation and analysis of rectifiers – Operation of three-phase Half Wave Rectifier and Full Wave Rectifier with R and RL loads – Effect of source impedance in single-phase full converter – single-phase dual converter operation.

UNIT-III: DC CHOPPERS 9

Classification and operation of different types of choppers – Control strategies – Regulators-Buck Regulator – Boost Regulator – Buck Boost Regulator – SEPIC converters and Resonant Converters – SMPS – Applications.

UNIT-IV: INVERTERS 9

Types of inverters – Operation of single-phase – Three-phase bridge inverters (120 deg and 180 deg modes) – Current Source Inverter – Single-phase ASCSI – Types of PWM techniques (single pulse, multiple pulse and sine PWM) – Modulation Index – Introduction to Multilevel inverter – Applications

UNIT-V: AC VOLTAGE CONTROLLERS 9

Types of control (Phase and Integrated cycle control) – Operation of single-phase voltage regulator with R- RL loads – Operation of three-phase AC voltage controller with R load – Single-phase step up and step down cyclo converters – Matrix Converter.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Muhammad H. Rashid, "Power Electronics - Circuits- Devices and Applications", Prentice Hall of India- New Delhi, Fourth Edition, 2014.
2. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3 rd Edition, John Wiley & Sons, 2009.
3. Dr. P.S.Bhimbra, "Power Electronics", Khanna Publishers, 3rd Edition, Reprint 2014.

4. Singh. M.D and Khanchandani. K.B, "Power Electronics", Tata McGraw Hill Publishing Co. Ltd, New Delhi, 3rd Reprint, 2012.
5. Dubey G.K., Doradla.S.R., Joshi.A. and Sinha.R.M.K, "Thyristorised Power Controllers", New Age International Publishers Ltd., 1st Edition, Reprint 2012.
6. VedamSubramaniam, "Power Electronics", New Age International (P) Publishers Ltd., 2nd Edition, Reprint, 2012.
7. Muhammad H. Rashid, "Power Electronics - Circuits- Devices and Applications", Prentice Hall of India, New Delhi, Fourth Edition, 2014.

COURSE OUTCOMES:

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

CO1: Acquire knowledge about fundamental concepts and techniques used in power electronics.
CO2: Illustrate and compare performance of various controlled rectifiers.
CO3: Demonstrate the operation of switching regulators.
CO4: Acquire knowledge about various types of inverters and PWM techniques.
CO5: Acquire knowledge about various types of AC voltage controllers.

19ECPE701 CAD FOR VLSI CIRCUITS SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study various physical design methods in VLSI.
- To understand the concepts behind the VLSI design rules and placement techniques.
- To study various algorithms used for routing techniques.
- To use the simulation techniques at various levels in VLSI design flow.
- To understand the concepts of various algorithms used for high level synthesis.

UNIT-I: INTRODUCTION TO VLSI DESIGN FLOW 9

Introduction to VLSI Design methodologies – Review of data structures and algorithms – Review of VLSI design automation tools – Algorithmic graph theory and computational complexity – Tractable and intractable problems – General purpose methods for combinatorial optimization.

UNIT-II: LAYOUT, PLACEMENT AND PARTITIONING 9

Layout compaction – Design rules – Problem formulation – Algorithms for constraint graph compaction – Placement and partitioning – Circuit representation – Placement algorithms – Partitioning.

UNIT-III: FLOOR PLANNING AND ROUTING 9

Floor planning concepts – Shape functions and floor plan sizing – Types of local routing problems – Area routing – Channel routing – Global routing – Algorithms for global routing.

UNIT-IV: SIMULATION AND LOGIC SYNTHESIS 9

Simulation – Gate – level modeling and simulation – Switch – level modeling and simulation Combinational logic synthesis – Binary decision diagrams – Two level logic synthesis.

UNIT-V: HIGH LEVEL SYNTHESIS 9

High level synthesis – Hardware models – Internal representation – Allocation – Assignment and scheduling – Simple scheduling algorithm – Assignment problem – High level transformations.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Gerez S.H., “Algorithms for VLSI Design Automation”, John Wiley & Sons, 2002.
2. Sherwani N.A., “Algorithms for VLSI Physical Design Automation”, Kluwer Academic Publishers, 2002.
3. Sadiq M. Sait and Habib Youssef, “VLSI Physical Design automation: Theory and Practice”, World scientific 1999.
4. Steven M. Rubin, “Computer Aids for VLSI Design”, Addison Wesley Publishing 1987.
5. Dressler R., “Evolutionary Algorithms for VLSI CAD”, Kluwer Academic Publishers, Boston, 1998.
6. Hill D., Shugard D., Fishburn J. and Keutzer K., “Algorithms and Techniques for VLSI Layout Synthesis”, Kluwer Accademic Publishers, Boston, 1989.
7. Gaynor E. Taylor and Russell G., “Algorithmic and Knowledge Based CAD for VLSI”, Peter peregrinus ltd. London.

COURSE OUTCOMES:

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

CO1: Comprehend and analyze the VLSI design methodologies.
CO2: Analyze and illustrate layout design rules, placement and partitioning.
CO3: Design and analyze floor planning and routing concept.
CO4: Examine and verify the various modeling of simulation.
CO5: Analyze and illustrate synthesis and scheduling.

19ECPE702 FIBER OPTIC COMMUNICATION SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Impart the knowledge about optical communication systems and optical test equipments.
- Understand the signal propagation degradation of an optical signal.
- Analyze the optical sources and receiver design issues.
- Explore the idea of power launching in long – haul systems coupling methods.
- Gain knowledge about advanced technologies in optical systems and system configuration.

UNIT-I: OPTICAL FIBERS AND TEST EQUIPMENTS 9

Introduction to optical MSM communication – Optical spectral bands – Elements of optical Fiber systems – Ray optics – Numerical aperture and acceptance angle – Optical fiber modes and configurations – Mode theory of circular waveguides – Single mode fiber – Graded index fiber optical measurement standards – Optical test equipments: Optical power meter, optical attenuators – Tunable laser sources – Spectrum analyzer – Optical time domain reflectometer.

UNIT-II: SIGNAL DEGRADATION IN OPTICAL FIBERS 9

Attenuation – Absorption losses – Scattering losses – Bending losses – Core and cladding losses, Signal distortion in optical fibers – Information capacity determination – Group delay – Material dispersion – Waveguide dispersion – Signal distortion in single mode and multi mode fibers – Polarization mode dispersion, Design optimization of single mode fibers – Refractive Index profile – Cut-off wavelength – Dispersion calculations – Mode field diameter.

UNIT-III: OPTICAL TRANSMITTERS AND RECEIVERS 9

Optical Sources: LED and their types, laser diodes – Optical transmitter design: Source – Fiber coupling – Driving circuitry – Optical modulators – Optoelectronic integration optical detectors: PIN, APD, MSM – Optical receiver design: front end – Linear channel – Decision circuit – Photo detector noise – Detector response time – Avalanche multiplication of noise – Temperature effects on photo detectors.

UNIT-IV: OPTICAL SYSTEMS 9

Optical link design – Link power budget – Rise time budget – Noise effects on system performance – Optical power launching and coupling – System design considerations – Optical amplifiers – EDFA, Raman amplifier – Multiplexing strategies – Wavelength division multiplexing. Soliton-based communication – Frequency chirp.

UNIT-V: ADVANCES IN OPTICAL FIBER SYSTEMS 9

DWDM – SONET/SDH – Wavelength routing networks – Optical switches – Optical fiber LAN link – Ultra high capacity networks – Optical networking technology in enterprise.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Gerd Keiser, "Optical Fiber Communications" McGraw– Hill, 4th Edition, 2008.
2. John M. Senior, "Optical Fiber Communications Principles and Practice", PHI, New Delhi, 3rd edition, 2009.
3. Govind P. Agrawal, "Fiber Optic Communication System", 3rd Edition, John Wiley and Sons, 2010.

4. Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki, "Optical Networks" – 3rd Edition, Morgan Kaufmann publishers, 2010.
5. Franz J.H and Jain V.K., "Optical Communication, Components and Systems", Narosa publications, New Delhi, 2000.
6. Djafar K. Mynbaev and Lowell L. Scheiner, "Fiber Optic Communication Technology", Prentice Hall, 2001.
7. Gowar J., "Optical Communication Systems", 2nd Edition, PHI, 2001.

COURSE OUTCOMES:

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

CO1: Understand principles of operation of optical communications and test equipments.
CO2: Analyze various signal degradation factors associated with optical fiber.
CO3: Design, analyze and evaluate various optical communication systems.
CO4: Establish optical communication systems and integrate as part of the system.
CO5: Analyze various optical network standards.

19ECPE703 ADVANCED DIGITAL SIGNAL PROCESSING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To bring out the concepts related to stationary and non– stationary random signals.
- To emphasize the importance of true estimation of power spectral density.
- To introduce the design of linear and adaptive systems for filtering and linear prediction.
- To introduce signal processing concepts in the systems having more than one sampling frequency.
- To study the wavelet transforms.

UNIT-I: DISCRETE– TIME RANDOM SIGNALS 9

Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Auto-covariance properties and matrices, White noise, Power spectral density, Spectral factorization, Filtering random processes, ARMA, AR and MA processes.

UNIT-II: POWER SPECTRUM ESTIMATION 9

Introduction to power spectrum estimation – Parameter estimation – Bias and consistency – Non parametric methods – Periodogram – Modified periodogram – Bartlett method – Welch method – Blackman Tukey method – Performance comparison – Parametric methods for spectral estimation.

UNIT-III: ADAPTIVE FILTERS 9

Forward and backward linear prediction – FIR Wiener Filter – Principles of adaptive filter – FIR adaptive filter – Newton‘s Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT-IV: MULTIRATE SIGNAL PROCESSING 9

Introduction to multirate signal processing – Decimation – Interpolation – Polyphase Decomposition of FIR filter – Multistage implementation of sampling rate conversion – Applications of multirate signal processing.

UNIT-V: WAVELET TRANSFORMS 9

Multiresolution analysis – Continuous and discrete wavelet transform – Short Time Fourier Transform – Application of wavelet transform – Cepstrum and Homomorphic filtering.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., New York, Indian Reprint, 2008.
2. John G.Proakis and Dimitris G. Manolakis, “Digital Signal Processing”, Pearson, 4th Edition, 2007.
3. Dwight F. Mix, “Random Signal Processing”, Prentice Hall, 1995.
4. Dimitris G. Manolakis, Vinay K. Ingle and Stephen M. Kogon, “Statistical and Adaptive Signal Processing”, Artech House, 2005.
5. Widrow B and Stearns S D., “Adaptive Signal Processing”, Prentice Hall Inc., 2011.
6. Fliege N J., “Multirate Digital Signal Processing”, John Wiley and Sons, 2010.
7. Soman K.P, Ramachandran K.I and Resmi N.G., “Insight into Wavelets from Theory to Practice”, 3rd Edition, PHI Learning Private limited, 2010.

COURSE OUTCOMES:

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

CO1: Analyze statistical characteristics of random signals.
CO2: Identify various power spectrum estimation methods.
CO3: Illustrate the concepts of linear prediction and adaptive filtering.
CO4: Analyze and design multi– rate systems.
CO5: Employ the concepts of wavelets in signal processing applications.

19ECPE704 SATELLITE COMMUNICATION SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand satellite orbits and trajectories.
- To have Knowledge on different satellite subsystems.
- To understand link design and control requirements for satellite
- To introduces the different aspects of multiple access methods.
- To learn real time applications of satellite communication.

UNIT-I: SATELLITE ORBITS 9

Orbital mechanics – Orbit equations – Kepler's laws – Orbital period – Orbits and their types – Orbital spacing – Look angle calculation – Satellite launch – Propagation delay – System performance.

UNIT-II: SATELLITE SUBSYSTEM 9

AOCS – TTC&M – Power – Transponders – Antennas – Earth control – Effects of earth Perturbation sun transit – Moon transit – Satellite power design – MTBF – Basic Equations – System noise and G/T ratio – Uplink – Downlink and design for a specified C/N ratio – GEO and LEO examples – Atmospheric and rain effects on link performance.

UNIT-III: SATELLITE LINK DESIGN 9

Link design equation – Noise temperature – Atmospheric effects on link design – Interference effects – Earth station parameters – Earth space propagation effects – Frequency window – Free space loss – Ionospheric scintillation – Telemetry – Tracking and command of satellites – Digital Modulation for satellite systems – Error control requirements for satellite.

UNIT-IV: SATELLITE MULTIPLE ACCESS SYSTEM 9

FDMA techniques – SCPC and CSSB systems – TDMA frame structure – Burst structure – Frame efficiency – Super- frame – Frame acquisition and synchronization – TDMA Vs FDMA – Burst time plan – Beam hopping – Satellite switched – Erlang call congestion formula – DA-FDMA – D-TDMA.

UNIT-V: SATELLITE SERVICES 9

Remote sensing – Navigation – Scientific and military application – VSAT – Network architecture – Access Control protocols and techniques – VSAT Earth stations – Satellite Mobile Telephony – Global star – DBS/DTH Television – GPS – Weather satellites.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Roddy D., "Satellite Communications", McGraw Hill, 4th Edition, 2017.
2. T, Bostian C and Allnutt J., "Satellite Communications", John Wiley and Sons, 2nd Edition, 2003.
3. Rappaport T.S., "Wireless Communications: Principles and Practice", 2nd Edition, Prentice Hall of India Pvt. Ltd., 2003.
4. Pritchard W.L, Suyderhoud H. G and Nelson R. A., "Satellite Communication System Engineering", 2nd Edition, Prentice Hall, 1993.
5. Tri. T. Ha, "Digital Satellite Communications", McGraw Hill, 2nd Edition, 1990.
6. Agarwal B.N., "Design of Geosynchronous Space craft", Prentice Hall, 1986.

7. Richharia M., “Satellite Communication Systems”, McGraw-Hill Professional, 1999.

COURSE OUTCOMES:

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

CO1: Ability to understand basics of satellite orbits and trajectories.
CO2: Have Knowledge on different satellite subsystems.
CO3: Ability to understand different aspects of communication link design.
CO4: Knowledge on multiple access methods.
CO5: Knowledge on important applications of satellites.

19ECPE705 DIGITAL IMAGE PROCESSING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn digital image fundamentals and be exposed to simple image processing techniques.
- To summarize the mathematical foundations of different image transformation concepts.
- To familiarize with image restoration and segmentation techniques.
- To explain the various compressions standards and interpret on image applications.
- To apply image processing techniques practically using MATLAB.

UNIT-I: DIGITAL IMAGE FUNDAMENTALS 9

Introduction – Origin – Steps in digital image processing – Components – Elements of visual perception – Image sensing and acquisition – Image sampling and quantization – Relationships between pixels – Color models.

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.

UNIT-III: IMAGE RESTORATION AND SEGMENTATION 9

Noise models – Mean filters – Order statistics – Adaptive filters – Band reject filters – Band pass filters – Notch filters – Optimum notch filtering – Inverse filtering – Wiener filtering Segmentation: Detection of discontinuities – Edge linking and Boundary detection – Region based segmentation – Morphological processing – Erosion and dilation.

UNIT-IV: WAVELETS AND IMAGE COMPRESSION 9

Wavelets – Sub band coding – Multi-resolution expansions – Compression: Fundamentals – image compression models – Error free compression – Variable length coding – Bit-Plane coding – Lossless predictive coding – Lossy compression – Lossy predictive coding – Compression Standards.

UNIT-V: DIGITAL IMAGE PROCESSING SIMULATION 9

Histograms equalization, Detection and recognition, Enhancement techniques, Image compression.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", 1st Edition, PHI Learning, 2010.
3. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing Using MATLAB", 2nd Edition, McGraw Hill Education, 2010.
4. Jayaraman S, Veerakumar T. and Esakkirajan S., "Digital Image Processing", 1st Edition, McGraw Hill Education, 2009.
5. William K. Pratt, "Digital Image Processing", 4th Edition, John Wiley, New York, 2007.

COURSE OUTCOMES:

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

CO1: Understand the digital image fundamentals and be exposed to simple image processing techniques.

CO2: Analyze the basic concept of different image transformation.

CO3: Summarize image restoration and segmentation techniques.

CO4: Explain the various compressions standards and interpret on image applications.

CO5: Apply image processing techniques practically using MATLAB.

19ECPE706 GREEN COMMUNICATION SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To familiarize different concepts and basic principles of green communication strategies.
- To help the learners to design a future architecture for green communication and networking.
- To give exposure to implement green communication by overcoming technical challenges.
- To introduce the measurement of energy gain for future opportunities.
- To study the energy harvesting and management on WSNS.

UNIT-I: GREEN COMMUNICATION ENERGY MANAGEMENT AND MODULATION 9

Energy Management for Location – Based Services on Mobile Devices, Energy Efficient Supply of Mobile Devices, Green Radio network – PHY and MAC layer optimization for energy – Harvesting wireless networks – Green modulation and coding schemes in energy-constrained wireless networks.

UNIT-II: ENERGY CONSERVATION ON VARIOUS APPLICATIONS 9

QoE-Based Energy Conservation for VoIP Applications in WLAN, Minimum Energy Multi-criteria Relay Selection in Mobile Ad Hoc Networks; Energy Optimization Techniques for Wireless Sensor Networks.

UNIT-III: ENERGY HARVESTING SYSTEMS 9

Design Issues in EM Energy Harvesting Systems, Energy Scavenging for Magnetically Coupled Communication Devices-Case study.

UNIT-IV: TECHNIQUES ON ENERGY HARVESTING SYSTEMS 9

Mixed-Signal, Low-Power Techniques in Energy Harvesting Systems, Toward Modeling Support for Low-Power and Harvesting Wireless Sensors for Realistic Simulation of Intelligent Energy-Aware Middleware.

UNIT-V: ENERGY HARVESTING AND MANAGEMENT ON WSNS 9

Energy Consumption Profile for Energy Harvested WSNs, Radio Frequency Energy Harvesting and Management for Wireless Sensor Networks.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Venkataraman H., "Green Mobile Devices and Networks: Energy Optimization and Scavenging Techniques", Gabriel-miroMuntean - CRC Press 2012.
2. Ekram Hossain, Vijay K. Bhargava, Gerhard P. Fettweis, "Green Radio Communication Networks", Cambridge University Press, 30 Jun 2012.
3. Jinsong Wu, Sundeep Rangan , Hong gang Zhang, "Green Communications: Theoretical Fundamentals, Algorithms and Applications", CRC Press, September 20, 2012.
4. Richard Yu F., Xi Zhang, Victor C.M. Leung, "Green Communications and Networking", CRC Press, December 7, 2012.
5. Bhuvan Unhelkar, "Green IT Strategies and Applications: Using Environmental Intelligence", CRC Press, June 22, 2011.

COURSE OUTCOMES:

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

CO1: Analyze the location based services and energy scavenging systems.
CO2: Explain the different level of energy optimization techniques.
CO3: Analyzes of design issues in EM energy harvesting schemes.
CO4: Illustration of energy constraints and energy harvesting.
CO5: Analyze energy consumption of WSN.

19ECPE707 ELECTRONIC PACKAGING AND TESTING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To give an overview of electronic systems packaging.
- To understand electrical issues in packing.
- To have Knowledge on different types of chip packages.
- To introduces the different design issues in packing.
- To understand the testing concepts in packaging.

UNIT-I: OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, Medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates

UNIT-II: ELECTRICAL ISSUES IN PACKAGING 9

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps – Hybrid circuits – Resistive, Capacitive and Inductive parasitics.

UNIT-III: CHIP PACKAGES 9

IC Assembly – Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn-in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends, Multi chip packaging: types, design, comparison, trends, System - in - package (SIP): Passives, discrete, integrated and embedded.

UNIT-IV: PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 9

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards, Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges, Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements.

UNIT-V: TESTING 9

Reliability, Basic concepts, Environmental interactions, Thermal mismatch and fatigue – Failures – Thermo mechanically induced – Electrically induced – Chemically induced, Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Blackwell (Ed), "The electronic packaging handbook", CRC Press, 2000.
2. Tummala, Rao R., "Fundamentals of Microsystems Packaging", McGraw Hill, 2001.
3. Bosshart, "Printed Circuit Boards Design and Technology", TataMcGraw Hill, 1988.

4. Tummala, Rao R., “Microelectronics packaging handbook”, McGraw Hill, 2008.
5. Khandpur R.S., “Printed Circuit Board”, Tata McGraw Hill, 2005
6. Abramovici M., Breuer M. A. and A.D. Friedman A.D., “Digital System Testing and Testable Design”, Computer Science Press,1990
7. Michael L. Bushnell and Vishwani D. Agrawal, “Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits”, Kluwer Academic Publishers.2000.

COURSE OUTCOMES:

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

CO1: Give a comprehensive introduction to the various packaging types.
CO2: Have Knowledge on different electrical issues in packaging.
CO3: Enable design of packages, which can withstand higher temperature, vibrations and shock.
CO4: Design of PCBs, which minimize the EMI and operate at higher frequency.
CO5: Analyze the concepts of Testing and testing method.

19CAHS005 TOTAL QUALITY MANAGEMENT SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the basic concept of TQM.
- To understand the quality management principles.
- To analyze the TQM tool.
- To learn the tools and techniques of quality management to manufacturing
- To introduce the quality systems.

UNIT-I: INTRODUCTION 9

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, and Customer retention.

UNIT-II: TQM PRINCIPLES 9

Leadership – Quality Statements, Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Quality circle – Recognition and Reward, Performance appraisal – Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT-III: TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT-IV: TQM TOOLS AND TECHNIQUES II 9

Quality Circles – Cost of Quality – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures.

UNIT-V: QUALITY MANAGEMENT SYSTEM 9

Introduction – Benefits of ISO Registration – ISO 9000 Series of Standards – Sector – Specific Standards – AS 9100, TS16949 and TL 9000– ISO 9001 Requirements –Implementation – Documentation – Internal Audits – Registration. Environmental Management System: Introduction – ISO 14000 Series Standards – Concepts of ISO 14001 – Requirements of ISO 14001 – Benefits of EMS

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Dale H. Besterfiled, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
3. Janakiraman B. and Gopal R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
4. Suganthi L. and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
5. ISO 9001-2015 standards.

COURSE OUTCOMES:

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

CO1: Understand the quality concepts and philosophies of TQM.

CO2: Apply TQM principles and concepts of continuous improvement.

CO3: Explain quality tools, management tools and statistical fundamentals to improve quality.

CO4: Clarify the TQM tools as a means to improve quality.

CO5: Remember the quality systems and procedures adopted.

19ECPE709 OPTO ELECTRONIC DEVICES SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of solid– state physics.
- To know the basics of display devices.
- To understand the basics of Laser and application.
- To introduce the optical detection devices.
- To learn the design of optoelectronic integrated circuits.

UNIT-I: ELEMENTS OF LIGHT AND SOLID 9

Wave nature of light, Polarization, Interference, Diffraction, Light source, Review of quantum Mechanical concept, Review of solid state physics, Review of semiconductor physics and semiconductor junction device.

UNIT-II: DISPLAY DEVICES AND LASERS 9

Introduction, Photo luminescence, Cathode luminescence, Electro luminescence, Injection luminescence, Injection luminescence, LED, Plasma display, Liquid Crystal Displays, Numeric displays, Laser emission, Absorption, Radiation, Population inversion, Optical feedback, Threshold condition, Laser modes, Classes of lasers, Mode locking, Laser.

UNIT-III: OPTICAL DETECTION DEVICES 9

Photo detector, Thermal detector, Photo devices, Photo conductors, Photo diodes, Detector performance.

UNIT-IV: OPTOELECTRONIC MODULATOR 9

Introduction, Analog and digital modulation, Electro – Optic modulators, Magneto optic devices, Acoustoptic devices, Optical, Switching and logic devices.

UNIT-V: OPTOELECTRONIC INTEGRATED CIRCUITS 9

Introduction, Hybrid and monolithic Integration, Application of Optoelectronic integrated circuits, Integrated transmitters and receivers, Guided wave devices.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Pallab Bhattacharya, "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
2. Jasprit Singh, "Opto Electronics – As Introduction to Materials and Devices", McGraw– Hill International Edition, 1998.
3. Gupta S. C., "Opto Electronic Devices and Systems", Prentice Hal of India, 2005.
4. Wilson J and Haukes J., "Opto Electronics – An Introduction", Prentice Hall, 1995.
5. Safa O. Kasap, "Optoelectronics & Photonics: Principles & Practices", 2nd Edition, Pearson Education.
6. Yanhua Shih, "An Introduction to Quantum Optics," 1st Edition, CRC Press.
7. Emmanuel Rosencher & BorgeVinter , "Optoelectronics", 1st Edition, Cambridge University Press.

COURSE OUTCOMES:

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

CO1: Familiarize the basics of solid– state physics.
CO2: Design display devices.
CO3: Analyze optoelectronic detection devices.
CO4: Design optoelectronic modulators.
CO5: Examine optoelectronic integrated circuits.

19CAPE001 SOFT COMPUTING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the basic concepts of soft computing.
- To become familiar with soft computing techniques like neural networks.
- To familiarize about fuzzy systems.
- To learn genetic algorithms.
- To apply soft computing techniques to solve problems.

UNIT-I: INTRODUCTION TO SOFT COMPUTING 9

Introduction – Artificial intelligence – Artificial Neural Networks – Fuzzy systems – Genetic algorithm and evolutionary programming – Swarm intelligent systems – Classification of ANNS – Mcculloch and Pitts neuron model – Learning rules: Hebbian and Delta – Perceptron network – Adaline network – Madaline network.

UNIT-II: ARTIFICIAL NEURAL NETWORKS 9

Back propagation neural networks – Kohonen neural network – Learning vector quantization – Hamming Neural network – Hopfield Neural network – Bi-directional Associative memory – Adaptive resonance theory neural networks – Support vector machines – Spike neuron models.

UNIT-III: FUZZY SYSTEMS 9

Introduction to fuzzy logic, Classical sets and Fuzzy sets – Classical relations and Fuzzy relations – Membership functions – Defuzzification – Fuzzy arithmetic and Fuzzy measures –Fuzzy rule base and Approximate reasoning – Introduction to fuzzy decision making.

UNIT-IV: GENETIC ALGORITHMS 9

Basic concepts – Working principles – Encoding – Fitness function – Reproduction –Inheritance operators – Cross over – Inversion and deletion – Mutation operator – Bit-wise operators – Convergence of Genetic algorithm

UNIT-V: HYBRID SYSTEMS 9

Hybrid systems – Neural networks, Fuzzy logic and Genetic – GA based weight determination – LR – Type fuzzy numbers – Fuzzy neuron – Fuzzy BP architecture – Learning in Fuzzy BP– Inference by Fuzzy BP – Fuzzy Art Map: A brief introduction – Soft computing tools – GA in Fuzzy logic controller design – Fuzzy logic controller.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Sivanandam S.N and Deepa S.N., "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.
2. Padhy N.P and Simon S.P., "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
3. Rajasekaran S and Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.
4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.

5. Kwang H. Lee, “First course on Fuzzy Theory and Applications”, Springer, 2005.
6. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1996.
7. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.

COURSE OUTCOMES:

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

CO1: Apply various soft computing frame works.
CO2: Design of various neural networks.
CO3: Use fuzzy logic.
CO4: Apply genetic programming.
CO5: Discuss hybrid soft computing.

19ECPE711 **ASIC DESIGN** **SEMESTER VII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the design flow of different types of ASIC.
- To familiarize the different types of programming technologies and logic devices.
- To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC.
- To analyze the synthesis, Simulation and testing of systems.
- To know about different high performance algorithms and its applications in ASIC.

UNIT-I: OVERVIEW OF ASIC AND PLD **9**

Types of ASICs – Design flow – CAD tools used in ASIC design – Programming technologies: Antifuse – Static RAM – EPROM and EEPROM technology, Programmable logic devices: ROMs and EPROMs – PLA – PAL. Gate arrays – CPLDs and FPGAs.

UNIT-II: PROGRAMMABLE ASIC **9**

Programmable ASIC logic cells for ACTEL and XILINX – DC & AC inputs and outputs – Clock and power inputs – ACTEL and XILINX I/O blocks – Programmable ASIC architecture: Xilinx XC 4000 – FLEX 8000/10000, ACTEL's ACT – 1,2,3 and their speed performance, Altera MAX 5000 and 7000 – Altera MAX 9000 – Spartan II and Virtex II FPGAs – Apex and cyclone FPGAs.

UNIT-III: ASIC PHYSICAL DESIGN **9**

System partition partitioning – Partitioning methods – Interconnect delay models and measurement of delay – Floor planning – Placement – Routing: Global routing – Detailed routing – Special routing.

UNIT-IV: LOGIC SYNTHESIS, SIMULATION AND TESTING **9**

Design systems – Logic synthesis – Verilog and VHDL synthesis – Types of simulation – Boundary scan test – Fault simulation – Automatic test pattern generation.

UNIT-V: HIGH PERFORMANCE ALGORITHMS FOR ASICS/ SOCS. **9**

Canonic signed digit arithmetic, KCM, Distributed arithmetic, High performance filters using delta – Sigma modulators. Case studies: Digital camera, SDRAM, High speed data standards.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Smith M.J.S., "Application – Specific Integrated Circuits", Pearson, 2003.
2. Steve Kilts, "Advanced FPGA Design," Wiley Inter– Science.
3. Roger Woods, John McAllister, Dr. Ying Yi and Gary Lightbody, "FPGA– based Implementation of Signal Processing Systems", Wiley, 2008.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw Hill, 1994.
5. Douglas J. Smith, "HDL Chip Design", Madison, AL, USA: Doone Publications, 1996.
6. Jose E. France, Yannis Tsividis, "Design of Analog – Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.
7. Hodges D. A., "Analysis and Design of Digital Integrated Circuits", 3rd Edition, MGH 2004.

COURSE OUTCOMES:

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

CO1: Demonstrate VLSI tool– flow and appreciate FPGA architecture.
CO2: Analyze about programmable ASIC design.
CO3: Gain Knowledge of ASIC physical design.
CO4: Determine the logical synthesis, simulation and testing aspects of ASIC.
CO5: Understand the high performance algorithms for ASICs/ SOCs.

19ECPE712 DATA ANALYTICS SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce Big data.
- To learn the different ways of Data Analysis.
- To be familiar with data streams.
- To learn the mining and clustering.
- To be familiar with the visualization.

UNIT-I: INTRODUCTION TO BIG DATA 9

Introduction to Big Data Platform – Challenges of conventional systems – Web data – Evolution of analytic scalability, Analytic processes and tools, Analysis Vs reporting – Modern data analytic tools, Statistical concepts: Sampling distributions, Resembling, statistical inference, prediction error.

UNIT-II: DATA ANALYSIS 9

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics – Rule induction – Neural networks: learning and generalization, competitive learning, Principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT-III: MINING DATA STREAMS 9

Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Real-time Analytics Platform(RTAP) applications – Case studies – Real time sentiment analysis, stock market predictions.

UNIT-IV: FREQUENT ITEM SETS AND CLUSTERING 9

Mining frequent item sets – Market based model – Apriori algorithm – Handling large data sets in Main memory – Limited pass algorithm – Counting frequent item sets in a stream – Clustering techniques – Hierarchical – K-Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-Euclidean space – Clustering for streams and Parallelism.

UNIT-V: FRAMEWORKS AND VISUALIZATION 9

Map Reduce – Hadoop, Hive, Map R – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, Interaction techniques; Systems and applications.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Michael Berthold and David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics", John Wiley & sons, 2012.

4. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O‟ Reilly, 2011.
5. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

COURSE OUTCOMES:

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

CO1: Apply the statistical analysis methods.
CO2: Compare and contrast various soft computing frameworks.
CO3: Design distributed file systems.
CO4: Apply stream data model.
CO5: Use visualization techniques.

19ECPE713 PHOTONIC NETWORKS SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of the backbone infrastructure for our present and future communication.
- To familiarize the architectures and the protocols.
- To enable the student to learn the different ways of routing.
- To understand the differences switching and the resource allocation methods.
- To expose the student to network management and the advances in networking and the future trends.

UNIT-I: OPTICAL SYSTEM COMPONENTS 9

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects; Solitons, Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT-II: OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media Access Control Protocols, Wavelength Routing Architecture.

UNIT-III: WAVELENGTH ROUTING NETWORKS 9

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations – Linear Light wave networks, Logically Routed Networks.

UNIT-IV: PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks, Contention Resolution Access Networks – Network Architecture overview, Optical Access Network Architectures and OTDM networks.

UNIT-V: NETWORK DESIGN AND MANAGEMENT 9

Transmission System Engineering – System model, Power penalty - Transmitter, Receiver, Optical amplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2004.
2. Siva Ram C., Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, Prentice Hall of India, 1st Edition, 2002.
3. Green P.E., Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.
4. Biswanath Mukherjee, “Optical WDM Networks”, Springer Series, 2006.

COURSE OUTCOMES:

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

CO1: Use the backbone infrastructure for our present and future communication needs.
CO2: Analyze the architectures and the protocol stack.
CO3: Compare the differences in the design of data plane, control plane, routing.
CO4: Apply switching, resource allocation methods.
CO5: Use network management and protection methods in vogue.

19ECPE714 COMPRESSIVE SENSING SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic theory.
- To enable the student to learn the reconstruct sparse or nearly sparse signals from undersampled data.
- To expose students to recent ideas in modern convex optimization allowing rapid signal recovery.
- To familiarize sensor elements in WSN.
- To give students a sense of real time applications that might benefit from compressive sensing ideas

UNIT-I: INTRODUCTION TO COMPRESSED SENSING 9

Introduction, Motivation, Mathematical Background, Traditional Sampling, Traditional Compression, Conventional Data Acquisition System, Drawbacks of Transform coding, Compressed Sensing (CS).

UNIT-II: SPARSITY AND SIGNAL RECOVERY 9

Signal Representation, Basis vectors; Sensing matrices, Restricted Isometric Property, Coherence, Stable recovery, Number of measurements.

UNIT-III: RECOVERY ALGORITHMS 9

Basis Pursuit algorithm: L1 minimization, Matching pursuit, Orthogonal Matching Pursuit(OMP), Stage wise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP), Iterative Thresholding algorithm: Hard thresholding, Soft thresholding, Model based: Model based CoSaMP, Model based HIT.

UNIT-IV: COMPRESSIVE SENSING FOR WSN 9

Basics of WSN, Wireless Sensor without Compressive Sensing, Wireless Sensor with Compressive Sensing, Compressive Wireless Sensing, Spatial compression in WSNs, Projections in WSNs, Compressed Sensing in WSNs.

UNIT-V: APPLICATIONS OF COMPRESSIVE SENSING 9

Compressed Sensing for Real-Time Energy-Efficient Compression on Wireless Body Sensor Nodes, Compressive sensing in video surveillance, An Application of Compressive Sensing for Image Fusion, Single-Pixel Imaging via Compressive Sampling.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Radha S., Hemalatha R. and Aasha Nandhini S., "Compressive Sensing for Wireless Communication: Challenges and Opportunities", River publication, 2016.
2. Mark A. Davenport, Marco F. Duarte, Yonina C. Eldar and Gitta Kutyniok, "Introduction to Compressed Sensing, in Compressed Sensing: Theory and Applications", Cambridge University Press, 2011.
3. Duarte M.F., Davenport M.A., Takhar D., Laska, J.N., Ting Sun, Kelly K.F. and Baraniuk, R.G., "Single-Pixel Imaging via Compressive Sampling", Signal Processing Magazine, IEEE, vol.25, no.2, pp.83-91, March 2008.

4. Tao Wan., Zengchang Qin, “An application of compressive sensing for image fusion”, CIVR '10 Proceedings of the ACM International Conference on Image and Video Retrieval, Pages 3-9.
5. Mamaghanian H., Khaled N., Atienza D. and Vandergheynst P. “Compressed sensing for real-time energy-efficient ECG compression on wireless body sensor nodes”, IEEE Trans. Biomed. Eng., vol. 58, no. 9, pp.2456 -2466 2011.

COURSE OUTCOMES:

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

CO1: Appreciate the motivation and the necessity for compressed sensing technology.
CO2: Analyze the sparse signals from undersampled data.
CO3: Compare the design of data plane, control plane, routing.
CO4: Apply sensor elements in WSN.
CO5: Use compressive sensing in real time applications.

19ECPE801 MIXED SIGNAL DESIGN SEMESTER VIII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of various CMOS amplifiers.
- To investigate the different configurations of current mirrors.
- To learn the principles of CMOS OP– AMP and comparator.
- To gain knowledge in the Phase Locked Loop.
- To understand the different types in DAC and ADC.

UNIT-I: CMOS AMPLIFIERS 9

Amplifiers – Common source with diode connected loads and current source load – CS stage with source degeneration – CG stage and source follower. Cascoded stages – Cascoded amplifier – Cascoded amplifier with cascoded loads – Folded cascade amplifier.

UNIT-II: CURRENT MIRROR AND DIFFERENTIAL AMPLIFIER 9

MOS current mirror – Basic circuit – PMOS and NMOS current mirrors – Current mirror copying circuits, MOSFET cascode current mirror circuits, Differential amplifiers – Differential Amplifier with MOS current source load – With cascaded load and with current mirror load – MOS telescopic cascode amplifier.

UNIT-III: CMOS OP– AMP AND COMPARATOR 9

CMOS OP AMPS – Two stage operational amplifiers – Frequency compensation of OPAMPS – Miller compensation – Design of classical two stage OP AMP, Comparator – characterization of a comparator – static and dynamic – A Two stage open loop comparator.

UNIT-IV: PLL AND BANDGAP REFERENCE 9

Band gap references – Supply independent biasing – Temperature independent references – Band gap reference, Phase locked loop – Simple PLL – Basic PLL topology, Charge pump PLL – Basic charge pump PLL.

UNIT-V: DAC AND ADC ARCHITECTURE 9

Switched Capacitor Circuits – Sample and hold circuits – Switched capacitor integrator, Ladder filters, DAC specifications – DNL – INL – Latency – SNR, Dynamic range ADC Specifications – Quantization error – Aliasing – SNR – Aperture error – DAC architecture – Resistor string Charge scaling and pipeline types, ADC architecture – Flash and pipe line types.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Razavi B., “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 2001.
2. Jacob Baker R., “CMOS: Mixed – Signal Circuit Design”, Wiley India, New Delhi, 2008.
3. Phillip E. Allen and Douglas R. Holbery, “CMOS Analog Circuit Design”, Oxford, 2004.
4. Razavi B., “Fundamentals of Microelectronics”, Wiley student Edition, 2014.
5. Baker, Li and Boyce, “CMOS: Circuits Design, Layout and Simulation”, Prentice Hall India, 2000.
6. David A. Jones and Ken Martin, “Analog Integrated Circuit Design”, Wiley India, New Delhi, 2008.
7. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert J. Meyer, “Analysis and Design of Analog Integrated Circuits”, 5th Edition, Wiley India, New Delhi, 2008.

COURSE OUTCOMES:

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

CO1: Analyze the CMOS amplifier and understanding the concept of cascoded amplifier.
CO2: Design the different current mirrors and understanding the differential amplifier.
CO3: Be familiar with characterization of CMOS OP– AMP and comparator.
CO4: Gain the knowledge about Bandgap reference and importance of PLL.
CO5: Expertise in the building block of DAC and ADC.

19ECPE802 ELECTROMAGNETIC INTERFERENCE & ELECTROMAGNETIC COMPATIBILITY **SEMESTER VIII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce important system concepts in EMI & EMC.
- To familiarize with unavoidable and naturally happening sources of EMI.
- To introduce the problems to ensure EMC.
- To study various techniques to reduce EMI.
- To investigate the methods to improve EMC of electronic systems.

UNIT-I: SOURCES OF EMI **9**

Definition of EMI and EMC, Classification, Natural and man-made EMI sources, Switching transients, Electrostatic discharge, Nuclear electromagnetic Pulse and high power electromagnetic. EMI/EMC standards: Introduction, Standards for EMI/EMC – MIL –STD 461/462 – IEEE/ANSI standards – CISPR/IEC, Standards – FCC regulations.

UNIT-II: EMI COUPLING MODES **9**

Penetration: Introduction, Shielding theory – Shielding effectiveness, The circuit approach, The wave approach, Aperture theory, Calculation of effectiveness of a conducting box with an aperture, Introduction to propagation and cross talk – Introduction, Basic principles, Determination of EM field from transmission lines.

UNIT-III: EMI CONTROLLING TECHNIQUES – I **9**

Grounding, Principles and practice of Earthing, Precautions in Earthing, Measurements of ground resistance, System grounding for EMC, Cable shielding grounding. Shielding, Theory and effectiveness, Materials, Integrity at discontinuities, Conductive coatings, Cable shielding, Effectiveness measurements, Electrical bonding.

UNIT-IV: EMI CONTROLLING TECHNIQUES – II **9**

Characteristics and types of filters – Impedance mismatch, Lumped element Low-Pass, High-Pass, Band-Pass and Band-Reject filters, Power line filter design – Common mode, Differential mode, Combined CM and DM filters, Design example. EMC gaskets – Knitted Wire-Mesh gaskets, Wire-Screen gaskets, Oriented wire mesh, Conductive elastomer, Transparent conductive Windows, Conductive adhesive, Conductive grease, Conductive coatings, Isolation transformers, Opto-Isolators.

UNIT-V: EMI MEASUREMENTS **9**

Introduction to open area test site measurements – Measurement precautions – Open area test Site – Terrain roughness – NSA – Measurement of test site imperfections – Antenna factor measurement – Measurement errors. Radiated interference measurements – Anechoic chamber – TEM cell – Reverberating chamber – Ghz TEM cell – Comparison of test facilities – Measurement uncertainties Conducted interference measurements – Characterization – conducted EM noise on power supply lines – Conducted EMI from equipment – Immunity – Detectors and measurement – Pulsed EMI immunity – Electrostatic discharge.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Prasad Kodali V., "Engineering Electromagnetic Compatibility", 2nd Edition, IEEE Press – Wiley India Pvt. Ltd – 2001.
2. Clayton R. Paul, "Introduction to Electromagnetic Compatibility", John Wiley & Sons, 1992.
3. Sonia Ben Dhia, Mohamed Ramdani and Etienne Sicard, "Electromagnetic Compatibility of Integrated Circuits Techniques for Low Emission and Susceptibility", Springer, 2006.
4. Mills J.P., "EMI reduction in Electronic Systems", Prentice Hall Inc.
5. Henry W. Ott, "Noise Reduction in Electronic Systems", 2nd Edition, Wiley Interscience, 1988.

COURSE OUTCOMES:

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

CO1: Gain basic knowledge about the problems associated with EMI and EMC from electronic circuits and systems.

CO2: Analyze various sources of EMI and various possibilities to provide EMC.

CO3: Understand the methods to improve compatibility of electronic circuits and systems in a given electromagnetic environment.

CO4: Analyze possible EMI prevention techniques such as grounding, shielding, filtering.

CO5: Illustrate the use of proper coupling mechanisms.

19ECPE803 TESTING OF VLSI CIRCUITS SEMESTER VIII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To Learn fault models and fault simulation techniques.
- To understand faults in combinational logic circuits.
- To Have Knowledge on faults in sequential logic circuits.
- To introduces the different testability methods.
- To understand fault diagnosis approaches.

UNIT-I: FAULT MODELLING AND SIMULATION 9

Introduction to testing – Faults in digital circuits – Modeling of faults – Logical fault models – Fault detection – Fault location – Fault dominance – Single stuck fault model and multiple stuck.

UNIT-II: TESTING FOR SINGLE STUCK AT FAULTS 9

Test generation algorithms for combinational circuits – Fault oriented ATG – D Algorithm – Examples – PODEM – Fault independent ATG – Random Test generation – ATGs for SSFs in sequential circuits – TG using iterative array models – Random test generation.

UNIT-III: DELAY TEST 9

Delay test problem – Path delay test – Test generation for combinational circuits, Number of paths in a circuit– Transition faults – Delay test methodologies – Slow clock combinational test, Enhanced scan test, normal scan sequential test, Variable – Clock Non-scan sequential test, Rated-clock Non-scan sequential test.

UNIT-IV: DESIGN FOR TESTABILITY 9

Testability – Controllability and observability, Ad-hoc design for testability techniques – Controllability and observability by means of scan registers – Storage cells for scan design – Level sensitive scan design (LSSD) – Partial scan using I-Paths – Boundary scan standards.

UNIT-V: FAULT DIAGNOSIS 9

Logical level diagnosis – Diagnosis by UUT reduction – Fault diagnosis for combinational circuits – Self-checking design – System level diagnosis.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Abramovici M, Brever A and Friedman D., "Digital Systems Testing and Testable Design", Jaico Publishing House, 2002.
2. Parag K. Lala, “Fault Tolerant and Fault Testable Hardware Design”, BS Publications, 2002.
3. Michael L. Bushnell and Vishwani D. Agarwal, “Essentials of Electronic Testing for Digital, Memory and Mixed Signal Circuits”, Springer, Verlag2000.
4. Stanley L. Hurst, “VLSI Testing: Digital and Mixed Analogue Digital Techniques”, Institute of Electrical Engineers, 1998.
5. Xiaoqing Wen, Cheng Wen Wu and LaungTerng Wang, “VLSI Test Principles and Architectures: Design for Testability”, Cambridge University Press, 2000.
6. Robert J. Feuguate and Steven M. Mcintyre, “Introduction to VLSI testing’, Prentice Hall, Englewood Cliffs, 1998.
7. Kropf T., “Introduction to Formal Hardware verification”, Springer Verlag 1999.

COURSE OUTCOMES:

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

CO1: Discuss various fault models and fault simulation techniques.
CO2: Examine faults in combinational logic circuits.
CO3: Analyze faults in sequential logic circuits.
CO4: Explain different testability methods.
CO5: Outline fault diagnosis approaches.

19ECPE804 WIRELESS COMMUNICATION SEMESTER VIII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the characteristic of wireless channel.
- To understand the design of a cellular system.
- To study the various digital signaling techniques.
- To learn the various multipath mitigation techniques.
- To understand the concepts of multiple antenna techniques.

UNIT-I: WIRELESS CHANNELS 9

Large scale path loss – Path loss models: Free Space and Two – Ray models – Link budget design – Small scale fading – Parameters of mobile multipath channels – Time dispersion parameters – Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – Flat fading – Frequency selective fading – Fading due to Doppler spread – Fast fading – Slow fading.

UNIT-II: CELLULAR ARCHITECTURE 9

Multiple Access techniques – FDMA, TDMA, CDMA – Capacity calculations – Cellular concept – Frequency reuse – Channel assignment – Hand off – Interference & system capacity trunking & grade of service – Coverage and capacity improvement.

UNIT-III: DIGITAL SIGNALING FOR FADING CHANNELS 9

Structure of a wireless communication link, Principles of Offset-QPSK, pi/4-DQPSK, Minimum shift keying, Gaussian minimum shift keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT-IV: MULTIPATH MITIGATION TECHNIQUES 9

Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

UNIT-V: MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – Spatial multiplexing – System model – Pre-coding – Beam forming – Transmitter diversity, receiver diversity – Channel state information – Capacity in fading and non-fading channels.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Rappaport T.S., “Wireless communications”, Pearson Education, 2nd Edition, 2010.
2. Andreas F. Molisch, “Wireless Communications”, John Wiley, India, 2006.
3. Andrea Goldsmith, “Wireless Communication”, Cambridge University Press, 2011.
4. Van Nee R and Ramji Prasad, “OFDM for Wireless Multimedia Communications”, Artech House, 2000.
5. David Tse and PramodViswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
6. UpenaDalal, “Wireless Communication”, Oxford University Press, 2009.

COURSE OUTCOMES:

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

CO1: Characterize a wireless channel and evolve the system design specifications.
CO2: Design a cellular system based on resource availability and traffic demands.
CO3: Apply the different modulation techniques for fading channels.
CO4: Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.
CO5: Understand the concepts of multiple antenna techniques.

19ECPE805 REAL TIME OPERATING SYSTEMS SEMESTER VIII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn about significance and usage of Real Time Operating System.
- To introduce different scheduling strategies and optimization principles.
- To learn about the resource allocation or sharing process involved in RTOS.
- To study about the different firmware and tools related to RTOS development.
- To design and develop an innovative real time embedded system.

UNIT-I: REAL TIME EMBEDDED SYSTEMS 9

Introduction – History of real time systems and embedded systems – Real time services and standards – System resources – Analysis – Service utility – Scheduling classes – Cyclic executive – Scheduler concepts – Real time operating System – Thread safe Reentrant Functions.

UNIT-II: RESOURCES AND SERVICES 9

Processing – Resources – Memory – Multisource services: Blocking, Deadlock, Livelock, Critical sections to protect shared resources, Priority inversion, Power management and Processor clock modulation – Soft real time services: Missed deadlines, Quality of service, Alternatives to rate monotonic policy, Mixed hard and soft real time services.

UNIT-III: REAL TIME EMBEDDED COMPONENTS 9

Hardware components – Firmware components – RTOS system software – Software application components – Traditional Hard real time operating systems: Asymmetric multicore processing and symmetric multi – Core processing – Processor core affinity – SMP support models – RTOS hypervisors – Open source real time operating systems.

UNIT-IV: INTEGRATING EMBEDDED LINUX 9

Integrating embedded Linux into real time systems – Debugging components – Performance tuning – High availability and Reliability design – Hierarchical approaches for fail – Safe design.

UNIT-V: CASE STUDIES 9

System life cycle – Continuous media applications – Video and audio processing – Robotic applications – Computer vision applications.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Sam Siewert and John Pratt, "Real– Time Embedded Components and Systems with Linux and RTOS", Mercury Learning and Information LLC, 2016.
2. Jonathan W. Valvano, "Embedded Systems: Real time operating systems for ARM Cortex–M Microcontrollers", Create space Independent Publishing Platform, 4th Edition, 2017.
3. Giorgio C. Buttazzo, "Hard Real– Time Computing Systems – Predictable Scheduling Algorithms and Applications", Springer Science + Buisness Media, LLC, 3rd Edition, 2011.
4. Wang K.C., "Embedded and Real Time Operating System", Springer, 2017.
5. Albert M. K. Cheng, "Real– Time Systems – Scheduling, Analysis and Verification", A John Wiley & Sons INC Publication, 2002.
6. Herma K., "Real Time Systems - Design for distributed Embedded Applications", Kluwer Academic, 2000.
7. Charles Crowley, "Operating Systems – A Design Oriented approach", McGraw Hill 2005.

COURSE OUTCOMES:

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

CO1: Understand the concepts of scheduling algorithm and process.
CO2: Explore the firmware and tools related to the development of RTOS.
CO3: Design and develop an embedded system with RTOS functionality.
CO4: Design and develop the systems in Linux environments.
CO5: Develop large real– time embedded systems.

19ECPE806 **VIDEO ANALYTICS** **SEMESTER VIII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the need for video Analytics.
- To introduce the basic configuration and functional blocks of video analytics.
- To understand the functions of classifiers.
- To get exposed to the various security aspects of video analytics.
- To develop an innovative real time system for video analytics.

UNIT-I: VIDEO ANALYTIC COMPONENTS **9**

Need for Video Analytics – Overview of video Analytics – Foreground extraction – Feature extraction classifier – Preprocessing – Edge detection – Smoothening – Feature space – PCA-FLD-SIFT features.

UNIT-II: FOREGROUND EXTRACTION **9**

Background estimation – Averaging – Gaussian mixture model – Optical flow based – Image segmentation – Region growing – Region splitting – Morphological operations – Erosion – Dilation Tracking in a multiple camera environment.

UNIT-III: CLASSIFIERS **9**

Neural networks (back propagation) – Deep learning networks – Fuzzy classifier – Bayesian classifier – HMM based classifier.

UNIT-IV: VIDEO ANALYTICS FOR SECURITY **9**

Abandoned object detection – Human behavioral analysis – Human action recognition – Perimeter security crowd analysis and prediction of crowd congestion.

UNIT-V: VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITIRING AND ASSISTANCE **9**

Customer behavior analysis – People counting – Traffic rule violation detection – Traffic congestion identification for route planning – Driver assistance – Lane change warning.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor), "Video-Based Surveillance Systems: Computer Vision and Distributed Processing", Kluwer academic publisher, 2001.
2. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), "Applied Video Processing in Surveillance and Monitoring Systems", IGI global, 2016.
3. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), "The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite", Create Space Independent Publishing Platform, 2014.
4. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) "Video Analytics for Business Intelligence", Springer, 2012.

COURSE OUTCOMES:

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

CO1: Understand the need for video Analytics.
CO2: Explore the basic configuration and functional blocks of video analytics.
CO3: Design and develop a video analytic algorithms.
CO4: Design video analytic algorithms for security applications.
CO5: Design custom made video analytics system for the given target application.

19ECPE807 FUNDAMENTALS OF NANOSCIENCE SEMESTER VIII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basis of nanomaterial science.
- To expose the preparation methods.
- To learn the various nanomaterials.
- To get exposed to the various characterization techniques.
- To develop an innovative real time application.

UNIT-I: INTRODUCTION 9

Nanoscale Science and Technology – Implications for Physics, Chemistry, Biology and Engineering – Classifications of nanostructured materials – Nano particles – Quantum dots, nanowires ultra-thin films – Multilayered materials – Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties – Introduction to properties and motivation for study (qualitative only).

UNIT-II: GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis – Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT-III: NANOMATERIALS 9

Nanoforms of Carbon – Buckminster fullerene – Graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT) – Methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications – Nanometal oxides – ZnO, TiO2,MgO, ZrO2, NiO, Nano alumina, CaO, AgTiO2, Ferrites, Nano clays – Functionalization and applications – Quantum wires, Quantum dots – Preparation, properties and applications.

UNIT-IV: CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy – Environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT-V: APPLICATIONS 9

Nano InfoTech: Information storage – Nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bio-imaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) – Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products – In Photostat, printing, solar cell, battery.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Edelstein A.S. and Cammearata R.C., eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. John Dinardo N., "Nanoscale Characterization of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.
3. Timp G., "Nanotechnology", AIP press / Springer, 1999.

4. Akhlesh Lakhtakia, “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

COURSE OUTCOMES:

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

CO1: Familiarize about the science of nanomaterials.
CO2: Demonstrate the preparation of nanomaterials.
CO3: Develop knowledge in characteristic nanomaterial.
CO4: Familiarize various characterization techniques.
CO5: Demonstrate innovative real time applications.

19ECPE808 CRYPTOGRAPHY AND FORENSICS SEMESTER VIII

L	T	P	C
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COURSE OBJECTIVES:

- To be familiar with symmetric and asymmetric encryption schemes.
- To learn the principles of Authentication techniques, Hash functions and MAC.
- To understand the concepts of Email and Web security.
- To understand the Computer crimes, the Computer Forensics techniques to avoid them and data acquisition techniques.
- To study the tools for analyzing and validating the collected evidence.

UNIT-I: CRYPTOGRAPHY AND BLOCK CIPHERS 9

Services, Mechanisms and attacks – The OSI security architecture – Network security model – Classical encryption techniques: Data encryption standard – Block cipher principles – Block cipher modes of operation – Advanced Encryption Standard (AES) – Triple DES – Blowfish – RC5 algorithm. Public key cryptography: Principles of public key cryptosystems – The RSA algorithm – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT-II: PUBLIC KEY CRYPTOSYSTEMS AND AUTHENTICATION TECHNIQUES 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

UNIT-III: EMAIL AND WEB SECURITY 9

PGP – S/MIME – Internet firewalls for trusted system: Roles of firewalls – Firewall related terminology – Types of firewalls – Firewall designs – SET for E-Commerce transactions. Web security: SSL/TLS Basic protocol – Computing the keys – Client authentication – PKI as deployed by SSL attack fixed in v3 – Exportability – Encoding – Secure Electronic Transaction (SET).

UNIT-IV: INTRODUCTION TO COMPUTER FORENSICS 9

Introduction to traditional computer crime, Traditional problems associated with computer crime. Introduction to identity theft &identity fraud. Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team – Forensics technology and systems – Understanding computer investigation – Data acquisition.

UNIT-V: EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing crime and incident scenes – Working with Windows and DOS systems. Current Computer Forensics Tools: Software/ Hardware Tools, Validating forensics data – Data hiding techniques – Performing remote acquisition – Network forensics – Email investigations – Cell phone and Mobile devices forensics.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. William Stallings, “Cryptography and Network Security Principles and Practice”, Pearson Education, 4th Edition, 2005.

2. Man Young Rhee, “Internet Security: Cryptographic Principles, Algorithms and Protocols”, Wiley Publications, 2003.
3. SahadeoPadhye , Rajeev A. Sahu and Vishal Saraswat, “ Introduction to Cryptography”, CRC Press, 2018.
4. Jonathan Katz and Yehuda Lindell, “Introduction to Modern Cryptography”, Second Edition, CRC Press, 2014.
5. Niels Ferguson and Bruce Schneier and Tadayoshi, “Cryptography Engineering: Design Principles and Practical Applications”, Wiley Publishing, 2011.
6. Richard E.Smith, “Internet Cryptography”, 3rd Edition Pearson Education, 2008.
7. Marjie T.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3rd Edition, Prentice Hall, 2013.

COURSE OUTCOMES:

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

CO1: Perform symmetric and asymmetric encryption for a given data.
CO2: Explain the techniques used for authentication, Hash functions and MAC.
CO3: Characterize the security issues in Email and Web.
CO4: Represent the computer crimes and forensic techniques used to avoid them.
CO5: Analyze the evidence data in learnt Forensic tools.

19ECPE809 **COGNITIVE RADIO** **SEMESTER VIII**

L	T	P	C
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COURSE OBJECTIVES:

- To know the basics of the software defined radios.
- To learn the design of wireless networks based on cognitive radios.
- To understand the concepts of wireless networks and next generation networks.
- To illustrate cognitive radio architecture.
- To apply cross-layer design for cognitive radio.

UNIT-I: INTRODUCTION TO SOFTWARE DEFINED RADIO **9**

Information – Entropy, Information rate, Classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding – Joint and conditional entropies, Mutual information – Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit.

UNIT-II: SDR ARCHITECTURE **9**

Essential functions of the software radio, Basic SDR, Hardware architecture, Computational processing resources, Software architecture, Top level component interfaces, Interface topologies among plug and play modules.

UNIT-III: INTRODUCTION TO COGNITIVE RADIO **9**

Marking radio self-aware, Cognitive techniques – Position awareness, Environment awareness in cognitive radios, Optimization of radio resources, Artificial intelligence techniques.

UNIT-IV: COGNITIVE RADIO ARCHITECTURE **9**

Cognitive Radio – Functions, Components and design rules, Cognition cycle – Orient, Plan, Decide and act phases, Inference Hierarchy, Architecture maps, Building the cognitive radio architecture on software defined radio architecture.

UNIT-V: NEXT GENERATION WIRELESS NETWORK **9**

The XG Network architecture, Spectrum sensing, Spectrum management, Spectrum mobility, spectrum sharing, Upper layer issues, Cross – Layer design.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Joseph J. Mitola III, “Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering”, John Wiley & Sons Ltd., 2000.
2. Thomas W.Rondeau and Charles W.Bostain, “Artificial Intelligence in Wireless communication”, Artech House, 2009.
3. Simon Haykin, “Cognitive Radio: Brain –Empowered Wireless Communications”, IEEE Journal on selected areas in communications, Feb 2005.
4. HasariCelebi and HuseyinArslan, “Enabling Location and Environment Awareness in Cognitive Radios”, Elsevier Computer Communications, Jan 2008.
5. Markus Dillinger, KambizMadani and Nancy Alonistioti, “Software Defined Radio”, John Wiley, 2003.
6. Huseyin Arslan, “Cognitive Radio, SDR and Adaptive System”, Springer, 2007.
7. Alexander M. Wyglinski and Maziarnekovee,Thomas Hu Y., “Cognitive Radio Communication and Networks”, Elsevier, 2010.

COURSE OUTCOMES:

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

CO1: Discuss the basics of the software defined radios.
CO2: Describe the basics and the architecture of SDR.
CO3: Explain the concepts behind the cognitive radio architecture.
CO4: Describe the basics and the architecture of cognitive radio.
CO5: Design the wireless networks based on the cognitive radios

19ECPE810 BLOCKCHAIN TECHNOLOGY SEMESTER VIII

L	T	P	C
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COURSE OBJECTIVES:

- To know the history and different applications of blockchain.
- To learn the decentralization and practical aspects of cryptography.
- To understand the concepts of bitcoin technology, alternative coins and smart contracts.
- To illustrate distributed application using Ethereum.
- To apply an application using Hyperledger.

UNIT-I: BLOCKCHAIN 101 **9**

Distributed systems - The history of blockchain - Introduction to blockchain – Definitions - Elements - Features - Applications of blockchain technology - Tiers - Types of blockchain - Consensus in blockchain - CAP theorem - Benefits and limitations of blockchain

UNIT-II: DECENTRALIZATION **9**

Decentralization using blockchain – Methods – Routes - Blockchain and full ecosystem decentralization -Smart contract - Decentralized applications - Platforms for decentralization. Cryptography and Technical Foundations – Introduction - Cryptography - Confidentiality - Integrity – Authentication - Cryptographic primitives - Asymmetric cryptography - Public and private keys – RSA - Discrete logarithm problem - Hash functions - Elliptic Curve Digital signature algorithm

UNIT-III: BITCOIN **9**

Bitcoin – Transactions – Blockchain - Bitcoin payments - Alternative Coins, Theoretical foundations - Bitcoin limitations – Namecoin - Litecoin – Primecoin – Zcash - Smart Contracts.

UNIT-IV: ETHEREUM 101 **9**

Introduction – Ethereum blockchain - Elements of the Ethereum blockchain - Precompiled contracts – Accounts – Block – Ether – Messages – Mining - Clients and wallets - The Ethereum network - Ethereum Development.

UNIT-V: HYPERLEDGER **9**

Projects – protocol – Hyperledger Fabric – Sawtooth lake – Corda – Blockchain – Outside of Currencies: Internet of Things – Government – Health – Finance.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Imran Bashir, "Mastering Blockchain Distributed ledgers, decentralization and smart contracts Explained", 1st Edition, Packt Publishing, Mumbai, 2017.
2. Brenn Hill, Samanyu Chopra & Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", 1st Edition, Packet Publishing, Mumbai, 2018.
3. Andreas Antonopoulos, "Mastering Bitcoin: Programming the open blockchain", 2nd Edition, O‟Reilly Media, USA, 2017.

COURSE OUTCOMES:

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

CO1: Outline the history and different applications of blockchain.
CO2: lustrate decentralization and practical aspects of cryptography.
CO3: Present bitcoin technology, alternative coins and smart contracts.
CO4: Develop a distributed application using Ethereum.
CO5: Deploy an application using Hyperledger

19ECPE811 WIRELESS NETWORKS SEMESTER VIII

L	T	P	C
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COURSE OBJECTIVES:

- To study about Wireless networks, protocol stack.
- To understand about mobile network layer.
- To learn about fundamentals of 3G Services, its protocols and applications.
- To study about wireless wide area network.
- To introduce about evolution of 4G Networks, its architecture and applications.

UNIT-I: WIRELESS LAN 9

Introduction – WLAN technologies: Infrared, UHF narrowband, spread spectrum – IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security – IEEE802.16 – WiMAX: Physical layer, MAC, Spectrum allocation for WiMAX.

UNIT-II: MOBILE NETWORK LAYER 9

Introduction – Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6 – Network layer in the internet – Mobile IP session initiation protocol – Mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.

UNIT-III: MOBILE TRANSPORT LAYER 9

TCP enhancements for wireless protocols – Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility – Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP – TCP over 3G wireless networks.

UNIT-IV: WIRELESS WIDE AREA NETWORK 9

Overview of UTMS Terrestrial Radio access network – UMTS Core network Architecture: 3G – MSC, 3GSGSN, 3G-GGSN, SMS – GMSC/SMS – IWMSC, Firewall, DNS/DHCP – High speed downlink packet access (HSDPA) – LTE network architecture and protocol.

UNIT-V: 4G NETWORKS 9

Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM – MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Jochen Schiller, "Mobile Communications", 2nd Edition, Pearson Education 2012.
2. Vijay Garg, "Wireless Communications and Networking", 1st Edition, Elsevier 2007.
3. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", 2nd Edition, Academic Press, 2008.
4. Anurag Kumar, Manjunath Dand Joy Kuri, "Wireless Networking", 1st Edition, Elsevier 2011.
5. Simon Haykin, Michael Moher and David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013.

COURSE OUTCOMES:

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

CO1: Define the function of WLAN and WiMAX networks and its architecture.

CO2: Design and implement wireless network environment for any application using latest wireless protocols and standards.

CO3: Implement different type of applications for smart phones and mobile devices with latest network strategies.

CO4: Conversant with the latest 3G/4G.

CO5: Understand the concept of 4G technology.

19ECPE812 VLSI SIGNAL PROCESSING SEMESTER VIII

L	T	P	C
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COURSE OBJECTIVES:

- To understand the various VLSI architectures for digital signal processing.
- To know the techniques of critical path.
- To learn the algorithmic strength reduction in the filter structures.
- To introduce the pipeline based architectures in the design.
- To study the performance parameters, viz. area, speed and power.

UNIT-I: INTRODUCTION 9

Overview of DSP – FPGA technology – DSP technology requirements – Design implementation.

UNIT-II: METHODS OF CRITICAL PATH REDUCTION 9

Binary Adders – Binary Multipliers – Multiply-Accumulator (MAC) and sum of product (SOP) – Pipelining and parallel processing – Retiming – Unfolding – Systolic architecture design.

UNIT-III: ALGORITHMIC STRENGTH REDUCTION METHODS AND RECURSIVE FILTER DESIGN 9

Fast convolution – Pipelined and parallel processing of recursive and adaptive filters – Fast IIR filters design.

UNIT-IV: DESIGN OF PIPELINED DIGITAL FILTERS 9

Designing FIR filters – Digital lattice filter structures – Bit level arithmetic architecture – Redundant arithmetic – Scaling and round-off noise.

UNIT-V: SYNCHRONOUS, ASYNCHRONOUS PIPELINING AND PROGRAMMABLE DSP 9

Numeric strength reduction – Synchronous – Wave and asynchronous pipelines – Low power design – Programmable DSPs – DSP architectural features/alternatives for high performance and low power.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Keshab K. Parhi, “VLSI Digital Signal Processing Systems, Design and Implementation”, John Wiley, Indian Reprint, 2007.
2. Meyer U. – Baese, "Digital Signal Processing with Field Programmable Arrays", Springer, Second Edition, Indian Reprint, 2007.
3. Kuang S.Y., White house H.J., and Kailath T., “VLSI and Modern Signal Processing”, Prentice Hall, 1995.
4. Magdy A. Bayoumi, “VLSI Design Methodologies for Digital Signal Processing Architecture”, Springer Science, 1994.
5. Earl E. Swartzlander, “VLSI signal processing systems”, Springer Science, 1985.

COURSE OUTCOMES:

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

CO1: Design architectures for DSP algorithms.
CO2: Optimize design in terms of area, speed and power.
CO3: Incorporate pipeline based architectures in the design.
CO4: Design the synchronous and asynchronous pipeline architecture.
CO5: Carry out HDL simulation of various DSP algorithms.

19CAPE002 INTELLECTUAL PROPERTY RIGHTS SEMESTER VIII

L	T	P	C
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COURSE OBJECTIVES:

- To give an idea about IPR.
- To understand registration of IPRs.
- To have knowledge on patents Act.
- To introduces the different aspects IP laws.
- To understand enforcement 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 9

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 9

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 9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

Contact periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Scople Vinod V., “Managing Intellectual Property”, Prentice Hall of India pvt Ltd, 2012.
2. Satakar S. V., “Intellectual Property Rights and Copy Rights”, Ess Publications, New Delhi, 2002.
3. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
4. Prabuddha Ganguli, “Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
5. Derek Bosworth and Elizabeth Webster, “The Management of Intellectual Property”, Edward Elgar Publishing Ltd., 2013.

COURSE OUTCOMES:

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

CO1: Ability to manage Intellectual Property portfolio to enhance the value of the firm.
CO2: Have Knowledge on different registration of IPRs.
CO3: Ability to recognize on patents Act.
CO4: Knowledge on different aspects IP laws.
CO5: Knowledge on enforcement of IPRs.

19ECPE814 PRINCIPLES OF MEDICAL IMAGING SEMESTER VIII

L	T	P	C
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COURSE OBJECTIVES:

- To understand the basics of image acquisition.
- To learn mathematical preliminaries for image reconstruction.
- Discuss the principles of fluoroscopy and computed tomography.
- To understand the concepts of magnetic resonance.
- Discuss the principles of ultrasound imaging.

UNIT-I: ACQUISITION OF IMAGES 9

Introduction to Imaging Techniques – Single crystal scintillation camera – Principles of scintillation camera operation – Multiple crystal scintillation camera – Solid state camera – Rectilinear scanner- Emission computed Tomography – Radiography: Digital Radiography.

UNIT-II: MATHEMATICAL PRELIMINARIES FOR IMAGE RECONSTRUCTIONS 9

Image Reconstruction from Projections in Two dimensions – Mathematical Preliminaries for Two and Three dimensional Image Reconstructions – Radon Transform- Projection Theorem – Central slice Theorem – Sinogram – Two Dimensional Projection Reconstruction - Three Dimensional Projection Reconstruction – Iterative Reconstruction Techniques – Fourier Reconstruction.

UNIT-III: FLUOROSCOPY, CT, IMAGES QUALITY 9

Digital fluoroscopy – Automatic Brightness control cinefluorography – Principles of computed Tomographic Imaging – Reconstruction algorithms – Scan motions – X-ray sources Influences of Images quality: Unsharpness – contrast – Image Noise – Image distortion – Artifacts.

UNIT-IV: MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY 9

Fundamentals of Magnetic Resonance overview – Pulse sequences – Spatial encoding of magnetic Resonance Imaging signal – Motion suppression Techniques – Contrast Agents – Tissue contrast in MRI – MR Angiography, spectroscopy – Chemical shift Imaging.

UNIT-V: ULTRA SOUND, NEURO MAGNETIC IMAGING 9

Ultra sound:Presentation modes – Time required to obtain Images – System components, signal processing – Dynamic Range – Ultrasound Image Artifacts – Quality control, Origin of Doppler shift – Limitations of Doppler systems. Neuro magnetic Imaging: Background – Models and Image Reconstruction – Instrumentation.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. William R. Hendee, E. Russell Ritenour, "Medical Imaging Physics", A John Wiley & sons, Inc., Publication, Fourth Edition, 2002.
2. Zang-Hee Cho, Joie P. Jones and Manbir Singh, "Foundations of Medical Imaging", John Wiley and sons Inc.,1993.
3. Avinash C. Kak, Malcolm Slaney, "Principles of Computerized Tomographic Imaging", IEEE Press, New york,1998.

COURSE OUTCOMES:

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

CO1: Develop knowledge about radiography techniques.
CO2: Understand the concepts of three dimensional and iterative image reconstructions.
CO3: Analyse image noise, distortion and artifacts.
CO4: Explain the contrast agents used in different imaging modalities.
CO5: Explain the model, reconstruction and instrumentation of neuro magnetic imaging.

19CEOE01 GEOGRAPHICAL INFORMATION SYSTEM

L	T	P	C
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COURSE OBJECTIVES:

- To introduce the fundamentals and components of Geographic Information System.
- To provide details of spatial data structures and input, management and output processes.

UNIT-I: FUNDAMENTALS OF GIS **9**

Introduction to GIS – Basic spatial concepts – Coordinate Systems – GIS and Information Systems – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software – Types of data – Spatial, Attribute data – Types of attributes – Scales/ levels of measurements.

UNIT-II: SPATIAL DATA MODELS **9**

Database Structures – Relational, Object Oriented – ER diagram – Spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster vs Vector Models – TIN and GRID data models – OGC standards – Data Quality.

UNIT-III: DATA INPUT AND TOPOLOGY **9**

Scanner – Raster Data Input – Raster Data File Formats – Vector Data Input – Digitizer – Topology – Adjacency, Connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS – Concept GPS based mapping.

UNIT-IV: DATA ANALYSIS **9**

Vector Data Analysis tools – Data Analysis tools – Network Analysis – Digital Education models – 3D data collection and utilization.

UNIT-V: APPLICATIONS **9**

GIS Applicant – Natural Resource Management – Engineering – Navigation – Vehicle tracking and fleet management – Marketing and Business applications – Case studies.

Contact periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Kang-Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver and Srinivasa Raju, "An Introduction to Geographical Information Systems", Pearson Education, 2nd Edition, 2007.

COURSE OUTCOMES:

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

CO1: Have basic idea about the fundamentals of GIS.
CO2: Understand the types of data models.
CO3: Get knowledge about data input and topology.
CO4: Gain knowledge on data quality and standards.
CO5: Understand data management functions and data output.

19CEOE02	GREEN BUILDINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the different concepts of sustainable design and green building techniques and how they may be synthesized to best fit a specific construction project.

UNIT-I: INTRODUCTION **9**

Life Cycle impacts of materials and products – Sustainable design concepts – Strategies of Design for the Environment – The sun-earth relationship and the energy balance on the earth's surface, climate, wind – Solar radiation and solar temperature – Sun shading and solar radiation on surfaces – Energy impact on the shape and orientation of buildings – Thermal properties of building materials.

UNIT-II: ENERGY EFFICIENT BUILDINGS **9**

Passive cooling and day lighting – Active solar and photovoltaic – Building energy analysis methods - Building energy simulation – Building energy efficiency standards –Lighting system design – Lighting economics and aesthetics – Impacts of lighting efficiency – Energy audit and energy targeting – Technological options for energy management.

UNIT-III: INDOOR ENVIRONMENTAL QUALITY MANAGEMENT **9**

Psychrometry – Comfort conditions – Thermal comfort – Ventilation and air quality – Air-conditioning requirement – Visual perception – Illumination requirement – Auditory requirement – Energy management options – Air conditioning systems – Energy conservation in pumps – Fans and blowers – Refrigerating machines – Heat rejection equipment – Energy efficient motors – Insulation.

UNIT-IV: GREEN BUILDING CONCEPTS **9**

Green building concept – Green building rating tools – Leeds and IGBC codes – Material selection Embodied energy – Operating energy – Façade systems – Ventilation systems –Transportation – Water treatment systems – Water efficiency – Building economics.

UNIT-V: GREEN BUILDING DESIGN CASE STUDY **9**

Students to work through a controlled process of analysis and design to produce drawings and models of their own personal green building project. Topics include building form, orientation and site considerations; conservation measures; energy modeling; heating system and fuel choices; renewable energy systems; material choices; and construction budget – Case Study on green construction and design.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Kibert C., "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2005.
2. Edward G. Pita, "An Energy Approach - Air - Conditioning Principles and Systems", Pearson Education, 2003.
3. Colin Porteous, "The New Eco–Architecture", Spon Press, 2002.
4. Energy Conservation Building Codes: www.bee–india.nic.in.
5. Lever More G J., "Building Energy Management Systems", E and FN Spon, London, 2000.

6. Ganesan T P., “Energy Conservation in Buildings”, ISTE Professional Center, Chennai, 1999.
7. John Littler and Randall Thomas, “Design with Energy: The Conservation and Use of Energy in Buildings”, Cambridge University Press, 1984.

COURSE OUTCOMES:

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

CO1: Describe the concepts of sustainable design.
CO2: Familiarize with green building techniques including energy efficiency management.
CO3: Understand the indoor environmental quality management in green building.
CO4: Perform the green building rating using various tools.
CO5: Create drawings and models of their own personal green building project.

19CEOE03 PLANNING OF SMART CITIES

L	T	P	C
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COURSE OBJECTIVES:

- To have an exposure on development of smart cities considering various fields related and their challenges.

UNIT-I: SMART CITIES DEVELOPMENT POTENTIALS AND CHALLENGES 9

Perspectives of smart cities: Introduction and overview – Implementation challenges – Methodological issues – Spatial distribution of startup cities – Re imagining post industrial cities – Implementation challenges for establishing smart urban information and knowledge management system.

UNIT-II: ROLE OF ICT, REMOTE SENSING, AND GEOGRAPHICAL INFORMATION SYSTEM 9

Optimizing green spaces for sustainable urban planning – 3D city models for extracting urban environmental quality indicators – Assessing the rainwater harvesting potential – The strategic role of green spaces – Monitoring urban expansion.

UNIT-III: ENVIRONMENT, ENERGY, DISASTER MANAGEMENT AND SUSTAINABLE DEVELOPMENT 9

Alternatives for energy stressed cities – Social acceptability of energy – Efficient lighting – Energy management – Urban dynamics and resource consumption – Issues and challenges of sustainable tourism – Green buildings: Eco-friendly technique for modern cities.

UNIT-IV: MULTIFARIOUS MANAGEMENT FOR SMART CITIES 9

An Assessment of domestic water use practices – An issue of governance in urban water supply – Assessment of water consumption at urban household level – Water sustainability – Socio-economic determinants and reproductive healthcare system – Problems and development of slums.

UNIT-V: INTELLIGENT TRANSPORT SYSTEM 9

Introduction to Intelligent Transportation Systems (ITS) – The range of ITS applications – Network optimization – Sensing traffic using virtual detectors - In-vehicle routing, and Personal route information – The smart car-commercial routing and delivery – Electronic toll collection – The smart card – Dynamic assignment – Traffic enforcement. urban Mobility and economic development.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Poonam Sharma and Swati Rajput, "Sustainable Smart Cities in India Challenges and Future Perspectives", Springer 2017 Co.(P) Ltd. 2013.
2. Ivan Nunes Da Silva, "Rogerio Andrade Flauzino-Smart Cities Technologies" –ExLi4EvA, 2016.
3. Stan McClellan, Jesus A. Jimenez and George Koutitas (eds.), "Smart Cities Applications, Technologies, Standards, and Driving Factors", Springer International Publishing, 2018.
4. Stan Geertman, Joseph Ferreira, Jr. Robert Goodspeed and John Stillwell., "Planning Support Systems and Smart Cities" , Springer, 2015

COURSE OUTCOMES:

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

CO1: Identify the potential and challenges in smart city development.
CO2: Apply the different tools for sustainable urban planning.
CO3: Understand the concepts of environment, energy and disaster management.
CO4: Identify the proper methods for water and waste water management.
CO5: Familiarize with the intelligent transport systems.

19CEOE04 **VASTU SCIENCE FOR BUILDING CONSTRUCTION**

L	T	P	C
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COURSE OBJECTIVES:

- To impart basic knowledge of Vastu science and its impact on human well being.

UNIT-I: INTRODUCTION **9**

Traditional definition – Meaning of Vastu and Vaastu - its classification – Relationship to earth – Concept of existence and manifestation – Placatory influence on earth**.**

UNIT-II: SPACE THEORY IN VASTU **9**

Features of good building site – Good building shapes – Macro, micro, enclosed and material spaces – Relationship between built space, living organism and universe – Impact of built space on human psyche. Flow of energy within built space and outside – Zoning of functional areas – Fitting of components in the building – Significance of water bodies and energy – The cube as the basic structure.

UNIT-III: COSMOGRAM & SETTLEMENT CONCEPTS **9**

Orientation of building, site, layout and settlement – Positive and negative energies – importance of cardinal and ordinal directions – The celestial grid or- mandala and its type. The Vaastu Purusha Mandala and its significance in creation of patterns, and lay-outs, extension of this to aural and visual fields.

UNIT-IV: INTERFACE OF TIME, VIBRATION AND RHYTHM **9**

Theory of vibration and energy transfer – Equation of time and space – Manifestation in living organism – Human beings – Measurement of the energy – Kirlian energy of various forms – Documentation of objects – Filaments and streamers.

UNIT-V: MEASUREMENTS & MATERIALS **9**

Units of measurement – Mana shastra – Ayadi techniques – Tala system and Hasta system of measures – Musical measurements compared to space measurements – Resultant ambience in built space. Use of wood, stone, metal, brick and time – Making technology, corbelling technology, jointing technology – Foundations for heavy and light structures –Landscaping in and around buildings – Aesthetic in Indian Architecture.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Dr. Prasanna Kumar Acharya, “Manasara”, Oxford1 University Press, (English version), 1927.
2. Subramanya Sastri K.S., “Maya Matam”, Thanjavur Maharaja Sarjoji Saraswathil Mahal Library, Thanjavur, 1966.
3. Stella Kramresh, “The Hindu Temple Vol.1 & II”, Motital Banarsidass Publishers Pvt. Ltd., Delhi, 1994.
4. Bruno Dagens, “Mayamatam, Vol.1 & IIIGNCA and Motilal Bamarsidars Publishers Pvt. Ltd–s Delhi –1994.
5. George Birdsall – Feng Shui: The Key Concepts , January 2011

COURSE OUTCOMES:

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

CO1: Obtain exposure on various concepts of Vastu.
CO2: Understand the theories in Vastu.
CO3: Familiarize with the Cosmo gram and settlement concepts of Vastu.
CO4: Understand the role of Vasthu in energy flow manifestation in living beings.
CO5: Plan a structure considering various Vastu techniques.

19CEOE05 DISASTER MANAGEMENT AND MITIGATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To give knowledge about basics of disaster management.
- To impart knowledge about Hazards and Vulnerability.
- To give knowledge about mitigation and preparedness.
- To teach about response and recovery.
- To impart knowledge about the participants involved in the disaster management activity.

UNIT-I: INTRODUCTION **9**

Disaster throughout history, History of disaster management, Capacity by demand, UN International strategy for disaster reduction, The Hyogo framework for action, Post 2015 framework, Disaster trends.

UNIT-II: HAZARDS AND RISK VULNERABILITY **9**

Hazard identification and hazard profiling, Hazard analysis, Types of hazards – Natural and technological components of risk – Likelihood and consequence, Trends and computation of likelihood and consequence. Risk evaluation – purpose, Risk acceptability Alternatives, Personnel. Political/ social, Economic vulnerability – Physical profile, Social profile, Environmental profile, Economic profile. Factors influencing vulnerability, Risk perception.

UNIT-III: MITIGATION AND PREPAREDNESS **9**

Mitigation – Types of mitigation, Obstacles in mitigation, Assessment and selection of mitigation options, Emergency response capacity as incorporating mitigation into development and relief projects. Preparedness – Government preparedness, Public preparedness, Media as a public educator. Obstacles to public education and preparedness.

UNIT-IV: RESPONSE AND RECOVERY **9**

Response the Emergency – Pre disaster, post disaster, Provision of water, Food and shelter, Volunteer management, Command, Control and Coordination. Recovery – short term and long term recovery components of recovery – Planning, coordination, information, money and supplies, Allocation of relief funds, personnel. Types of recovery – Government, infrastructure, Debris removal disposal and processing, Environment, housing, economic and livelihood, individual, family and social recovery special considerations in recovery.

UNIT-V: PARTICIPANTS **9**

Governmental disaster management agencies – Fire, law, Emergency management, Emergency medical service, Military and other resources. Structures – Local, regional, National. Bilateral assistance and its types. Types of national agencies involved in international disaster management. Political implications of bilateral assistance. Nongovernmental organizations – Operations, NGO/ military coordination, standard of conduct. The role of private sector and academia. Multilateral organizations – UN agencies and programmers', Regional & International organizations. International financial institutions – The world bank, IMF, ADB, IADB. Special considerations.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Brassard, Caroline, Giles, David W and Howitt, Arnold M., "Natural Disaster Management in the Asia–Pacific", Policy and Governance.
2. "Disaster Management", Global Challenges and Local Solutions, Universities Press, 2009.

3. Jack Pinkowski, “Disaster Management Handbook”, CRC Press, January 22, 2008.
4. Disaster Management Guidelines, GOI–UNDP Disaster Risk Reduction Programme (2009 - 2012).

COURSE OUTCOMES:

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

CO1: Able to get knowledge about basics of Disaster management.
CO2: Able to impact knowledge about Hazards and vulnerability.
CO3: Able to know about Mitigation and preparedness.
CO4: Able to attain knowledge about response and recovery.
CO5: Able to learn about the participants involved in the disaster management activity.

19CSOE06 OPEN SOURCE TECHNOLOGIES

L	T	P	C
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COURSE OBJECTIVES:

- Exposed to differentiate open source software and commercial software.
- Familiarity with Linux operating system.
- Development of web applications using open source web technologies like Apache, My Sql and PHP (LAMP/XAMP).

UNIT-I: OPEN SOURCE **9**

Introduction to Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Where I can use Linux? Linux Kernel – Linux Distributions.

UNIT-II: LINUX **9**

Introduction to Linux Essential Commands - File system Concept - Standard Files – The Linux Security Model – Vi Editor – Partitions creation – Shell Introduction – String Processing – Investigating and Managing Processes – Network Clients – Installing Application.

UNIT-III: APACHE **9**

Apache Explained – Starting, Stopping, and Restarting Apache – Modifying the Default Configuration – Securing Apache – Set User and Group – Consider Allowing Access to Local Documentation – Don't Allow public html Web sites – Apache control with hatches.

UNIT-IV: MYSQL **9**

Introduction to MYSQL – The Show Databases and Table – The USE command – Create Database and Tables – Describe Table - Select, Insert, Update, and Delete statement – Some Administrative detail – Table Joins – Loading and Dumping a Database.

UNIT-V: PHP **9**

Introduction – General Syntactic Characteristics – PHP Scripting – Commenting your code – Primitives, Operations and Expressions – PHP Variables – Operations and Expressions Control Statement – Array – Functions – Basic Form Processing – File and Folder Access – Cookies – Sessions – Database Access with PHP – MySQL – MySQL Functions – Inserting Records – Selecting Records – Deleting Records – Update Records.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, OReilly Media, 2009.
2. James Lee and Brent Ware ,"Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", , Dorling Kindersley(India) Pvt. Ltd, 2008.
3. Eric Rosebrock, Eric Filson ,"Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.

COURSE OUTCOMES:

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

CO1: Differentiate the open source software and commercial software.
CO2: Identify, install and run Linux operating system.
CO3: Identify and install open source web technology Apache and manage applications.
CO4: Manage users and privileges in MySQL and to handle SQL functions.
CO5: Design and develop complete website using PHP.

19CSOE07 **ETHICAL HACKING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand numerous methods of real-world information intelligence.
- To learn about vulnerability scanners.
- To understand techniques used to sniff traffic across a network.
- To familiarize with the methodologies that can be used to hack into a target.
- To appreciate the wide variety of attacks that can be performed against a wireless network.

UNIT-I: INTRODUCTION TO HACKING **9**

Terminologies, Categories of penetration test, Writing reports, Structure of a penetration Testing report, Vulnerability assessment summary, Risk assessment, Methodology, Linux basics: File structure, Cron Job, Users, Common applications, Back track, Services.

UNIT-II: INFORMATION GATHERING, TARGET ENUMERATION AND PORT SCANNING TECHNIQUES **9**

Active, Passive and sources of information gathering, Copying Websites locally, Neo Trace, Cheops-ng, Intercepting a response, What Web, Net craft, Basic parameters, Xcode Exploit scanner, Interacting with DNS servers, Fierce, Zone transfer with host command and automation, DNS Cache snooping – Attack scenario, Automating attacks, SNMP – Problem, Sniffing passwords, Solar winds Toolset, Sweep, Brute Force and Dictionary – Tools , Attack, Enumeration, Intelligence gathering using shodan, Target enumeration and Port scanning techniques.

UNIT-III: VULNERABILITY ASSESSMENT & NETWORK SNIFFING **9**

Introduction to vulnerability assessment – Pros and cons, NMap, Updation of database, Testing SCADA environments with Nmap, Nessus, Sniffing: Types, Hubs versus Switches, Modes, MITM attacks, ARP protocol basics – working, Attacks, DoS attacks, Dsniff tool, Using ARP spoof to perform MITM attacks, Sniffing the Traffic with Dsniff, Sniffing pictures with Drifnet, Urlsnarf and Webspy, Sniffing with Wireshark, Ettercap – ARP poisoning, Hijacking session with MITM attack, ARP poisoning with CAIN and Abel, Sniffing session Cookies with Wire shark, Hijacking the session, SSL strip: Stripping HTTPS traffic, Requirements, Automating man in the middle attacks, DNS spoofing, DHCP spoofing.

UNIT-IV: BASICS OF EXPLOITATION **9**

Remote exploitation : Understanding network protocols, Attacking network remote services, Common target protocols, Tools for cracking network remote services, Attacking SMTP, Attacking SQL servers, Client side exploitation methods: E-Mails leading to malicious attachments and malicious links, Compromising client side update, Malware loaded on USB sticks, Post exploitation: Acquiring situation awareness, Privilege escalation, Maintaining access, Data mining, Identifying and exploiting further targets, Windows exploit development basics.

UNIT-V: PHP WIRELESS & WEB HACKING **9**

Wireless hacking : Requirements, Air cracking, Hidden SSIDs, Monitor mode, Monitoring tool – Beacon frames on Wire shark, Airodump-ng, Wireless adapter in monitor mode, Determining the target, Cracking a WPA/WPA2 wireless network Using Air cracking, Capturing packets and Four-Way handshake, Web hacking: Attacking the authentication, Brute force and dictionary attacks, Types of authentication, Crawling restricted links, Testing for the vulnerability, Authentication bypass with insecure cookie handling, SQL Injection, XSS – DOM based, BeEF, CSRF, Bypassing CSRF and BeEF with XSS, Vulnerability in FCK editor, Efront.

Contact periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2015.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Media, 2nd Revised Edition, 2013.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands On Ethical Hacking and Network Defense", Cengage Learning, 2012.

COURSE OUTCOMES:

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

CO1: Comprehend the basic concepts of hacking.
CO2: Know the core concepts related to malware, hardware and software vulnerabilities and their causes.
CO3: Recognize ethics behind hacking and vulnerability disclosure.
CO4: Appreciate the Cyber Laws and impact of hacking.
CO5: Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies.

19CSOE08	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand smart objects and IoT architectures.
- To learn about various 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.

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: DESIGN AND DEVELOPMENT **9**

Design methodology – Embedded computing logic – Microcontroller, System on chips –IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi -Interfaces and raspberry Pi with 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 AND INDUSTRIAL APPLICATIONS **9**

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged plant wide Ethernet model (CPwE) – Power utility industry – Grid blocks reference model – Smart and connected cities: Layered architecture, Smart lighting, Smart parking architecture and Smart traffic control.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

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.
2. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
3. Olivier Hersent, David Boswarthick and Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

4. Jan Holler, Vlasios Tsiatsis, 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 .
5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011
6. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

COURSE OUTCOMES:

Upon completion of this course, the 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 using Rasperry Pi/Arduino.
CO4: Apply data analytics and use cloud offerings related to IoT.
CO5: Analyze applications of IoT in real time scenario.

19CSOE09 SOFTWARE TESTING

L	T	P	C
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COURSE OBJECTIVES:

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

UNIT-I: INTRODUCTION **9**

Testing as an engineering activity – Testing as a process – Testing maturity model- Testing axioms – Basic definitions – Software testing principles – The tester's role in a software development organization – Origins of defects – Cost of defects – Defect classes – The defect repository and test design – Defect examples - developer/tester support of developing a defect repository.

UNIT-II: TEST CASE DESIGN STRATEGIES **9**

Test case design strategies – Using black box approach to test case design – Boundary value analysis – Equivalence Class partitioning – State based testing – Cause-effect graphing – Compatibility testing – User documentation testing – Domain testing - Random testing – Requirements based testing – Using white box approach to test design – Test adequacy criteria – Static testing vs. structural testing – Code functional testing – Coverage and control flow graphs – Covering code logic – Paths – Code complexity testing – Additional white box testing approaches- Evaluating test adequacy criteria.

UNIT-III: LEVELS OF TESTING **9**

The need for levels of testing – Unit test – Unit test planning – Designing the unit tests – The test harness – Running the unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – Scenario testing – Defect bash elimination system Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Adhoc testing – Alpha, Beta tests – Testing OO systems – Usability and accessibility testing – Configuration testing –Compatibility testing – Testing the documentation- Website testing.

UNIT-IV: TEST MANAGEMENT **9**

People and organizational issues in testing – Organization structures for testing teams – Testing services – Test Planning – Test plan components – Test plan attachments – Locating test items – test management – test process – Reporting test results – Introducing the test specialist – Skills needed by a test specialist – Building a testing group- The structure of testing group, The technical training program.

UNIT-V: TEST AUTOMATION **9**

Software test automation – Skills needed for automation – Scope of automation – Design and architecture for automation – Requirements for a test tool – Challenges in automation – Test metrics and measurements – Project, Progress and Productivity metrics.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles, and Practices", Pearson Education, 2006.
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.

3. Iene Burnstein, “Practical Software Testing”, Springer International Edition, 2003.
4. Edward Kit,” Software Testing in the Real World – Improving the Process”, Pearson, Education, 1995.
5. Boris Beizer,” Software Testing Techniques” , 2nd Edition, Van Nostrand Reinhold, New York, 1990.
6. Aditya P. Mathur, “Foundations of Software Testing Fundamental Algorithms and Techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

COURSE OUTCOMES:

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

CO1: Design test cases suitable for a software development for different domains.
CO2: Identify suitable tests to be carried out.
CO3: Prepare test planning based on the document.
CO4: Document test plans and test cases designed.
CO5: Use automatic testing tools, develop and validate a test plan.

19CSOE10	USER INTERFACE DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts user interface design.
- To design Menus and GUI.
- To understand the components of windows control.
- To visualize web controls.

UNIT-I: INTRODUCTION **9**

Human-Computer interface - Characteristics of graphics interface - Direct manipulation Graphical system - Web user interface – Popularity – Characteristic & principles.

UNIT-II: HUMAN COMPUTER INTERACTION **9**

User Interface design process - Obstacles – Usability - Human characteristics in design – Human Interaction speed - Business functions - Requirement analysis - Direct - Indirect methods - Basic business functions - Design standards - System timings - Human consideration in screen design - Structures of menus - Functions of menus - Contents of menu – Formatting - Phrasing the menu - Selecting menu choice – Navigating menus - Graphical menus.

UNIT-III: WINDOWS **9**

Characteristics - Components - Presentation styles - Types - Managements - organizations - Operations - Web systems - Device-based controls Characteristics - Screen-based controls - Operate control – Text boxes – Selection control - Combination control - Custom control – Presentation control.

UNIT-IV: MULTIMEDIA **9**

Text for web pages - Effective feedback - Guidance and Assistance - Internationalization - Accessibility – Icons - Image – Multimedia - Coloring.

UNIT-V: WINDOWS LAYOUT-TEST **9**

Prototypes - Kinds of tests – Retest – Information search - Hypermedia - WWW -Software tools -Visualizations to present and explore big data -Visualization of text data and protein sequences.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Wilbent O. Galitz,"The Essential Guide To User Interface Design", John Wiley & Sons, 2001.
2. Ben Sheiderman, "Design The User Interface", Pearson Education, 1998.
3. Alan Cooper, "The Essential of User Interface Design", Wiley Dream Tech, 2002.

COURSE OUTCOMES:

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

CO1: Design the GUI components.
CO2: Design the Menu components.
CO3: Design the windows based controls.
CO4: Realize multimedia components.
CO5: Design windows layout for big data.

19ECOE11 AUTOMOTIVE ELECTROICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of Automotive Electronics and its evolution.
- To introduce overview of automotive systems and subsystems.
- To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
- To understand, design and model various automotive control systems using Model based development technique.
- To understand role of Embedded in various communication systems, wired and wireless protocols used in vehicle networking.

UNIT-I: AUTOMOTIVE MECHANICAL SYSTEMS: VEHICLE SYSTEMS 9

Power train system (Air system, Fuel system (carburetor and diesel fuel injection, Ignition system, Exhaust system and other auxiliary systems (cooling, lubrications and electrical systems), Transmission system (Front, rear and 4 wheel drive, manual, automatic transmission, differential). Braking system (drum, disc, hydraulic, pneumatic), Steering system (rack and pinion, power steering).

UNIT-II: ELECTRONICS IN AUTOMOTIVE SYSTEMS 9

Need for electronics in automotive systems: Performance (speed, power, and torque), Control (emission, fuel economy, drivability, and safety) and legislation (environmental legislation for pollution and Safety Norms). Overview of vehicle electronic systems: Basic electrical components and their operation in an automobile: Power train subsystem (Starting systems, Charging systems – Ignition systems – Electronic fuel control), Chassis subsystem (ABS, TCS, and ESP) – Comfort and safety subsystems (Night vision, Airbags, Seatbelt Tensioners, Cruise control– Lane– Departure– Warning, Parking).

UNIT-III: INTEGRATED DEVELOPMENT ENVIRONMENT 9

Introduction to integrated development environment (IDE) – Getting started, HW / SW configuration (boot service, Host – Target interaction) – Booting reconfiguration – Managing IDE – Target servers, agents, Cross development, debugging – Introduction to an IDE for lab board – RTOS, PC based debugger.

UNIT-IV: EMBEDDED SYSTEM IN AUTOMOTIVE APPLICATIONS 9

Engine management systems – Gasoline / Diesel systems, various sensors used in system – Electronic transmission control – Vehicle safety system – Electronic control of braking and traction – Body electronics – Infotainment systems – Navigation systems – System level tests – Software calibration using engine and vehicle dynamometers – Environmental tests for electronic control unit – Application of control elements and control methodology in automotive system.

UNIT-V: EMBEDDED SYSTEM COMMUNICATION PROTOCOLS 9

Introduction to control networking – Communication protocols in embedded systems – SPI, I2C, USB – Vehicle communication protocols – Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. JoergSchaeuffele, Thomas Zurawka, "Automotive Software Engineering Principles, Processes, Methods and Tools", SAE International, 2005.
2. Robert Bosch, "Automotive Handbook", John Wiley and Sons, 6th Edition, 2014.
3. Denton T., "Automobile Electrical and Electronic Systems", 4th Edition, 2012.
4. Ronald K. Jurgen, "Automotive Electronics Handbook", McGraw Hill Publications, 1999.
5. Nicholas Navit, "Automotive Embedded System Handbook", CRC Press, Taylor and Francis Group, 2009.
6. Knowles D., "Automotive Electronic and Computer Controlled Ignition Systems", Prentice Hall, 1998.
7. William B. Ribbens, "Learning Automotive Electronics", Newnes Publishing, 6th Edition 2003.

COURSE OUTCOMES:

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

CO1: Describe various mechanical systems in an automobile.
CO2: Illustrate different types of electronic systems in an automobile.
CO3: Outline the various stages of integrated development environment to design an embedded system.
CO4: Explain the various embedded systems used in automotive applications.
CO5: Compare Vehicle Communication Protocols.

19ECOE12 HARDWARE DESCRIPTIVE LANGUAGE

L	T	P	C
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COURSE OBJECTIVES:

- To impart the skill in various modeling in Verilog.
- To understand the basics of Verilog HDL.
- To learn the features in Verilog HDL.
- To understand the branching in Verilog,
- To be familiar with programming in digital circuits.

UNIT-I: OVERVIEW OF DIGITAL DESIGN WITH VERILOG HDL 9

Overview of Digital Design with Verilog HDL, Evolution of CAD, emergence of HDLs, typical HDL-flow, Trends in HDLs. Hierarchical Modeling Concepts Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.

UNIT-II: BASIC CONCEPTS 9

Basic Concepts, Lexical conventions, data types, system tasks, compiler directives. Modules and Ports, Module definition, port declaration, connecting ports, hierarchical name referencing.

UNIT-III: GATE-LEVEL MODELING 9

Gate-Level Modeling - Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. Dataflow Modeling, Continuous assignments, delay specification, expressions, operators, operands, operator types.

UNIT-IV: BEHAVIORAL MODELING 9

Behavioral Modeling, Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.

UNIT-V: LOGIC DESIGN USING VERILOG 9

Basic concepts – Identifiers – Procedural assignments – Design of combinational and sequential circuits using data flow – Structural gate level – Switch level modeling and behavioral modeling – Test benches.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Bhasker J., "Verilog HDL", Prentice Hall, 2000.
2. Stephen Brown, "Fundamental of Digital logic with Verilog Design", Tata McGraw Hill, 2008.
3. Samir Palnitkar, "Verilog HDL", Pearson, 2nd Edition, 2003.
4. Zainalabedin Navabi, "Verilog digital systems design", McGraw Hill, 2nd Edition, 1999.
5. Charles H Roth Jr., "Digital System Design using VHDL", Thomson learning, 2004.

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of Verilog HDL.
CO2: Gain the knowledge about various modeling in Verilog HDL.
CO3: Be familiar with features in Verilog HDL.
CO4: Understand the fundamentals branching Verilog HDL.
CO5: Analyze the logic design using Verilog HDL.

19ECOE13 EMBEDDED SYSTEM DESIGN USING ARM PROCESSOR

L	T	P	C
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COURSE OBJECTIVES:

- To understand ARM7TDMI assembly instructions and their formats and usage.
- To be very good in writing ARM7 based assembly level programs.
- To understand how various coprocessors are interfaced in a SoC.
- To be very conversant and knowledgeable in cache design, virtual memory and memory protection concepts and their implementation details in a typical SoC designs.
- To know about various families of ARM and different case studies.

UNIT-I: ARM ARCHITECTURE 9

Advanced RISC machine – Architecture inheritance – ARM programming model – ARM development tools – 3 and 5 stages pipeline ARM organization – ARM instruction execution and implementation – ARM Co-Processor interface.

UNIT-II: ASSEMBLY LANGUAGE PROGRAMMING 9

ARM instruction types – Data transfer, Data processing and control flow instructions – ARM instruction set – Co-processor instructions – Data processing instruction – Data transfer instruction – Control flow instructions.

UNIT-III: THE THUMB INSTRUCTION SET 9

Thumb bit in the CPSR – Thumb programmer‘s model – Thumb branch instructions – Thumb software interrupt instruction – Thumb data processing instructions – Thumb single register data transfer instructions – Thumb multiple register data transfer instructions – Thumb breakpoint instructions – Thumb implementation – Thumb applications.

UNIT-IV: MEMORY HIERARCHY 9

Memory size and speed – On-chip memory – Caches – Cache design – Memory management – Examples and exercises. Abstraction in software design – Date type – Floating point data type and architecture – Expressions – Conditional statement – Loops – Functions and procedures – Use of memory.

UNIT-V: ARM PROCESSOR AND CPU CORES. 9

ARM cores – ARM architecture – ARM7TDMI, ARM8, ARM9TDMI, ARM10TDMI, ARM710T – ARM810 – ARM920T AND ARM940T – ARM1020E – Case study.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Steve Furber, “ARM System on Chip Architecture‖ Addison”, Wesley Professional, 2nd Edition, Aug 2000.
2. Andrew N. Sloss, Dominic Symes and Chris Wright, “ARM System Developer‘s Guide Designing and Optimizing System Software”, Morgan Kaufmann Publishers, Elsevier, 2004.
3. Ricardo Reis, “Design of System on a Chip: Devices and Components”, Springer, 1st Edition, July 2004.
4. Jason Andrews-Co, “Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)”, Newnes, BK and CD– ROM (Aug 2004).

5. Rashinkar P., Paterson and Singh L., "System on a Chip Verification – Methodologies and Techniques", Kluwer Academic Publishers, 2001.
6. David Seal, "ARM Architecture reference Manual", Addison – Wesley Professional; 2nd Edition, 2001.
7. Alan Clement, "The principle of computer Hardware", 3rd Edition, Oxford University Press.

COURSE OUTCOMES:

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

CO1: Explain ARM architecture.
CO2: Illustrate special features of ARM instruction set.
CO3: Make use of thumb instruction set to write assembly language program.
CO4: Explain memory and I/O management with ARM processor.
CO5: Review different ARM CPU cores.

19ECOE14 BIO - INSPIRED COMPUTING TECHNOLOGIES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concept of Genetic algorithm.
- To learn the operators in Genetic algorithm.
- To understand the concept of PSO algorithm.
- To introduce advanced optimization algorithm.
- To know about hybrid optimization algorithm.

UNIT-I: INTRODUCTION **9**

Features of Evolutionary Computation – Advantages of Evolutionary Computation – Applications of Evolutionary Computation.

Genetic Algorithms: Introduction – Conventional Optimization and Search Techniques – Advantages and Limitations of Genetic Algorithm – Terminologies and Operators of GA

UNIT-II: OPERATORS AND APPLICATIONS **9**

Advanced Operators and Techniques in Genetic Algorithm – Classification of Genetic Algorithm – Application of GA in solving combinatorial optimization problems

UNIT-III: PSO ALGORITHM **9**

PSO Algorithm – Accelerated PSO – Implementation – Convergence Analysis – Binary PSO – Applications. Ant Colony Optimization – Characteristics- Algorithm –Applications.

UNIT-IV: ADVANCED OPTIMIZATION ALGORITHM **9**

Cuckoo Life Style – Flowchart – Algorithm , Bat Algorithm (Binary Bat Algorithm) – Echolocation of Bats – Flowchart – Algorithm, Bee-Inspired Algorithm (Artificial Bee Colony) – Flowchart – Algorithm

UNIT-V: HYBRID OPTIMIZATION ALGORITHM **9**

Teacher-Learner Based Optimization algorithm – Jaya Algorithm – Hybrid Optimization Algorithm: Hybrid Swarm Intelligence Optimization Algorithm – Hybrid Firefly Algorithm.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Sivanandam S. N. and Deepa S.N., "Introduction to Genetic Algorithms", 1st Edition, Springer, USA, 2008.
2. OmidBozorg - Haddad, "Advanced Optimization by Nature-Inspired Algorithms", Springer, Volume 720, Singapore, 2018.
3. SrikantaPatnaik, Xin-She Yang and Kazumi Nakamatsu, "Nature-Inspired Computing and Optimization Theory and Applications", Springer, Volume 10,USA, 2017.
4. Nancy Arana-Daniel, Carlos Lopez-Franco, Alma Y Alanis, "Bio-inspired Algorithms for Engineering", Butterworth-Heinemann 2018.
5. David E. Goldberg, "Genetic Algorithm in search, Optimization and Machine Learning" Pearson Education India, 2008.

COURSE OUTCOMES:

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

CO1: Explain concept of Genetic algorithm.
CO2: Illustrate operators in Genetic algorithm.
CO3: Gain knowledge on the concept of PSO algorithm.
CO4: Explain the concepts on advanced optimization algorithm.
CO5: Review about hybrid optimization algorithm.

19ECOE15 VEHICULAR COMMUNICATION AND NETWORKING TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the vehicle-to-x (v2x) communication.
- To conceptualize standards and technologies.
- To understand the basics wireless propagation and channel characteristics.
- To learn Medium access control (MAC**).**
- To introduction to vehicular networks.

UNIT-I: VEHICLE-TO-X (V2X) COMMUNICATION 9

Vehicle-to-X (V2X) Communication for Intelligent Transportation Systems (ITS) - safety and non-safety applications, use cases, network service requirements of different applications, V2X communication regimes.

UNIT-II: STANDARDS AND TECHNOLOGIES 9

Standards and Technologies - layered architecture, infrastructure-based vs. infrastructure-less technologies, Long-Term Evolution (LTE), Dedicated Short Range Communication (DSRC), Wireless Access in Vehicular Environments (WAVE).

UNIT-III: WIRELESS PROPAGATION AND CHANNEL CHARACTERISTICS 9

Wireless Propagation and Channel Characteristics - path loss, shadowing, small-scale fading, delay spread and Doppler spread, coherence bandwidth and coherence time, techniques for combating wireless channel impairments; Physical Layer - digital modulation schemes in DSRC, design of OFDM in DSRC (symbol time, sub-carrier spacing, pilot spacing).

UNIT-IV: MEDIUM ACCESS CONTROL (MAC) 9

802.11p EDCA, multi-channel operation in the WAVE MAC; Routing - flooding, broadcast storm problem, Geocast; Security and Privacy in Vehicular Networks; Vehicular Network Simulation - mobility models, bidirectionally coupled road traffic and communication network simulators for vehicular network simulation.

UNIT-V: INTRODUCTION TO VEHICULAR NETWORKS

Introduction to Vehicular Networks: Controller Area Networks (CAN) , Field of application, Physical layer and bit coding, Frame types and format, Bit stuffing and synchronization, Error management, Overview of Other communication protocols: LIN, Flex ray.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Christophe Sommer and Falko Dressler, "Vehicular Networking", Cambridge University Press, 2014.
2. Hannes Hartenstein and Kenneth Laberteaux(eds.), "VANET Vehicular Applications and Inter-networking Technologies", John Wiley & Sons, 2009.
3. Claudia Campolo, Antonella Molinaro and Riccardo Scopigno, "Vehicular ad hoc Networks: Standards, Solutions, and Research", Springer, 2015.
4. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", Second Edition, Prentice Hall, 2001.
5. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.

6. Dominique Paret, “Multiplexed Networks for Embedded Systems: CAN, LIN, FlexRay, Safe–by–Wire”, First Edition, Wiley, 2007.

COURSE OUTCOMES:

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

CO1: Define vehicle-to-x (v2x) communication.
CO2: Solve specific problems with standards and technologies.
CO3: Gain knowledge of the basics wireless propagation and channel characteristics**.**
CO4: Review on Medium Access Control (MAC).
CO5: Explain about vehicular networks.

19EEOE16 ENERGY EFFICIENT LIGHTING SYSTEM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of lightning.
- To known the fundamentals of illumination and its methods.
- To familiar lighting control methods for various applications.
- To understand energy efficient lighting in building management system**.**
- To study the renewable energy methods for energy efficient lighting.

UNIT-I: LIGHTING **9**

Lighting - Importance of lighting in buildings - Interior designing, Photography, Architecture - Difference between good and bad lighting - Challenges in lighting - Types of lighting.

UNIT-II: ILLUMINATION FUNDAMENTALS & VARIOUS ILLUMINATION METHODS **9**

Introduction - Terms used in illumination - Laws of illumination - Polar curves - Photometry - Integrating sphere - Sources of light - Discharge lamps - Incandescent lamps - MV and SV lamps.

UNIT-III: ENERGY EFFICIENT LIGHTING **9**

Smart lighting - Fluorescent lamps - Comparison between Tungsten filament lamps and Fluorescent tubes - Basic principles of light control - Types and design of lighting and flood lighting - CFL - LED - High Intensity Discharge lamps.

UNIT-IV: BUILDING MANAGEMENT SYSTEM **9**

Energy efficient landscape design - Natural lighting - Choice of building materials for energy efficient lighting - Light pipes - Light fixtures - Green buildings - Construction techniques..

UNIT-V: CASE STUDY **9**

Solar lighting techniques - Lighting using wind power - Energy conservation building code - Energy efficient buildings in the country.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Philip Gordon., "Principles and Practices of Lighting Design: The Art of Lighting Composition", Blue Matrix Productions, 2011.
2. Jerry Yudelson, "Green Building Through Integrated Design" The McGraw – Hill Companies, Inc., 2009.
3. Derek Phillips, "Daylighting: Natural Light in Architecture", Elsevier, 2004.
4. Jerry Yudelson , "Greening Existing Buildings", The McGraw - Hill Companies, Inc.,1st Edition, 2010.
5. Sam Kubba,"Handbook of Green Building Design and Construction", Elsevier Inc., 2012.
6. Solanki.C.S, "Solar Photovoltaic Technology and Systems", PHI, 2013.
7. J. F. Manwell, J.G. MC Gowan and A.L. Rogers, "Wind Energy Explained: Theory, Design and Application", Wiley, 2nd Edition, 2010

COURSE OUTCOMES:

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

CO1: Understand the properties of light, importance of lighting in various fields and types of lighting.

CO2: Understand the properties and laws of illumination, working of discharge lamps, fluorescent lamps, tungsten filament lamps and light control techniques.

CO3: Compare the various lighting techniques and employ suitable lighting control methods various applications.

CO4: Choose the building materials and construction techniques for energy efficient lighting.

CO5: Employ renewable energy methods for energy efficient lighting.

19EEOE17 SENSORS AND TRANSDUCERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of measurement technology.
- To learn the various motion, proximity and ranging sensors used to measure various physical parameters.
- To understand the various force, magnetic and heading sensors used to measure various physical parameters.
- To know the various optical, pressure and temperature sensors used to measure various physical parameters**.**
- To understand the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT-I: INTRODUCTION 9

Basics of measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor output signal types.

UNIT-II: MOTION, PROXIMITY AND RANGING SENSORS 9

Motion sensors – Potentiometers, resolver, encoders – Optical, magnetic, inductive, capacitive, LVDT – RVDT – Synchro – Microsyn, accelerometer – GPS, bluetooth, Range sensors – RF beacons, Ultrasonic ranging, Reflective beacons, Laser range sensor (LIDAR).

UNIT-III: FORCE, MAGNETIC AND HEADING SENSORS 9

Strain gage, Load cell, Magnetic sensors – Types, principle, requirement and advantages: Magneto resistive – Hall effect – Current sensor, Heading sensors – Compass, gyroscope, inclinometers.

UNIT-IV: OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, Photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, bellows, Piezoelectric – Tactile sensors, Temperature – IC, thermistor, RTD, thermocouple. Acoustic Sensors – Flow and level measurement, Radiation sensors – Smart Sensors – Film sensor, MEMS & Nano sensors, LASER sensors.

UNIT-V: SIGNAL CONDITIONING and DAQ SYSTEMS 9

Amplification – Filtering – Sample and hold circuits – Data acquisition: single channel and multi channel data acquisition – Data logging – Applications – Automobile, aerospace, Home appliances, Manufacturing, Environmental monitoring.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Ernest O. Doebelin, “Measurement Systems - Applications and Design”, Tata McGraw-Hill, 2009.
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th Edition, Dhanpat Rai & Co, New Delhi, 2013.
3. Patranabis D., “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2010.
4. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.

5. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd Edition, CRC Press, 2015.

COURSE OUTCOMES:

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

CO1: Expertise in various calibration techniques and signal types for sensors.
CO2: Apply the various sensors in the automotive and mechatronics applications.
CO3: Study the basic principles of various magnetic sensors.
CO4: Study the basic principles of various smart sensors.
CO5: Implement the DAQ systems with different sensors for real time applications.

19EEOE18 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To identify the presence of electrical hazards and measures to minimize risks.
- To determining the cause of electrical accidents, fires and explosions.
- To apply various grounding and bonding techniques.
- To adequate safety method for low, medium and high voltage equipment**.**
- To know the various fundamentals and provide solutions to a practical case study.

UNIT-I: INTRODUCTION AND HAZARDS OF ELECTRICITY 9

Introduction – Hazard analysis: Primary and secondary hazards – Arc, blast, shocks – Causes and effects – Summary of causes – Protection and precaution – Injury and death protective strategies – IE Rules 1956 – Basic rules for new installations: Power system, domestic and industry (Qualitative treatment only).

UNIT-II: ELECTRICAL SAFETY EQUIPMENT 9

General inspection and testing procedure for electrical safety equipment – Electrical safety equipment for external protection: Flash and thermal protection – Head and eye protection – Insulation protection. Electrical safety equipment for internal protection: Over voltage, short circuit, earth fault, leakage current, high/low frequency – Single line diagram of industrial power system with safety control – Electrician's safety kit and materials.

UNIT-III: SAFETY PROCEDURES 9

Introduction – Six-step safety method – Job briefings – Energized or De-energized – Safe switching of power systems – General energy control programs – Lockout – Tag out – Voltage measurement techniques – Placement of safety grounds – Flash hazard calculations and approach distances – Calculating the required level of arc protection (flash hazard calculations) – Barriers and warning signs – Tools and test equipment – Field marking of potential hazards – Shock avoidance techniques – One-minute safety audit.

UNIT-IV: GROUNDING AND ELECTRICAL MAINTENANCE 9

Need for electrical equipment grounding – System grounding – Equipment grounding – Types of Earthing – Earth testing for electrical equipment's in power house and industry – Eight step maintenance program – Maintenance requirements for specific equipment and location – IEC and UL standard.

UNIT-V: VOLTAGE SAFETY SYNOPSIS AND MEDICAL SAFETY MANAGEMENT 9

Safety equipment's and safety procedures for low voltage and high voltage system – Electrical safety around electronic circuits – Electrical safety for medical equipment like over current safety, isolation, EMI and harmonics – Battery maintenance procedure – Stationary battery safety – Accident prevention – Accident investigation – First aid – Rescue techniques – Electrical safety program structure and development – Safety meetings – Safety audits.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. John Cadick, Mary Capelli-Schellpfeffer and Dennisneitzel, “Electrical Safety Handbook”, Mcgraw Hill Publishing Company Ltd., 4th Edition, 2012.

2. Dennis Neitzel and Al Winfield, “Electrical Safety Handbook”, McGraw – Hill Education, 4th Edition, 2012.
3. Mohamed A El-Sharkawi, “Electric safety: Practice and Standards”, CRC press, New York, 2013.
4. Martha J. Boss and Gayle Nicoll, “Electrical Safety: Systems, Sustainability and Stewardship”, CRC press, New York, 2014.
5. Ray A. Jones and Jane G. Jones, “The Electrical Safety Program Guide”, National fire protection association, Quincy, 2011.
6. James H and Wiggins JR., “Managing Electrical Safety”, Abs Consulting, Maryland, 2011.

COURSE OUTCOMES:

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

CO1: Expand skills in identifying the presence of electrical hazards, implementing measures to minimize risks.

CO2: Develop skills in investigative techniques for determining the cause of electrical accidents, fires and explosions.

CO3: Analyze and apply various grounding and bonding techniques.

CO4: Select appropriate safety method for low, medium and high voltage equipment.

CO5: Assess and provide solutions to a practical case study.

19EEOE19 **ELECTRIC VEHICLES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of electric vehicle components and configuration.
- To analyze suitable drive scheme for developing an electric trains.
- To analyze energy storage system.
- To identify an energy management system**.**
- To understand the infrastructure for electric vehicles and business potential.

UNIT-I: INTRODUCTION **9**

Conventional vehicles: Basics of vehicle performance, Vehicle power source characterization, Transmission characteristics and mathematical models to describe vehicle performance. Introduction to hybrid electric vehicles: History of hybrid and electric vehicles, Social and environmental importance of hybrid and electric vehicles, Impact of modern drive-trains on energy supplies. Hybrid electric drive-trains: Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis.

UNIT-II: ELECTRIC TRAINS **9**

Electric drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, Power flow control in electric drive-train topologies, fuel efficiency analysis. Electric propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC motor drives, Induction motor drives, permanent magnet motor drives, switch reluctance motor drives – Drive system efficiency.

UNIT-III: ANALYSIS OF ENERGY STORAGE **9**

Energy storage: Introduction to energy storage requirements in hybrid and electric vehicles, Battery based energy storage and its analysis, Fuel cell based energy storage and its analysis, super capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, Sizing the power electronics, Selecting the energy storage technology, Communications, supporting subsystems.

UNIT-IV: ENERGY MANAGEMENT STRATEGIES **9**

Introduction to energy management strategies used in hybrid and electric vehicles, Classification of different energy management strategies, Comparison of different energy management strategies, implementation issues of energy management strategies.

UNIT-V: BUSINESS PERSPECTIVE OF ELECTRIC VEHICLE **9**

Design of a hybrid electric vehicle (HEV) – Design of a battery electric vehicle (BEV), hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles. Business: E-mobility business, electrification challenges, Connected mobility and autonomous mobility – Case study: E-mobility Indian roadmap perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid, Social dimensions of EVs.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design”, CRC press, 2004.

2. Mi C, Masrur M A and Gao D W., “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2017.
3. Onori S, Serrao L and Rizzoni G., “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
4. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth - Heinemann, 2002.
5. Ronald K. Jurgen, “Electric and Hybrid - Electric Vehicles”, SAE, 2010.

COURSE OUTCOMES:

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

CO1: Understand the basics of electric vehicle components and configuration.
CO2: Analyze suitable drive scheme for developing an electric vehicle.
CO3: Analyze a proper energy storage system.
CO4: Opt a proper energy management system.
CO5: Understand the infrastructure for electric vehicles and business potential.

19EEOE20 **SCADA SYSTEM AND APPLICATION MANAGEMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge about the SCADA system.
- To provide knowledge about the SCADA components.
- To grasp knowledge about SCADA communication.
- To understand the concepts of SCADA monitoring and control**.**
- To understand the concepts of SCADA application in power system.

UNIT-I: INTRODUCTION TO SCADA **9**

Evolution of SCADA, SCADA definitions, SCADA functional requirements and components, SCADA hierarchical concept, SCADA architecture, General features, SCADA applications, benefits.

UNIT-II: SCADA SYSTEM COMPONENTS **9**

Remote terminal unit (RTU), Interface units, human-machine interface units (HMI), Display monitors/data logger systems, Intelligent electronic devices (IED), Communication network, SCADA server, SCADA control systems and control panels.

UNIT-III: SCADA COMMUNICATION **9**

SCADA communication requirements, Communication protocols: Past, present and future, structure of a SCADA communications protocol, Comparison of various communication protocols, IEC61850 based communication architecture, Communication media like fiber optic, PLCC etc. Interface provisions and communication extensions, Synchronization with NCC, DCC.

UNIT-IV: SCADA MONITORING AND CONTROL **9**

Online monitoring the event and alarm system, Trends and reports, Locking list, Event disturbance recording. Control function: Station control, Bay control, Breaker control and disconnector control.

UNIT-V: SCADA APPLICATIONS IN POWER SYSTEM **9**

Applications in generation, Transmission and distribution sector, Substation SCADA system functional description, System specification, system selection such as substation configuration, IEC61850 ring configuration, SAS cubicle concepts, Gateway interoperability list, Signal naming concept. System installation, Testing and commissioning.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, 2016.
2. Gordon Clarke, Deon Reynders, "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.
3. William T. Shaw, "Cybersecurity for SCADA Systems", PennWell Books, 2006.
4. David Bailey and Edwin Wright, "Practical SCADA for Industry", Newnes, 2003.
5. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT Systems for Electric Power", PennWell 1999.

6. Dieter K. Hammer, Lonnie R. Welch and Dieter K. Hammer, "Engineering of Distributed Control Systems", Nova Science Publishers, USA, 1st Edition, 2002.

COURSE OUTCOMES:

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

CO1: Understand the concepts of SCADA system.

CO2: Acquire knowledge about the SCADA components.

CO3: Acquire knowledge about SCADA communication.

CO4: Understand the concepts of SCADA monitoring and control.

CO5: Understand the concepts of SCADA application in power system.

19MEOE21 TESTING OF MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To apply knowledge of mechanics of materials for designing mechanical elements including design process, failure prevention under static & variable loadings.

UNIT-I: INTRODUCTION 9

Strength of materials – Basic assumptions – Elastic and plastic behaviour – Average stress and strain – Concept of stress, Strain and the types of stresses and strains.

UNIT-II: PLASTIC DEFORMATION OF CRYSTALS 9

Deformation by slip – Slip in a perfect lattice – Slip by dislocation movement – Critical resolved shear stress for slip – Deformation of single crystals – Polycrystalline materials – Deformation by twinning, stacking faults, strain hardening.

UNIT-III: FRACTURE MECHANICS AND HARDNESS TESTING 9

Types of fracture, Griffith theory and modified Griffith – Orowan theory, metallographic aspects of fracture, crack propagation, concept of fracture curve. Concept of fracture curve – Fracture toughness KIC Testing. R-curve, J-Integral, drop weight test – Brinell hardness testing, Rockwell hardness testing, Vickers hardness testing and knoop hardness testing, Nano indentation, Problems.

UNIT-IV: TENSION TESTING 9

ASTM Standards and specification, Engineering stress & strain, True stress strain curves, Holloman – Ludwig equation – Plastic Instability (Necking) – Testing machines – Types, testing procedures, Properties measured, Specimen dimensions, Problems.

UNIT-V: TORSION, SHEARING AND IMPACT TEST 9

ASTM Standards and specification Testing Machines and procedures. Impact testing: Principle – Izod and Charpy Impacts tests, ASTM Standards and specification. Ductile to Brittle Transition Temperature (DBTT), Factors affecting DBTT – Determination of DBTT.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. George E. Dieter, "Mechanical Metallurgy" 3rd Edition, Mc Graw Hill, 2013.
2. Hull D and Bacon D J., "Introduction to dislocations", Butterworth Heinemann, Oxford, 2001.
3. Wullf et al, Vol. III "Mechanical Behavior of Materials", John Wiley and Sons, New York, 1983.

COURSE OUTCOMES:

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

CO1: Understand the static force and inertia forces and their effect that exist in materials.

CO2: Perform balancing, vibration and critical speeds with respect to material.

CO3: Understand the standards, concepts and terminology of material testing.

CO4: Select the appropriate measuring device based on measuring requirements.

CO5: Gain knowledge regarding impacts and testing of materials.

19MEOE22 **ROBOTICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the functions of the basic components of a robot.
- To study the use of various types of end effectors and sensors.
- To impart knowledge in robot kinematics and programming.
- To learn robot safety issues and economics.

UNIT-I: FUNDAMENTALS OF ROBOT **9**

Robot – Definition – Robot anatomy – Coordinate systems, Work envelope, Types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of motion, Pay load – Robot parts and their functions – Need for robots – Different applications.

UNIT-II: ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – D.C. Servo motors, Stepper motors, A.C. Servo motors – Salient features, Applications and comparison of all these drives, End effectors – Grippers – Mechanical grippers, Pneumatic and hydraulic grippers, Magnetic grippers, Vacuum grippers; Two fingered and Three fingered grippers; Internal grippers and external grippers; Selection and design considerations.

UNIT-III: SENSORS AND MACHINE VISION **9**

Requirements of a sensor, Principles and Applications of the following types of sensors – Position sensors – Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors, Range sensors – Triangulations principles, Structured, Lighting approach, Time of flight, Range finders, Laser range meters, Touch sensors, Binary sensors., Analog sensors, Wrist sensors, Compliance sensors, Slip sensors, Camera, Frame grabber, Sensing and Digitizing image data – Signal conversion, Image storage, Lighting techniques, Image processing and analysis – Data deduction, Segmentation, Feature extraction, Object recognition, Other algorithms, Applications – Inspection, Identification, Visual serving and navigation.

UNIT-IV: ROBOT KINEMATICS AND ROBOT PROGRAMMING **9**

Forward kinematics, Inverse kinematics and Difference; Forward kinematics and Reverse kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of Freedom (in 3 Dimension) Jacobians, Velocity and Forces – Manipulator dynamics, Trajectory generator, Manipulator mechanism design – Derivations and Problems. Lead through programming, Robot programming languages – VAL Programming – Motion commands, Sensor commands, End effectors commands and Simple programs.

UNIT-V: IMPLEMENTATION AND ROBOT ECONOMICS **9**

RGV, AGV; Implementation of robots in industries – Various steps; Safety considerations for robot operations – Economic analysis of robots.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Groover M P., "Industrial Robotics – Technology Programming and Applications", McGraw Hill, 2012.
2. Klafter R D., Chmielewski T A and Negin M., "Robotic Engineering – An Integrated Approach", Prentice Hall, 2003.

3. Craig JJ. “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
4. Deb S R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 2013.
5. Fu.KS, Gonzalz R C and Lee C S G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
6. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
7. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992

COURSE OUTCOMES:

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

CO1: Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.

CO2: Illustrate the different types of robot drive systems as well as robot end effectors.

CO3: Apply the different sensors and image processing techniques in robotics to improve the ability of robots.

CO4: Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.

CO5: Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

19MEOE23 INDUSTRIAL ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Assume Technical and Managerial roles in the Industries.
- Apply Engineering Principles to the working environment.
- Use quality tools to foresee and solve issues in the industrial situations.
- Work collaboratively.

UNIT-I: FORECASTING **9**

Characteristics and principles – Qualitative methods, Delphi technique, Market research – Time series methods – Moving average, Exponential smoothing, Box Jenkins method –Autoregressive moving average (ARMA) or autoregressive integrated moving average (ARIMA) models – Fitting regression models – Measurement of forecast errors, Coefficient of correlation – Problem solving.

UNIT-II: FACILITIES PLANNING AND WORK STUDY **9**

Factors affecting site location decisions – Principles and types of layout – Layout planning – Layout tools and computerized layout techniques – Design of group technology layout – Line balancing – Line balancing methods – Objectives of work study – Method study procedure, Recording techniques – Motion study – Principles of motion Economy – Techniques of work measurement – Time study – Synthesis method – Analytical estimating – Predetermined Motion Time System (PMTS) – Work sampling techniques.

UNIT-III: LEAN MANUFACTURING **9**

Elements of Just In Time (JIT) – Pull and push system, Kanban system – Optimized production technology and synchronous manufacturing – Implementation of Six sigma – Single Minute Exchange of Die (SMED) 5S concept – Concurrent engineering – Cellular manufacturing – Enablers of agile manufacturing – Rapid manufacturing - Business Process Reengineering (BPR) – Enterprises Resources Planning (ERP) – Role of KAIZEN, Quality circles and POKA YOKE in modern manufacturing – Seven wastes in lean manufacturing.

UNIT-IV: AGGREGATE PRODUCTION PLANNING **9**

Objectives of aggregate planning – Capacity Requirement Planning (CRP) process – Types of capacity planning – Strategies for aggregate capacity planning – Master production scheduling – Procedure for developing MPS – Materials Requirements Planning (MRP-I), Issues in MRP, Designing and Managing the MRP System, Evaluation of MRP – Manufacturing Resources Planning (MRP-II).

UNIT-V: SCHEDULING OF OPERATIONS **9**

Operations planning and scheduling – Scheduling techniques – Stages in scheduling – Loading, dispatching, Expediting – Finite loading and infinite loading – Load charts and machine loading charts – Priority sequencing – Dynamic sequencing rules – Batch scheduling – Economic Batch Quantity (EBQ) or Economic Run Length (ERL) – Scheduling in repetitive, Batch and job shop manufacturing – Allocation of units for a single resource, Allocation of multiple resources – Resource balancing - Flexible manufacturing system.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Panneerselvam R., "Production & Operations Management", 3rd Edition, PHI Learning Private Limited, New Delhi, 2012.

2. Elwood S. Buffa, and Rakesh K. Sarin, "Modern Production/Operation Management", 8th Edition, John Wiley & Sons, 2000.
3. Dilworth B. James, "Operations Management Design, Planning and Control for Manufacturing and Services", Mcgraw Hill Inc., New York, 1992.
4. Vollman TE., "Manufacturing Planning and Control Systems", Galgotia Publications, 2002.

COURSE OUTCOMES:

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

CO1: Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.

CO2: Illustrate the different types of robot drive systems as well as robot end effectors.

CO3: Apply the different sensors and image processing techniques in robotics to improve the ability of robots.

CO4: Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.

CO5: Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

19MEOE24 MARKETING MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart elementary knowledge to the students regarding the various aspects of sales management.

UNIT-I: SALESMANSHIP **9**

Meaning, Definition, Characteristics, Concept, Kinds, Nature – Evolution, and psychology in selling, Scope, Limitations and importance – Sales management: meaning, definition, Characteristics, Principles, Functions and importance, Difference between sales management and marketing management.

UNIT-II: SALESMAN **9**

Types, Qualities, Objectives, Duties and responsibilities of good salesman, Recruitment, selection and training of salesman: Sources of recruitment, Principles of selection, Selection procedure, Meaning, Advantages, Disadvantages, Methods, Principles and limitation, Subject matter and Types of good training programme.

UNIT-III: REMUNERATION / COMPENSATION **9**

Essentials of Good Remuneration Plan, Objectives – Methods, Factors determining Remuneration Plan, Comparative study of various plans. Motivating sales force: Meaning, Definition, Objectives, Importance and methods.

UNIT-IV: SALES PLANNING **9**

Meaning, Components, Elements, Types, Importance and limitations, Sales fields or territories: Meaning, Definition, Objectives, Factors determining Size, Allocation of sales territories, Steps in setting sales territories. Sales quota: Meaning, Definition, Objectives, Factors determining sales quota, Methods of determining sales quota, Types, Principles of successful sales quota, Advantages and disadvantages of sales quota.

UNIT-V: CONSUMER BEHAVIOUR **9**

Meaning, Definition, Variables and factors affecting Consumer behaviour – Buying Motives: Meaning, Kinds, Chief buying motives – Different types of consumers – Behaviour and customer service.

Contact periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Santoki, "Sales Management", Kalyani Publisher.
2. Gupta S L., "Sales and Distribution Management", Excel Books, New Delhi, 2008.
3. Still R and Richard, "Sales Management", Pearson Prentice Hall, Delhi.
4. Schiffman, Kanuk and Kumar, "Consumer Behaviour", Pearson, 10th Edition.
5. Kotler and Keller, "Marketing Management", Pearson Publication.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Understand the concepts for salesmanship.
CO2: Developed knowledge of salesman responsibilities.
CO3: Understand the concepts for remuneration and compensation methods.
CO4: Developed knowledge of sales planning techniques.
CO5: Understand the use of consumer behavior concepts.

19MEOE25 ENERGY CONSERVATION AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study about the energy data, energy accounting and balancing of industries.

UNIT-I: INTRODUCTION **9**

Energy – Power – Past & present scenario of world; National energy consumption data – Environmental aspects associated with energy utilization – Energy auditing: Need, Types, Methodology and barriers. Role of energy managers. Instruments for energy auditing.

UNIT-II: ELECTRICAL SYSTEMS **9**

Components of EB billing – HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors – Motor efficiency Computation, Energy efficient motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of Encon in illumination.

UNIT-III: THERMAL SYSTEMS **9**

Stoichiometry, Boilers, Furnaces and thermic fluid heaters – Efficiency computation and Encon measures. Steam: Distribution & usage: Steam traps, Condensate recovery, Flash steam utilization, Insulators & refractories.

UNIT-IV: ENERGY CONSERVATION IN MAJOR UTILITIES **9**

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and air conditioning Systems – Cooling towers – D.G. sets.

UNIT-V: ECONOMICS **9**

Energy economics – Discount rate, Payback period, Internal rate of return, Net present Value, Life cycle costing – ESCO concept.

Contact periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCES:

1. Witte LC, Schmidt P S and Brown D R., “Industrial Energy Management and Utilisation”, Hemisphere Publ, Washington, 1988.
2. Callaghn P W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Energy Manager Training Manual (4 Volumes) available at www.energymanager. training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.
4. Dryden I G C., “The Efficient Use of Energy”, Butterworths, London, 1982.
5. Turne W C., “Energy Management Hand book”, Wiley, New York, 1982.
6. Murphy W R and Mc KAY G., “Energy Management”, Butterworths, London 1987.

COURSE OUTCOMES:

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

CO1: Understand the significance and procedure for energy conservation and audit.

CO2: Analyze, Calculate and Improve the energy efficiency and performance of electrical utilities.

CO3: Analyze, Calculate and Improve the energy efficiency and performance of thermal utilities.

CO4: Analyze, Calculate and Improve the energy efficiency and performance of mechanical utilities.

CO5: Carry out the energy accounting and balancing.

19ECVAC01 EMBEDDED SYSTEM DESIGN USING MSP430 AND TIVA C SERIES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the system design cycle of Embedded systems.
- To learn the design aspects of I/O and Memory Interfacing for MSP430 and TIVA C.
- To acquire the programming knowledge of Embedded systems.

MODULE-I: INTRODUCTION TO EMBEDDED SYSTEMS (MSP430 and TIVA C) 10

Introduction to Embedded Systems – Hardware and software Architecture – Introduction about Embedded Processors & Controllers – MSP430 (G2,5529), TIVA C, CC3100, CC3200) Introduction to Embedded C – How do configure Port Pins – Input/ Output Configuration – SFR Configuration – Library files Declaration – Variable declarations – Importance of While Loop – Function Declaration and Handling of Functions – Pointers - Array

MODULE-II: IDE AND INTERFACING CONCEPTS (Hands-On Session) 10

IDE – Integrated Development Environment's – Introduction to Energia and CCS for MSP430 and TIVA C – How to create Projects – Interfacing Techniques – Handling of Input/ Output Devices (using Switch & LED) – Running LED- Concept of RELAY & Application – LCD Display – Command Lines Explanation – 8-Bit LCD Programming – 4-Bit LCD Programming – Seven Segment Display.

MODULE-III: DESIGN APPLICATIONS (Hands-On Session) 10

Timer Concepts – Generation of Waveforms – Counter Concepts – Display Counting values in 7-Segment Display – Interrupt Programming – Serial Communication – Microcontroller to PC (Terminal) – PC to Microcontroller – Analog to Digital Conversion – Stepper Motor Interfacing – Real Time Clock (RTC) – Setting up CC3200 as a HTTP Server.

Contact periods:
Lecture: 30 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30 Periods

REFERENCES:

1. MSP430G2553 Datasheet - https://www.ti.com/lit/ds/symlink/msp430g2553.pdf.
2. MSP430F5529 Datasheet - https://www.ti.com/lit/ds/symlink/msp430f5529.pdf?ts=1619624658440&ref_url=https%253A%252F%252Fwww.ti.com%252Fproduct%252FMSP430F5529
3. Tiva C Series TM4C123G LaunchPad Evaluation Kit User's Manual - https://www.ti.com/lit/pdf/spmu296.
4. Simple Link Wi-Fi CC3200 Launch Pad Development Workshop by Agus Kurniawan Publisher:PE Press.
5. MSP430 Microcontroller Basics by John H. Davies, 2008 Publisher: Elsevier Science.

COURSE OUTCOMES:

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

CO1: Demonstrate the design configurations of MSP430 and TIVA C.
CO2: Know how to interface microcontroller with their peripherals.
CO3: Execute the c programs for various applications based on TI microcontrollers.

19ECVAC02 INTRODUCTION TO CADENCE DESIGN TOOL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of logic circuits.
- To learn the design aspects of combinational and sequential circuits.
- To acquire the programming knowledge using testbench.

MODULE-I: INTRODUCTION BASIC CIRCUITS 10

Adders, Multiplexers, Magnitude Comparator, Flip-Flops, Counters, FSM, VLSI Design flow - Modeling, Verilog HDL.

MODULE-II: DESIGN AND SIMULATION OF COMBINATIONAL CIRCUITS 10

Design and Simulation of Combinational Circuits along with Testbench (Multiplexer, Design for a given Specification)

- HDL Coding.
- Testbench for the HDL Code.
- Functionality verification.

MODULE-III: DESIGN AND SIMULATION OF SEQUENTIAL CIRCUITS 10

Design and Simulation of Sequential Circuits along with Testbench (Serial Adder using FSM)

- HDL Coding.
- Testbench for the HDL Code.
- Functionality verification.

Synthesis and verification with the given specification

- Create SDC file.
- Create TCL Command.
- Report Generation.
- View RTL Schematic.

Contact periods:

Lecture: 30 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30 Periods

REFERENCES:

1. Samir Palnitkar - Verilog HDL–Guide to Digital design and synthesis, Second Edition Pearson Education, 2009.
2. J.Bhasker, Verilog HDL, Prentice Hall, 2000.
3. Stephen Brown, Fundamental of Digital logic with Verilog Design, Tata McGraw Hill, 2008.
4. Zainalabedin Navabi, Verilog digital systems design, McGraw Hill Second Edition, 1999.
5. Cadence Manual.

COURSE OUTCOMES:

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

CO1: Understanding the basics of logic circuits.
CO2: Impart knowledge on design aspects of logic circuits.
CO3: Apply programming knowledge with testbench.

19ECVAC03 SIGNAL AND IMAGE PROCESSING USING RASPBERRY PI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of Python programming.
- To understand the basics of Raspberry Pi hardware and its capabilities.
- To realize the processing of real-time signals and images.
- To create their own signal and image processing algorithms.

MODULE-I: PYTHON PROGRAMMING **10**

Introduction to Python: Installation, Significance of Python, Python as an Interpreter, Line structure, Simple statements, Python Syntax, Strings and Console Output, Conditionals and Control Flow, Functions, Tuples and Sequence, Sets, Lists and Dictionaries, Control Flow Tools, Classes, File Input and Output, Lists and functions, Looping Techniques and Conditions. Exercises.

MODULE-II: RASPBERRY PI **10**

Introduction to the Hardware, setup and installation of Raspbian OS, Interfacing peripherals with raspberry pi. Python console in Raspbian – installing necessary libraries through console, Methods for accessing raspberry pi ports. Interfacing camera with raspberry pi.

Recalling signal and image processing fundamentals, Introduction to the signal and image processing libraries available in python. Simple mathematical functions on the benchmark signals and images through raspberry pi.

MODULE-III: PROJECTS AND CASE STUDIES **10**

Projects:Applying equalizer to audio files – simple image processing applications using OpenCV – real time image and Video processing – audio recognition and identifying the person's name – Face recognition and predicting age of the person – counting number of objects in a real-time video.

Case study: Capturing real time audio signal and applying equalizer - emulation of ALEXA using raspberry pi – Real-time video analysis using DNN algorithms.

Contact periods:

Lecture: 30 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30 Periods

REFERENCES:

1. Mark Pilgrim 'Dive into Python', Apress media LLC, second Edition, 2004.
2. Martin. C. Brown, 'Python: A complete Reference', Osborne / McGraw Hill, 2018.
3. Sean McManus, Mike Cook, 'Raspberry Pi for Dummies', Third Edition, LME Publishers, 2013.
4. Simon Monk, 'Programming the Raspberry pi', second Edition, McGraw Hill, 2015.
5. Sandipan Dey, 'Hands-On Image Processing with Python', Packt publishers, 2018.

COURSE OUTCOMES:

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

CO1: Create own Python programmes.

CO2: Build own projects with the Raspberry Pi hardware.

CO3: Share knowledge of signal and image processing.

CO4: Use the knowledge to create real-time signal and image processing applications.

19ECVAC04	Mobile Phone Servicing	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals aspects of mobile.
- To understand the basic software used in mobile phone.
- To have hands-on operations based on internal operations.

MODULE-I: Introduction **10**

- Mobile History- History of mobile phone, 1G-2G-3G-4G evolution, cell phone towers, CDMA-GSM, mobile internet.
- Basic Electronics- Identification of resistor, capacitor, diode, regulator, transistor, IC.
- Mobile Accessories - Headset, Bluetooth, charger, battery, memory card, sim card, data cable.
- Mobile Diagrams and Applications - Block diagram, circuit diagram, mobile software, games and applications

MODULE-II: SOFTWARE **10**

- Pattern lock , phone lock and Sim lock
- Flashing of various brands of handsets.
- Formatting of virus affected handsets.
- Unlocking of handset through codes and software.
- Use of secret codes.
- Steps of repairing hardware and software problems.
- Circuit tracing and Jumpering techniques and solutions.
- Troubleshooting through schematic diagrams.

MODULE-III: PROJECTS **10**

- Finding mobile model
- Basics of mobile communication and electronics.
- Use of various tools and instruments used in mobile phone repairing.
- Study of basic parts of mobile phone (mic, speaker, ringer, vibrator, LCD, antenna).
- Testing of various parts with multi-meter.
- Internal parts of a mobile
- Parts type and handling
- Disassembling a mobile
- Finding fault and replacing the faulty parts
- Assembling a mobile
- Soldering & De-soldering.
- Repairable items and Non-Repairable items
- How to solder and de-solder a component
- Quickly finding a hardware solution
- Handling static and anti-static parts

Contact periods:

Lecture: 30 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 30 Periods**

REFERENCES:

1. Sanjib Pandit, 'Advance Mobile Repairing: Multicolour Circuits, Service Diagrams & Repairing', BPB Publications, 2010.
2. Chukky Oparandu, 'Mobile Phones and Tablets Repairs: A Complete Guide for Beginners and Professionals: 1 (Smartphones and Tablets Repairs)' McGraw Hill, 2016.
3. Manahr Lotia , 'Modern Mobile Phone Multicolour Circuits & Service Diagrams', Volume - 3, BPB Publishers, 2010.

COURSE OUTCOMES:

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

CO1: Understanding the basic aspects of mobile phone.
CO2: Impart knowledge on software used in mobile phone.
CO3: Apply programming knowledge for basic operations.

19ECVAC05	EMBEDDED SYSTEM DESIGN USING PIC MICROCONTROLLER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the system design cycle of Embedded systems.
- To learn the design aspects of I/O and Memory Interfacing for PIC microcontroller.
- To acquire the programming knowledge of Embedded systems for PIC16F877A.

MODULE-I: INTRODUCTION TO EMBEDDED SYSTEMS (PIC16F877A) 10

Introduction to Embedded Systems - Hardware and software Architecture - Introduction about Embedded Processors & Controllers–PIC16f877A – Features -Introduction to Embedded C - How do configure Port Pins- Input/ Output Configuration- SFR Configuration- Library files Declaration- Variable declarations- Importance of While Loop- Function Declaration and Handling of Functions – Pointers- Array.

MODULE-II: IDE AND INTERFACING CONCEPTS (Hands-On Session) 10

IDE – Integrated Development Environment's - Introduction to MPLAB- How to create Projects - Interfacing Techniques- Handling of Input/ Output Devices (using Switch & LED)- Running LED- Concept of RELAY & Application- LCD Display - Command Lines Explanation - 8-Bit LCD Programming - 4-Bit LCD Programming - Seven Segment Display.

MODULE-III: DESIGN APPLICATIONS (Hands-On Session) 10

Timer Concepts- Generation of Waveforms - Counter Concepts - Display Counting values in 7-Segment Display - Interrupt Programming - Serial Communication - Microcontroller to PC (Terminal) - PC to Microcontroller - Analog to Digital Conversion - Stepper Motor Interfacing - Real Time Clock (RTC).

Contact periods:

Lecture: 30 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30 Periods

REFERENCES:

1. PIC16F877A Datasheet: https://ww1.microchip.com/downloads/en/DeviceDoc/39582C.pdf.
2. John B. Peatman, 'Design with PIC Microcontrollers', Pearson Education, 1998.
3. Tim Wilmshurst, 'Designing Embedded Systems with PIC Microcontrollers Principles and Applications', Elsevier Science Publication, 2006.
4. Martin Bates, 'Interfacing PIC Microcontrollers Embedded Design by Interactive Simulation', Elsevier Science publisher, 2013.
5. Mazidi, 'Pic Microcontroller and Embedded Systems: Using Assembly and C for Pic 18', Pearson Education, 2008.

COURSE OUTCOMES:

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

CO1: Demonstrate the design configurations of PIC16F877A.

CO2: Know how to interface PIC16F877Amicrocontroller with their peripherals.

CO3: Execute the C programs for various applications based on PIC microcontrollers.

19ECVAC06	PROGRAMMING USING ARDUINO	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understanding the basics concepts of Arduino.
- To familiarize the basics of Arduino Sensors.
- To Design for simple circuits.

MODULE-I: Introduction to Embedded Systems and Arduino **10**

Introduction to Embedded Systems - Introduction of Electronic Components - Introduction to Sensors - Introduction to Arduino - Pin configuration and architecture - Device and platform features - Concept of digital and analog ports - Familiarizing with Arduino Interfacing Board - Introduction to Embedded C and Arduino platform.

MODULE-II: Review of Basic Concepts **10**

Arduino data types - Variables and constants - Operators - Control Statements - Arrays - Functions - Arduino i/o Functions - Arduino Time - Arduino Displays - Arduino Sensors - Arduino Secondary Integrations - Giving Input to the controller - Arduino Communications.

MODULE-III: Arduino Projects **10**

LED Blinking - Running LEDs - Decoration LEDs/LED Patterns - Sensor Interfacing - Seven Segment Display - Intelligent home locking system - Intelligent water level management system - Home automation using RFID.

Contact periods:

Lecture: 30 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 30 Periods**

REFERENCES:

1. Jeremy Blum, 'Exploring Arduino: Tools and Techniques for Engineering Wizardry', Wiley publication, 2019.
2. John Boxall, 'Arduino Workshop: A Hands-On Introduction with 65 Projects', 2013.
3. Sams, 'Arduino Programming in 24 Hours', 2015.
4. Simon Monk, 'Programming Arduino: Getting Started with Sketches' 2nd Edition 2016.
5. Massimo Banzi, 'Getting started with Arduino' 2011.

COURSE OUTCOMES:

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

CO1: Understanding the basics concepts of Arduino.
CO2: Impart knowledge on Arduino Sensors.
CO3: Apply the knowledge to design circuits.

19ECVAC07	PCB DESIGNING & FABRICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understanding the basics of PCB Designing.
- To familiarize the basics of PCB fabrication.
- To Design PCB for simple circuits.

MODULE-I: Introduction to PCB Design Process **10**

Theory and Introduction to Printed Circuit Boards- Overview of the Designing process: PCB Design Flow, Placement and routing- Steps involved in layout design- - Layout and Artwork making for Single-side, double-side and Multi-layer Boards- Design for manufacturability- Design-specification standards.

Hands On : Design a layout for Circuit Schematic in PCB CAD

Hands On : Design the Board File (Gerber file creation)

MODULE-II: PCB Fabrication & Assembly **10**

Steps involved in fabrication of PCB- PCB Fabrication techniques: single, double sided and multilayer- Etching: chemical principles and mechanisms- Post operations- stripping, black oxide coating and solder masking- PCB component assembly processes

Hands On : Converting Board File (Gerber) into "G Code"

Hands On : Understanding and Leveling of engraving/printing surface

MODULE-III: Design and Testing of Analog and Digital **10**

General design factor for analog and digital circuits- Testing and Troubleshooting Methods- Design and Testing : Regulator circuit using 7805- Full-wave Rectifier- Full-Adder using half-adders-4 bit binary counter using D-Flip flops.

Contact periods:

Lecture: 30 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 30 Periods**

REFERENCES:

1. Khandpur RS, 'Printed Circuit Board', Tata McGraw Hill Education Pvt Ltd., New Delhi.
2. Walter C. Bosshart , 'Printed circuit Board Design and technology',1983.
3. Clyde F. Coombs, Jr, Happy T. Holden, 'Printed Circuits Handbook', Sixth Edition,McGraw-Hill Education,2016.
4. Kraig Mitzner, Bob Doe, Alexander Akulin, Anton Suponin and Dirk Müller, 'Complete PCB Design Using OrCAD Capture and PCB' 2nd Edition, 2009.
5. Rao R Tummala and Madhavan Swaminathan, 'Introduction to System-on-Package', McGraw Hill, 2008.

COURSE OUTCOMES:

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

CO1: Understanding the basics of PCB Designing.

CO2: Impart knowledge on PCB fabrication.

CO3: Apply the knowledge to design circuits.