KPRIET
Learn Beyond

B.E. – Electronics and Communication Engineering

Curriculum and Syllabi

Regulations 2019

I. Vision and Mission of the Institute

Vision

To become a premier institute of academic excellence by imparting technical, intellectual and professional skills to students for meeting the diverse needs of the industry, society, the nation and the world at large.

Mission

- Commitment to offer value-based education and enhancement of practical skills
- Continuous assessment of teaching and learning process through scholarly activities
- Enriching research and innovative activities in collaboration with industry and institute of repute
- Ensuring the academic process to uphold culture, ethics and social responsibility

II. Vision and Mission of the Department

Vision

To be a department of repute for learning and research with state-of-the-art facilities to enable the students to succeed in globally competitive environment.

Mission

The Mission of the Department is to

- To impart knowledge and skill-based education with competent faculty striving for academic excellence
- To instil research centres in the field that industry needs, by collaborating with organizations of repute
- To provide ethical and value-based education by promoting activities addressing the societal needs and facilitate lifelong learning

III. Program Educational Objectives (PEOs)

PEO1: Graduates will possess technical expertise for a successful career in electronics, communication and allied fields.

PEO2: Graduates will continue their life-long professional development by acquiring knowledge on emerging technologies.

PEO3: Graduates will have leadership qualities with professional and ethical values.

IV. Program Outcomes (POs)

Graduates of Electronics and Communication Engineering will be able to

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex electronics and communication engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ development of solutions: Design solutions for complex electronics and communication engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex electronics and communication engineering activities with an understanding of the limitations.

PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

V. Program Specific Outcomes (PSOs)

Graduates of Electronics and Communication Engineering will be able to

PSO 1: Design and develop intelligent systems using embedded controllers, Internet of Things and network security protocols.

PSO 2: Apply engineering knowledge and modern tools to design and implement the projects pertaining to VLSI, communication, signal and image processing.

VI. Mapping of Course Outcomes with Program Outcomes

SEM	Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
SEM I	Language Elective I*	-	-	-	-	-	✓	-	-	✓	✓	-	✓	-	-
	Calculus and Differential Equations	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
	Engineering Physics	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	-	-
	Engineering Chemistry I	✓	✓	✓	✓	-	-	✓	✓	✓	✓	-	-	-	-
	Basics of Electrical Engineering	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
	Problem Solving using Python Programming	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	-	✓
	Workshop (ECE)	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	-	-
SEM II	Language Elective II**	-	-	-	-	-	✓	-	-	✓	✓	-	✓	-	-
	Transforms and Fourier Series	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	✓
	Semiconductor Physics and Devices	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	-	-	✓
	Chemistry for Electronics Engineers	✓	✓	✓	✓	-	-	✓	✓	✓	✓	-	-	-	-
	Circuit Analysis	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	✓
	Computational Thinking	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	-	-
	Engineering Graphics	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	-
SEM III	Linear Algebra and Complex Variables	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	✓
	Signals and Systems	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	✓
	Digital Electronics and VHDL	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	-	✓
	Electronic Circuits	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	✓
	Electromagnetic Fields and Waveguides	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Data Structures	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	-	-	✓
	Analog and Digital Electronics Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	✓
	Numerical Aptitude and Verbal Ability - I	-	-	-	-	-	✓	-	-	-	✓	-	✓	-	-

SEM	Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
SEM IV	Probability and Random Processes	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Linear Integrated Circuits	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	-	-	✓
	Analog Communication	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Microprocessors and Microcontrollers	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	-
	Digital Signal Processing	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	-	-	✓
	Object Oriented Programming and Advanced Data Structures	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	-	-	-
	Microprocessors and Microcontrollers Laboratory	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	-
	Numerical Aptitude and Verbal Ability - II	-	-	-	-	-	✓	-	-	-	✓	-	✓	-	-
SEM V	Web Technologies	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	-	-	-
	Digital Communication	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Control Systems	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	✓	-
	Transmission Lines and Antennas	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Analog and Digital Communication Laboratory	✓	✓	-	✓	✓	-	-	✓	✓	✓	-	✓	-	✓
	RF and Antenna Design Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	✓
	Technical Seminar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓
SEM VI	VLSI Design	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Computer Networks	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	-	-	✓
	Embedded Systems	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-
	Embedded Systems Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	-
	VLSI Design Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	✓
	Mini Project I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SEM VII	Optical and Microwave Engineering	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Wireless Communication	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	-	-	✓
	Optical and Microwave Engineering Laboratory	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	-	-	✓

SEM	Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
SEM VIII	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Professional Elective I	Verilog Programming	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Sensors and Transducers	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	-
	Digital Image Processing	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	-	✓
	Electromagnetic Interference and Compatibility	✓	✓	✓	-	-	✓	✓	✓	-	-	-	-	-	✓
	Computer Architecture	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	-
Professional Elective II	Digital IC Design	✓	✓	-	-	✓	-	-	-	-	-	-	-	-	✓
	Machine Learning	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Satellite Communication	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Wireless Sensor Networks	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Cloud Computing	✓	✓	✓	-	✓	-	-	-	-	-	-	-	✓	-
Professional Elective III	Physical Design Automation	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Internet of Things	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	✓	-
	Soft Computing	✓	✓	✓	-	✓	-	-	-	-	-	-	-	✓	-
	RF MEMS	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Multimedia Compression and Communication	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
Professional Elective IV	VLSI Signal Processing	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Deep Learning	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Cognitive Radio	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Blockchain Technologies	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	-
	Robotics and Automation	✓	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	-

SEM	Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Professional Elective V	Low Power VLSI Design	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Computer Vision	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Augmented Reality and Virtual Reality	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Advanced Communication System	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Nano Electronics	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
Professional Elective VI	Testing of VLSI Circuits	✓	✓	✓	-	✓	-	-	-	-	-	-	-	-	✓
	Natural Language Processing	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Network Security	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	-
	Wireless Adhoc Networks	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Optical Networks	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
Professional Elective (S)	Project Management and Entrepreneurship	✓	✓	-	✓	-	-	✓	✓	✓	✓	✓	✓	-	-

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR I - VIII SEMESTERS

SEMESTER I

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1		Language Elective I*	HSM	1	0	2	2
2	U19MA101	Calculus and Differential Equations	BS	3	1	0	4
3	U19PH101	Engineering Physics	BS	2	0	2	3
4	U19CY101	Engineering Chemistry I	BS	2	0	2	3
5	U19EEG03	Basics of Electrical Engineering	ES	3	0	0	3
6	U19CSG01	Problem Solving using Python Programming	ES	2	0	2	3
7	U19EC101	Workshop (ECE)	ES	0	0	4	2
TOTAL				**13**	**1**	**12**	**20**

*** U19LE101- Basic English / U19LE102-Communicative English**

8	U19MYC01	Induction Program	MC	3 Weeks

SEMESTER II

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1		Language Elective II**	HSM	1	0	2	2
2	U19MA204	Transforms and Fourier Series	BS	3	1	0	4
3	U19EC201	Semiconductor Physics and Devices	BS	2	0	2	3
4	U19CY203	Chemistry for Electronics Engineers	BS	3	0	0	3
5	U19EC202	Circuit Analysis	ES	3	0	0	3
6	U19CSG02	Computational Thinking	ES	2	0	2	3
7	U19MEG01	Engineering Graphics	ES	1	0	4	3
		TOTAL		**15**	**1**	**10**	**21**

**** U19LE201- Advanced Communicative English/ U19LE20* Other languages**

SEMESTER III

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19MA305	Linear Algebra and Complex Variables	BS	3	1	0	4
2	U19EC301	Signals and Systems	PC	3	1	0	4
3	U19EC302	Digital Electronics and VHDL	PC	3	0	0	3
4	U19EC303	Electronic Circuits	PC	3	0	0	3
5	U19EC304	Electromagnetic Fields and Waveguides	PC	3	0	0	3
6	U19EC305	Data Structures	ES	2	0	2	3
7	U19EC306	Analog and Digital Electronics Laboratory	PC	0	0	2	1
8	U19CA001	Numerical Aptitude and Verbal Ability - I	EEC	1	0	0	1
TOTAL				**18**	**2**	**4**	**22**

SEMESTER IV

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19MA406	Probability and Random Processes	BS	3	0	0	3
2	U19EC401	Linear Integrated Circuits	PC	2	0	2	3
3	U19EC402	Analog Communication	PC	2	0	0	2
4	U19EC403	Microprocessors and Microcontrollers	PC	3	0	0	3
5	U19EC404	Digital Signal Processing	PC	3	0	2	4
6	U19EC405	Object Oriented Programming and Advanced Data Structures	ES	2	0	2	3
7		Open Elective I	OE	3	0	0	3
8	U19EC406	Microprocessors and Microcontrollers Laboratory	PC	0	0	2	1
9	U19CA002	Numerical Aptitude and Verbal Ability - II	EEC	1	0	0	1
		TOTAL		**19**	**0**	**8**	**23**

10	U19MYC02	Environmental Science	MC	20 Hours

SEMESTER V

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19EC501	Web Technologies	ES	2	0	2	3
2	U19EC502	Digital Communication	PC	2	0	0	2
3	U19EC503	Control Systems	PC	3	0	0	3
4	U19EC504	Transmission Lines and Antennas	PC	3	1	0	4
5		Professional Elective I	PE	3	0	0	3
6		Open Elective II	OE	3	0	0	3
7	U19EC505	Analog and Digital Communication Laboratory	PC	0	0	2	1
8	U19EC506	RF and Antenna Design Laboratory	PC	0	0	2	1
9	U19EC507	Technical Seminar	EEC	0	0	2	1
			TOTAL	**16**	**1**	**8**	**21**

10	U19MYC03	Essence of Indian Traditional Knowledge	MC	20 Hours

SEMESTER VI

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19EC601	VLSI Design	PC	3	0	0	3
2	U19EC602	Computer Networks	PC	3	0	2	4
3	U19EC603	Embedded Systems	PC	3	0	0	3
4		Professional Elective II	PE	3	0	0	3
5		Professional Elective III	PE	3	0	0	3
6		Open Elective III	OE	3	0	0	3
7	U19EC604	Embedded Systems Laboratory	PC	0	0	2	1
8	U19EC605	VLSI Design Laboratory	PC	0	0	2	1
9	U19EC606	Mini Project I	EEC	0	0	2	1
		TOTAL		**18**	**0**	**8**	**22**

10	U19MYC04	Indian Constitution	MC	20 Hours

SEMESTER VII

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19EC701	Optical and Microwave Engineering	PC	3	1	0	4
2	U19EC702	Wireless Communication	PC	3	0	2	4
3		Professional Elective IV	PE	3	0	0	3
4		Professional Elective (S)	PE	3	0	0	3
5		Open Elective IV	OE	3	0	0	3
6	U19EC703	Optical and Microwave Engineering Laboratory	PC	0	0	2	1
TOTAL				**15**	**1**	**4**	**18**

SEMESTER VIII

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1		Professional Elective V	PE	3	0	0	3
2		Professional Elective VI	PE	3	0	0	3
3	U19EC801	Project Work	EEC	0	0	20	10
		TOTAL		**6**	0	**20**	16

INDUSTRIAL INTERNSHIP

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19ECI01	Mandatory Internship I	EEC	0	0	0	2
			TOTAL	**0**	**0**	**0**	**2**

***Four Weeks during any semester vacation from III to VI Semester**

TOTAL CREDITS: 165

PROFESSIONAL ELECTIVE (PE)

SL.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
		PROFESSIONAL ELECTIVE-I				
1.	U19ECP01	Verilog Programming	3	0	0	3
2.	U19ECP02	Sensors and Transducers	3	0	0	3
3.	U19ECP03	Digital Image Processing	3	0	0	3
4.	U19ECP04	Electromagnetic Interference and Compatibility	3	0	0	3
5.	U19ECP05	Computer Architecture	3	0	0	3
		PROFESSIONAL ELECTIVE-II				
6.	U19ECP06	Digital IC Design	3	0	0	3
7.	U19ECP07	Machine Learning	3	0	0	3
8.	U19ECP08	Satellite Communication	3	0	0	3
9.	U19ECP09	Wireless Sensor Networks	3	0	0	3
10.	U19ECP10	Cloud Computing	3	0	0	3
		PROFESSIONAL ELECTIVE-III				
11.	U19ECP11	Physical Design Automation	3	0	0	3
12.	U19ECP12	Internet of Things	3	0	0	3
13.	U19ECP13	Soft Computing	3	0	0	3
14.	U19ECP14	RF MEMS	3	0	0	3
15.	U19ECP15	Multimedia Compression and Communication	3	0	0	3
16.	U19ECP16	Comprehension I	3	0	0	3
		PROFESSIONAL ELECTIVE-IV				
17.	U19ECP17	VLSI Signal Processing	3	0	0	3
18.	U19ECP18	Deep Learning	3	0	0	3
19.	U19ECP19	Cognitive Radio	3	0	0	3
20.	U19ECP20	Block chain Technologies	3	0	0	3
21.	U19ECP21	Robotics and Automation	3	0	0	3
22.	U19ECP22	Comprehension II	3	0	0	3
		SPECIAL ELECTIVE				
23.	U19AUG01	Professional readiness for Innovation, Employability and Entrepreneurship	3	0	0	3
24.	U19ECP33	Project Management and Entrepreneurship	3	0	0	3

PROFESSIONAL ELECTIVE-V						
25.	U19ECP23	Low Power VLSI Design	3	0	0	3
26.	U19ECP24	Computer Vision	3	0	0	3
27.	U19ECP25	Augmented Reality and Virtual Reality	3	0	0	3
28.	U19ECP26	Advanced Communication System	3	0	0	3
29.	U19ECP27	Nano Electronics	3	0	0	3
PROFESSIONAL ELECTIVE-VI						
30.	U19ECP28	Testing of VLSI Circuits	3	0	0	3
31.	U19ECP29	Natural Language Processing	3	0	0	3
32.	U19ECP30	Network Security	3	0	0	3
32.	U19ECP31	Wireless Adhoc Networks	3	0	0	3
33.	U19ECP32	Optical Networks	3	0	0	3

SUGGESTED LIBERAL ARTS COURSES

SL NO.	COURSES
1.	Positive Attitude and Emotional Intelligence
2.	Art of Public Speaking
3.	Roof Gardening
4.	Industrial Psychology
5.	Entrepreneurship
6.	Memory Techniques
7.	Two-Wheeler Mechanics
8.	Drama
9.	Occupational Safety and Health
10.	Yoga for Youth Empowerment
11.	Vedic Mathematics

VII. Scheme of Credit distribution – Summary

S. No.	Stream	Credits/Semester								Credits	%	Suggestedby AICTE
		I	II	III	IV	V	VI	VII	VIII			
1.	Humanities and SocialSciences including Management	2	2	-	-	-	-	-	-	4	2.4	12
2.	Basic Sciences	10	10	4	3	-	-	-	-	27	16.4	25
3.	Engineering Sciences	8	9	3	3	3	-	-	-	26	15.8	24
4.	Professional Core	-	-	14	13	11	12	9	-	59	35.8	48
5.	Professional Elective	-	-	-	-	3	6	6	6	21	12.7	18
6.	Employability Enhancement Courses	-	-	1	1	1	1	-	10	14	8.5	15
7.	Open Elective	-	-	-	3	3	3	3	-	12	7.2	8
8.	Internship	-	-	-	-	-	-	-	-	02	1.2	-
	Total	**20**	**21**	**22**	**23**	**21**	**22**	**18**	**16**	**165**	**100**	**160**

Head
Centre for Academic Courses
KPR Institute of Engineering and Technology
Coimbatore - 641 407

SEMESTER I

U19LE101	BASIC ENGLISH	Category: HSM			
		L	T	P	C
		1	0	2	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To read the text, understand and write the meaning under Technical, Business, Social and Academic contexts
- To listen and comprehend monologues, dialogues and discussions
- To speak effectively with appropriate use of words and participate in discussions

UNIT I BASICS FOR COMMUNICATION 3

Regular & Irregular Verbs – Modal Verbs – Prepositions –Tenses – Subject Verb Agreement – Spotting Errors – Homonyms & Homophones – Phrasal Verbs – Single word Substitute – Word formation – Reported Speech

UNIT II LISTENING 3

Listening for Specific Information – Listening to short texts – Listening to Product description and Process – Listening to Formal and Informal Conversations – Listening to Announcements – Listening Comprehension

UNIT III SPEAKING 3

Introducing Oneself – Seeking and Sharing Information – JAM – Enquiring – asking for clarification– Describing a Place, Person, Process, Product and Experience – Current Affairs – Making Presentation

UNIT IV READING 3

Reading for Information – Skimming – Scanning –Predicting the Content – Reading Comprehension –Reading short texts – Proof Reading (Editing)

UNIT V WRITING 3

Memo – Email – Letter Writing (Formal & Informal) – Dialogue Writing – Descriptive Writing – Instructions – Filling forms of Application – Paraphrasing

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Total: 45 Periods

COURSE CONTENT FOR LABORATORY LISTENING

1. Listening for information
2. Listening to announcements
3. Listening to stories
4. Song based listening
5. Listening to conversation

SPEAKING

1. Self-introduction
2. Just a Minute
3. Story narration
4. Picture description
5. Movie review

TEXT BOOKS:

1. "Mindscapes: English for Technologists and Engineers", Orient BlackSwan, 2014
2. Sudharshana NP and Savitha C. "English for Technical Communication". Cambridge University Press, 2016

REFERENCES:

1. Murphy, Raymond. "Intermediate English Grammar". Cambridge University Press. 2009
2. Means, Thomas L. "English and Communication for Colleges". Cengage, 2017
3. "Using English: A Course book for Undergraduate Engineers and Technologists". OrientBlack Swan, 2017
4. www.revolutionenglish.org
5. www.learnenglishteens.britishcouncil.org/skills
6. www.learnenglish.de

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Choose an appropriate vocabulary required for spoken and written communication	Apply
CO2	Comprehend and answer questions and take part in conversations	Understand
CO3	Organize the presentation with active participation and discussion	Apply
CO4	Interpret the meaning of the content present in letters, reports and newspaper	Understand
CO5	Make use of appropriate words to draft letters and emails.	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO2	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO3	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO4	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO5	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO	-	-	-	-	-	1	-	-	3	3	-	2	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)						3: Substantial (High)		

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SEMESTER I

		Category: HSM			
U19LE102	COMMUNICATIVE ENGLISH	L	T	P	C
		1	0	2	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop the ability to read, write and comprehend various texts
- To enhance the listening skills to understand conversations and deliberations on diverse contexts
- To make effective presentations and demonstrate concepts within a team

UNIT I BASICS FOR COMMUNICATION 3

Active & Passive – Conditionals – Reported Speech – Degrees of Comparison– Phrases and Clauses – Idioms – Kinds of Sentences – Connectives & Discourse markers – Idioms – Purpose Statement

UNIT II LISTENING 3

Listening to TED Talks – Listening to Product Description – Listening to Orations – Listening to News – Radio Based Listening

UNIT III SPEAKING 3

Group Discussion – Extempore – Technical Seminars–Product & Process Description – Role Play – Conversation and Etiquettes – Short group conversation – Narrating a story – Formal and Informal Discussions

UNIT IV READING 3

Pre – Reading &Post – Reading –Intensive Reading – Extensive Reading – Newspaper Reading – Reading Longer texts – Reviewing Company Profile – Reading Strategies – Interpreting Visual Graphics

UNIT V WRITING 3

Interpreting Charts and Graphs – Recommendations – Minutes of Meeting – Job Application and Cover Letter – Report Writing – Drafting Circulars (Business Context)

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Total: 45 Periods

COURSE CONTENT FOR LABORATORY LISTENING

1. Listening to TED talks
2. Listening to Product Description
3. Listening to News
4. Radio based listening
5. Listening to Oration

SPEAKING

1. Self–Introduction
2. Role Play
3. Extempore
4. Presentation
5. Group Discussion

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TEXT BOOKS:

1. "Mindscapes: English for Technologists and Engineers", Orient BlackSwan, 2014
2. Sudharshana NP and Savitha C. "English for Technical Communication". Cambridge University Press, 2016

REFERENCES:

1. Murphy, Raymond. "Intermediate English Grammar". Cambridge University Press. 2009
2. Means, Thomas L. "English and Communication for Colleges". Cengage, 2017
3. "Using English: A Coursebook for Undergraduate Engineers and Technologists". Orient Black Swan, 2017
4. www.tolearnenglish.com
5. www.englishgrammarhelp.com
6. www.myenglishpages.com
7. www.learnenglish.de

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Make use of relevant vocabulary in formal and informal contexts.	Apply
CO2	Infer and exhibit the ability to listen various professional interactions.	Understand
CO3	Explain views and perceptions in a technical forum.	Understand
CO4	Interpret a given text and relate the content effectively.	Understand
CO5	Rephrase coherent and cohesive sentences in select contexts.	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO2	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO3	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO4	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO5	-	-	-	-	-	1	-	-	3	3	-	2	-	-
CO	-	-	-	-	-	1	-	-	3	3	-	2	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)						3: Substantial (High)		

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SEMESTER I

		Category: BS			
U19MA101	CALCULUS AND DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- Understand the concepts of matrices and calculus which will enable them to model and analyze physical phenomena involving continuous change
- Apply and summarize the methodologies involved in solving problems related to fundamental principles of calculus
- Develop confidence to model mathematical pattern and give appropriate solutions

UNIT I MATRICES **9 + 3**

Eigenvalues and Eigenvectors – Properties (without proof) – Cayley Hamilton theorem (without proof) – Diagonalization using orthogonal transformation – Applications : Elastic membrane

UNIT II DIFFERENTIAL CALCULUS **9 + 3**

Curvature – Radius of curvature (Cartesian form only) – Center of curvature – Circle of curvature – Evolute and Envelope of plane curves

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9 + 3**

Partial derivatives – Total derivative – Jacobians – Taylor's series expansion – Extreme values of functions of two variables – Lagrange multipliers method

UNIT IV INTEGRAL CALCULUS **9 + 3**

Evaluation of definite and improper integrals – Applications of definite integrals – Surface areas – Volume of revolutions

UNIT V ORDINARY DIFFERENTIAL EQUATIONS **9 + 3**

Second and Higher order linear differential equations with constant coefficients – variable coefficients – Euler-Cauchy equation – Legendre's equation – Method of variation of parameters –Applications

Contact Periods:

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

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition Wiley India Pvt Ltd, New Delhi, 2018
2. Grewal B S, "Higher Engineering Mathematics", 44th edition, Khanna Publishers, New Delhi, 2017

REFERENCES:

1. Bali N P and Manish Goyal, "A text book of Engineering Mathematics", 12th edition, Laxmi Publications, 2016
2. Thomas G B and Finney R L, "Calculus and Analytic Geometry", 14th edition, Pearson Education India, 2018
3. Maurice D Weir, Joel Hass, Christopher Heil, "Thomas Calculus", 14th edition, Pearson Education, India, 2018
4. James Stewart, "Calculus: Early Transcendental", 7th edition, Cengage Learning, New Delhi, 2015

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Solve engineering problems using the concept of matrices	Apply
CO2	Develop the mathematical model of a function using principles of curvature	Apply
CO3	Apply the idea of Lagrange multipliers to find extreme of functions with constraints	Apply
CO4	Utilize definite and improper integrals to compute area and volume	Apply
CO5	Make use of ordinary differential equation to solve real world problems	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER I

		Category: BS			
U19PH101	ENGINEERING PHYSICS	L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Higher secondary physics

COURSE OBJECTIVES:

- To understand the concepts of surface tension, flow of liquids, heat transfer and thermal conductivity of materials
- To acquire the knowledge of ultrasonic waves and its production methods with its industrial and medical applications
- To understand the fundamental principles of laser and fiber optics with their applications

UNIT I PROPERTIES OF LIQUIDS 6

Surface tension – Determination of surface tension by Jaeger's method – Effect of temperature on surface tension – Viscosity – Coefficient of viscosity – Streamline and turbulent flow – Stokes law and terminal velocity – Poiseuille's equation for the flow of a liquid through a capillary tube and experimental determination

UNIT II HEAT 6

Modes of heat transfer – Thermal properties (solids and liquids) – Specific heat capacity, thermal capacity, thermal diffusivity and coefficient of linear thermal expansion – Lee's disc method for the determination of thermal conductivity – Heat conduction through compound media (series and parallel) – Solar water heater

UNIT III ULTRASONICS 6

Properties of ultrasonic waves – Production of ultrasonic waves – Magnetostrictive generator – Piezoelectric generator – Acoustic grating – Applications – SONAR – Cavitation – Drilling and welding – Nondestructive testing (flaw detection) – Medical applications (fetus heart movement)

UNIT IV LASER 6

Laser characteristics – Spatial and Temporal coherence – Einstein coefficient and its importance – population inversion – optical resonator – Pumping methods – Nd-YAG laser – CO_2 laser – Material processing (drilling, welding) – Medical applications in ophthalmology

UNIT V FIBRE OPTICS 6

Fiber optic cable – Features – Total internal reflection – Numerical aperture and acceptance angle – Classification of optical fibers based on refractive index, modes and materials – Fiber optical communication – Medical endoscopy

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS

1. Determination of viscosity of the given liquid using Poiseuille's flow method
2. Determination of thermal conductivity of a bad conductor using Lee's disc method
3. Determination of velocity of sound and compressibility of a liquid using Ultrasonic interferometer
4. Determination of particle size of lycopodium powder using laser light
5. Determination of wavelength of a given laser source
6. Determination of acceptance angle and numerical aperture of an optical fiber using laser source

7. Determination of dispersive power of prism using spectrometer
8. Determination of refractive index of a liquid using spectrometer

TEXT BOOKS:

1. Bhattacharya D K. and Poonam Tandon, "Engineering Physics", Oxford University Press, 2016
2. Pandey B K. and Chaturvedi S, "Engineering Physics", Cengage Learning India, 2013

REFERENCES:

1. Arumugam M, "Engineering Physics", Anuradha Publishers, 2014
2. Murugeshan R, "Properties of Matter", S. Chand and Company Ltd, 2012
3. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publishers, 2016
4. https://nptel.ac.in/downloads/104104085/(Laser)
5. https://nptel.ac.in/courses/122107035/8(Ultrasonics)

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Identify the surface tension and viscosity of liquids	Apply
CO2	Apply the thermal properties of materials for engineering applications	Apply
CO3	Make use of ultrasonic waves for medical applications	Apply
CO4	Utilize the laser sources for various industrial applications	Apply
CO5	Examine the characteristics of fiber optic cable	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	2	1	-	1	-	-
CO2	3	2	1	1	-	-	-	1	2	1	-	1	-	-
CO3	3	2	1	1	-	-	-	1	2	1	-	1	-	-
CO4	3	2	1	1	-	-	-	1	2	1	-	1	-	-
CO5	3	3	2	1	-	-	-	1	2	1	-	1	-	-
CO	3	2.2	1.2	1	-	-	-	1	2	1	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER I

		Category: ES			
U19CY101	ENGINEERING CHEMISTRY I	L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To inculcate the fundamentals of water technology and electrochemistry
- To gain basic knowledge of corrosion of metals and change of phases in alloys
- To acquire knowledge about the preparation, properties and applications of nanomaterials

UNIT I WATER 6

Hardness of water – types – problems in hardness calculations – estimation of hardness by EDTA – boiler feed water – boiler trouble (scale, sludge, priming, foaming and caustic embrittlement) – softening methods – internal treatment (phosphate & calgon) – external treatment (deionization process) – desalination of water- reverse osmosis

UNIT II ELECTROCHEMISTRY 6

Electrochemical cells – types – galvanic cells – redox reactions – EMF – concept of electrode potential – Electrodes (Standard Hydrogen and Calomel electrode) – Nernst equation (derivation only) – Electrochemical series and its applications – Estimation of iron by potentiometry, determination of pHby pH metry

UNIT III CORROSION AND ITS CONTROL 6

Types – Chemical corrosion – Electrochemical corrosion (galvanic & differential aeration) – Factors influencing corrosion – Corrosion control methods – Sacrificial anode and impressed current method – Protective coating – Electroplating – Ni plating

UNIT IV PHASE RULE AND ALLOYS 6

Phase rule – Explanation of terms – Advantages and limitations of phase rule – Application of phase rule to one component system (water) – Reduced phase rule –Two component system (simple eutectic system – Lead – silver system) – Alloys – Definition – Purpose of making alloys – Ferrous (stainless steel), heat treatment – Non-ferrous alloys (Brass -Dutch metal, German Silver) – Composition, properties and uses

UNIT V NANOCHEMISTRY AND ITS APPLICATIONS 6

Types – Properties of nanomaterials – Size dependent properties – General methods of synthesis – Top down (laser ablation and CVD) – Bottom up (solvothermal and precipitation) – Application of nanotechnology (medicine, electronics, defence and agriculture)

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS

1. Determination of total, permanent and temporary hardness of a given sample water by EDTAmethod
2. Determination of chloride content in the water sample
3. Estimation of ferrous ion by potentiometric titration
4. Determination of strength of HCl by pH metric method
5. Determination of corrosion rate by weight loss method
6. Electroplating of Cu and electroless plating of Cu
7. Estimation of Copper in Brass by EDTA method

8. Determination of phase and degrees of freedom in CuSO4. 5H2O / KI and water / FeCl3. 12H2O/ phenol-water
9. Preparation of nano ruby (Al2O3-Cr) by combustion method
10. Preparation of nano ZnO by co-precipitation method

TEXT BOOKS:

1. Jain P C and Monika Jain, "Engineering Chemistry", 16th edition, Dhanpat Rai Publishing Company, Pvt. Ltd., New Delhi, 2015
2. Vairam S, Kalyani P and Suba Ramesh, "Engineering Chemistry", 2nd edition, Wiley India Pvt. Ltd, New Delhi, 2013

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", 2nd edition, Scientific International Pvt. Ltd, New Delhi, 2014
2. Prasanta Rath, "Engineering Chemistry", 1st edition, Cengage Learning India, Pvt. Ltd,Delhi, 2015
3. Shikha Agarwal, "Engineering Chemistry, Fundamentals and Applications", 1st edition,Cambridge University Press, 2015

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Apply the principles of water technology in treatment of industrial and domestic water	Apply
CO2	Utilize the electrochemical principles for chemical cells to determine the EMF of the cells	Apply
CO3	Demonstrate the corrosion prevention methods	Understand
CO4	Examine the number of phases, components and variants in different heterogeneous systems.	Analyze
CO5	Identify the ferrous alloys and properties of different nanomaterials	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	1	1	2	1	-	-	-	-
CO2	3	2	1	1	-	-	1	1	2	1	-	-	-	-
CO3	2	1	-	-	-	-	1	1	2	1	-	-	-	-
CO4	3	3	2	1	-	-	1	1	2	1	-	-	-	-
CO5	3	2	1	1	-	-	1	1	2	1	-	-	-	-
CO	2.8	2	1.3	1	-	-	1	1	2	1	-	-	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

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SEMESTER I

U19EEG03	BASICS OF ELECTRICAL ENGINEERING	Category: ES			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the knowledge on constructional details of DC and AC machines
- To understand the operation and characteristics of DC and AC machines
- To explain the starting methods and control of DC motors and induction motors

UNIT I DC GENERATORS **9**

Construction – Operating principle – EMF equation – Method of excitation – Types of DC generator – Characteristics – Applications

UNIT II DC MOTORS **9**

Operating principle – Torque equation – Types of DC motor – Mechanical and electrical characteristics – Speed control (Armature and field control) – Starters – Applications. (Qualitative analysis)

UNIT III TRANSFORMER **9**

Construction of single phase transformer – Principle of operation – EMF equation – Operation on no-load and load condition – Losses – Efficiency and all day efficiency – Voltage regulation – Auto transformer – Three phase transformer connections. (Qualitative analysis)

UNIT IV THREE PHASE INDUCTION MOTOR **9**

Construction – Principle of operation – Types of rotor – Torque equation – Torque slip characteristics – Power stages – Losses and efficiency – Starters

UNIT V SINGLE PHASE INDUCTION MOTOR **9**

Construction – Principle of operation – Double field revolving theory – Starting methods – Types – Capacitor start capacitor run, shaded pole, split phase – Stepper motor. (Qualitative analysis)

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Nagrath I.J. and Kothari D.P., "Electric Machines", 4th edition, Tata McGraw Hill Publishing Company Ltd, 2010
2. Rajput R.K., "Electrical Machines", 6th edition, Laxmi Publications, 2016

REFERENCES:

1. Gupta B.R., "Fundamental of Electric Machines", New Age International Publishers, Reprint 2015
2. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw Hill Education Pvt. Ltd, 2010
3. Bhattacharya S.K., "Electrical Machines", 4th edition, McGraw-Hill Education, New Delhi, 2017

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Make use of dc generator for real time applications	Apply
CO2	Outline the characteristics of dc motor	Understand
CO3	Interpret the principles of transformers	Understand
CO4	Examine the characteristics of three phase induction motors	Analyze
CO5	Illustrate the operation of single phase induction motors	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO	2.4	1.6	1.5	-	-	-	-	-	-	-	-	1	-	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER I

		Category: ES			
U19CSG01	PROBLEM SOLVING USING PYTHON PROGRAMMING	L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn basics of computers and problem solving techniques
- To understand syntax and semantics of python programming
- To develop simple python programs

UNIT I COMPUTER BASICS AND PROBLEM SOLVING STRATEGIES 6

Introduction to Computers: Characteristics, Classification, Applications, Components– Hardware and Software– Algorithms – Algorithmic building blocks – Notations: Pseudo code, Flow chart, Programming language – Programming Paradigms – Computational thinking

UNIT II LANGUAGE BASICS 5

Python interpreter and interactive mode - Tokens - Data types –Numbers and math functions - Input and Output operations - Comments - Reserved words - Indentation - Operators and expressions - Precedence and associativity - Type conversion- Debugging - Common errors in Python – Classes and objects.

UNIT III CONTROL STATEMENTS, FUNCTIONS AND MODULES 6

Selection/Conditional branching statements: if, if–else, Nested–if, if–el if–else statements – Iterative statements: while, for loop – break, continue and pass statements – Functions: Function Definition and Function call, Variable scope and Lifetime, Return statement, Lambda functions or Anonymous functions, Recursion – Modules and Packages

UNIT IV PYTHON DATA STRUCTURES 7

Strings: Slicing, Immutability, Built–in string methods and functions, Concatenating, Appending and Multiplying strings, String modules, Regular expressions – List: Creation, Accessing values, Slicing, List methods, In–built functions for Lists – Tuples: Creation, Operations on tuples, Traversing, Indexing and Slicing, Tuple assignment, In–built functions for tuples – Sets: Creation, Operations– Dictionaries: operations and methods

UNIT V EXCEPTION AND FILE HANDLING 6

Exceptions: Errors and Exceptions, Handling exception, Built-in and User-defined exceptions - Files: Types, Operations: Open, Read, Write, Close.

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS

1. Algorithms, flowchart and pseudo code
2. Language basics
3. Input and output statements
4. String operations
5. Recursive functions
6. Python data structures
7. Searching and Sorting
8. Generating histogram
9. File and exception handling

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TEXT BOOKS:

1. ReemaThareja, "Python programming: Using problem solving approach", Oxford Press, 2017

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. http://greenteapress.com/wp/think–python/
3. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python". McGrawHill Education, 2018
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter–disciplinary Approach". Pearson India Education Services Pvt. Ltd., 2016
5. Roland Backhouse, "Algorithmic Problem Solving", John Wiley & Sons

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Apply the basics of computer language to find algorithmic solutions	Apply
CO2	Choose suitable data types, operators and expressions in python programming	Apply
CO3	Make use of functions and modules in python	Apply
CO4	Develop programs using python data structures	Apply
CO5	Demonstrate the usage of exceptions and file handling in python	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	2	1	-	1	-	1
CO2	3	2	1	1	-	-	-	1	2	1	-	1	-	1
CO3	3	2	1	1	-	-	-	1	2	1	-	1	-	1
CO4	3	2	1	1	-	-	-	1	2	1	-	1	-	1
CO5	2	1	-	1	-	-	-	1	2	1	-	1	-	1
CO	2.8	1.8	1	1	-	-	-	1	2	1	-	1	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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Arasur, Coimbatore - 641 407.

SEMESTER I

U19EC101	WORKSHOP (ECE)	Category: ES			
		L	T	P	C
		0	0	4	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge about carpentry and fitting models
- To study wiring systems, soldering tools and Cathode Ray Oscilloscope
- To learn about household electrical appliances

LIST OF EXPERIMENTS

1. Study of joining the wooden materials by dove tail method
2. Preparation of square fitting and vee – fitting models
3. Study of welding methods
4. House wiring
5. Two way switching and fluorescent lamp fitting
6. Study of measuring instruments– MI, MC meters, multimeters
7. Identification of passive components and soldering/de-soldering practices
8. Study of CRO–AC, DC voltage measurement using CRO
9. Study of fuses, MSBs, importance of earthing and human safety
10. Study of assembly and disassembly of computers
11. Trouble shooting of mobile phones
12. Study of iron box and vacuum cleaner

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Total: 60 Periods

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Demonstrate dove tail joint method by using wooden materials	Understand
CO2	Model the V and Square joints	Apply
CO3	Apply the basics of electrical engineering for house wiring	Apply
CO4	Make use of CRO to measure the electrical quantities	Apply
CO5	Experiment with electronic circuits for real time applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	1	2	1	-	2	-	-
CO2	3	2	1	1	-	-	-	1	2	1	-	2	-	-
CO3	3	2	1	1	-	-	-	1	2	1	-	2	-	-
CO4	3	2	1	1	-	-	-	1	2	1	-	2	-	-
CO5	3	2	1	1	-	-	-	1	2	1	-	2	-	-
CO	2.8	1.8	1	1	-	-	-	1	2	1	-	2	-	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER II

U19LE201	ADVANCED COMMUNICATIVE ENGLISH	Category: HSM			
		L	T	P	C
		1	0	2	2

PRE–REQUISITES:

- Communicative English

COURSE OBJECTIVES:

- To foster their ability to develop communicative strategies and skills
- To strengthen the learners to evocate their listening skills and enhance writing ability
- To exhibit proactive reading strategies and speaking technique

UNIT I LANGUAGE ADEPTNESS 3

Cloze test – Sentence Completion – Relative Clause – Transformation of Sentences – Common Errors – Discourse Markers – Formal and Informal Expressions – Framing Questions – Figures of Speech

UNIT II LISTENING 3

Listening to Announcements – Interviews – Group discussions – Dialogues – News items – Documentaries – IELTS – GRE – TOEFL based listening

UNIT III SPEAKING 3

Real – life situations through role play – Language use – Pronunciation, Stress and Intonation – Narrating Events– Presentation, Group Discussion

UNIT IV READING 3

Reading Strategies – Reading Comprehension – Reading Short Stories – Journal articles – Inferring Editorial Column – Cloze Reading

UNIT V WRITING 3

Book Review – Guided Writing – Writing Gadget Review – Free Writing – Rephrasing – Interpreting Text – Email Writing – Process Description

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Total: 45 Periods

COURSE CONTENT FOR LABORATORY

LISTENING

1. Listening for Announcements
2. Listening to Dialogues
3. Listening to Documentaries
4. Listening to Interviews
5. IELTS based listening

SPEAKING

1. Role Play
2. Product Description
3. Group Discussion
4. Book Review
5. Presentation

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TEXT BOOKS:

1. K.N.Shoba, Lourdes JoavaniRayen, "Communicative English", Cambridge University Press, 2017
2. Sudharshana NP &Savitha C, "English for Technical Communication". Cambridge University Press, 2016

REFERENCES:

1. Murphy, Raymond. "Intermediate English Grammar". Cambridge University Press. 2009
2. Means, Thomas L. "English and Communication for Colleges". Cengage, 2017
3. Using English: A Coursebook for Undergraduate Engineers and Technologists". Orient BlackSwan, 2017
4. www.tolearnenglish.com
5. www.englishgrammarhelp.com
6. www.myenglishpages.com

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Infer the effective reading strategies	Understand
CO2	Interpret the real–life situations	Understand
CO3	Rephrase the sentences for academic and professional writing	Apply
CO4	Develop listening ability using self-learning	Apply
CO5	Build language proficiency for the needs of second language learner	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	1	3	-	2	-	-
CO2	-	-	-	-	-	1	-	-	1	3	-	2	-	-
CO3	-	-	-	-	-	1	-	-	1	3	-	2	-	-
CO4	-	-	-	-	-	1	-	-	1	3	-	2	-	-
CO5	-	-	-	-	-	1	-	-	1	3	-	2	-	-
CO	-	-	-	-	-	1	-	-	1	3	-	2	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)						3: Substantial (High)		

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SEMESTER II

U19LE202	GERMAN LANGUAGE	Category: HSM			
		L	T	P	C
		1	0	2	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To enhance the ability to read, write and understand the basic contexts of German language
- To develop the listening skills and comprehend basic conversation
- To construct and articulate basic exchange of sentences in German language

UNIT I 3

Alphabets, Numbers, Personal pronouns and basic verbs, Greetings, Self–Introduction

UNIT II 3

WH–Questions, Definite Article, Irregular Verbs and Personal Pronouns, Hobbies, arranging an unofficial appointment and Profession

UNIT III 3

Yes/No questions, Indefinite Article and Negation Article, Questions and Answers regarding places and finding way to places, Reading longer text

UNIT IV 3

Irregular verbs, modal verbs and Sentence formation, Food, Shopping and preferences in food, Listening to basic conversation

UNIT V 3

Accusative case, verbs with Accusative, time information, Questions and answers with time, Arranging an official appointment and excuse for a delay

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Total: 45 Periods

TEXT BOOKS:

1. Stefanie Dengler, Netzwerk A1,Helen Schmitz, Muenchen 2013

REFERENCES:

1. Sandra Evans, Angela Pude, Franz Specht–Menschen A1 Hueber Verlag,2012.
2. Hermann Funk,ChristinaKuhn,SilkeDemme,Studio d A1,Goyal Publishers & Distributors Pvt.Ltd,2009
3. Rosa–Maria Dallapiazza,Eduard von Jan,TilSchoener,TangramAktuell 1(Deutschals Fremdsprache),Max Hueber Verlag,2004

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Choose proper vocabulary in German language	Apply
CO2	Infer the implied meaning in general and classroom conversations	Understand
CO3	Interpret the texts in various contexts	Understand
CO4	Demonstrate the basic exchanges in German language	Understand
CO5	Select the proper sentences for effective communication	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	1	3	-	1	-	-
CO2	-	-	-	-	-	1	-	-	1	3	-	1	-	-
CO3	-	-	-	-	-	1	-	-	1	3	-	1	-	-
CO4	-	-	-	-	-	1	-	-	1	3	-	1	-	-
CO5	-	-	-	-	-	1	-	-	1	3	-	1	-	-
CO	-	-	-	-	-	1	-	-	1	3	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER II

		Category: BS			
U19MA204	TRANSFORMS AND FOURIER SERIES	L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand Fourier series analysis in solving boundary value problems
- To apply Laplace transforms to find solutions of initial value problems for linear Ordinary Differential Equations
- To apply and summarize the concept of Z–transforms techniques for the solutions of difference equations for discrete time systems

UNIT I MULTIPLE INTEGRALS **9 + 3**

Double integrals–Change of order of integration–Triple integrals – Applications: Areas and Volume

UNIT II FOURIER SERIES **9 + 3**

Dirichlet's conditions – Full Range Fourier series – Odd and Even functions – Half Range series – Parseval's Identity – Harmonic Analysis

UNIT III FOURIER TRANSFORM **9 + 3**

Fourier Transform pair – Fourier sine and cosine transforms – Properties(without proof) – Transform of simple functions – Convolution theorem – Parseval's identity

UNIT IV LAPLACE TRANSFORM **9 + 3**

Laplace transform – Conditions for Existence – Transform of elementary functions – Standard properties (statement only) –Transforms of Unit step function– Impulse function – Periodic function– Initial and Final value theorems– Convolution theorem(without proof)–Inverse Laplace transform– Standard properties (statement only)–Second order linear differential equations with constant coefficients

UNIT V Z – TRANSFORM **9 + 3**

Z–transforms – Elementary properties – Inverse Z–transform– Initial and Final value theorems (statement only) – Convolution theorem – Formation of difference equations –Difference equations using Z – transform

Contact Periods:

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

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017
2. Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015

REFERENCES:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014
2. Peter V.O Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage, New Delhi, 2016
3. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2011

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply multiple integrals in area and volume calculations	Apply
CO2	Identify the periodicity of sine and cosine functions	Apply
CO3	Analyze the spectral characteristics of signals using Fourier transforms	Analyze
CO4	Solve second order differential equations using Laplace transforms	Apply
CO5	Apply Z- transform for engineering problems	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO	3	2.2	1.2	-	-	-	-	-	-	-	-	1	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER II

		Category: BS			
U19EC201	SEMICONDUCTOR PHYSICS AND DEVICES	L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Engineering Physics

COURSE OBJECTIVES:

- To understand the fundamentals of semiconductor materials and diodes
- To learn the concepts of bipolar junction transistors and field effect transistors
- To acquaint special semiconductor devices and DC power supply

UNIT I BASICS OF SEMICONDUCTOR MATERIALS 6

Classification of semiconductors – Conductivity of semiconductors – Carrier concentration in intrinsic semiconductor and extrinsic semiconductor – Law of mass–action – Variation in semiconductor parameters with temperature – Drift and diffusion current – Hall effect – Characteristics of PN junction diode and Zener diode

UNIT II BIPOLAR JUNCTION TRANSISTORS 6

NPN and PNP Transistors – Early effect – Biasing – Input and output characteristics of CE, CB, CC – Hybrid–π model – Transistor switching characteristics

UNIT III FIELD EFFECT TRANSISTORS 6

JFETs – Drain and Transfer characteristics – MOSFET Characteristics – Depletion MOSFET and enhancement MOSFET – FINFET – Dual–Gate MOSFET

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 6

Characteristics –Tunnel diode, LDR, UJT, SCR, LED, LCD, Photo transistor, Opto–Coupler, Solar cell

UNIT V REGULATED DC POWER SUPPLY 6

Half wave, full wave and bridge rectifiers – Capacitor and inductor filters – Voltage regulators – Series, shunt regulators – Switched mode power supply

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS

1. Characteristics of PN Junction diode
2. Rectifiers using PN Junction diode
3. Regulation Characteristics of Zener diode
4. Input–output characteristics of BJT for common emitter (CE) configuration
5. Input–output characteristics of BJT for common emitter (CB) configuration
6. Drain and transfer characteristics of JFET
7. Characteristics of UJT
8. Switching characteristics of SCR
9. Automatic street light control using LDR
10. Design of 5V power supply

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TEXT BOOKS:

1. Donald A Neaman, Semiconductor Physics and Devices, 4th edition, Tata McGraw–Hill Inc. 2012
2. S. Salivahanan, N.Sureshkumar, A. Vallavaraj, Electronic Devices and Circuits, 3rd edition, Tata McGraw–Hill Inc., 2010

REFERENCES:

1. Robert Boylestad and Louis Nashelsky, Electron Devices and Circuit Theory, 11th edition,Pearson Prentice Hall, 2014
2. Yang, Fundamentals of Semiconductor devices, 1st edition, McGraw Hill International, 2017.
3. Jacob Millman, Christos C Halkias, Satyabrata Jit, Electronic Devices and Circuits, 4th edition, Mc Graw Hill India, 2015
4. R.S.Sedha, A Text Book of Applied Electronics, 3rd edition, S. Chand Publications, 2006

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Classify the semiconductors based on its properties	Understand
CO2	Choose suitable transistor configuration for BJT amplifier	Apply
CO3	Experiment with field effect transistor to study its characteristics	Apply
CO4	Develop simple application using special semiconductor devices	Apply
CO5	Apply the principle of semiconductor devices for AC–to DC conversion	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	2	-	-	-	1
CO2	3	2	2	2	-	-	-	2	2	2	-	-	-	1
CO3	3	2	2	2	-	-	-	2	2	2	-	-	-	1
CO4	3	2	2	2	-	-	-	2	2	2	-	-	-	1
CO5	3	2	2	2	-	-	-	2	2	2	-	-	-	1
CO	2.8	1.8	2	2	-	-	-	2	2	2	-	-	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER II

		Category: BS			
U19CY203	CHEMISTRY FOR ELECTRONICS ENGINEERS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Basics of Chemistry

COURSE OBJECTIVES:

- To make the students acquire knowledge on energy sources and batteries for industrial applications
- To impart the knowledge on polymers, types of chemicals and process for various applications
- To learn silicon wafer technology

UNIT I ENERGY SOURCES 9

Energy demand in Indian scenario – Nuclear energy – Nuclear fission – Nuclear fusion – Controlled nuclear fission – Nuclear chain reactions – Light water nuclear power plant – Solar energy conversion – solar cells – wind energy

UNIT II BATTERIES 9

Batteries – Types – Merits and Demerits – Applications – primary battery (dry cell) – secondary battery (lead acid battery – Ni-Cad Battery – Lithium–ion–battery) – Fuel cells – H2–O2 fuel cell – Super capacitors

UNIT III POLYMERS 9

Classification of polymers: Thermoplastics – PVC, Nylon 6, Nylon 66, Nylon 11, Teflon – thermosetting plastics – Properties and industrial applications of important thermoplastic, thermosetting plastics (Bakelite) – Conducting polymers (Polyaniline) – Properties and applications

UNIT IV ELECTROCHEMICAL TECHNOLOGY 9

Chemicals for electronics industry – Bulk gases, dopant gases, etchant gases, wet chemicals – Applications of Electroplating – Electro winning of Al, Electro polishing, Electrochemical machining and Electrophoretic deposition

UNIT V SILICON WAFER TECHNOLOGY 9

Silicon for chips – Single crystal – preparation by Czechralski and float zone processes – Wafer preparation – PN junction formation (by Diffusion technique only) – insulator layer by oxidation – Photolithography – Chemical etching method – Planar technology

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

LIST OF EXPERIMENTS:

1. EMF measurement of a battery
2. Determination of molecular weight and degree of polymerization of a polymer by viscositymeasurements (Ostwald's viscometer)
3. Chemical etching
4. Determination of the iron content by spectrophotometry
5. Estimation of sodium present in water using flame photometer

TEXT BOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", DhanpatRai Publishing Company (P) LTD, New Delhi, 2015
2. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015
3. Shikha Agarwal, "Engineering Chemistry–Fundamentals and Applications", Cambridge University Press, Delhi, 2015
4. B K Sharma, "Industrial Chemistry", GOEL Publishing House, Meerut, 2016
5. Vogel's Textbook of Quantitative Chemical Analysis, 8th edition, 2014

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Illustrate the process of nuclear energy generation	Understand
CO2	Experiment with various batteries for EMF measurements	Apply
CO3	Examine the various parameters of polymers	Analyze
CO4	Outline the different types of chemicals and processes for electronics industry	Understand
CO5	Summarize the steps involved in chip manufacturing	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	2	1	2	1	-	-	-	-
CO2	3	2	1	1	-	-	2	1	2	1	-	-	-	-
CO3	3	3	2	1	-	-	2	1	2	1	-	-	-	-
CO4	2	1	-	-	-	-	2	1	2	1	-	-	-	-
CO5	2	1	-	-	-	-	2	1	2	1	-	-	-	-
CO	2.4	1.6	1.5	1	-	-	2	1	2	1	-	-	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER II

U19EC202	CIRCUIT ANALYSIS	Category: ES			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Basics of Electrical Engineering

COURSE OBJECTIVES:

- To learn the basic concepts and different methods of circuit analysis for DC and AC circuits
- To understand the concept of network theorems and transient response
- To study the basic concepts of resonance circuits and two port network parameters

UNIT I BASIC CIRCUITS ANALYSIS 9

Basic electrical components – Resistor, capacitor, Inductor – DC and AC Circuits – Resistors in series and parallel circuits – Ohm's Law – Kirchhoff's laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Network reduction – Voltage and current division, source transformation, star–delta conversion

UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS 9

Network theorems – Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, Maximum power transfer theorem

UNIT III TRANSIENT ANALYSIS 9

Natural response and forced response – Transient response of RC and RL for step input – Complete response of RLC circuits for step input

UNIT IV RESONANCE AND COUPLED CIRCUITS 9

Series and Parallel resonance – Variation of impedance and current with frequency, bandwidth, Q factor and selectivity – Coupled circuits – Self–inductance, mutual inductance, Dot rule, Coefficient of coupling

UNIT V NETWORK PARAMETERS 9

Network parameters – Z parameters, Y parameters, Transmission (ABCD) parameters, hybrid (h) parameters – Interconnection of two port networks – Interrelationship between two port network parameters

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", 8th edition, McGraw Hill, 2018
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, 5th edition, Tata McGraw Hill, New Delhi, 2018

REFERENCES:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 6th edition, McGraw Hill, 2019
2. A.Bruce Carlson, "Circuits: Engineering Concepts and Analysis of Linear Electric Circuits", 2nd edition, 2017
3. Allan H.Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", 5th edition, Cengage Learning, 2013
4. Sudhakar.A and Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", 5th edition, McGraw Hill, 2015

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Choose the suitable network simplification method for DC and AC circuits	Apply
CO2	Apply network theorems for complex network reduction	Apply
CO3	Compute the transient response of RL, RC and RLC circuits	Apply
CO4	Illustrate the concepts of resonance and coupled circuits	Understand
CO5	Infer the characteristics of two port network	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO	2.6	1.6	1	-	-	-	-	-	-	-	-	1	-	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER II

U19CSG02	COMPUTATIONAL THINKING	Category: ES			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To formulate problems in a way that enables the use of a computer to solve them
- To logically organize and analyze data
- To automate solutions through algorithmic thinking
- To identify, analyze and implement possible solutions with the goal of achieving the most efficient and effective combination of steps and resources
- To generalize and transfer this problem solving process to wide variety of problems

UNIT I PRINCIPLES OF COMPUTATIONAL THINKING 7

Programming – Algorithmic thinking – Bitwise and Boolean algebra – Compiler vs. interpreter – Pseudo coding – Problem definition – Data collection – Problem decomposition – Abstraction – Flowcharting – Name binding – Selection – Repetition – Modularization – Sample exercise problems and deriving solutions

UNIT II DATA ORGANIZATION & PROCESSING USING PYTHON 5

Operators, Variables and Data types – Loops and conditions – Nested loop – Strings – Euclid's algorithm – Arrays – Functions – Recursion

UNIT III REVERSE ENGINEERING & SOLUTIONS 6

Algorithm Tracing Technique (simulating execution) – Best practices: keeping it simple, documentation, style, idioms, DRY code, naming conventions, and comments – Debugging – Anticipating output from pseudo code.

UNIT IV APPLIED COMPUTATIONAL THINKING 6

Operating systems basics – Networking basics – Database Management System (DBMS) – SQL – No SQL – JSON – API – XML.

UNIT V EFFICIENCY ANALYSIS AND BENCHMARKING 6

Algorithm efficiency – Time complexity in programs – Mathematical preliminaries – Asymptotic analysis – Recurrence relations – Algorithm design paradigms: Divide and conquer algorithms, Dynamic programming and Greedy algorithms

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS

1. Print the difference of indices of largest and smallest number in an array
2. Length of the longest substring without repeating characters
3. Prime factors of a given number
4. Product of the sum of diagonals of an array
5. The greatest common divisor (GCD) of two numbers – with & without Euclid's algorithm
6. Finding output of sequencing and looping puzzles
7. Finding output of pattern matching puzzles
8. Using only indexing technique– storing and retrieving Array elements (without library functions)
9. Add, subtract, multiply and check for equality in the two given matrices (without library functions)

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10. Utilize the Pythagorean Theorem to calculate a third side of a right triangle, given the other two sides
11. Time complexity analysis – Tower of Hanoi (using Recursion) – 3 rods and n disks
12. Time complexity analysis – Tower of Hanoi (using Recursion) – 4 rods and n disks

REFERENCES:

1. David Riley and Kenny Hunt, "Computational thinking for modern solver", Chapman & Hall/CRC, 2014.
2. R.G. Dromey, "How to solve it by Computer", PHI, 2008.
3. Exploring computational thinking–https://edu.google.com/resources/programs/ exploring computational–hinking/.
4. GUVI Technical Learning Platform, Certifications, Assessments and FDP/FEM for KPRIET

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Inspect a given problem to arrive solutions	Analyze
CO2	Choose suitable algorithms to solve simple problems	Apply
CO3	Make use of best practices for documentation to ensure long term maintenance	Apply
CO4	Explain the basics of operating system, networking, database management system, API and XML	Understand
CO5	Apply computational thinking skills to solve simple real world problems	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	1	2	1	-	1	-	-
CO2	3	2	1	1	-	-	-	1	2	1	-	1	-	-
CO3	3	2	1	1	-	-	-	1	2	1	-	1	-	-
CO4	2	1	-	-	-	-	-	1	2	1	-	1	-	-
CO5	3	2	1	1	-	-	-	1	2	1	-	1	-	-
CO	2.8	2	1.3	1	-	-	-	1	2	1	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER II

		Category: ES			
U19MEG01	ENGINEERING GRAPHICS	L	T	P	C
		1	0	4	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- The students will be exposed to standards and conventions followed in preparation of engineering drawings
- The students will understand the concepts of orthographic and isometric projections using CAD software
- The students will develop the ability of producing engineering drawings and conveying the information through drawings using CAD software

BASICS OF ENGINEERING DRAWING AND CAD (Not for examination)

Introduction, drawing instruments and uses, sheet layout, BIS conventions, lines, lettering and dimensioning practices lines, Co–ordinate points, axes, poly–lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off–set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity.

UNIT I CONICS, SPECIAL CURVES AND PROJECTION OF POINTS 3+12

Construction of parabola, ellipse and hyperbola using eccentricity method, construction of cycloids and involutes of squares and circles, Construction of Tangent and normal to the above curves Introduction, method of projection, planes of projection, reference line and notations. Projection of points: Points in all the four quadrants

UNIT II PROJECTION OF STRAIGHT LINES AND SURFACES 3+12

Projection of straight lines: Lines inclined to HP/VP plane, inclined to both HP and VP planes (straight lines are assumed to be in first quadrant only). Projection of planes: Projection of square, rectangle, pentagon, hexagon and circular plane– inclined to both the plane by change of position method

UNIT III PROJECTION OF SOLIDS 3+12

Introduction, projection of solids: prisms, pyramids, cylinders and cones with axis inclined to both the planes. (Solids resting on HP only)

UNIT IV DEVELOPMENT OF LATERAL SURFACES OF SOLIDS 3+12

Introduction, Cutting plane, sectional views of right regular solids resting with base on HP: prisms pyramids, cylinder and cone and true shapes of the sections. Development of lateral surfaces of right regular prisms, pyramids, cylinders, cones resting with base on HP only. Development of their frustums and truncations

UNIT V ORTHOGRAPHIC AND ISOMETRICPROJECTIONS 3+12

Orthographic projection: Simple machine components using free hand sketching. Isometric projection: Simple Solid exercises and combination of solids

Contact Periods:

Lecture: 15 Periods Tutorial: Periods Practical: 60 Periods Total: 75 Periods

TEXT BOOKS:

1. NDBhat, VMPanchal,"EngineeringDrawing", Charotar, Publishing House, 2013
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2010

REFERENCES:

1. Natrajan K.V, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2017
2. Sam Tickoo, "AutoCAD 2013 for Engineers and Designers", Dreamtech Press, 2013
3. M.H.Annaiah & Rajashekar Patil, "Computer Aided Engineering Drawing", New Age International Publishers, 4th edition, 2012
4. Basant Aggarwal, "Engineering Drawing", Tata McGraw Hill Education Private Limited, 1st edition, 2010
5. D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, New Delhi, Revised Edition, 2010

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Illustrate curves, orthographic projections of points as per BIS conventions	Understand
CO2	Examine the orthographic projections of straight lines and plane surfaces	Analyze
CO3	Build the orthographic projections of solids, frustums and truncated solids	Apply
CO4	Experiment with the projections of lateral surfaces of frustums, truncated solids andits development	Apply
CO5	Develop the orthographic views from pictorial and isometric views of simple objects	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	1	2	1	-	1	-	-
CO3	3	2	1	1	1	-	-	1	2	1	-	1	-	-
CO4	3	2	1	1	1	-	-	1	2	1	-	1	-	-
CO5	3	2	1	1	1	-	-	1	2	1	-	1	-	-
CO	2.8	2	1.3	1	1	-	-	1	2	1	-	1	-	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER III

		Category: BS			
U19MA305	**LINEAR ALGEBRA AND COMPLEX VARIABLES**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of vector space for solving time domain control theory
- To equip with the concepts of partial differential equations
- To use the concepts of complex analysis, in the study of heat flow, fluid dynamics and electrostatics

UNIT I VECTOR SPACES **9+3**

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

UNIT II PARTIAL DIFFERENTIAL EQUATIONS **9+3**

Formation of Partial Differential Equations – Solutions of standard types of first order partialdifferential equations – Lagrange's linear equation – Solution methods for second order homogeneous equations with constant coefficients

UNIT III VECTOR CALCULUS **9+3**

Gradient –Divergence and curl – Directional Derivative– Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem – Stokes' theorem (excluding proof) – Simple applications involving cubes and rectangular parallelepipeds

UNIT IV COMPLEX DIFFERENTIATION **9+3**

Functions of a complex variable – Analytic functions: Cauchy-Riemann equations (Cartesian form) and sufficient conditions (excluding proof) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions –Bilinear transformation

UNIT V COMPLEX INTEGRATION **9+3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Applications

Contact Periods:

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

TEXT BOOKS

1. GrewalB.S, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt Ltd, New Delhi, 2018

REFERENCES:

1. BaliN.P and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications; 12th edition, 2016
2. Thomas G.B and R.L Finney, "Calculus and Analytic Geometry", Pearson Education India; 14th edition, 2010
3. Maurice D Weir, Joel Hass, Christopher Heil, "Thomas Calculus", 14th edition, Pearson Education, India, 2018
4. JamesG, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2011

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Identify linear independence and dependence of vectors and basis ofvector space	Apply
CO2	Make use of partial differential equations for homogenous equations	Apply
CO3	Apply the theoretical aspects of vector integral calculus in Electro Magnetic Theory	Apply
CO4	Identify the complex functions and their mapping in certain complex planes	Apply
CO5	Compare different complex integration methods	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO	2.8	1.8	1	-	-	-	-	-	-	-	-	1	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER III

		Category: PC			
U19EC301	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- Transforms and Partial Differential Equations

COURSE OBJECTIVES:

- To understand the basic properties of signals and systems
- To analyze continuous time and discrete time signals using various transforms
- To analyze continuous time systems using Laplace transform and discrete time systems using Z-transform

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS **9 + 3**

Introduction to signals – Standard signals – Operations on signals – Classification of CT and DT signals – Deterministic and random signals, odd and even signals, periodic and aperiodic signals, energy and power signals, causal and non–causal signals – Introduction to systems – Classification of CT and DT systems – Linear and nonlinear, time–variant and time–invariant, causal and non–causal, stable and unstable

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS **9 + 3**

Fourier series representation – Exponential Fourier series for periodic signals – Transforms – Continuous Time Fourier Transform (CTFT) – Properties – Inverse CTFT – Laplace Transform (LT) – ROC and properties – Inverse LT

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS **9 + 3**

Introduction to LTI CT system – Convolution integral – Properties – CT system analysis using Laplace transform – Impulse and step response – CT systems connected in series and parallel

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS **9 + 3**

Baseband signal sampling – Discrete Time Fourier Transform (DTFT) and properties – z transform – ROC and properties – Inverse z transform

UNIT V LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS **9 + 3**

Introduction to LTI DT system – Convolution sum – Properties – DT system analysis using z Transform – Impulse and step response – DT systems connected in series and parallel

Contact Periods:

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

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", 2nd edition, Pearson, 2015
2. Simon Haykin and Barry Van Veen, "Signals & Systems", 2nd edition, Wiley, 2008

REFERENCES:

1. B. P. Lathi, "Principles of Linear Systems and Signals", 2nd edition, Oxford Univ Press, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals and Systems – Continuous and Discrete", 2nd edition, Pearson, 2008
3. Hsu., H.P., "Signals and Systems", 1st edition, Tata McGraw Hill, 2008.
4. Michael J. Roberts, "Fundamentals of Signals and Systems", 1st edition, Tata McGraw Hill, 2007

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Classify different types of signals and systems with its properties	Understand
CO2	Apply Fourier series, Fourier and Laplace transforms for continuous time signals	Apply
CO3	Compute the response of linear time invariant continuous time systems using Laplace transform	Apply
CO4	Determine Fourier and Z transforms of discrete time signals	Apply
CO5	Examine linear time invariant discrete time systems using Z transform	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	3	2	2	-	-	-	-	-	-	-	-	2	-	3
CO3	3	2	2	-	-	-	-	-	-	-	-	2	-	3
CO4	3	2	2	-	-	-	-	-	-	-	-	2	-	3
CO5	3	2	2	-	-	-	-	-	-	-	-	2	-	3
CO	3	2	2	-	-	-	-	-	-	-	-	2	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER III

		Category: PC			
U19EC302	DIGITAL ELECTRONICS AND VHDL	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Number systems

COURSE OBJECTIVES:

- To understand the fundamentals of digital logic circuits
- To design the combinational circuits and sequential circuits
- To acquaint VHDL programming in logic circuit design

UNIT I BOOLEAN THEOREMS AND LOGIC REDUCTION 9

Boolean theorems – Logic gates – Circuit implementation – NAND and NOR gates – Representation of boolean expression – Sum of product, product of sum, minterm to maxterm conversion – Simplification of logic functions using K–map, Quine McCluskey method – CMOS logic family

UNIT II COMBINATIONAL LOGIC DESIGN 10

1 Bit adder – 1 Bit subtractor – RCA – CLA – Adder/Subtractor – Decoders – Encoders– Multiplexers – Demultiplexers – Implementation of combinational circuits using multiplexers– Code converters – Error detection and correction codes – Parity generator and checker, Hamming codes

UNIT III LATCHES AND FLIPFLOPS 8

Latches – NOR, NAND – Digital pulses – Clocked flipflops – Asynchronous inputs – Flipflop timing considerations – Potential timing problem in flipflop circuits – Master/Slave flipflop – Conversion of flipflops – Applications of flipflop – Data storage and transfer

UNIT IV SEQUENTIAL CIRCUITS AND REGISTERS 10

General model of sequential circuits – Mealy/Moore models, excitation table, state table, state diagram – Design of synchronous sequential circuits – Synchronous up/down counters, modulus counters, shift registers, ring counter, Johnson counter, sequence detector – Asynchronous sequential logic – Asynchronous counter – Hazards in logic circuits, hazard free realization

UNIT V HARDWARE DESCRIPTION LANGUAGE 8

Introduction about VHDL – Operators – Modeling – Dataflow, structural, behavioral – IF statements – CASE statements – Simulation of logic circuit using VHDL

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. M.Morris Mano, Michael D Ciletti, "Digital Design", 5th edition, Pearson, 2013
2. J.Bhaskar, "A VHDL Primer", 3rd edition, Prentice Hall, 2003

REFERENCES:

1. A.Anand Kumar, "Fundamentals of Digital Circuits", 2nd edition, PHI Learning, 2013
2. Ronald J Tocci, Neal S Widmer, Gregory L Moss, "Digital Systems Principles and Applications", 10th edition, Pearson, 2009
3. Thomas L.Floyd, "Digital Fundamentals", 11th edition, Prentice Hall, 2015
4. D. Donald Givone, "Digital Principles and Design", 4th edition, Tata McGraw Hill, 2008

COURSE OUTCOMES:

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

Cos	Statements	K–Level
CO1	Compare various reduction methods to simplify logic expressions	Analyze
CO2	Explain the combinational logic circuits design using gates	Understand
CO3	Illustrate the operation of latches and flip-flops	Understand
CO4	Implement the sequential logic circuits using flip-flops	Apply
CO5	Design digital circuit using hardware description language	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	-	2
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	2
CO3	2	2	-	-	-	-	-	-	-	-	-	1	-	2
CO4	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO5	3	2	2	-	2	-	-	-	-	-	-	1	-	2
CO	2.6	2.2	2	-	2	-	-	-	-	-	-	1	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER III

U19EC303	ELECTRONIC CIRCUITS	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Semiconductor physics and devices

COURSE OBJECTIVES:

- To understand the methods of biasing, and small signal analysis of BJT, FET and MOSFET amplifiers
- To learn the feedback concepts in oscillators
- To acquaint knowledge about multistage and power amplifiers

UNIT I SINGLE STAGE BJT AMPLIFIER 9

Operating conditions – Various biasing methods of BJT – Stability factor – Small signal analysis of BJT (CE, CB, CC) amplifiers using hybrid π model – Frequency response of transistor amplifiers

UNIT II SINGLE STAGE JFET AND MOSFET AMPLIFIERS 9

Biasing methods of JFET amplifier – Small signal analysis of JFET (CS, CD, CG) amplifiers using hybrid π model–Biasing methods of MOSFET amplifier – Small signal analysis of MOSFET (CS, CD,CG) amplifiers using hybrid π model

UNIT III MULTISTAGE BJT AMPLIFIERS 9

Differential amplifier – DC transfer characteristics, small signal analysis and CMRR – Darlington amplifier – Bootstrap technique – Cascade and cascode configurations

UNIT IV OSCILLATORS AND WAVE SHAPING CIRCUITS 9

Introduction to feedback topologies – Oscillators – Barkhausen criterion, RC phase shift oscillator, Hartley oscillator, Colpits oscillator – Wave shaping circuits – Integrator and differentiator, diode clipper and clamper

UNIT V POWER AMPLIFIERS AND TUNED AMPLIFIERS 9

Class A power amplifier, efficiency of Class A power amplifier resistive load, transformer load– classB power amplifier, efficiency of Class B power amplifier, push pull, complimentary symmetry–class Cpower amplifier–Single tuned capacitive coupled amplifier, quality factor of a tank circuit, gain & bandwidth, stagger tuned amplifiers

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1 R. L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th edition, Pearson education, 2015
2 J.Millman, C.C.Halkias and Chetan D Parikh, Integrated Electronics, 2nd edition, Tata McGraw Hill, 2017

REFERENCES:

1 David A. Bell, "Electronic Devices & Circuits", 5th edition, Oxford University Press, 2008
2 Millman J, Halkias.C.and Sathyabrata Jit, "Electronic Devices and Circuits", 4th edition, McGraw Hill Education, 2015
3 Donald A Neamen, "Electronic Circuit –Analysis and Design", 3rd edition, Tata McGraw Hill, 2016
4 Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, "Microelectronic Circuits: Theory and Applications", 7th edition, Oxford higher education, 2017

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Choose the suitable methods of biasing for small signal BJT amplifier	Apply
CO2	Analyze different single stage FET amplifiers using hybrid equivalent circuit	Analyze
CO3	Illustrate the multistage concepts in various BJT amplifier configurations	Understand
CO4	Apply the principles of feedback topologies for oscillator design	Apply
CO5	Summarize the different power amplifiers and tuned amplifiers	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	2	-	1
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	1
CO4	3	2	-	-	-	-	-	-	-	-	-	2	-	1
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	1
CO	2.6	2.3	2	-	-	-	-	-	-	-	-	2	-	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER III

		Category: PC			
U19EC304	ELECTROMAGNETIC FIELDS AND WAVEGUIDES	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Engineering Physics

COURSE OBJECTIVES:

- To assimilate the nature of static electric and magnetic fields in free space and in materials
- To understand the relation between electric and magnetic fields through Maxwell's equation
- To learn the general wave behaviour in different waveguides

UNIT I STATIC ELECTRIC FIELD 9

Vector algebra – Coordinate systems – Differential operators – Divergence theorem – Stokes theorem – Coulomb's law, principle of superposition – Electric field intensity due to a straight line – Electric flux density – Gauss law, applications – Electric potential – Electric dipole – Electrostatic energy and energy density

UNIT II STATIC MAGNETIC FIELD 9

Biot–Savart law – Magnetic field intensity for a straight wire – Magnetic flux density – Ampere's circuital law and its applications – Scalar and vector magnetic potentials – Magneto static energy

UNIT III MATERIALS FOR ELECTRIC AND MAGNETIC FIELD 9

Conductors and dielectrics in electric field – Continuity equation – Boundary conditions for electric field – Parallel plate, coaxial and spherical capacitors – Poisson and Laplace equation – Polarization – Forces on magnetic field – Magnetic materials – Magnetic boundary conditions – Magnetization – Inductance for solenoid and toroid

UNIT IV TIME VARYING FIELDS AND MAXWELL'S EQUATIONS 9

Faraday's law for electromagnetic induction – Transformer and motional electromotive forces – Lorentz force equation – Displacement current – Maxwell's equations – Electromagnetic boundary conditions – Wave equations and their solutions – Poynting theorem – Wave propagation on different media

UNIT V WAVEGUIDES 9

General wave behaviours – Transverse Electric waves, Transverse Magnetic waves, Transverse Electromagnetic waves – TM and TE waves between parallel plates – TM and TE waves in rectangular waveguide – Bessel's differential equation and Bessel function, TM and TE waves in circular waveguides – Cavity resonators

Contact Periods:

Lecture: 45 Periods Tutorial: –Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. M.N.O. Sadiku and S.V.Kulkarni, "Principles of Electromagnetics", 6th edition, Oxford, 2015
2. John.D.Ryder, "Networks, Lines and Fields", 2nd edition, Pearson (India), 2016

REFERENCES:

1. W.H.Hayt and J.A.Buck, "Engineering Electromagnetics", 9th edition Mc–Graw– Hill, 2018
2. D.J.Griffiths, "Introduction of Electrodynamics", 4th edition, Pearson (India), 2013
3. D.K. Cheng, "Field and wave Electromagnetic", 2nd edition, Pearson (India), 2013
4. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines", 1st edition, Pearson (India), 2006

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Summarize the coordinate systems and basic theorems of static electric field	Understand
CO2	Explain the basic laws and theorems of static magnetic field	Understand
CO3	Illustrate the boundary conditions based on materials for electric and magnetic field	Understand
CO4	Apply Maxwell's equation on different wave propagation media	Apply
CO5	Examine the wave behavior and mode of propagation in rectangular and cylindrical waveguides	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER III

U19EC305	**DATA STRUCTURES**	**Category: ES**			
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

PRE–REQUISITES:

- Basic C programming

COURSE OBJECTIVES:

- To study the fundamentals of C programming
- To learn and explore the applications of linear and non–linear data structures
- To understand basic sorting and searching algorithms

UNIT I BASICS OF C PROGRAMMING 7

Structure of C program –Pre–processor directives – Compilation and Linking processes – Data Types –Storage classes – Constants – Variables – Operators – Expressions – Input / Output statements – Assignment statements – Decision making statements – Switch statement – Looping statements – Arrays–: declaration, initialization, one–dimensional and two–dimensional arrays –Strings: declaration, initialization and operations on strings

UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS 6

Functions: Pass by value, Pass by reference and Recursion – Pointers – definition, initialization, Pointers arithmetic – Structures and Unions– definition, structure within a structure, Programs using structures and unions

UNIT III LINEAR DATA STRCUTURES 7

Stacks and Queues – Array–based implementation– Linked lists – Linked list–based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition

UNIT IV NON–LINEAR DATA STRCUTURES 5

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 SORING ALGORITHMS 5

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

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS:

1. Josephus Problem, Subset Sum Problem, Kadane's Algorithm
2. Shuffling Algorithms, Sliding Window, Prefix Sum Technique
3. Memorization, Tabulation
4. LCS, Coin Change, Knapsack
5. Subset Sum, Palindrome Partitioning
6. Rabin Karp Algorithm and KMP Algorithm
7. Rotations Check of two Strings and Anagram
8. Multidimensional Array Search, Transpose and Rotate
9. Egg drop puzzle
10. Backtracking
11. Stack: array–based and linked–list based implementation

12. Queue: array–based and linked–list based implementation
13. Shortest path problem
14. Searching –Two pointer approach
15. Sorting
    a. Union and Intersection of sorted arrays
    b. Inversions count
    c. Tail call elimination quick sort
    d. Cycle Sort
    e. Merge

TEXT BOOKS:

1. Reema Thareja, "Programming in C", 1st edition, Oxford University Press, 2018
2. ReemaThareja, "Datastructures using C", Oxford University Press, 2014

REFERENCES:

1. Pradip Dey, Manas Gosh, "Programming in C", 1st edition, Oxford University Press, 2018
2. Herbert Schildt, "C: The Complete Reference", 2nd edition, McGraw Hill Education, 2017
3. R. Venkatesan, S. Lovelyn Rose, "Data Structures", 2nd edition, Wiley, 2019
4. Seymour Lipschutz, "Data structures with C", 4th edition, McGraw Hill Education, 2017

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Apply the concepts of C programs to solve basic problems	Apply
CO2	Make use of functions, pointers, structures and unions to write simple programs	Apply
CO3	Construct stack and queue using arrays and linked–list	Apply
CO4	Utilize non–linear data structure to minimize computational complexity	Apply
CO5	Examine the performance of different searching and sorting techniques	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	-	-	-	2	2	2	-	-	-	2
CO2	3	2	-	2	-	-	-	2	2	2	-	-	-	2
CO3	3	2	-	2	-	-	-	2	2	2	-	-	-	2
CO4	3	2	-	2	-	-	-	2	2	2	-	-	-	2
CO5	3	3	2	2	-	-	-	2	2	2	-	-	-	2
CO	3	2.2	2	2	-	-	-	2	2	2	-	-	-	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER III

U19EC306	ANALOG AND DIGITAL ELECTRONICS LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Semiconductor Physics and Devices, Circuit Analysis

COURSE OBJECTIVES:

- To design amplifier circuits using BJT and FET
- To design sequential and combinational circuits
- To acquaint simulation software

LIST OF EXPERIMENTS

I ANALOG EXPERIMENTS

1. Design of common emitter amplifier circuit using BJT
2. CMRR measurement in differential amplifier
3. Frequency response of CS amplifier
4. Design of RC phase shift oscillator
5. Simulation of CE and CC amplifier using Multisim software

II DIGITAL EXPERIMENTS

1. Study of basic logic gates
2. Realization of half/ full adder using XOR and NAND gates
3. Implementation of 4x1 multiplexer and 1x4 de-multiplexer using logic gates
4. Binary to gray code conversion using NAND gate
5. Verification of truth table for RS, JK, T and D flip–flops using NAND & NOR gates
6. Design of 4–bit serial in parallel out shift registers
7. Design of 4– bit synchronous counter

III MANDATORY MINIPROJECT

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Examine the frequency response of amplifier circuits using BJT and FET	Analyze
CO2	Construct the RC phase shift oscillator circuit	Apply
CO3	Make use of logic gates to implement combinational circuits	Apply
CO4	Build sequential circuits using flip–flops	Apply
CO5	Experiment with BJT amplifiers using simulation tools	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	2	2	2	-	2	-	1
CO2	3	2	2	3	-	-	-	2	2	2	-	2	-	1
CO3	3	2	2	3	-	-	-	2	2	2	-	2	-	1
CO4	3	2	2	3	-	-	-	2	2	2	-	2	-	1
CO5	3	2	2	3	1	-	-	2	2	2	-	2	-	1
CO	3	2.2	2	3	1	-	-	2	2	2	-	2	-	1
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)							

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SEMESTER III

		Category: EEC			
U19CA001	NUMERICAL APTITUDE AND VERBAL ABILITY – I	L	T	P	C
		1	0	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of coding, decoding, interpreting and applying
- To comprehend the basics concepts of logical reasoning and verbal reasoning

UNIT I CODING AND DECODING 3

Clocks & calendars – Alpha numeric series – Coding & decoding – Blood relations – Odd man out – Direction

UNIT II DATA INTERPRETATION 3

Syllogism – Order and ranking – Puzzles – Cubes and dices – Statements – Assumptions and conclusions – Seating arrangements – Data sufficiency – Data interpretation

UNIT III GRAMMAR 3

Parts of speech (Nouns – Pronouns – Verbs – Adjectives – Adverbs – Prepositions – Conjunctions – Interjections) – Gerunds – Phrases and clauses

UNIT IV WRITING 3

Tenses – Active and passive voice (Tense usage) – Reported speech – Verbal ability (Vocabulary and Reasoning)

UNIT V READING 3

Cloze test – Sentence formation – Para jumbles – Passage formation – Spotting errors – Verbal analogies

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: – Periods Total: 15 Periods

TEXT BOOKS:

1. "R S Aggarwal – Quantitative Aptitude for Competitive Examinations", 17th Edition S Chand Publishing, New Delhi, 2017
2. "R S Aggarwal – Objective General English", S Chand Publishing, New Delhi, 2017

REFERENCES:

1. Abhijit Guha – Quantitative Aptitude for Competitive Examination, McGraw Hill Education (India) Private Limited, 5th Edition, 2015
2. R S Aggarwal - A Modern Approach to Verbal & Non-Verbal Reasoning, S Chand Publishing, New Delhi, 2017

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply the concept of coding and decoding for numerical reasoning and data interpretation through Graphs and Charts	Apply
CO2	Choose appropriate words and phrases for comprehension	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	2	-	-	-	3	-	2	-	-
CO	-	-	-	-	-	2	-	-	-	3	-	2	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)						3: Substantial (High)		

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SEMESTER IV

		Category: BS			
U19MA406	**PROBABILITY AND RANDOM PROCESSES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the mathematical concepts of probability, one and two dimensional random variables and distributions
- To apply the concept of spectral density in communication systems, networks, signal processing systems, and control systems
- To identify noise sources in simulations using the concept of spectral densities and linear systems

UNIT I PROBABILITY AND RANDOM VARIABLES **9**

Probability–Axioms of Probability–Conditional Probability – Baye's Theorem, Random Variables–Moments–Moment Generating Functions– Distributions: Poisson, Exponential and Normal

UNIT II TWO DIMENSIONAL RANDOM VARIABLES **9**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression

UNIT III RANDOM PROCESSES **9**

Classification – Stationary process – Markov process – Poisson process – Random telegraphprocess

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: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Oliver C.Ibe, "Fundamentals of Applied Probability and Random Processes",Elsevier Academic Press, 2nd edition, 2014
2. Peebles P.Z., "Probability, Random Variables and Random Signal Principles", TataMcGraw Hill, 4th Edition, New Delhi, 2002
3. Dimitri P. Bertsekas, John N. Tsitsiklis.,"Introduction to Probability", 2nd edition, Athena Scientific, 2008

REFERENCES:

1. Cooper. G.R. and McGillem C.D, "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian edition, 2012
2. Stark. H., and Woods J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Asia, 2002

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3. Miller.S.L. and Childers D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004
4. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability", Random Variables and Random Processes, Tata McGraw Hill Edition, New Delhi, 2004

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply probability and random variables for complex engineering problems	Apply
CO2	Compare correlation and linear regression in two dimensional random variables	Understand
CO3	Choose suitable random process for engineering applications	Apply
CO4	Explain the properties of correlation and power spectral density	Understand
CO5	Examine the response of linear time invariant systems	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	1
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	1
CO	2.6	2.3	2	-	-	-	-	-	-	-	-	-	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER IV

		Category: PC			
U19EC401	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Electronic Circuits

COURSE OBJECTIVES:

- To study the characteristics of operational amplifier
- To learn different applications of op-amp
- To understand the operation of PLL, 555 timer, A/D and D/A conversion techniques

UNIT I OP–AMP CHARACTERISTICS 6

Introduction – Ideal Op-amp – Functional blocks of op-amp – DC characteristics – bias, offset, thermal drift – AC characteristics – closed–loop frequency response, slew rate

UNIT II LINEAR OP– AMP CIRCUITS 6

Inverting and non-inverting amplifier – Adder – Subtractor – Instrumentation amplifier – Integrator – Differentiator – Active filter

UNIT III COMPARATORS AND WAVEFORM GENERATORS USING OP – AMP 6

Comparator – IC Voltage regulators – Schmitt trigger – Multivibrators – RC phase shift oscillator – Wein bridge oscillator

UNIT IV PLL AND TIMERS 6

Operation of PLL – VCO – Monolithic PLL – PLL applications – AM and FM detection – IC 555 timer– Astable and monostable operation and applications

UNIT V A/D AND D/A CONVERTERS 6

ADC and DAC specifications – D/A conversion techniques – R-2R, weighted resistor – A/D conversion techniques – Successive approximation, dual slope and flash converters

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS:

1. Inverting and Non-inverting amplifiers
2. Integrator and Differentiator
3. Active low-pass, High-pass and band-pass filters
4. Instrumentation amplifier
5. Wein bridge oscillator
6. Astable and Monostable multivibrators using Op-amp
7. Schmitt Trigger using op-amp
8. DC power supply using LM723
9. Astable and Monostable multivibrators using NE555 timer
10. A/D converter using SPICE
11. R-2R Ladder type D/A converter using Op-amp

TEXT BOOKS:

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 5th edition, New Age International Pvt. Ltd., 2018
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th edition, Tata Mc Graw-Hill, 2016

REFERENCES:

1. Ramakant A. Gayakwad," OP-AMP and Linear Integrated Circuits", 4th edition, PHI, 2015
2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6th edition, PHI, 2001
3. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", 5th edition, Wiley International, 2009
4. S.Salivahanan, V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", 2nd edition, fourth reprint, Tata Mc Graw-Hill, 2016

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the characteristics of operational amplifier	Understand
CO2	Implement linear circuits using op-amp	Apply
CO3	Construct waveform generators using op-amp	Apply
CO4	Design PLL and timer circuits using op - amp	Apply
CO5	Examine the performance of different ADC and DAC conversion techniques using SPICE	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	2	2	2	-	-	-	2
CO2	3	2	2	3	-	-	-	2	2	2	-	-	-	2
CO3	3	2	2	3	-	-	-	2	2	2	-	-	-	2
CO4	3	2	2	3	-	-	-	2	2	2	-	-	-	2
CO5	3	3	2	3	2	-	-	2	2	2	-	-	-	2
CO	2.8	2.3	2	3	2	-	-	2	2	2	-	-	-	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER IV

U19EC402	ANALOG COMMUNICATION	Category: PC			
		L	T	P	C
		2	0	0	2

PRE–REQUISITES:

- Physics

COURSE OBJECTIVES:

- To learn the concepts of various amplitude modulations and their spectral characteristics
- To study the fundamentals of angle modulation and pulse modulation system
- To understand the properties of random process and effect of noise on communication systems

UNIT I AMPLITUDE MODULATION SYSTEMS 7

Introduction to communication system model - Principles of amplitude modulation - Time and Frequency domain representations - Power relations - Generation and detection of DSB-FC - Square law modulator, envelope detector - Generation and detection of DSB-SC - Balanced modulator, Costas loop - SSB-SC - Vestigial sideband modulation- Simulation of amplitude modulation

UNIT II ANGLE MODULATION SYSTEMS 5

Introduction to angle modulation - FM and PM - Narrow band FM and wideband FM - Generation of FM Signal - Direct and indirect methods - Detection of FM -Phase discriminator- Simulation of FM

UNIT III PULSE MODULATION SYSTEMS 5

Low pass sampling - Quantization - Pulse amplitude modulation - Pulse width modulation - Pulse position modulation - Pulse code modulation

UNIT IV TRANSMITTERS AND RECEIVERS 6

AM broadcasting transmitters - FM transmitter - Receiver characteristics - Super heterodyne receiver - FM receiver - Automatic Gain Control (AGC) - Automatic Frequency Control (AFC) - Time division multiplexing - Frequency division multiplexing

UNIT V FUNDAMENTALS OF NOISE THEORY 7

Noise sources and types - Gaussian and white noise characteristics - Noise margin - Noise temperature - Noise figure - Noise performance in AM systems - DSB-SC - Noise performance in FM systems - Pre-emphasis and de-emphasis - Threshold effects in angle modulation

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: – Periods Total: 30 Periods

TEXT BOOKS:

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems", 4th edition, Tata McGraw Hill, 2013
2. G. Kennedy, Bernard Davis, S R M Prasanna, "Electronic Communication Systems", 5th edition, Tata McGraw Hill, 2012

REFERENCES:

1. Simon Haykin, "Communication Systems", 4th edition, Wiley, 2014
2. B.P. Lathi, ZHI Ding, "Modern Digital and Analog Communication Systems", 4th edition, Oxford University Press, 2017
3. A Bruce Carlson, Paul B. Crilly, Janet C. Rutledge, "Communication Systems", 4th edition, Tata McGraw Hill, 2002
4. D.Roody, J.Coolen, "Electronic Communications", 4th edition, Prentice Hall of India, 2006

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply the suitable amplitude modulation technique for analog communication	Apply
CO2	Illustrate the performance of angle modulation techniques	Understand
CO3	Classify the pulse modulation systems	Understand
CO4	Explain the fundamentals of different transmitters and receivers	Understand
CO5	Examine the noise performance of AM and FM systems	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	-	-	3
CO2	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO	2.4	2	2	-	2	-	-	-	-	-	-	-	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER IV

		Category: PC			
U19EC403	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Principles

COURSE OBJECTIVES:

- To understand the architecture of 8086 microprocessor, 8051 microcontroller, ARM and RISC-V processors
- To learn the instruction set of 8086 microprocessors and 8051 microcontroller to write assembly language programs
- To study the interfacing concepts of 8086 microprocessors and 8051 microcontroller

UNIT I 8086 MICROPROCESSOR 9

Von-Neumann architecture – 8086 microprocessor – Internal architecture and signals – Addressing modes – Instruction set – Machine cycles and timing diagrams – Programming using 8086 – Interrupts and interrupt service routines

UNIT II 8086 MEMORY AND I/O INTERFACING 9

Memory interfacing – Typical EPROM and RAM interfacing – I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller

UNIT III 8051 MICROCONTROLLER 9

Harvard architecture – 8051 microcontroller – Internal architecture and signals, Special Function Registers (SFR), I/O ports and circuits – Instruction set – Addressing modes – Assembly language programming

UNIT IV INTERFACING 8051 MICROCONTROLLER 9

Programming 8051 timers – Serial port programming – Interrupts programming – LCD and keyboard interfacing – ADC interfacing – DAC and sensor interfacing – Stepper motor

UNIT V ARM AND RISC-V PROCESSORS 9

Introduction to ARM processors and its versions – Features, internal architecture, advantages – RISC-V processor – architecture, applications

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085, 8086, 8051, 8096", 1st edition, Prentice Hall of India, 2011
2. Kris Schindler, "Introduction to Microprocessor Based Systems Using the ARM Processor", 2nd edition, Pearson Learning Solutions, 2013

REFERENCES:

1. Soumitra Kumar Mandal, "Microprocessors and Microcontrollers Architecture Programming and Interfacing using 8085 8086 & 8051", 1st edition, Tata McGraw Hill, 2011
2. Mazidi Muhammed Ali, Mazidi Janice Gillispie, "The 8051 Microcontroller and Embedded Systems", 2nd edition, Pearson Education India, 2012
3. Yu. Cheng Liu, Glenn A Gibson, "Microcomputer System, 8086/8088 Family", 2nd edition, PHI, 2000
4. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the architecture, addressing modes and instruction sets of 8086 microprocessor	Understand
CO2	Build programs for interfacing peripheral devices with 8086 microprocessor	Apply
CO3	Interpret the architecture, addressing modes and instruction sets of 8051 microcontroller	Understand
CO4	Develop programs for interfacing peripheral devices with 8051 microcontroller	Apply
CO5	Summarize the architectural features and applications of ARM and RISC-V processors	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO	3	1.4	2	-	-	-	-	-	-	-	-	-	2	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER IV

		Category: PC			
U19EC404	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	2	4

PRE–REQUISITES:

- Signals and Systems

COURSE OBJECTIVES:

- To understand DFT using FFT
- To design IIR and FIR filters using different techniques
- To analyze finite word length effects and the architecture of digital signal processors

UNIT I DISCRETE FOURIER TRANSFORM 9

Introduction to DFT and IDFT – Properties of DFT – Periodicity, symmetry and circular convolution – Computation of DFT using direct method – Fast computation of DFT using Fast Fourier Transform (FFT) – Radix-2 Decimation-in-Time (DIT) and Decimation-in- Frequency (DIF) algorithms – Filtering long data sequences – Overlap save and overlap add methods

UNIT II INFINITE IMPULSE RESPONSE FILTERS 9

Introduction to filters - Analog filter design – Butterworth and Chebyshev filters – Design of digital IIR filters from analog filters (LPF, HPF) – Impulse invariance and bilinear transform methods – Structure of IIR filter – Direct form I, direct form II, cascade and parallel realizations

UNIT III FINITE IMPULSE RESPONSE FILTERS 9

Introduction to FIR – Linear phase characteristics – Symmetric and anti-symmetric FIR filters – Design of linear phase FIR filters – Fourier series, windows (Rectangular, Hamming and Hanning windows), frequency sampling method – Structure of FIR filter – direct form and linear phase realizations

UNIT IV FINITE WORD LENGTH EFFECTS AND MULTIRATE DSP 9

Number representation – Fixed point and floating point – Quantization – Truncation and rounding – Types of quantization errors – Input, product and coefficient quantization – Derivation of quantization noise power – Limit cycle oscillations – Dead band effect – Multirate signal processing – Decimation and interpolation – Sampling rate conversion

UNIT V DIGITAL SIGNAL PROCESSORS 9

Introduction – Selection of processor – Von Neumann, Harvard and VLIW architectures – Pipelining – TMS320C5x processor – Architecture and addressing modes

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 30 Periods Total: 75 Periods

LIST OF EXPERIMENTS

1. Generation of elementary Discrete –Time sequences
2. Linear convolution and circular convolution
3. Frequency analysis using DFT
4. Design of IIR Filters (a) Butterworth Filter (b) Chebyshev Filter
5. Design of FIR filters using (a) Rectangular (b) Hamming (c) Hanning windows
6. Up-sampling and down-sampling
7. Generation of various signals and random noise using TMS320C50 processor
8. Implementation of Up-sampling and down-sampling using TMS320C50 processor

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TEXT BOOKS:

1. John G.Proakis and Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", 4th edition, Pearson Education, 2013
2. B.Venkataramani, M.Bhaskar, "Digital Signal Processors : Architecture, Programming and Applications", 2nd edition, Tata Mc Graw Hill, 2011

REFERENCES:

1. Emmanuel C.Ifeachor and Barrie.W.Jervis, "Digital Signal Processing: A Practical Approach", 2nd edition, Pearson Education, 2017
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", 4th edition, Tata Mc Graw Hill, 2017
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 3rd edition, Pearson, 2019
4. Andreas Antoniou, "Digital Signal Processing: signals systems and Filters", 1st edition, Tata Mc Graw Hill, 2017

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply FFT algorithms for DFT computations	Apply
CO2	Design digital IIR filters using various methods	Apply
CO3	Examine the characteristics of FIR filters based on windowingtechniques	Analyze
CO4	Analyze the effect of finite word length and sampling rate conversion	Analyze
CO5	Implement multi-rate signalprocessing using TMS320C50 processor	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	-	-	2	2	2	-	-	-	2
CO2	3	2	2	3	2	-	-	2	2	2	-	-	-	2
CO3	3	3	2	3	2	-	-	2	2	2	-	-	-	2
CO4	3	3	2	3	2	-	-	2	2	2	-	-	-	2
CO5	3	2	2	3	2	-	-	2	2	2	-	-	-	2
CO	3	2.4	2	3	2	-	-	2	2	2	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER IV

		Category: ES			
U19EC405	OBJECT ORIENTED PROGRAMMING AND ADVANCED DATA STRUCTURES	L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Data Structures in C

COURSE OBJECTIVES:

- To learn basics of Object Oriented Programming concepts and characteristics of Java
- To understand the Exceptions and use I/O streams
- To learn the usage of hierarchical data structures, Graphs and its applications.

UNIT I OOP AND JAVA FUNDAMENTALS 6

Object Oriented Programming – abstraction – objects and classes – encapsulation – inheritance – polymorphism – OOP in Java – Characteristics of Java – The Java Environment – Java Source File – Structure – Compilation – Fundamental Programming Structures in Java – Defining classes in Java – constructors – methods – access specifiers – static members – Comments – Data Types – Variables – Operators – Control Flow – Arrays – Packages – JavaDoc comments

UNIT II INHERITANCE AND INTERFACES 6

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

UNIT III EXCEPTION HANDLING AND I/O 6

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

UNIT IV HIERARCHICAL DATA STRUCTURES 6

AVL Trees – AVL Tree Rotation – BTree – B+ Tree – Heap – Applications of heap

UNIT V GRAPHS 6

Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs

LIST OF EXPERIMENTS

1. Program to implement Operators, Flow Controls concepts
2. Program to implement Classes, Constructors, Overloading and access control
3. Program using Nested & Inner Classes, Static and Final
4. Program using File Streams and IO Streams
5. Program to implement Strings, String Buffer Concept
6. Program using Interfaces, Abstract Classes
7. Develop a Java application to generate telephone bill
8. Develop a java application to implement currency converter, distance converter, time converter using packages
9. Develop a java application for an employee payroll system
10. Program to implement AVL-Tree
11. Program to implement B-Tree
12. Program to implement Topological sort
13. Shortest path algorithm using Dijkstra

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

TEXT BOOKS:

1. Herbert Schildt, "Java The complete reference", 11th Edition, McGraw Hill Education, 2018
2. Mark allen Weiss,"Data Structures and Algorithm Analysis in JAVA", 3rd Edition, Pearson Publication, 2012

REFERENCES:

1. Cay S. Horstmann, Gary cornell, "Core Java Volume – I Fundamentals", 9th Edition, Prentice Hall, 2013
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
4. S.Sridhar, "Design and Analysis of Algorithms", 1st Edition, Oxford University Press. 2014

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Develop Java programs using OOPs concept	Apply
CO2	Apply the concept of inheritance and interfaces for simple Java programs	Apply
CO3	Implement Java applications using exceptions and I/O streams	Apply
CO4	Demonstrate the various tree concepts	Understand
CO5	Solve real-life problems using graph structure algorithms	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	2	2	2	-	-	-	-
CO2	3	2	2	2	-	-	-	2	2	2	-	-	-	-
CO3	3	2	2	2	-	-	-	2	2	2	-	-	-	-
CO4	2	-	-	2	-	-	-	2	2	2	-	-	-	-
CO5	3	2	2	2	-	-	-	2	2	2	-	-	-	-
CO	2.8	2	2	2	-	-	-	2	2	2	-	-	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER IV

		Category: PC			
U19EC406	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Digital Electronics

COURSE OBJECTIVES:

- To study the basic operations using 8086 microprocessor
- To understand the string and manipulation operations using 8051 microcontroller
- To acquaint peripheral interfacing concepts using 8051 microcontroller

LIST OF EXPERIMENTS

I. 8086 Experiments

1. Implementation of ALU operations
2. Sorting an array in ascending and descending order
3. Computation of maximum and minimum marks in the database
4. String manipulations for an input stream

II. 8051 Experiments

1. Calculation of area and volume of an object
2. Signed number addition using 2's complement

III. Peripherals and Interfacing with 8051

1. Robotic arm control using stepper motor
2. Scrolling display using 8279
3. LED switch control using A/D interface
4. Waveform generation using D/A interface

IV. Mandatory mini-project

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply the fundamental concepts of 8086 microprocessor	Apply
CO2	Utilize 8086 microprocessor for string operations	Apply
CO3	Solve arithmetic problems using 8051 microcontroller	Apply
CO4	Examine different peripheral interfacing mechanisms with 8051 microcontroller	Analyze
CO5	Implement real time applications using 8051 microcontroller	Apply

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COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	-	-	-	2	2	2	-	2	2	-
CO2	3	2	2	3	-	-	-	2	2	2	-	2	2	-
CO3	3	2	2	3	-	-	-	2	2	2	-	2	2	-
CO4	3	3	2	3	-	-	-	2	2	2	-	2	2	-
CO5	3	2	2	3	-	-	-	2	2	2	-	2	2	-
CO	3	2.2	2	3	-	-	-	2	2	2	-	2	2	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER IV

		Category: EEC			
U19CA002	NUMERICAL APTITUDE AND VERBAL ABILITY – II	L	T	P	C
		1	0	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of number system, profit and loss and infer time, speed and distance
- To write sentences with appropriate grammatical structure in a professional context

UNIT I NUMBER SYSTEMS 3

Divisibility tests (Divisibility factor – Prime factor – Divisibility rules – Finding unit digit) – LCM & HCF (Listing multiples, Prime Factorization, Division method, etc.) – Number System (Numbers, Prime, Composite, Co-prime, numbers) – Percentage (Percentage – Fractions of percentages– Expenditure – Price – Consumption – Population – Depreciation)

UNIT II PROFIT AND LOSS 3

Profit, Loss & Discounts – (CP, SP, MP, Profit, Loss, Discount) – Ratio & Proportion (Compounded Ratio – Mean – Proportional – Componendo.– Dividendo – Directly proportional – Inversely proportional), Age problems (Various techniques to solve age problems)

UNIT III AVERAGES AND ALLIGATIONS 3

Averages (Simple average, weighted average) – Mixture and Alligations (Various techniques to solve mixtures and alligations) – Boats and streams (Downstream, upstream, average speed)

UNIT IV PERMUTATION AND COMBINATION 3

Time & work (Problems on time, work and effectively) – Permutations & combinations (Arrangements & selections, together and not together problems) – Probability (Coins, card, dice)Logarithms (Log function, common log, natural log, binary log, laws of logarithms) – Areas and volumes

UNIT V WRITING 3

Reading comprehension – Letter writing – Email writing – Creative writing – Resume building

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: – Periods Total: 15 Periods

TEXT BOOKS:

1. R S Aggarwal, "Quantitative Aptitude for Competitive Examinations", 17th Edition S Chand Publishing, New Delhi, 2017
2. R S Aggarwal, "Objective General English", S Chand Publishing, New Delhi, 2017

REFERENCES:

1. R S Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand Publishing, New Delhi, 2017
2. Abhijit Guha, "Quantitative Aptitude for Competitive Examination", McGraw Hill Education (India) Private Limited, 5th Edition, 2015
3. Arun Sharma, "How to prepare for Quantitative Aptitude for CAT", 8th edition McGraw Hill Education, Chennai, 2018

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Make use of permutation and combination for the task of arrangement	Apply
CO2	Choose appropriate words to draft letters, emails and notes	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	2	-	-	-	3	-	2	-	-
CO	-	-	-	-	-	2	-	-	-	3	-	2	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)						3: Substantial (High)		

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SEMESTER V

U19EC501	WEB TECHNOLOGIES	Category: ES			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Java Fundamentals

COURSE OBJECTIVES:

- To learn the basic concepts of World Wide Web (WWW)
- To understand technologies used to design web and client/server programming
- To acquaint with database and database connectivity

UNIT I WEB FUNDAMENTALS 6

Web essentials and basics of internet – History of internet and World Wide Web (WWW) – Web (2.0) – Technology reviews – Integrating with web services – Motivation and characteristics – Basic operational model – Core web services – Challenges – Building web service architecture

UNIT II TECHNOLOGIES FOR WEB DESIGN 6

Markup languages – HTML & XHTML – Basics – Headers – Linking – Images – Frames – Forms – Tables – CSS – Simple web page designs

UNIT III CLIENT–SIDE AND SERVER–SIDE PROGRAMMING 6

Introduction to Java script – Control statements – function – Basic java script programs – Server side programming basics – Java Servlets – Simple web based applications – Session

UNIT IV DATABASE CREATION 6

DBMS and RDBMS – Basics of Data Definition Language, DML, DCL&TCL, Databases Tables – Database normalization – Indexing in database – Joins – Triggers

UNIT V DATABASE CONNECTIVITY 6

Introduction to database, representing of Web data – Data base connectivity – SQL/MS – Access – Insert Select, Drop Alter, Primary Key, Count & Sum Distinct, Update & Delete – Dynamic web pages – Building web applications – Cookies

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

LIST OF EXPERIMENTS:

1. Create a XHTML document for the college website with Text styling, Linking, Images, Lists, Tableby highlighting the facilities in the department.
2. Create an XHTML document for an online Bookstore that has a Registration form with text box,Radio Button, Selection box, Checkbox, Submit and reset buttons.
3. Design a web page using CSS which includes the following:
   a) Use different font styles
   b) Set background image for both the page and single elements on page
   c) Control the repetition of image with background–repeat property
4. Write a java script to validate the following fields in a registration page
   a) Name (should contains alphabets and the length should not be less than 6 characters)
   b) Password (should not be less than 6 characters)
   c) E–mail (should not contain invalid addresses)

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5. Write a JavaScript function to get nth largest element from an unsorted array
6. Create a web page with real time clock using Java script event handling mechanism
7. Creation and Modification of Tables using Oracle and DB2
8. Simple SQL Queries in DB2
9. Creation and usage of other database objects in Oracl
10. Creation of Procedures and functions using Oracle and DB2
11. Create a Webpage to handle Events and Objects using Java Script
12. Develop a Java program to connect to database using JDBC Drivers
13. Create a relational Database and display the concurred data's from two tables in a web page
14.BookMyShow : Movie ticket booking application

TEXT BOOKS:

1. Deitel and Deitel, "Internet and World Wide Web How to program", 4th edition, Prentice Hall of India, 2007
2. Silberschatz, Korth, Sudarshan, "Database System Concept", 5th edition, Tata McGrawHill, 2006

REFERENCES:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno and Vijay Machiraju, "Web services", 1st edition, Springer International Edition, 2009
2. Nilesh Sha, "Database Systems using Oracle", 2nd edition, Prentice Hall of India, 2007
3. Paul J.Deitel and Harvey M.Deitel, "AJAX, Rich Internet Applications, and Web Development for Programmers", 1st edition,, Pearson Education, 2009
4. S.Sridhar, "Design and Analysis of Algorithms", 1st edition,, Oxford University Press, 2014

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the working principle of internet applications	Understand
CO2	Apply the concepts of HTML for webpage creation	Apply
CO3	Implement web application for JavaScript	Apply
CO4	Develop a database system with SQL	Apply
CO5	Examine the performance of web applications using database connectivity	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	2	2	2	-	-	-	-
CO2	3	2	2	2	-	-	-	2	2	2	-	-	-	-
CO3	3	2	2	2	-	-	-	2	2	2	-	-	-	-
CO4	3	2	2	2	-	-	-	2	2	2	-	-	-	-
CO5	3	3	2	2	-	-	-	2	2	2	-	-	-	-
CO	2.8	2.2	2	2	-	-	-	2	2	2	-	-	-	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)				

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SEMESTER V

U19EC502	DIGITAL COMMUNICATION	Category: PC			
		L	T	P	C
		2	0	0	2

PRE–REQUISITES:

- Analog Communication

COURSE OBJECTIVES:

- To study the principles of waveform coding schemes and channel coding
- To learn various baseband transmission schemes
- To understand the various band pass signaling schemes

UNIT I INFORMATION THEORY 6

Discrete memory less source, Entropy, Mutual information, channel capacity – Hartley-Shannon law – Source coding theorem – Shannon-Fano and Huffman coding

UNIT II WAVEFORM CODING AND REPRESENTATION 6

Elements of digital communication system – PCM –DPCM – ADPCM – Delta modulation – ADM – Linear predictive coding – Simulation of Line coding

UNIT III BASEBAND TRANSMISSION AND RECEPTION 6

Inter Symbol Interference – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding – Eye pattern – Receiving filters – Matched filter – Correlation receiver

UNIT IV DIGITAL MODULATION SCHEME 6

Geometric representation of signals – Generation and detection of ASK, FSK, PSK, QPSK, QAM – Carrier synchronization

UNIT V ERROR CONTROL CODING 6

Channel coding theorem – Linear block codes – Hamming codes – Simulation of cyclic codes – Convolutional codes – Viterbi decoder

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: – Periods Total: 30 Periods

TEXT BOOKS:

1. S. Haykin, "Digital Communications", 4th edition, John Wiley, 2016
2. John G. Proakis, "Digital Communication", 5th edition, Tata Mc Graw Hill, 2018

REFERENCES:

1. B. Sklar, "Digital Communication Fundamentals and Applications", 2nd edition, Pearson Education, 2014
2. B. P. Lathi, "Modern Digital and Analog Communication Systems", 3rd edition, Oxford University Press, 2017
3. Dennis Silage, "Digital Communication systems using MATLAB and Simulink", 2nd edition, Bookstand Publishing, 2009
4. John G. Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2nd edition, Pearson Education, 2014

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Examine the performance of different source coding techniques	Analyze
CO2	Summarize the various waveform coding concepts	Understand
CO3	Compare the performances of various pulse shaping and signaling methods	Understand
CO4	Illustrate different digital modulation and demodulation techniques	Understand
CO5	Implement error detection and correction using error control coding techniques	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO2	2	1	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	2	2	-	2	-	-	-	-	-	-	-	-	3
CO	2.4	1.6	2	-	2	-	-	-	-	-	-	-	-	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER V

		Category: PC			
U19EC503	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Engineering Mathematics

COURSE OBJECTIVES:

- To comprehend the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems
- To understand various methods for the state variable analysis

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Components of control system – Open loop and closed loop – Mathematical models of electrical and mechanical systems – Electrical analogous of mechanical systems – Block diagram reduction – Signal flow graph

UNIT II TIME RESPONSE ANALYSIS 9

Transient response – Steady state response – Time response of the standard first order and second order system for unit step input – Basics of time domain specifications – Steady state error and error constant – Analytical design and simulation of PD, PI, PID controllers

UNIT III STABILITY ANALYSIS 9

Concepts of stability – Necessary conditions for stability – Routh Hurwitz criterion – Root locus– Construction of root loci – Nyquist stability criterion

UNIT IV FREQUENCY RESPONSE AND COMPENSATOR DESIGN 9

Frequency domain specification of standard second order system – Bode plot – Polar plot – Design of compensators using Bode plots – Cascade compensation – lead, lag, lag–lead compensation – Simulation of lead, lag compensators

UNIT V STATE VARIABLE ANALYSIS 9

State space model – Representation using physical and phase variable – Conversion between state variable models and transfer functions – Solution of state equations – State space representation using canonical variables – Concepts of controllability and observability – Kalman's and Gilbert's Test

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. J.Nagrath and M.Gopal, "Control System Engineering", 6th edition, New Age International, 2011
2. K. Ogata, "Modern Control Engineering", 5th edition, Prentice Hall of India, 2012

REFERENCES:

1. M.Gopal, "Control System – Principles and Design", 4th edition, Tata McGraw Hill, 2012
2. R. Anandha Natarajan and B. Ramesh Babu "Control System Engineering", 3rd edition, Scitech Publication, 2015
3. Smarajit Ghosh, "Control Systems Theory and Applications", 2nd edition, Pearson Education, New Delhi, 2013
4. S.K.Bhattacharya, "Control System Engineering", 3rd edition, Pearson, 2013

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Compute the transfer function models for dynamical systems	Understand
CO2	Calculate various time domain parameters of first and second order systems	Apply
CO3	Examine the stability of control systems using various techniques	Analyze
CO4	Design compensator using different frequency response plots	Apply
CO5	Model the control system using state variables	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	-	2	-	-	-	-	-	-	2	1	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	1	-
CO4	3	2	2	-	2	-	-	-	-	-	-	2	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	2	1	-
CO	2.8	2	2	-	2	-	-	-	-	-	-	2	1	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER V

U19EC504	TRANSMISSION LINES AND ANTENNAS	Category: PC			
		L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- Electromagnetic Fields and Waveguides

COURSE OBJECTIVES:

- To learn the concept of transmission lines and signal propagation at radio frequencies
- To solve real time impedance matching problems using Smith chart
- To understand the radiation characteristics of different types of antennas

UNIT I TRANSMISSION LINE THEORY **9 + 3**

General solution of transmission lines – The infinite line – Input and transfer impedance – Open and short circuited lines – High frequency transmission lines – Line of zero dissipation – Voltage and current equations – Open and short circuit impedance – Standing waves

UNIT II IMPEDANCE MATCHING IN HIGH FREQUENCY LINES **9 + 3**

Impedance matching – Quarter wave transformer – Impedance matching by stubs – Single stub matching – Double stub matching – Smith chart and its applications – Problems based on Smith chart

UNIT III FUNDAMENTALS OF RADIATION **9 + 3**

Antenna parameters – Radiation pattern, gain, directivity, effective aperture, radiation resistance, beam width, bandwidth, input impedance – Radiation from short dipole – Half wave dipole – Folded dipole – Yagi-Uda antenna – Wire antenna design using simulation tool

UNIT IV ANTENNA ARRAYS AND APERTURE ANTENNAS **9 + 3**

Uniform linear array – N element linear array – Broadside and end fire array – Binomial arrays – Pattern multiplication – Horn antenna – Reflector antenna – Aperture blockage, feeding structures – Slot antenna – Micro strip antenna – Patch antenna design using simulation tool

UNIT V SPECIAL ANTENNAS **9 + 3**

Principle of frequency independent antennas – Spiral antenna – Helical antenna – Log–periodic antenna – Modern antennas – Reconfigurable antenna, 5G antenna – Antenna measurements

Contact Periods:

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

TEXT BOOKS:

1. John D Ryder, "Networks, lines and fields", 2nd edition, Pearson Education India, 2017
2. John D Kraus, "Antennas and Wave Propagation", 4th edition, Mc Graw Hill, 2017

REFERENCES:

1. Edward C.Jordan and Keith G.Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition, Pearson Education, 2015
2. Constantine.A.Balanis, "Antenna Theory Analysis and Design", 4th edition, Wiley, 2016
3. K. D. Prasad, "Antenna and Wave Propagation", 3rd edition, Satya Prakashan, 2016
4. Drabowitch., "Modern Antennas", 2nd edition, Springer Publications, 2007

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the characteristics of different types of transmission lines	Understand
CO2	Solve impedance matching issues in high frequency transmission lines	Apply
CO3	Summarize different antenna parameters and radiation patterns of wire antennas	Understand
CO4	Select suitable antenna arrays / aperture antennas for specific design	Apply
CO5	Illustrate the characteristics of special antennas	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO4	3	2	2	-	2	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO	3	2	2	-	2	-	-	-	-	-	-	-	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER V

U19EC505	ANALOG AND DIGITAL COMMUNICATION LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Analog and Digital Communication

COURSE OBJECTIVES:

- To implement amplitude and frequency modulation techniques
- To understand waveform encoding schemes and time division multiplexing
- To simulate various digital modulation techniques and error control coding scheme

LIST OF EXPERIMENTS

I. HARDWARE EXPERIMENTS

1. Signal sampling and reconstruction
2. Generation and detection of AM
3. Generation and detection of FM
4. Pulse width modulation
5. Pulse code modulation and demodulation
6. Delta modulation and adaptive delta modulation

II. SIMULATION EXPERIMENTS

1. Line coding schemes
2. Generation of ASK and FSK
3. Generation and signal constellations of BPSK and QPSK
4. Error control coding scheme – Linear block codes

III. MANDATORY MINIPROJECT

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Construct modulator and demodulator circuits for AM and FM schemes	Apply
CO2	Implement digital transmission techniques using sampling	Apply
CO3	Experiment with various waveform coding schemes	Apply
CO4	Compare various types of digital modulation techniques	Understand
CO5	Examine errors in digital transmission using error control coding techniques	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	2	2	2	-	2	-	3
CO2	3	2	-	3	-	-	-	2	2	2	-	2	-	3
CO3	3	2	-	3	-	-	-	2	2	2	-	2	-	3
CO4	2	1	-	3	3	-	-	2	2	2	-	2	-	3
CO5	3	3	-	3	3	-	-	2	2	2	-	2	-	3
CO	2.8	2	-	3	3	-	-	2	2	2	-	2	-	3
Correlation levels:		1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)						

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SEMESTER V

U19EC506	RF AND ANTENNA DESIGN LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Electromagnetic Fields and Waveguides

COURSE OBJECTIVES:

- To study the characteristics of RF filters, couplers and isolators
- To measure various antenna parameters such as radiation pattern, gain, directivity, beam width and polarization
- To design modern antennas using EM simulation tools

LIST OF EXPERIMENTS

I. HARDWARE EXPERIMENTS

1. Measurement of radiation pattern of horn antenna
2. Measurement of radiation pattern of parabolic reflector antenna
3. Characteristics of RF low pass filter
4. Characteristics of RF high pass filter

II. SIMULATION EXPERIMENTS

5. Measurement of antenna parameters of dipole antenna
6. Parametric analysis of helical and slot antenna using time domain solver
7. Parametric analysis of array antenna using frequency domain solver
8. Design of couplers and isolators for RF systems
9. Design of microstrip antenna for Wi–Fi application
10. Design of 5G antennas for base station application

III. MANDATORY MINIPROJECT

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Demonstrate the radiation pattern of horn and parabolic reflector antennas	Understand
CO2	Analyze the behavior of RF filters for various cut off frequencies	Analyze
CO3	Determine the radiation pattern of wired, planar and array antennas	Apply
CO4	Examine the return loss and isolation of RF couplers and isolators	Analyze
CO5	Implement various applications using real time antennas	Apply

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COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	3	-	-	-	2	2	2	-	2	-	3
CO2	3	3	2	3	-	-	-	2	2	2	-	2	-	3
CO3	3	2	2	3	3	-	-	2	2	2	-	2	-	3
CO4	3	3	2	3	3	-	-	2	2	2	-	2	-	3
CO5	3	2	2	3	3	-	-	2	2	2	-	2	-	3
CO	2.8	2.5	2	3	3	-	-	2	2	2	-	2	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER V

U19EC507	TECHNICAL SEMINAR	Category: EEC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To interpret the technical information related to electronics and allied domains
- To acquire communication and presentation skills
- To foster teamwork and collaboration with fellow participants

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Develop domain-specific knowledge in emerging technologies through independent and collaborative learning	Understand
CO2	Demonstrate the ethical considerations and responsibilities in the context of the technical area of study	Understand
CO3	Explain the technical content through effective presentation and communication skills	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	3	1	-	2	2	2
CO2	1	-	-	-	-	1	1	3	-	1	-	2	2	2
CO3	2	-	-	-	1	-	-	-	1	3	-	2	2	2
CO	2	3	-	-	1	1	1	3	2	1.67	-	2	2	2
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

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SEMESTER VI

U19EC601	VLSI DESIGN	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Electronics and VHDL

COURSE OBJECTIVES:

- To understand the IC fabrication techniques and low power logic circuits
- To design sequential logic circuits
- To learn various arithmetic circuits and testing methodologies

UNIT I MOS TRANSISTOR THEORY 9

Basic MOS transistors – I-V, C-V characteristics, DC transfer characteristics, Non ideal I-V effects – Fabrication of CMOS Integrated Circuits – Stick diagram – Layout design rules

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Circuit families – Static CMOS, ratioed circuits, CVSL, dynamic circuits, pass transistors, transmission gates – Delay estimation – Logical efforts and transistor sizing – Power dissipation – Scaling – Low power logic design

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Timing metrics – Static latches and registers – Dynamic latches and registers – Pipelining – Array subsystems – SRAM, DRAM, CAM and PLA

UNIT IV ARITHMETIC BUILDING BLOCKS 9

Data path subsystems – Manchester carry chain adder – 4-bit adder – Array multiplier – Modified Booth multiplier, Wallace tree multiplier – Barrel and logarithmic shifters – Power and speed trade off – Case study

UNIT V PROGRAMMABLE ASIC 9

ASIC Design flow – Types of ASICs – Full custom – Standard cell-based ASICs – Gate array based ASIC – FPGA – Programmable ASIC – Anti fuse, SRAM, EPROM, EEPROM technology – Programmable ASIC logic cells – Xilinx3000 CLB, Xilinx4000 logic block

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. N. E. Weste, David Harris, Ayan Banerjee, "Principles of CMOS VLSI Design, A Circuits and System Perspective", 3rd edition, Pearson, 2012
2. Jan Rabaey, Anantha Chandrakasan, B. Nikolic, "Digital Integrated circuits: A Design Perspective", 2nd edition, Pearson, 2019

REFERENCES:

1. Pucknell, Kamran Eshraghian, "Basic VLSI Design", 3rd edition, Prentice Hall of India, 2008
2. M.J. Smith, "Application Specific Integrated Circuits", 1st edition, Addison Wesley, 1997
3. R.Jacob Baker, Harry W.LI., David E. Boyee, "CMOS Circuit Design, Layout and Simulation", 1st edition, Prentice Hall of India, 2005
4. Wayne Wolf, "Modern VLSI Design: System on Chip", 1st edition, Pearson Education, 2007

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Design the layout of given circuit using stick diagram	Apply
CO2	Illustrate the performance of combinational logic circuit families	Understand
CO3	Summarize the time metrics and array subsystems of sequential logic circuits	Understand
CO4	Construct the optimized subsystem for the given application	Apply
CO5	Compare and contrast various FPGA architectures	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	3
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
O4	3	2	1	-	-	-	-	-	-	-	-	-	-	3
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO	2.4	1.5	1	-	-	-	-	-	-	-	-	-	-	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER VI

U19EC602	COMPUTER NETWORKS	Category: PC			
		L	T	P	C
		3	0	2	4

PRE–REQUISITES:

- Communication Fundamentals

COURSE OBJECTIVES:

- To study about the functionality of each layer
- To understand with routing protocols and quality of service
- To learn the application layer protocols with network security

UNIT I FUNDAMENTALS OF DATA COMMUNICATION 9

Overview of Data Communications – Network types – Protocol Layering – OSI Model – Physical Layer – Data Link Layer – Link layer Addressing – Error detection and correction – CRC, Parity, Check sum

UNIT II MAC AND NETWORK LAYER PROTOCOLS 9

Random access – ALOHA, CSMA – Controlled access – Ethernet (802.3) – Wireless LANs – Bluetooth – Wi-Fi – Network layer services – Packet Switching – IPV4 Address – Network layer Protocols – IP, ICMP, Mobile IP – I2C, SPI – Wireshark

UNIT III ROUTING ALGORITHMS 9

Routing algorithms – Unicast routing protocols – Multicast routing – Intra-domain protocols and Inter-domain protocols – IPv6 addressing – Transition from IPv4 to IPv6

UNIT IV TRANSPORT LAYER 9

Introduction to transport layer protocols – User Datagram Protocols (UDP), Transmission Control Protocols (TCP), Services, Features, TCP Connection, State Transition Diagram, Flow, Error and Congestion Control – QoS

UNIT V APPLICATION LAYER 9

Application layer paradigms – World Wide Web and HTTP – FTP – DNS – Electronic mail – SMTP, POP3, IMAP – Fundamentals of cryptography and network security – Firewalls

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 30 Periods Total: 75 Periods

LIST OF EXPERIMENTS:

1. Network topology - Star, Bus, and Ring
2. Error Detection / Error Correction Techniques
3. CSMA/CD and CSMA/CA protocols
4. High Level Data Link Control
5. IP address configuration and execution of IP commands
6. Distance vector routing algorithm
7. Link state routing algorithm
8. Stop and wait and sliding window protocols
9. Go-back-N and selective repeat protocols
10. TCP congestion control algorithm
11. Data Encryption and decryption

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TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communication and Networking", 5th edition, Tata McGraw-Hill, 2017.
2. William Stallings, "Data and Computer Communication", 10th edition, Pearson Education, 2018

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", 7th edition, Pearson Education, 2016
2. Nader.F.Mir, "Computer and communication networks", 2nd edition, Pearson, 2015
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", 3rd edition, Mc Graw Hill, 2011
4. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th edition, Morgan Kaufmann, 2011

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Experiment with various communication network topology	Apply
CO2	Implement network layer protocols using media access and internetworking concepts	Apply
CO3	Apply the suitable routing algorithms for given network	Apply
CO4	Utilize the transport layer protocols for error and congestion control	Apply
CO5	Illustrate the principles of different application layer protocols	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	2	-	-	2	2	2	-	-	-	1
CO2	3	2	1	3	2	-	-	2	2	2	-	-	-	1
CO3	3	2	1	3	2	-	-	2	2	2	-	-	-	1
CO4	3	2	1	3	2	-	-	2	2	2	-	-	-	1
CO5	2	-	-	3	-	-	-	2	2	2	-	-	-	1
CO	2.8	2	1	3	2	-	-	2	2	2	-	-	-	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER VI

		Category: PC			
U19EC603	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Microprocessor and Microcontroller

COURSE OBJECTIVES:

- To study the embedded computing design and analysis
- To learn the architecture and programming of PIC microcontroller and ARM processor
- To understand the basic concepts of various peripheral interfaces and networking concepts

UNIT I FUNDAMENTALS OF EMBEDDED SYSTEM DESIGN 9

Introduction – Embedded system design process – Requirement analysis, specifications, system analysis and architecture design – Design example – Model train controller – Quality assurance techniques

UNIT II PIC MICROCONTROLLER 9

Overview of PIC family – Architecture – Addressing modes – Instruction set – Assembly language programming – PIC programming in C

UNIT III ARM PROCESSOR 9

Introduction – ARM architecture – ARM programming using C – ARM instruction set – LPC 2148 – Salient features, applications, block diagram – Peripheral interfacing – Timers / counters, ADC / DAC, memory, sensors, display devices

UNIT IV DISTRIBUTED EMBEDDED SYSTEMS 9

Multiprocessors – Categories of multiprocessors – CAN bus – I2C bus – Ethernet – Internet – MPSoCs and shared memory multiprocessors – Accelerators and its performance analysis

UNIT V OPERATING SYSTEM AND CASE STUDIES USING ARM 9

Real time operating systems – POSIX-Windows CE – Digital still camera – Home automation – Health monitoring system – Notice board display – Gas leakage detection

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd edition, Morgan Kaufmann (An imprint from Elsevier), 2012
2. Muhammad Ali Mazidi, Rolin D. McKinlay, Danny Causey, "PIC Microcontroller and Embedded Systems", 2nd edition, Pearson Education, 2008

REFERENCES:

1. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", Morgan Kaufmann Publisher (An imprint from Elsevier), 2004
2. Steve Furber, "ARM System-on-Chip Architecture", 2nd edition, Pearson Education, 2009
3. Raj Kamal, "Embedded Systems Architecture, Programming and Design", Original edition, McGraw-Hill Higher Education, 2011
4. T. Bansod, Pratik Tawde, "Microcontroller Programming (8051, PIC, ARM7 ARM Cortex)", Original edition, Shroff Publishers & Distributors Pvt. Ltd, 2017

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the fundamental concepts of embedded computing system	Understand
CO2	Interpret the architecture, addressing modes and instruction sets of PIC microcontroller with basic programming	Understand
CO3	Outline the architecture of ARM processor and build programs for interfacing peripheral devices with the processor	Apply
CO4	Summarize the concepts of distributed embedded systems	Understand
CO5	Develop real time applications using ARM processor	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	2	3	-
CO3	3	2	1	-	-	-	-	-	-	-	-	2	3	-
CO4	3	1	-	-	-	-	-	-	-	-	-	2	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	2	3	-
CO	3	1.8	1.33	-	-	-	-	-	-	-	-	2	3	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER VI

U19EC604	EMBEDDED SYSTEMS LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Microprocessor and Microcontroller

COURSE OBJECTIVES:

- To understand the working of ARM processor
- To write programs to interface the peripheral devices with ARM processor
- To learn the concept of serial communication

LIST OF EXPERIMENTS

Study on KEIL and Proteus software

I. Using LPC2148 and MSP430

1. Interfacing LED to toggle at equal time delay
2. Interface an LED circuit to vary the intensity by varying the duty cycle to 50%, 75% and 100%
3. Measurement of room temperature using LM35

II. Using LPC2148

1. Display a character in a 16x2 LCD
2. Stepper motor to rotate in clockwise and anti-clockwise direction
3. Display a character using serial port
4. Interfacing ADC and DAC
5. Real Time Clock
6. Gas monitoring system
7. Smart power saving system for home automation

III. MANDATORY MINIPROJECT

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Construct LED based running display with brightness control	Apply
CO2	Develop a system for room temperature measurement	Apply
CO3	Apply the principle of ADC / DAC for stepper motor control	Apply
CO4	Utilize serial port for data transmission and reception	Apply
CO5	Implement the real-world applications using embedded systems	Apply

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COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	-	-	2	2	2	-	2	3	-
CO2	3	2	2	3	3	-	-	2	2	2	-	2	3	-
CO3	3	2	2	3	3	-	-	2	2	2	-	2	3	-
CO4	3	2	2	3	3	-	-	2	2	2	-	2	3	-
CO5	3	2	2	3	3	-	-	2	2	2	-	2	3	-
CO	3	2	2	3	3	-	-	2	2	2	-	2	3	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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KPRIET

SEMESTER VI

U19EC605	VLSI DESIGN LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- VLSI Design

COURSE OBJECTIVES:

- To study Hardware Descriptive Language tool (Verilog/VHDL)
- To learn the fundamental principles of circuit design and FPGA implementation
- To understand the Electronic Design Automation platforms

LIST OF EXPERIMENTS

I. Simulation and Implementation in FPGA

1. Design and implementation of combinational circuits
2. Design and implementation of sequential circuits
3. Design and implementation of 4-bit ALU
4. FSM design and implementation

II. Schematic design using backend tool

1. Simulation of inverter using CMOS logic
2. Simulation of basic gates using CMOS logic
3. Simulation of combinational circuits using CMOS logic
4. Simulation of flip-flops using CMOS logic
5. Simulation of shift register using CMOS logic

III. Design and synthesis of traffic light controller using Backend tool

IV. Mandatory Mini Project

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Develop HDL code for combinational and sequential circuits	Apply
CO2	Implement logic modules using FPGA board	Apply
CO3	Design CMOS Logic circuits using electronic design automation tools	Apply
CO4	Experiment with schematics of sequential and combinational circuits	Apply
CO5	Construct a traffic light controller using backend tool	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	-	-	2	2	2	-	2	-	3
CO2	3	2	2	3	3	-	-	2	2	2	-	2	-	3
CO3	3	2	2	3	3	-	-	2	2	2	-	2	-	3
CO4	3	2	2	3	3	-	-	2	2	2	-	2	-	3
CO5	3	2	2	3	3	-	-	2	2	2	-	2	-	3
CO	3	2	2	3	3	-	-	2	2	2	-	2	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER VI

U19EC606	MINI PROJECT - I	Category: EEC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To identify the real life problems and to design solutions using the concepts of electronics and communication engineering
- To develop communication skills to work in a collaborative environment
- To demonstrate ethical and professional attributes

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply the acquired knowledge of electronic and communication for project development	Apply
CO2	Identify and analyze the technical aspects of the chosen project with a comprehensive and systematic approach	Analyze
CO3	Develop electronic based prototype model as a team to provide solutions for societal needs	Create
CO4	Demonstrate the project model with ethical and professional practices	Apply
CO5	Prepare the technical report related to project findings	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	3	3	-	1	-	-	-	3	3
CO2	3	3	2	2	-	3	3	-	1	-	-	2	3	3
CO3	-	-	3	3	3	3	3	-	3	-	-	2	3	3
CO4	-	-	-	-	-	-	-	3	3	3	3	2	3	3
CO5	-	-	-	-	-	-	-	2	3	2	2	-	3	3
CO	3	3	2.5	2.5	3	3	3	2.5	2.5	2.5	2.5	2	3	3

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMESTER VII

U19EC701	OPTICAL AND MICROWAVE ENGINEERING	Category: PC			
		L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- Transmission Lines and Waveguides

COURSE OBJECTIVES:

- To learn about optical fiber sources and transmission techniques
- To study the different microwave active and passive components
- To understand the basic principles in microwave system design

UNIT I FUNDAMENTALS OF OPTICAL FIBER SYSTEM 9+3

Element of an optical fiber system Basic laws and definitions – Total internal reflection, Acceptance angle, Numerical aperture, Ray optics representation – Types of optical fiber – Single mode step index fiber, Single mode graded index fiber, Multi–mode step index fiber, Multi–mode graded index fiber

UNIT II FIBER OPTICAL SOURCES AND RECEIVERS 9+3

Light source – LED structures – Modulation of a LED – Types of LED – LED power and quantum efficiency – LASER diodes – Modes and threshold condition, External quantum efficiency – Fundamental receiver operation – Photo diode – PIN diodes – Error sources – Probability of error, Quantum limit

UNIT III PASSIVE AND ACTIVE MICROWAVE DEVICES 9+3

Microwave passive components – Attenuator, Isolator, Dielectric phase shifter, Directional Couplers, E plane Tee, H plane Tee, Magic Tee – Microwave active devices – Schottky barrier diodes, IMPATT diode, BARITT diode

UNIT IV MICROWAVE SOURCE 9+3

Microwave tubes – Two–cavity Klystron amplifier – Mechanism of oscillation, Mode of oscillation, Power output and efficiency – Cylindrical magnetron – resonant modes, Mechanism of oscillation – Construction and operation – Reflex Klystron oscillator, Traveling wave tube amplifier, Gunn oscillator

UNIT V MICROWAVE DESIGN PRINCIPLES 9+3

Quarterwave impedance transformers – Microstrip line impedance matching – Microwave filter design by insertion loss method – Single stage microwave transistor amplifier design – Microwave power amplifier design – Low noise amplifier design

Contact Periods:

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

TEXT BOOKS:

1. Gerd Keiser, "Optical Fiber Communication", 5th edition, McGraw Hill Publishing Company Ltd, India, 2017
2. David M. Pozar, "Microwave Engineering", 4th edition, John Wiley and Sons, India, 2012

REFERENCES:

1. John M. Senior, "Optical Fiber Communication", 3rd edition, Pearson Education, India, 2010
2. Annapurna Das and Sisir K Das, "Microwave Engineering", 4th edition, McGraw Hill Publishing Company Ltd, India, 2020

3. Robert. E. Collin, "Foundations for Microwave Engineering", 2nd edition, John Wiley and Sons, India, 2005
4. Michael Steer, " Microwave and RF Design, Volume 5: Amplifiers and Oscillators", 3nd edition, University of North Carolina Press, 2019

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the basic principles of ray optics and optical fiber configurations	Understand
CO2	Illustrate the operation of fiber optic sources and receivers	Understand
CO3	Interpret the working of passive and active microwave devices	Understand
CO4	Select suitable microwave source for high frequency communication	Apply
CO5	Apply microwave design principles to design microwave filters, low-noise and high-power microwave amplifiers	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	2
CO	3	2	1	-	-	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER VII

U19EC702	WIRELESS COMMUNICATION	Category: PC			
		L	T	P	C
		3	0	2	4

PRE–REQUISITES:

- Analog and digital communication

COURSE OBJECTIVES:

- To learn the characteristics of wireless channels and digital signaling techniques
- To understand the design of a cellular system
- To study multipath mitigation and smart antenna techniques

UNIT I CELLULAR ARCHITECTURE 9

Multiple Access techniques – FDMA, TDMA, CDMA – Capacity calculations – Cellular concept – Frequency reuse – Channel assignment – Hand off strategies – Interference and system capacity – Trunking and grade of service – Coverage and capacity improvement

UNIT II MOBILE RADIO PROPAGATION 9

Free space propagation and two–ray models – Link budget design – Outdoor propagation models – Indoor propagation models – Small scale fading – Parameters of mobile multipath channels – Time dispersion parameters – Coherence bandwidth – Doppler spread and coherence time – Types of small scale fading

UNIT III DIGITAL MODULATION TECHNIQUES FOR FADING CHANNELS 9

Structure of a wireless communication link – Principles – Offset QPSK , π/4 QPSK , 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 – Linear and non–linear equalization – Adaptive equalization – Zero forcing algorithm , LMS algorithms – Diversity techniques – Micro and macro diversity, diversity combining techniques – Error probability in fading channels with diversity reception – Rake receiver

UNIT V MULTIPLE ANTENNA TECHNIQUES 9

Antennas for mobile stations – MIMO systems – Array gain and diversity – 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: Periods Practical: 30 Periods Total: 75 Periods

LIST OF EXPERIMENTS:

Simulation of

1. Frequency Division Multiple Access (FDMA)
2. Code Division Multiple Access (CDMA)
3. Time Division Multiple Access (TDMA)
4. Carrier to Noise ratio for wireless communication
5. Outdoor Propagation – Okumura and Hata Model
6. Error performance in fading channel
7. Generation and signal constellations of MSK
8. Orthogonal Frequency Division Multiplexing (OFDM)
9. Diversity reception using rake receiver
10. MIMO channel capacity

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TEXT BOOKS:

1. Rappaport T.S, "Wireless Communications", 2nd edition, Pearson Education, 2018
2. Andreas.F.Molisch, "Wireless Communications, 2nd edition, John Wiley, 2014

REFERENCES:

1. Andrea Goldsmith, "Wireless Communication", 2nd edition, Cambridge University Press, 2015
2. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", 1st edition, Cambridge University Press, 2005
3. Upena Dalal, "Wireless Communication", 1st edition, Oxford University Press, 2009
4. Van Nee.R and Ramji Prasad, "OFDM for Wireless Multimedia Communications", 1st edition, Artech House, 2000

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Implement different multiple access techniques and cellular concept for wireless communication	Apply
CO2	Simulate mobile radio propagation models	Apply
CO3	Apply the concepts of digital signaling schemes for fading channels	Apply
CO4	Select suitable equalization and diversity techniques for mitigation	Apply
CO5	Choose appropriate multiple antenna techniques for mobile communication	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	2	2	2	-	-	-	3
CO2	3	2	2	2	2	-	-	2	2	2	-	-	-	3
CO3	3	2	2	2	2	-	-	2	2	2	-	-	-	3
CO4	3	2	2	2	2	-	-	2	2	2	-	-	-	3
CO5	3	2	2	2	2	-	-	2	2	2	-	-	-	3
CO	3	2	2	2	2	-	-	2	2	2	-	-	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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SEMESTER VII

U19EC703	OPTICAL AND MICROWAVE ENGINEERING LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Optical and Microwave Engineering

COURSE OBJECTIVES:

- To learn the working principle of optical sources and detectors
- To analyze the characteristics and measurements in optical fiber and microwave devices
- To determine the scattering matrix parameters of various microwave passive devices

LIST OF EXPERIMENTS

I. OPTICAL EXPERIMENTS

1. Set–up of analog and digital optical link
2. DC characteristics of LED
3. VI and PI characteristics of PIN photo diode
4. Losses in optical fiber (1) attenuation (2) bending (3) coupling
5. Determination of numerical aperture in optical fibers

II. MICROWAVE EXPERIMENTS

1. Mode characteristics of Reflex klystron
2. VI characteristics of Gunn diode
3. Measurement of VSWR, frequency and wavelength using Reflex klystron
4. S–parameter analysis of E–plane Tee, H–plane Tee and Magic Tee
5. S–parameter analysis of directional coupler
6. Design of Isolator, Magic Tee and Circulator using simulation tool

III MANDATORY MINIPROJECT

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Design analog and digital link using optical fiber	Apply
CO2	Calculate the attenuation, bending and coupling losses in optical fibers	Apply
CO3	Experiment with optical and microwave devices for parameter estimation	Apply
CO4	Compute different parameters of microwave using Reflex klystron	Apply
CO5	Determine the S–parameters of microwave passive devices	Apply

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COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	2	2	2	-	-	-	3
CO2	3	2	1	2	-	-	-	2	2	2	-	-	-	3
CO3	3	2	1	2	-	-	-	2	2	2	-	-	-	3
CO4	3	2	1	2	-	-	-	2	2	2	-	-	-	3
CO5	3	2	1	2	-	-	-	2	2	2	-	-	-	3
CO	3	2	1	2	-	-	-	2	2	2	-	-	-	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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SEMESTER VIII

U19EC801	PROJECT WORK	Category: EEC			
		L	T	P	C
		0	0	20	10

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To identify the real life problems and to design solutions using the concepts of electronics and communication engineering
- To develop communication skills to work in a collaborative environment
- To demonstrate ethical and professional attributes

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Identify, interpret and formulate the problem statements with appropriate consideration of societal needs	Apply
CO2	Analyze complex electronics engineering problems and apply modern tools to get desired solution	Analyze
CO3	Design and develop an eco-friendly electronic system to serve the society	Create
CO4	Execute the project in a collaborative environment with ethical and professional attributes	Evaluate
CO5	Prepare documents and present the project clearly and coherently	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	3	3	-	2	-	-	2	3	3
CO2	-	3	3	-	3	2	2	-	2	-	-	2	3	3
CO3	-	-	3	3	2	3	3	-	2	-	-	1	3	3
CO4	-	-	3	3	-	-	-	3	3	3	3	2	3	3
CO5	-	-	-	-	-	-	-	-	3	3	2	2	3	3
CO	3	3	3	3	2.5	2.67	2.67	3	2.4	3	2.5	1.8	3	3

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE - I

U19ECP01	VERILOG PROGRAMMING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Electronics

COURSE OBJECTIVES:

- To learn various types of modeling techniques in Verilog HDL
- To understand logic synthesis in Verilog HDL
- To study the basic concept of system Verilog

UNIT I HIERARCHICAL MODELING CONCEPTS 9

Overview of digital design with Verilog HDL – Modules and ports – Gate level modeling – Dataflow modeling – Continuous assignments, delays, operators – Simulation of full adder and multiplexer using gate level and dataflow modelling

UNIT II BEHAVIORAL MODELING 9

Structured procedures – Procedural assignments – Timing controls – Conditional statements – Multiway branching – Loops – Sequential and parallel blocks – Generate blocks – Implementation of flip flops, shift registers and counters using ModelSim

UNIT III DELAYS AND SWITCH LEVEL MODELING 9

Types of delay models – Path delay modeling – Timing checks – Delay back annotation Switch modeling elements – Implementation of CMOS NAND, NOR, multiplexer, flip-flop – Power estimation using cadence

UNIT IV LOGIC SYNTHESIS 9

Verilog HDL synthesis – Synthesis design flow – Verification of the gate level netlist – Modeling tips for logic synthesis – Case study using Xilinx

UNIT V SYSTEM VERILOG 9

System Verilog variables – Structures – Union – Arrays – Tasks and functions – Design hierarchy – Module prototype, net aliasing – Interfaces

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd edition, Pearson Education, New Delhi, 2003
2. Stuart Sutherland, Simon Davidmann and Peter Flake, "System Verilog for Design:A Guide to Using System Verilog for Hardware Design and Modeling", 2nd edition, Springer, 2006

REFERENCES:

1. Cem Unsalan and Bora Tar,"Digital System Design with FPGA: Implementation using verilog andVHDL" 1st edition, Tata McGraw Hill, 2017
2. S.Brown and Z. Vranesic, "Fundamental of digital logic with verilog design", 3rd edition, Tata McGraw Hill, 2014
3. Chris Spear, "System Verilog for Verification: A Guide to Learning the Testbench LanguageFeatures", 3rd edition , Springer, 2012
4. Douglas A.Pucknell and Kamran Eshraghian, "Basic VLSI Design", 3rd edition, Prentice Hall ofIndia, 1995

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Compare gate level and dataflow modeling in Verilog HDL	Understand
CO2	Summarize various statements and blocks in behavioral modeling	Understand
CO3	Make use of simulation software for delays and switches level modeling	Apply
CO4	Examine the optimized gate level representation of real time applications	Analyze
CO5	Outline the concept of system Verilog and its functional elements	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	2	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	2	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	2	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	2	-	-	-	-	-	-	-	-	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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PROFESSIONAL ELECTIVE - I

U19ECP02	SENSORS AND TRANSDUCERS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Electronic Devices

COURSE OBJECTIVES:

- To understand basic concepts of measurement systems
- To learn different types of sensors and transducers
- To acquaint students with selection of sensors for particular field of applications

UNIT I BASICS OF MEASUREMENT SYSTEMS 9

Methods of measurement – Direct methods, Indirect methods – Instruments – Mechanical, electrical and electronic instruments – Modes of operation – Functions of instruments and measurement systems – Applications of measurement systems

UNIT II NON-ELECTRICAL TRANSDUCERS 9

Measurement of non-electrical quantities – Linear and rotary displacement using strain gauges, pressure, torque, vibration and temperature measurement – Measurement of flow, thickness and humidity

UNIT III ELECTRICAL TRANSDUCERS 9

Classification of electrical transducers – Primary and secondary transducers – Active and passive transducers – Analog and digital transducers – Resistive transducers – Potentiometer, thermistor – Inductive transducers – Capacitive transducer

UNIT IV DATA ACQUISITION SYSTEM 9

Components of analog and digital data acquisition systems – Uses of data acquisition systems – Use of recorders in digital systems – Digital recording systems – Input conditioning equipment, digitizer, multiplexer, programme pin board, linearizer – Digital clock

UNIT V APPLICATIONS OF SENSORS AND TRANSDUCERS 9

Assert management - Industrial automation, smart city applications - Sensors for bio-medical applications - Oxygen and carbon dioxide sensor for blood, heart sound sensor, blood flow sensor, respiration sensor

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Sawhney A.K., "A Course in Electrical and Electronic Measurement and Instrumentation", 7th edition, Dhanpat Rai & Co, 2010
2. Gaofeng Zhou, Yannian Wang and Lujun Cui., "Biomedical Sensor, Device and Measurement Systems", 1st edition, Intech open, 2015

REFERENCES:

1. Shantanu Bhattacharya, Avinash Kumar Agarwal., "Sensors for Automotive and Aerospace Applications", Original edition, Springer, 2019
2. Doebelin E.O., "Measurement Systems: Applications and Design", 4th edition, Tata McGraw Hill,2004
3. Cooper, "Electronic Instrumentation and Measurement Techniques", 3rd edition, PHI, 2007
4. Iansinclair, "Sensors and Transducers", 3rd edition, Newnes, 2009

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Infer the basic concepts of measurement system	Understand
CO2	Select suitable sensors for the measurements of non-electrical quantities	Apply
CO3	Classify electrical transducers based on applications	Understand
CO4	Implement data acquisition using appropriate sensors	Apply
CO5	Analyze the performance of various sensors for real time applications	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO	2.6	2.3	2	-	-	-	-	-	-	-	-	-	2	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE - I

U19ECP03	DIGITAL IMAGE PROCESSING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Signals processing

COURSE OBJECTIVES:

- To study the basic elements of image processing and image transforms
- To learn techniques for improving quality of information in spoilt images
- To introduce image segmentation for ROI, morphology for feature selection and compression for saving storage space in an image

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems – Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect – Colour models – RGB, HSI models – Image sampling and Quantization – 2D transforms – DFT, DCT, Haar transform, DWT – Demonstration of colour image conversion and image transforms using simulation tool

UNIT II IMAGE ENHANCEMENT 9

Fundamentals of spatial filtering – Histogram processing, equalization and specification techniques – Smoothing and sharpening spatial filters – Filtering in frequency domain – Homomorphic filtering – Simulation of histogram equalization for images

UNIT III IMAGE RESTORATION 9

Image Restoration – Noise models – Adaptive filter – Notch filter – Linear, Position – Invariant degradation – Inverse filtering – Wiener filtering – Constrained least square filtering

UNIT IV IMAGE SEGMENTATION AND MORPHOLOGY 9

Point, Line and Edge detection – Edge linking via Hough transform – Global and multivariable thresholding – Region based segmentation – Region growing, Region splitting and Merging – Morphological operations – Dilation, Erosion, Opening and Closing – Implementation of image segmentation and thresholding using simulation tool

UNIT V IMAGE COMPRESSION 9

Need for data compression – Huffman coding – Run length encoding – Arithmetic coding – Vector quantization – Transform coding – JPEG and MPEG standard

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 4th edition, Pearson Education, 2018
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Original edition, Pearson Education,2010

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Original edition, Pearson Education, 2010
2. Alan C. Bovik, "Handbook of image and Video Processing ", Original edition, Elsevier Academicpress, 2010
3. S.Sridhar, "Digital Image Processing" , Original edition, Oxford University press, 2011
4. Jayaraman S, Veerakumar T, Esakkirajan S, "Digital Image Processing", Original edition, TataMcGraw Hill, 2017

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the image fundamentals and image transform	Understand
CO2	Select appropriate preprocessing techniques for manipulation of images	Apply
CO3	Summarize various restoration techniques to recover the degraded image	Understand
CO4	Examine the image segmentation methods based on region of interest and morphological processing for feature selection	Analyze
CO5	Make use of various coding techniques for image compression	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	-	-	-	2	-	3
CO2	3	2	-	-	2	-	-	-	-	-	-	2	-	3
CO3	2	1	-	-	-	-	-	-	-	-	-	2	-	3
CO4	3	3	2	-	2	-	-	-	-	-	-	2	-	3
CO5	3	2	2	-	-	-	-	-	-	-	-	2	-	3
CO	2.6	1.8	2	-	2	-	-	-	-	-	-	2	-	3

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE - I

		Category: PE			
U19ECP04	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Electromagnetic Fields and Waveguides

COURSE OBJECTIVES:

- To learn the concept of electromagnetic interference and compatibility
- To understand about EMI devices and mitigation techniques
- To comprehend various EMC standards and measurements

UNIT I BASICS OF EMI AND EMC 9

Concepts of EMI and EMC – Practical experiences and concerns – Sources of EMI – EMI emission and susceptibility – Conducted, radiated – Radiation hazards

UNIT II EMI FROM APPARATUS AND CIRCUITS 9

Noise from relays and switches – Circuit nonlinearities – Intermodulation, Cross modulation – Cross – Talk in transmission lines – Transients in power supplies – Calculation of induced voltage and current

UNIT III MITIGATION TECHNIQUES 9

Principle of EM shielding – Shielding materials, cable shielding, shielding effectiveness, low frequency magnetic shielding – EMI suppression cables – Gasketting types – Principle of grounding – Measurement of ground resistance, cable shield grounding

UNIT IV EMC STANDARDS 9

Standards for EMI/EMC – Standardizing organizations – IEEE/ANSI and CISPR/IEC – Test andevaluation methods – FCC regulations – MIL-STD 461/462 standards

UNIT V TEST METHODS AND MEASUREMENTS 9

Open field test – Radiated interference measurement – Shielded anechoic chamber, transverse electromagnetic cell – Conducted interference measurement – Power supply noise, equipment interference

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Clayton R.Paul "Introduction to Electromagnetic Compatibility", 2nd edition, Wiley, 2006
2. V Prasad Kodali, "Engineering Electromagnetic Compatibility", 2nd edition, IEEE Press, 2001

REFERENCES:

1. Henry W. Ott, "Electromagnetic Compatibility Engineering", 2nd edition, John Wiley & Sons Inc, 2009
2. Daryl Gerke and William Kimmel, "EDN's Designer's Guide to Electromagnetic Compatibility", 1st edition, Elsevier, 2002
3. W Scott Bennett, "Control and Measurement of Unintentional Electromagnetic Radiation", 1st edition, John Wiley & Sons Inc.,1997
4. Kenneth L Kaiser, "The Electromagnetic Compatibility Handbook", 3rd edition, CRC Press, 2005

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the basic theory of electromagnetic interference and compatibility	Understand
CO2	Examine the effect of electromagnetic emissions from various apparatus and circuits	Analyze
CO3	Summarize various mitigation techniques available for EMI suppression	Understand
CO4	Classify basic standards and regulations of electromagnetic compatibility	Understand
CO5	Make use of anechoic chamber to measure radiated and conducted interference	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	2	-	-	-	-	-	-	2
CO2	3	3	2	-	-	2	2	-	-	-	-	-	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	-	-	2
CO4	2	-	-	-	-	-	2	2	-	-	-	-	-	2
CO5	3	2	1	-	-	2	2	-	-	-	-	-	-	2
CO	2.4	2	1.5	-	-	2	2	2	-	-	-	-	-	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE - I

U19ECP05	COMPUTER ARCHITECTURE	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Basics of Computer

COURSE OBJECTIVES:

- To understand the basic structure and operation of digital computer
- To learn the fixed point and floating-point arithmetic operations
- To study the concept of various memories and parallel processing techniques

UNIT I COMPUTER ORGANISATION AND DESIGN 9

Instruction codes – Computer registers, instructions – Timing and control – Instruction cycle – Memory reference instructions – I/O and interrupt – Computer system description – Design of computer - Design of accumulator logic

UNIT II CENTRAL PROCESSING UNIT 9

General register organization – Stack organization – Instruction format – Addressing modes – Data transfer and manipulation – Program control – RISC and CISC characteristics

UNIT III COMPUTER ARITHMETIC 9

Addition and subtraction algorithm – Multiplication algorithms – Division algorithms – Floating point arithmetic operations – Decimal arithmetic unit and operations

UNIT IV MEMORY SYSTEM AND PIPELINING 9

Semiconductor RAM memories – Read-only memories – Memory parameters – Cache memories – Performance considerations – Virtual memories – Secondary storage.
Pipeline performance – Data hazards – Instruction hazards – Influence of instruction sets – Data path and control considerations

UNIT V LARGE COMPUTER SYSTEMS 9

Forms of parallel processing – Array processors – GPU processor – Structure of general purpose multiprocessors – Interconnection networks – Memory organization in multiprocessors – Program parallelism – Case studies – Shared memory

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. M. Morris Mano, "Computer System Architecture", 3rd edition, Prentice Hall of India, 2007
2. V.Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, "Computer Organization", 5th edition,Mc Graw-Hill, 2014

REFERENCES:

1. William Stallings, "Computer Organization and Architecture", 8th edition, Pearson Education, 2006
2. John P. Hayes, "Computer Architecture and Organization", 7th edition, McGraw Hill, 2006
3. LeighW.E, AliD.L., "System Architecture: software and hardware concepts", 2nd edition, South Wester Publishing, 2000
4. Miles J. Murdocca, Vincent P. Heuring, "Computer Architecture and Organization: An Integratedapproach", 2nd edition, Wiley, 2015

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain elementary concepts of computer architecture	Understand
CO2	Illustrate the instruction formats and addressing modes	Understand
CO3	Apply various algorithms for performing arithmetic operations	Apply
CO4	Outline pipelining approach and different types of memories	Understand
CO5	Analyze the effect of parallelism for multithreaded applications	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	1	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE - II

		Category: PE			
U19ECP06	DIGITAL IC DESIGN	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Electronics

COURSE OBJECTIVES:

- To design and synthesize the combinational and sequential logic circuits
- To understand the datapath controller design and pipelined architecture
- To learn validation and verification techniques in IC design

UNIT I LOGIC DESIGN WITH BEHAVIORAL MODEL 9

Overview of combinational and sequential logic design – Structural models of combinational logic – Propagation delay – Behavioral modeling – Cyclic behavioral model of flip-flop and latches – Comparison of styles for behavioral modeling using Modelsim – Design documentation with functions and tasks

UNIT II SYNTHESIS OF SYSTEM BLOCKS 9

Introduction to synthesis – Synthesis of combinational and sequential logic using Xilinx – Three state devices, bus interfaces, flip-flops and registered logic – State encoding – Synthesis of loops – Divide and conquer algorithm

UNIT III DATAPATH CONTROLLER DESIGN 9

Design of data path controllers – Partitioned sequential machines – Design of a RISC stored program machine – Processor, ALU, controller and instruction set – UART

UNIT IV ARCHITECTURE FOR DIGITAL PROCESSOR 9

Algorithms – Nested loop programs and data flow graphs – Pipelined architecture – Adder, FIR filter – Circular buffers – Functional units for addition – Functional units for multiplication

UNIT V POSTSYNTHESIS DESIGN 9

Postsynthesis design validation – Timing verification – Elimination of ASIC timing violations – False paths – System tasks for timing verification – Fault simulation and manufacturing test

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL", 2nd edition, Pearson Education,2011
2. Charles H.Roth Jr ,"Fundamentals of Logic Design", 5th edition, Thomson Learning, 2004

REFERENCES:

1. Samir Palnitkar, "Verilog HDL", 2nd edition, Pearson Education, 2003
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd edition, McGraw-Hill,2014
3. O. Hamblen, T. S. Hall, and M. D. Furman, "Rapid Prototyping of Digital Systems", 2nd edition,Springer, 2008
4. S.Brown and Z. Vransesic, "Fundamental of Digital Logic with Verilog Design", 3rd edition, McGraw-Hill,2014

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Infer combinational and sequential logic using behavioral modeling	Understand
CO2	Examine the optimized gate level representation of logic blocks	Analyze
CO3	Interpret the design of various datapath controllers	Understand
CO4	Summarize various functional units of pipelined architecture	Understand
CO5	Identify the faults in the functional logic blocks	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	-	-	-	-	-	2
CO2	3	3	-	-	2	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	1.6	-	-	2	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)						3: Substantial (High)			

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PROFESSIONAL ELECTIVE - II

U19ECP07	MACHINE LEARNING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Fundamentals of Image Processing

COURSE OBJECTIVES:

- To understand the need for machine learning for problem solving
- To study various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To learn new approaches in machine learning

UNIT I CONCEPT LEARNING 9

Learning Problems – Perspectives and issues – Version spaces – Candidate eliminations — Inductive bias – Decision tree learning – Representation, algorithm – Heuristic space search

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Neural networks – Representation, problems – Perceptron – Multilayer networks, backpropagation algorithms – Genetic algorithms – Hypothesis space search, genetic programming, models of evaluation and learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9

Bayes theorem – Maximum likelihood, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Bayesian belief network, EM algorithm – Probability learning – Simulation – Spam filtering, Sentiment analysis.

UNIT IV INSTANCE BASED LEARNING 9

K- Nearest neighbour learning – Fine KNN, coarse KNN – Locally weighted regression – Radial bases functions – Case based learning – Simulation – Oil spill recognition, sleep classification.

UNIT V ADVANCED LEARNING 9

Learning sets of rules – Sequential covering algorithm, learning rule set – First order rules – Sets of first order rules, induction on inverted deduction, inverting resolution – Analytical learning – Perfect domain theories, explanation base learning, FOCL algorithm – Reinforcement learning.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", 1st print, McGraw-Hill Education, 2013
2. Ethem Alpaydin, "Introduction to Machine Learning: Adaptive Computation and Machine Learning", 1st print, The MIT Press, 2004

REFERENCES:

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", 1st print, CRC Press, 2009
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning:DataMining, Inference, and Prediction", 2nd edition, Springer ,2009
3. Bishop, Christopher, "Pattern Recognition and Machine Learning", 1st print, Springer, 2006
4. Giuseppe Ciaburro, "Matlab for Machine Learning", 1st edition, Packt publishing, 2017

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Illustrate the concept learning representation and algorithms	Understand
CO2	Compare supervised and unsupervised machine learning algorithms	Understand
CO3	Select suitable machine learning approaches for image classification	Apply
CO4	Examine the instance based learning algorithms to solve real time applications	Analyze
CO5	Explain advanced machine learning algorithms	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	2	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	2	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	1.6	2	-	2	-	-	-	-	-	-	-	-	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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PROFESSIONAL ELECTIVE - II

U19ECP08	SATELLITE COMMUNICATION	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Analog and Digital Communication

COURSE OBJECTIVES:

- To study the basics of satellite orbits and launching methods
- To understand the satellite subsystems and characteristics of satellite links
- To learn various applications of communication and remote sensing satellites

UNIT I SATELLITE ORBITS 9

Introduction to satellite orbits – Kepler's laws – Orbital elements – Apogee and Perigee –Satellite orbits – Orbital perturbations – Earth eclipse of satellite – Sun transit outage – Look angles – Azimuth angle, elevation angle

UNIT II SPACE AND EARTH SEGMENT 9

Satellite subsystem – Power supply subsystem, attitude and orbit control, tracking-telemetry and command subsystem, satellite transponders – Earth station – Receive-only home TV systems, master antenna TV systems, community antenna TV systems, transmitter and receiver earth stations

UNIT III SATELLITE LINK DESIGN 9

Transmission losses – Link power budget – C/N calculation – System noise – Satellite uplink and downlink – Rain induced attenuation and interference – Link design with and without frequency reuse

UNIT IV COMMUNICATION SATELLITES 9

Introduction to communication satellites – Design considerations – Spacecraft subsystems – Satellite and terrestrial networks – Satellite telephony – Satellite television

UNIT V REMOTE SENSING SATELLITES 9

Satellite services – INTELSAT Series, VSAT – Mobile satellite services – GSM, GPS – Direct broadcast satellites (DBS/DTH) – Home receiver indoor and outdoor unit – HDTV

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Dennis Roddy, "Satellite Communications", 4th edition, Mc Graw Hill (Reprint), 2014
2. Tri T. Ha, "Digital Satellite Communications", 2nd edition, Mc Graw Hill, 2009

REFERENCES:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication SystemsEngineering", 2nd edition, Pearson, 2007
2. Richharia M, "Satellite Communication Systems Design Principles", 2nd edition, Macmillan PressLtd., 1999
3. Bruce R. Elbert, "The Satellite Communication Applications", 3rd edition, Artech House Bostan 2008
4. Timothy Pratt, Charles W. Bostian, Jeremy E. Allnutt, "Satellite Communication", 2nd edition, Wiley,2006

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Apply Kepler's laws to calculate satellite orbital parameters	Apply
CO2	Illustrate the space and earth segment sub systems	Understand
CO3	Analyze link power budget in satellite systems	Analyze
CO4	Summarize various applications of communication satellites	Understand
CO5	Outline the different types of remote sensing satellite applications	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	3

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE - II

		Category: PE			
U19ECP09	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Computer Networks

COURSE OBJECTIVES:

- To understand the characteristics of WSN and MAC layer protocols
- To study about routing protocols and middleware principles
- To acquaint with applications of WSN

UNIT I BASICS OF WIRELESS SENSOR NETWORKS 9

Characteristic requirements – Challenges – WSN and Mobile adhoc networks – Sensor node architecture – Sensor nodes – Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot – Physical layer and transceiver design considerations in WSNs

UNIT II MEDIUM ACCESS CONTROL PROTOCOLS 9

Fundamentals of MAC protocols – Low duty cycle protocols and wakeup concepts – Contention based protocols – CSMA, PAMAS – Schedule based protocols – LEACH, SMACS, TRAMA – IEEE 802.15.4 MAC protocol

UNIT III ROUTING PROTOCOLS FOR WIRELESS SENSOR NETWORKS 9

Routing challenges and design issues – Routing strategies – Flooding and gossiping, SPIN, PEGASIS, directed diffusion routing, geographic routing – Real time routing protocols – SPEED, RAP

UNIT IV MIDDLEWARE AND OPERATING SYSTEMS 9

WSN middleware principles – Architecture – MiLAN – IRISNET – CLMF – MSM – Operating system design issues – TinyOS – MANTIS – OSPM – ContiOS

UNIT V APPLICATIONS OF WSN 9

WSN applications – Building automation – Industrial automation – Medical applications – Reconfigurable sensor networks – Highway monitoring – Military applications – Habitat monitoring.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Kazem Sohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks Technology, Protocols,and Applications", 3rd reprint, John Wiley & Sons, 2016
2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", 2nd reprint, John Wiley & Sons, Ltd, 2014

REFERENCES:

1. Zhao and L. Guibas, "Wireless Sensor Networks", 2nd reprint, Morgan Kaufmann, 2014
2. C. S. Raghavendra, K.M.Shivalingam and T.Znati, "Wireless Sensor Networks",1st reprint, Springer, 2004
3. Anna Hac, "Wireless Sensor Network Designs", 1st Reprint, John Wiley & Sons, 2004
4. Carlos De Morais Cordeiro Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory andApplications", 2nd edition, World Scientific, 2015

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the basics of sensor and transceiver design	Understand
CO2	Summarize various medium access protocols of WSN	Understand
CO3	Analyze the performance of routing protocol for traffic management	Analyze
CO4	Infer the operations of middleware and operating systems of sensors	Understand
CO5	Build a system for real world applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE - II

		Category: PE			
U19ECP10	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Basics of Networking

COURSE OBJECTIVES:

- To understand the concept of cloud computing and evolution of cloud from the existing technologies
- To acquaint with various cloud architecture and services
- To learn the emergence of cloud as the next generation computing paradigm

UNIT I CLOUD COMPUTING OVERVIEW 9

Introduction to cloud computing – Definition of cloud – Evolution of cloud computing – Underlying principles of parallel and distributed computing – Cloud characteristics – Elasticity in cloud, cloud on demand provisioning

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Service oriented architecture – REST and systems – Web services – Publish subscribe model – Basics of virtualization, types of virtualization, levels of virtualization, virtualization structures, simulation on open source software – Tools and mechanisms – Virtualization of CPU – Memory, I/O devices – Virtualization support and disaster recovery

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Layered cloud architecture design – NIST cloud computing reference architecture – Public, private and hybrid clouds – IaaS – PaaS – SaaS – Architectural design challenges – Cloud storage, storage as a service, advantages of cloud storage, cloud storage providers – Amazon S3

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Inter cloud resource management – Resource provisioning and resource provisioning methods – Global exchange of cloud resources – Security overview, cloud security challenges – Software as a service security – Security governance – Virtual machine security – IAM – Security standards

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – Map reduce – Virtual box – Google app engine – Programming environment for google app engine, open stack – Federation in the cloud – Four levels of federation, federated services and applications, future of federation

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From ParallelProcessing to the Internet of Things", 1st edition, Morgan Kaufmann, 2012
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Managementand Security", 1st edition, CRC Press, 2017

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", 1st edition,Tata Mcgraw Hill, 2013
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", 1stedition, Tata Mcgraw Hill, 2009
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in theCloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", 1st edition, O'Reilly, 2009
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms", 1st edition, Wiley, 2011

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Infer the principles of distributed and parallel computing for cloud technology	Understand
CO2	Summarize the key enabling technologies for cloud development	Understand
CO3	Compare different cloud architectures using storage providers	Understand
CO4	Analyze the resource management and security issues in cloud service	Analyze
CO5	Make use of the appropriate cloud technology for implementation of cloudservices	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO	2.4	2	1.5	-	2	-	-	-	-	-	-	-	1	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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PROFESSIONAL ELECTIVE - III

		Category: PE			
U19ECP11	PHYSICAL DESIGN AUTOMATION	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- VLSI Design

COURSE OBJECTIVES:

- To understand various stages of VLSI physical design process
- To learn logic simulation, synthesis and verification
- To design FPGA and MCM automation systems

UNIT I DESIGN METHODOLOGIES 9

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

UNIT II PARTITIONING, PLACEMENT AND FLOOR PLANNING 9

Circuit representation, placement algorithms - Partitioning-Simulation of KL algorithm - Floor planning - Linear programming algorithm - Representation and optimization - Shape functions and floor plan sizing

UNIT III ROUTING AND COMPACTION 9

Routing – Types of local routing problems, clock routing, power routing, channel routing – Global routing – Algorithms for global routing – Demonstration of routing using simulation tool
Compaction – Problem formulation – Classification – Algorithms for 1D, 2D compaction Performance driven compaction

UNIT IV LOGIC SIMULATION AND SYNTHESIS 9

Simulation – Gate-level modeling – Switch-level modeling – Combinational logic synthesis using Xilinx – Binary decision diagrams – ROBDD – Two level logic synthesis – Scheduling algorithm

UNIT V PHYSICAL DESIGN AUTOMATION OF FPGA AND MCM 9

FPGA and MCM technologies – MCM and FPGA Physical design cycle – Partitioning – Placement – Routing – Routing algorithm for the non-segmented and segmented model

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Gerez, S.H., "Algorithms for VLSI Design Automation", 2nd edition, John Wiley & Sons, 2006.
2. Sherwani, N.A., "Algorithms for VLSI Physical Design Automation", 3rd edition, Kluwar AcademicPublishers, 2002

REFERENCES:

1. Drechsler, R., "Evolutionary Algorithms for VLSI CAD", 3rd edition, Kluwer Academic Publisher,1998
2. Stephen Trimberger, "Introduction to CAD for VLSI", 2nd edition, Kluwer Academic, 2002
3. Charles J Alpert, Dinesh P Mehta, Sachin S. Sapatnekar, "Handbook of Algorithms for PhysicalDesign Automation", Original edition, CRC Press, 2009
4. Andrew B. Kahng, Jens Lienig, Igor L. Markov and Jin Hu, "VLSI Physical Design: from graphpartitioning to timing closure", 2nd edition, Springer, 2011

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain graph theory and optimization algorithms	Understand
CO2	Identify suitable algorithms for placement and floor planning	Apply
CO3	Summarize algorithm for routing and compaction	Understand
CO4	Examine the optimized gate level representation of combinational circuits	Analyze
CO5	Make use of suitable algorithms for FPGA and MCM automation	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	2
CO3	2	-	-	-	2	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	2
CO	2.6	2.3	1.3	-	2	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE - III

		Category: PE			
U19ECP12	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Embedded Concepts

COURSE OBJECTIVES:

- To study the basic concepts of Internet of Things
- To understand the hardware and software for IoT design for an application
- To learn the different interfacing methods of IoT with real world applications

UNIT I BASICS OF INTERNET OF THINGS 9

Definition and characteristics – Physical design – Logical design – IoT enabling technologies – IoT levels and deployment templates – Domain specific IoT – Healthcare, smart cities, industrial applications

UNIT II NETWORKING FOR IoT 9

IoT and M2M - LoRaWAN - Software defined networking - Network function virtualization - System management with NETCONF-YANG - IoT design methodology

UNIT III LOGICAL AND PHYSICAL DESIGNS USING PYTHON 9

Logical Design - Python data types and data structures - Control flow, functions, modules, packages, file handling, date and time operation, classes, python packages of IoT - IoT physical devices - Basic building blocks, Raspberry Pi, Linux on Raspberry Pi

UNIT IV RASPBERRY PI FOR IoT PROJECT DEVELOPMENT 9

Raspberry Pi Interfaces - Serial, SPI, I2C - Programming Raspberry Pi with python - Project development - Home temperature monitoring system, Webcam interfacing with Raspberry Pi

UNIT V APPLICATIONS OF IoT 9

Case studies - Illustrating IoT design - Home intrusion detection, IoT printer, forest fire detection system, weather monitoring system, smart agriculture system

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 1st edition, VPT Publishers, 2014
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", 1st edition, Cisco Press, 2017

REFERENCES:

1. Santanu Pattanayakl, "Intelligent Projects Using Python", 1st edition, Packt Publishing, 2019
2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1st edition, Wiley Publishers, 2013
3. Ovidiu Vermesan, Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", Original edition, River Publishers, 2013
4. Anthony Townsend., "Smart cities: big data, civic hackers, and the quest for a new utopia", Originaledition, W.W.Norton & Company, 2013

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Illustrate the basics of Internet of Things and its levels	Understand
CO2	Infer the IoT communications standards and networking	Understand
CO3	Interpret the logical and physical designs of IoT	Understand
CO4	Analyze the performance of various Raspberry Pi interfaces for simple applications	Analyze
CO5	Solve real world problem using the concept of Internet of Things	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	2	3	-
CO2	2	2	-	-	-	-	-	-	-	-	-	2	3	-
CO3	2	2	-	-	1	-	-	-	-	-	-	2	3	-
CO4	3	3	2	-	1	-	-	-	-	-	-	2	3	-
CO5	3	2	2	-	1	-	-	-	-	-	-	2	3	-
CO	2.4	2.2	2	-	1	-	-	-	-	-	-	2	3	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE - III

		Category: PE			
U19ECP13	SOFT COMPUTING	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Neural network basics

COURSE OBJECTIVES:

- To learn the fundamentals of fuzzy logic systems and various optimization techniques
- To understand the concepts of artificial neural networks and Neuro-fuzzy modeling
- To study the applications of Neuro-fuzzy model

UNIT I FUZZY LOGIC SYSTEMS AND CONTROL 9

Introduction to soft computing – Hard and soft computing — Fuzzy sets – Fuzzy logic operations – Fuzzy relations – Fuzzy rules and reasoning – Fuzzy logic control – Fuzzification, defuzzification, control architectures

UNIT II OPTIMIZATION TECHNIQUES 9

Introduction – Derivative based optimization – Descent methods, methods of steepest descent, classical Newton's method, step size determination – Derivative-free optimization – Genetic algorithms and its operators, simulated annealing

UNIT III ARTIFICIAL NEURAL NETWORKS 9

Neural network – Activation functions, learning algorithms – Supervised learning neural networks – Perceptron, Adaline, back propagation, radial basis function networks (RBFN), MATLAB examples – Unsupervised learning neural networks – Kohonen self-organizing networks, learning vector quantization

UNIT IV NEURO-FUZZY MODELING 9

Adaptive Neuro-fuzzy inference systems (ANFIS) – Architecture, hybrid learning algorithm, learning methods – Coactive Neuro-fuzzy modeling – Framework, neuron functions for adaptive networks, Neuro-fuzzy spectrum

UNIT V APPLICATIONS OF NEURO-FUZZY SYSTEM 9

ANFIS applications – Simulation of Printed character recognition, inverse kinematics (Robotics) problems, automobile MPG prediction – Fuzzy filtered neural networks – Plasma spectrum analysis, hand-written numeral recognition – Coactive Neuro-fuzzy inference systems (CANFIS) modeling for color recipe prediction using simulation software

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Fakhreddine O. Karray and Clarence de Silva, "Soft Computing and Intelligent Systems Design",7th Impression, Pearson Education, 2012
2. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro Fuzzy and Soft Computing- A Computational Approach to Learning and Machine Intelligence", 1st edition, Pearson Education, 2012

REFERENCES:

1. N. P. Padhy, "Artificial Intelligence and Intelligent Systems", 1st edition, Oxford University Press,2006
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", 1st edition,Prentice Hall of India, 2007
3. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, andProgramming Techniques", 3rd Impression, Pearson Education, 2008
4. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing", 3rd edition, Wiley India, 2012

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Summarize the basic concepts of fuzzy logic system	Understand
CO2	Outline the various optimization techniques	Understand
CO3	Implement neural networks for supervised and unsupervised learning	Apply
CO4	Explain the fundamentals of Neuro-fuzzy modeling	Understand
CO5	Build the applications using Neuro-fuzzy systems	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	2	-	-	-	-	-	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	2	-	2	-	-	-	-	-	-	-	2	-
CO	2.4	1.6	1.5	-	2	-	-	-	-	-	-	-	2	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE – III

		Category: PE			
U19ECP14	RF MEMS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- RF System design

COURSE OBJECTIVES:

- To understand the micro fabrication process, MEMS materials and various system issues
- To acquire basic knowledge on MEMS based filters, phase shifters and switches
- To learn the concepts of transmission lines and MEMS based antenna design

UNIT I MICROELECTROMECHANICAL SYSTEMS 9

Introduction to micro fabrication for MEMS – Electromechanical transducers – Electrostrictive transducers, magnetostrictive transducers, electrodynamic transducers, electrothermal actuators – Micro sensing for MEMS – MEMS materials and fabrication – Materials for polymer MEMS – Bulk micro machining for silicon-based MEMS – Micro stereo lithography for polymer MEMS

UNIT II RF MEMS SWITCHES 9

Switching parameters – Switches for RF and microwave applications – Electrostatic switching – Magnetic switching – Thermal switching - MEMS switch design – MEMS switch design considerations – MEMS inductors – Micromachined inductors, folded inductors, polymer based inductors – MEMScapacitors – MEMS sensors and actuators

UNIT III RF FILTERS AND PHASE SHIFTERS 9

Modeling of mechanical filters – Micromechanical filters – Types of phase shifters and their limitations – MEMS phase shifters, ferroelectric phase shifters

UNIT IV MEMS BASED TRANSMISSION LINES 9

Introduction to micromachined transmission lines and components – Microshield circuit components, micromachined waveguide components, micromachined mixer

UNIT V MICROMACHINED ANTENNA 9

Overview of microstrip antenna – Micromachining techniques to improve antenna performance – Micromachining as a fabrication process for small antenna – Micromachined reconfigurable antenna

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Gabriel M Rebeiz, "RF MEMS Theory, Design and Technology ", 1st edition, John Wiley & SonsLtd, 2010
2. Vijay K Varadan, Vinoy K J and Jose K A, "RF MEMS and Their Applications ", 1st edition, JohnWiley & Sons Ltd, 2011

REFERENCES:

1. James J.Allen, "Micro Electro Mechanical System Design", 1st edition, CRC Press Publisher, 2010
2. Tai Ran Hsu,"MEMS & Micro systems Design and Manufacture", 1st edition, Tata McGraw Hill,2002
3. Chang Liu, "Foundations of MEMS", 2nd edition, Pearson Education Inc., 2012
4. Mohamed Gad-el-Hak" The MEMS Handbook", 2nd edition, CRC press, 2002

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the basic concepts of MEMS	Understand
CO2	Summarize various types of switches and passive components	Understand
CO3	Illustrate MEMS based RF filters and phase shifters	Understand
CO4	Analyze the characteristics of micromachined transmission lines	Analyze
CO5	Apply appropriate micromachining technique to improve the performance of antenna	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE - III

		Category: PE			
U19ECP15	MULTIMEDIA COMPRESSION AND COMMUNICATION	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Fundamentals of Communication and Image Processing

COURSE OBJECTIVES:

- To understand multimedia compression standards
- To study the concepts of multimedia communication technologies
- To learn content based retrieval methods

UNIT I MULTIMEDIA BASICS AND TEXT COMPRESSION 9

Multimedia – Data types, features – Multimedia network – Multimedia applications – Applications and network terminology

Text compression – Characteristics of text data – Adaptive Huffman coding – Compression standards – GIF, TIF, JBIG – Simulation of text compression

UNIT II AUDIO COMPRESSION 9

Human auditory system – μ Law and A Law companding – Audio compression – G.726- ADPCM – CELP, MELP coders – MPEG audio

UNIT III IMAGE AND VIDEO COMPRESSION 9

Image data representation – JPEG standard – Fundamentals of wavelets – Multi resolution decomposition – DWT – Video compression – Motion compensation – H.261 – MPEG video compression standards – MPEG – 1, 2 and 4 - H.264 standard. Image compression using simulation software

UNIT IV MULTIMEDIA COMMUNICATION 9

Computer and multimedia networks – Multiplexing technologies – ISDN, ADSL – Quality of multimedia data transmission – Multimedia over IP – Multimedia over ATM networks – Media on demand

UNIT V MULTIMEDIA RETRIEVAL 9

Content based retrieval in digital libraries – C-BIRD – Color density, color layout, texture layout, search by illumination invariance, search by object model – QBIC – Blob world – Metaseek – Mars – Viper- Relevance feedback – Querying on videos

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Fred Halshall, "Multimedia communication - Applications, networks, protocols and standards", 1st edition, Pearson Education,2011
2. Ze-Nian Li, Mark S Drew, "Fundamentals of Multimedia", 1st edition, Prentice Hall of India, 2010

REFERENCES:

1. David Salomon, "Data Compression – The Complete Reference", 2nd edition, Springer, 2012
2. Khalid Sayood, "Introduction to Data Compression", 4th edition, Morgan Kauffman 2012
3. K. Rammohanarao, Z. S. Bolzkovic, D. A. Milanovic, "Multimedia Communication Systems", 1st edition, Prentice Hall of India, May 2002
4. Aura Ganz, Zvi Ganz and Kitti Wongthawaravat, "Multimedia Wireless Networks: Technologies,Standard and Qos", 1st edition, Prentice Hall of India, 2003

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Analyze the performance of various text compression techniques	Analyze
CO2	Summarize the audio and speech compression techniques	Understand
CO3	Make use of the appropriate standard for image and video compression	Apply
CO4	Compare the various methods of multimedia communication	Understand
CO5	Illustrate the concepts of multimedia retrieval	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	1	-	2	-	-	-	-	-	-	-	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	1.5	-	2	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE - III

U19ECP16	COMPREHENSION I	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Mathematics, Electronics, Signal concepts

COURSE OBJECTIVES:

- To solve analytical problems using fundamentals of mathematics
- To analyze the behavior of networks and systems in time and frequency domain
- To comprehend about the characteristics of various electronic devices

UNIT I ENGINEERING MATHEMATICS **10**

Linear Algebra - Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness

Calculus - Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series

Differential equations - First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems

UNIT II ENGINEERING MATHEMATICS **10**

Vector Analysis - Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stoke's theorems

Complex Analysis - Analytic functions, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem

Numerical Methods - Solution of nonlinear equations, single and multi-step methods for differential equations, convergence criteria

Probability and Statistics - Mean, median, mode and standard deviation; combinatorial probability, probability distribution functions – binomial, Poisson, exponential and normal; Joint and conditional probability; Correlation and regression analysis

UNIT III NETWORKS **9**

Circuit analysis – Node and mesh analysis – Superposition – Thevenin's theorem – Norton's theorem – Reciprocity – Sinusoidal steady state analysis – phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits – RL, RC and RLC circuits, solution of network equations using Laplace transforms
Linear 2–port network parameters – Wye–delta transformation

UNIT IV ELECTRONIC DEVICES **8**

Energy bands in intrinsic and extrinsic semiconductors – Equilibrium carrier concentration – Direct and indirect band–gap semiconductors

Carrier Transport – Diffusion current – Drift current – Mobility and resistivity – Generation and recombination of carriers – Poisson and continuity equations

P–N junction – Zener diode – BJT – MOS capacitor – MOSFET – LED – Photo diode and solar cell

UNIT V SIGNALS AND SYSTEMS **8**

Continuous time signals – Fourier series and Fourier transform – Sampling theorem and applications.

Discrete-time signals – DTFT – DFT – z–transform – Discrete time processing of continuous time signals – LTI systems – Definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

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PROFESSIONAL ELECTIVE IV

U19ECP17	VLSI SIGNAL PROCESSING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Signal Processing

COURSE OBJECTIVES:

- To learn various methods for critical path reduction and algorithmic strength reduction
- To familiarize the concept of digital filters and arithmetic architecture design
- To understand pipelining concepts in digital filters

UNIT I METHODS OF CRITICAL PATH REDUCTION 9

Representation of DSP algorithms–Data flow graph representations–Loop bound and Iteration Bound – Pipelining of FIR digital filters – Parallel processing– Retiming Algorithms– An algorithm for unfolding

UNIT II ALGORITHMIC STRENGTH REDUCTION IN FILTERS 9

Parallel FIR filters – Parallel architecture for rank order filters– Odd–even merge sort architecture, – Rank order filter architectures, Parallel rank order filters – Pipeline Interleaving in digitalfilters

UNIT III DIGITAL LATTICE FILTERS 9

Introduction – Schur algorithm– Computation of Schur polynomials, Polynomial expansion algorithm– Basicdigital lattice filters – Derivation of basic lattice filters–One multiplier lattice filter – Normalized lattice filter

UNIT IV BIT LEVEL ARITHMETIC ARCHITECTURES 9

Parallel Multipliers – Parallel Multiplication with sign extension, Baugh Wooley multipliers – Bit serial multipliers –Lyon's bit serial multipliers using Horner's rule – Canonic signed digit arithmetic – Conventional distributed arithmetic

UNIT V PIPELINING CONCEPTS 9

Synchronous pipelining and clock styles – Clock skew and clock distribution – Wave pipelining – Asynchronous pipelining – Bundled data versus dual rail protocol – Two phase versus four phase protocols

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Keshab K.Parhi, "VLSI Digital Signal Processing Systems, Design and Implementation", John Wiley, Student edition, 2008
2. U. Meyer – Baese, "Digital Signal Processing with Field Programmable Arrays", Springer, 2nd edition, 2007

REFERENCES:

1. J. G. Chung and Keshab K. Parhi, "Pipelined Lattice and Wave Digital Recursive Filters", Springer Publisher, 1st edition, 2012
2. Magdy A. Bayoumi, E. Swartzlander, "VLSI Signal Processing Technology", Springer Publisher, 1st edition, 2012

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3. Khan, Shoab Ahmed, "Digital Design of Signal Processing Systems: A Practical Approach", Wiley, 1st edition, 2011.
4. Jose E. France, Yannis Tsividis, "Design of Analog – Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 2nd edition, 1994

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Choose appropriate methods for critical path reduction	Apply
CO2	Examine the performance of various algorithmic strength reduction techniques in filters	Analyze
CO3	Implement different lattice filters using Schur algorithm	Apply
CO4	Outline the fundamentals of bit level arithmetic architectures	Understand
CO5	Compare synchronous and asynchronous pipelining concepts	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO	2.6	2.3	2	-	-	-	-	-	-	-	-	-	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE IV

U19ECP18	DEEP LEARNING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Linear Algebra, Machine learning

COURSE OBJECTIVES:

- To learn the operation of Deep Learning Neural Networks
- To understand the architecture of Deep Learning Artificial Neural Networks
- To familiarize with the real world applications of Deep Learning ANN

UNIT I FUNDAMENTALS OF DEEP LEARNING 9

Activation functions – Sigmoid – ReLU – Hyperbolic – Softmax – Loss functions – Perceptron training rule – Cross validation – Feature selection – Regularization – Hyperparamters

UNIT II CONVOLUTIONAL NEURAL NETWORKS 9

Introduction to Convolutional neural networks – Pooling – Evolution of CNN architectures – AlexNet – VGG – VNet – GoogLeNet – ResNet – DenseNet – CNN applications

UNIT III REGULARIZATION AND OPTIMIZATION 9

Regularization – Initialization – Batch normalization – Drop out – Sparse representation – Overfitting and underfitting – Optimization – Gradient descent – Stochastic gradient descent – ADAM

UNIT IV DEEP ARCHITECTURES 10

Recurrent Neural Networks (RNN) – Unfolded RNNs – Seq2Seq RNNs – Long short term memory (LSTM) – Recursive neural network – Gated recurrent unit (GRU) – Generative Adversarial Network (GAN) – Radial basis function networks (RBFN) – Deep belief networks (DBNs) – Auto encoders

UNIT V DEEP LEARNING APPLICATIONS 8

Character recognition – Speech synthesis – Speech recognition – Video analytics – Chatbots – Sentiment analysis

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", 1st edition, MIT Press, 2017
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", 1st edition, O'Reilly Media, 2017

REFERENCES:

1. K. P. Murphy, "Machine Learning: A Probabilistic Perspective", 1st edition, MIT Press, 2012
2. C. M. Bishop, "Pattern Recognition and Machine Learning", 1st edition, Springer, 2006
3. Navin Kumar Manaswi," Deep Learning with Applications Using Python Chatbots and Face,Object, and Speech Recognition with TensorFlow and Keras" 1st edition , Apress, 2018
4. Ethem Alpaydin,"Introduction to Machine Learning", 3rd edition, MIT Press, 2014

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the fundamentals of artificial neural networks in deep learning	Understand
CO2	Illustrate the various architectures of convolution neural network	Understand
CO3	Summarize the regularization and optimization techniques used in deep learning	Understand
CO4	Analyze the performance of different deep architectures	Analyze
CO5	Apply deep learning networks for real time applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	1
CO	2.4	2	1.5	-	-	-	-	-	-	-	-	-	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE IV

		Category: PE			
U19ECP19	COGNITIVE RADIO	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Wireless Networks
- Wireless Communication

COURSE OBJECTIVES:

- To understand the basic architecture of software defined radio and cognitive radio
- To learn different spectrum sensing techniques and mobility management in cognitive networks
- To acquaint with applications and advanced features of cognitive radio

UNIT I CONCEPTS OF SOFTWARE DEFINED RADIO 9

Evolution of software–defined radio – Interoperability – Dynamic spectrum access – Radio frequency regulatory challenges and actions – Regulatory issues of cognitive access – SDR and cognitive radio relationship – SDR architectures – Software tunable analog radio components

UNIT II COGNITIVE RADIO ARCHITECTURE 9

Cognition cycle – Cognitive radio network architectures – IEEE 802.22 physical layer – IEEE 802.22 MAC layer

UNIT III SPECTRUM SENSING AND SHARING 9

Primary signal detection – Energy detector, Cyclostationary feature detector, Matched filter, Cooperative sensing – Implications of spectrum opportunity and detection — Spectrum access and sharing – Unlicensed spectrum sharing, Licensed spectrum sharing

UNIT IV COGNITIVE WIRELESS NETWORKS 9

Cognitive wireless network model – Location estimation and sensing – Mobility management –OFDM based cognitive radio – Challenges of cognitive OFDM systems – Multi–band OFDM-MIMO CR

UNIT V APPLICATIONS OF COGNITIVE RADIO 9

On–demand spectrum auctions – Economically robust spectrum auctions – Cognitive Radio for wireless communications in a hospital environment – GNU radio for cognitive radio experimentation – GNU radio software architecture, Cognitive transmitter

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou "Cognitive Radio Communications and Networks", Academic Press, First edition, Elsevier, 2010
2. Huseyin Arslan (Ed.), "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", First edition, Springer, 2007

REFERENCES:

1. Bruce Fette, "Cognitive Radio Technology", First edition, Newnes, 2006
2. Kwang–Cheng Chen, Ramjee Prasad, "Cognitive Radio Networks", John Wiley and Sons, 1st edition, 2009
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H.Vincent Poor, "Principles of Cognitive Radio", 1st edition, Cambridge University Press, 2012
4. Geetam Tomar, Ashish Bagwari, Jyotshana Kanti, "Introduction to Cognitive Radio Networks and Applications", 1st edition, CRC press, 2016

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the design principles of software defined radio	Understand
CO2	Illustrate the architecture and standards of cognitive radio	Understand
CO3	Compare various spectrum sensing and sharing techniques	Understand
CO4	Implement the location estimation and mobility management systems for cognitive networks	Apply
CO5	Apply cognitive radio principle for real time applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE IV

		Category: PE			
U19ECP20	BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn basics of blockchain technology and decentralization
- To understand cryptocurrency fundamentals and Ethereum programming language
- To study the principle of Web3, Hyperledger, alternative blockchain and security

UNIT I BASICS OF BLOCKCHAIN 9

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and full ecosystem decentralization – Platforms for decentralization

UNIT II FUNDAMENTALS OF CRYPTOCURRENCY 9

Bitcoin – Digital keys and addresses – Transactions – Mining – Bitcoin networks and payments – wallets – Alternative coins – Theoretical limitations – Bitcoin limitations – Name coin – Prime coin – zcash – Smart contracts – Ricardian contracts

UNIT III ETHEREUM 9

The ethereum network – Components of ethereum ecosystem – Ethereum programming languages,runtime byte code, blocks and blockchain, fee schedule – Supporting protocols – Solidity language

UNIT IV WEB3 AND HYPERLEDGER 9

Introduction to web3 – Contract deployment – Post requests – Development frameworks – Hyperledger as a protocol – Architecture – Hyperledger fabric – Distributed ledger – Corda

UNIT V ALTERNATIVE BLOCKCHAINS AND SECURITY 9

Kadena – Ripple – Stellar – Rootstock – Quorum – Tezos – Storj – BigchainDB – Tendermint – Scalability – Privacy – Security – Smart contract security – Formal verification and analysis – Oyente Tool.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", 2nd edition, Packt Publishing, 2018
2. Imran Bashir, "Mastering Blockchain", 2nd edition, Packt Publishing, 2017

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Handson Approach", 2nd edition, VPT, 2017
2. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", 1st edition, O'Reilly, India, 2014.
3. Alex Leverington, "Ethereum Programming", Packt Publishing, 2017
4. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain basics of blockchain and decentralization	Understand
CO2	Illustrate various bitcoin types and its limitations.	Understand
CO3	Summarize the components of ethereum ecosystem and its protocols	Understand
CO4	Develop framework for hyperledger and web3 applications	Apply
CO5	Analyze the performance of different alternative coins	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	1	-
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

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PROFESSIONAL ELECTIVE IV

U19ECP21	ROBOTICS AND AUTOMATION	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Sensors and Transducers

COURSE OBJECTIVES:

- To introduce the basic concepts of robotics
- To explore the robot languages and computer interfacing
- To get familiarize with automation technology and quantitative techniques

UNIT I INTRODUCTION TO ROBOTICS 9

Laws of robotics – Robotics system and robot anatomy – Human systems and robotics – Specification of robots – Machine intelligence, future trends in Robotics – Flexible automation vs. robotic technology – Safety measures in robotics

UNIT II SENSORS AND INTELLIGENT ROBOTS 9

Artificial intelligence and automated manufacturing – AI and robotics – Need for sensing systems – Sensory devices – Types of sensors – Robot vision systems – Design and control of sensor integrated dexterous robot hand

UNIT III ROBOT LANGUAGES AND COMPUTER INTERFACING 9

Classification of robot languages – Computer control and robot software – VAL system and language – Computers and microprocessors – Common input and output devices – Standard interfaces – Controls of mechatronics press for assembling – MEMS

UNIT IV AUTOMATION AND CONTROL TECHNIQUES 9

Basic elements of an automated system – Levels of automation – Process industries vs. discrete manufacturing industries – Continuous vs. discrete control – Computer process control – Forms of computer process control – Sensors, actuators and other control system components

UNIT V APPLICATIONS OF ROBOT 9

Capabilities of robots – Robotic applications – Obstacle avoidance, walking robots, undersea robots – Robotic applications under computer integrated manufacturing (CIM)

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. S.R.Deb and S.Deb, "Robotics Technology and flexible Automation", McGraw Hill Education, 2nd edition, 2010
2. M.P.Grover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, 2nd edition, 2012

REFERENCES:

1. Terry L. M. Bartelt, "Industrial Automated Systems: Instrumentation and Motion Control", Cengage Learning, 2011
2. J.J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson Education, 4th edition, 2017
3. M.P. Groover, et.al., "Industrial Robots: Technology, Programming and applications", McGraw Hill, 2nd Indian edition, 2012
4. Ashitava Ghosal, "Robotic fundamental Concept and Analysis", Oxford University Press 11th impression 2015

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the basic concepts of robotics	Understand
CO2	Illustrate the different types of sensors and robot vision systems	Understand
CO3	Classify various robot languages and computer interfaces	Understand
CO4	Develop simple automation programs using PLCs	Apply
CO5	Implement robots for simple real time applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	-
CO5	3	2	2	2	-	2	-	-	-	-	-	-	2	-
CO	2.4	2	2	2	-	2	-	-	-	-	-	-	2	-
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

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PROFESSIONAL ELECTIVE IV

		Category: PE			
U19ECP22	COMPREHENSION II	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Mathematics, Electronics, Signal concepts

COURSE OBJECTIVES:

- To comprehend about analog and digital electronic circuits
- To analyze the behavior of control systems
- To explore the electromagnetic principles and communication concepts

UNIT I ANALOG CIRCUITS 9

Diode Circuits – Clipping – Clamping and rectifiers
BJT and MOSFET amplifiers – Biasing – AC coupling – Small signal analysis – Frequency response – Current mirrors and differential amplifiers
Op-amp Circuits – Amplifiers – Summers – Differentiators – Integrators – Active filters – Schmitt triggers and oscillators

UNIT II DIGITAL CIRCUITS 9

Number Representations – Binary – Integer and floating point numbers
Combinatorial circuits – Boolean algebra – Minimization of functions using Boolean identities and Karnaugh map – Logic gates and their static CMOS implementations – Arithmetic circuits – Code converters – Multiplexers – Decoders
Sequential Circuits – Latches and flip flops – Counters – Shift registers – Finite state machines – Propagation delay – Setup and hold time – Critical path delay
Data Converters – Sample and hold circuits, ADCs and DACs
Semiconductor Memories – ROM – SRAM – DRAM
Computer Organization – Machine instructions and addressing modes – ALU – Data path and control unit – Instruction pipelining

UNIT III CONTROL SYSTEMS 9

Basic control system components – Feedback principle – Transfer function – Block diagram representation – Signal flow graph – Transient and steady state analysis of LTI systems –Frequency response – Routh Hurwitz and Nyquist stability criteria – Bode and root locus plots – Lag, Lead and Lag–Lead compensation – State variable model and solution of state equation of LTI systems

UNIT IV COMMUNICATIONS 9

Random Processes – Autocorrelation and power spectral density – Properties of white noise – Filtering of random signals through LTI systems
Analog Communications – Amplitude modulation and demodulation – angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers
Information Theory – Entropy – Mutual information and channel capacity theorem
Digital Communications – PCM – DPCM – Digital modulation schemes (ASK, PSK, FSK, QAM) – Bandwidth – Inter–symbol interference – MAP – ML detection – Matched filter receiver – SNR and BER
Fundamentals of error correction – Hamming codes, CRC

UNIT V ELECTROMAGNETICS 9

Maxwell's equations – Differential and integral forms and their interpretation – Boundary conditions – Wave equation – Poynting vector
Plane waves and Properties – Reflection and refraction – Polarization – Phase and group velocity – Propagation through various media – Skin depth
Transmission Lines – Equations – Characteristic impedance – Impedance matching – Impedance transformation – S–parameters – Smith chart
Rectangular and circular waveguides – Light propagation in optical fibers – Dipole and monopole antennas – Linear antenna arrays

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

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SPECIAL ELECTIVE

		Category: PE			
U19ECP33	PROJECT MANAGEMENT AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To Understand the Project, Project Life Cycle, Roles, Challenges and Importance of Project Management.
- To Interpret the key aspects of managing risks in project proposals
- To Impart the entrepreneurial competencies efficiently and effectively

UNIT I INTRODUCTION TO PROJECT MANAGEMENT 9

Project Management – Definition –Goal – Lifecycles - Project Environment. Project Manager – Roles-Responsibilities and Selection

UNIT II PLANNING, BUDGETING AND RISK MANAGEMENT 9

The Planning Process – Work Break down Structure. Cost Estimating and Budgeting - Process, Summaries, schedules and forecasts. Managing risks - concepts, identification, assessment and response planning

UNIT III PROJECT EVALUATION 9

PERT & CPM Networks - Project durations and floats - Crashing – Capital Budgeting: Discountedand Non-Discounted Cash flow Techniques

UNIT IV ENTREPRENEURAL COMPETENCE AND BUSINESS 9

Entrepreneurship concept – Entrepreneurship as a Career – Personality, characteristics, Knowledgeand Skills of a successful Entrepreneur. Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product Project Profile Preparation

UNIT V BUSINESS PLAN AND LAUNCHING OF SMALL BUSINESS 9

Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria. Finance and Human Resource Mobilization - Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, Start-ups

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Panneerselvam. R, Senthilkumar. P, Project Management, PHI Learning, 2009
2. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016

REFERENCES:

1. John M. Nicholas, Project Management for Business and Technology - Principles and Practice,Second Edition, Pearson Education, 2006
2. Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH, 2006
3. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, TataMcGraw-Hill, 8 th edition, 2017

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the project life cycle, challenges and importance of project management	Understand
CO2	Illustrate the tools and techniques for successful project management	Understand
CO3	Summarize the risk management and mobilizing the project resources	Understand
CO4	Utilize the entrepreneurial skills in business	Apply
CO5	Develop the competencies for effective business management	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	2	1	2	1	3	1	-	-
CO2	2	1	-	1	-	-	2	1	2	1	3	1	-	-
CO3	2	1	-	1	-	-	2	1	2	1	3	1	-	-
CO4	-	-	-	1	-	-	2	1	2	1	3	1	-	-
CO5	-	-	-	-	-	-	2	1	2	1	3	1	-	-
CO	2	1	-	1	-	-	2	1	2	1	3	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE V

U19ECP23	LOW POWER VLSI DESIGN	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- VLSI Design

COURSE OBJECTIVES:

- To learn different sources of power dissipation and power optimization in CMOS
- To familiarize with power consumption and power estimation in CMOS
- To understand the concept for synthesis of different level low power transforms

UNIT I POWER DISSIPATION IN CMOS 9

Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design

UNIT II POWER OPTIMIZATION 9

Logical level power optimization – Circuit level low power design – Circuit techniques for reducing power consumption in Adders and Multipliers

UNIT III LOW POWER CMOS CIRCUITS 9

Computer Arithmetic techniques for low power systems – Reducing power consumption in memories – Low power clock – Clock switching Interconnect and layout design – Advanced techniques – Adiabatic computation, Pass transistor logic synthesis

UNIT IV POWER ESTIMATION 9

Power estimation techniques – Logic level power estimation – Simulation power analysis – Probabilistic power analysis

UNIT V SYNTHESIS FOR LOW POWER DESIGN 9

Behavioral level transforms – Algorithm level transforms, Circuit activity driven architectural transformations – Logic Level Optimization – Circuit Level Transforms

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. K.Roy and S.C. Prasad, "Low Power CMOS VLSI Circuit Design", 2nd edition, Wiley Publication, 2000
2. Dimitrios Soudris, Chirstian Pignet and Costas Goutis, "Designing CMOS Circuits for Low Power", 2nd edition, Kluwer Publishers, 2002

REFERENCES:

1. Abdellatif Bellaouar, Mohamed.I and Elmasry, "Low power digital VLSI design", 2nd edition, Kluwer Publication, 2008
2. Gary Yeap, "Practical low power digital VLSI design", 1st edition, Kluwer Publishers, 1998
3. J.B. Kuo and J.H Lou, "Low voltage CMOS VLSI Circuits", 1st edition, Wiley Inter Science Publication, 1999
4. James B. Kuo and Shin chia Lin, "Low voltage SOI CMOS VLSI Devices and Circuits", 2nd edition, John Wiley and sons Publishers, 2001

COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the principle of power dissipation in CMOS	Understand
CO2	Summarize the various power optimization techniques	Understand
CO3	Illustrate the different techniques for low power CMOS circuits	Understand
CO4	Examine the performance of power estimation techniques	Analyze
CO5	Apply the different transformation for logical level optimization	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE V

		Category: PE			
U19ECP24	COMPUTER VISION	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Image Processing

COURSE OBJECTIVES:

- To learn basic principles of image processing and formation models
- To understand the core vision tasks of mid–level and high–level
- To study different vision applications

UNIT I BASIC CONCEPTS OF COMPUTER VISION 9

Image Processing – Point operators – Linear filtering – More neighborhood operators – Pyramids and wavelets – Geometric transformations – Global optimization – Feature detection and matching, Points and patches – Edges – Lines

UNIT II IMAGE FORMATION MODELS 9

Geometric camera models – Image formation – Intrinsic and extrinsic parameters – Calibration – Light and shading – Modeling pixel brightness – Inference from shading – Modelling from inter–reflection, shape from one shaded image – Color – Human color – A model of image color – Inference from color

UNIT III MID LEVEL VISION 9

Image segmentation by clustering pixels – Segmentation – Clustering and graphs – Grouping and model fitting – Lines and planes – Robustness – Probabilistic models – Motion segmentation by parameter estimation – Tracking – Strategies – Matching – Linear dynamical models with Kalman filters – Data association – Particle filtering

UNIT IV HIGH LEVEL VISION 9

Registration – Rigid objects – Model–based vision – Deformable objects – Range data – Active range sensors – Range data segmentation – Image registration and model acquisition – Kinect–Learning for classification – Error and loss – Single object classification

UNIT V APPLICATIONS OF VISION 9

Image classification in practice – Detecting objects in images – Document image analysis – Biometric – Object recognition – Medical image analysis – Content based image retrieval – Vehicle vision system – Road marking – Surveillance applications

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd edition, Springer, 2010
2. Forsyth D and Ponce J, "Computer Vision – A modern approach", 2nd edition, Pearson Education, New Delhi, 2013

REFERENCES:

1. Ballard D H and Brown C M, "Computer Vision", 1st edition, Prentice Hall, Englewood Cliffs, 2010
2. Richard Szeliski, "Computer Vision: Algorithms and Applications (CVAA)", 4th edition, Springer, 2010
3. Davies E R, "Computer & Machine Vision", 5th edition, Academic Press, 2012
4. Trucco E and Verri A, "Introductory Techniques for 3D Computer Vision", 3rd edition, Prentice Hall, New Delhi, 2012

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the fundamentals of image processing techniques used for computer vision	Understand
CO2	Summarize the different models of image formation	Understand
CO3	Select suitable segmentation algorithms for mid-level analysis	Apply
CO4	Develop the solutions using image registration and classification techniques	Apply
CO5	Apply computer vision techniques for real time applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO	2.6	2	2	-	-	-	-	-	-	-	-	-	-	3
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)			

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PROFESSIONAL ELECTIVE V

U19ECP25	AUGMENTED REALITY AND VIRTUAL REALITY	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Image Processing

COURSE OBJECTIVES:

- To understand the basic concepts and framework of virtual reality
- To explore the techniques involved in development of Augmented Reality and Virtual Reality environments
- To learn various applications of Augmented and Mixed Reality in modern digital environments

UNIT I CONCEPT OF AUGMENTED REALITY 9

Introduction to Augmented Reality (AR) – Computer graphics, dimensionality, depth cues, registration and latency – Interaction in Augmented Reality – Interaction in real world – Manipulation – Navigation – Communication and multi–person AR – Interaction in projected AR environment – Mobile Augmented Reality

UNIT II FUNDAMENTALS OF VIRTUAL REALITY 9

Three I's of Virtual Reality (VR) – Classic components of VR system – 2D to 3D – 3D space curves – 3D boundary representation – Modeling transformations – Animating the Virtual Environment – Physical simulation

UNIT III INPUT AND OUTPUT INTERFACES 9

Input devices –Three-dimensional position trackers – Tracker performance parameters, magnetic trackers, ultrasonic trackers, optical trackers, hybrid inertial trackers – Navigation and manipulation interfaces – Trackballs, three dimensional probes – Gesture interfaces – Pinch glove, 5DT data glove, cyber glove – Output devices – Graphic displays – Sound displays – Haptic feedback

UNIT IV COMPUTING ARCHITECTURES 9

Rendering pipeline – Graphics rendering pipeline, haptics rendering pipeline – PC graphics architecture – PC graphics accelerators – Workstation based architecture – Sun blade 1000 architectures, SGI infinite reality architecture – Distributed VR architectures – Multi–pipeline synchronization

UNIT V AUGMENTED AND MIXED REALITY APPLICATIONS 9

Applications of Augmented Reality – Magic books – Magic mirrors – Magic windows and doors – Magic lens – Navigation assistance – Applications of Mixed reality – Non–referential augmentation – Objective view augmentation– collaborative augmentation – Simulation using modern VR-AR tools

Contact Periods:

Lecture: 45 Periods Tutorial: – Lecture: 45 Periods Tutorial: – Lecture 45 Periods

TEXT BOOKS:

1. Burdea, G. C. and P. Coffet, "Virtual Reality Technology," 2nd edition. Wiley–IEEE Press, 2006
2. Alan B. Craig," Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann Publishers, 2013

REFERENCES:

1. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", A K Peters/CRC Press; 3rd edition, 2009
2. Blake J. Harris, "The history of the future: Oculus, Facebook and the Revolution that swept Virtual Reality", 2019

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3. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2019
4. Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", O'Reilly Publishers, 2006

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Infer the significance and functions of Augmented Reality	Understand
CO2	Illustrate the basic concepts of virtual reality	Understand
CO3	Outline the multiple models of input and output interface in Virtual Reality	Understand
CO4	Examine different computing architectures in Virtual Reality	Analyze
CO5	Apply Augmented Reality concepts for modern digital environments	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	2	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	2	-	-	-	-	-	-	-	-	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE V

		Category: PE			
U19ECP26	ADVANCED COMMUNICATION SYSTEM	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Communication and Wireless Communication

COURSE OBJECTIVES:

- To understand the concepts of modulation techniques and channel coding methods
- To learn the evolution of 5G communication
- To study the principles of mobile cloud and SON

UNIT I BASEBAND AND BANDPASS TECHNIQUES 9

Baseband systems – Formatting text, message, character, symbol and analog information – Sources of corruption – Bandpass modulation techniques – Detection of signals in Gaussian noise – Error performance for binary systems

UNIT II CHANNEL CODING 9

Waveform coding and structured sequences – Types of error control – Structured sequences – Interleaving and concatenated codes – Coding and interleaving applied to the compact disc digital audio system – Turbo codes – LDPC codes

UNIT III 5G EVOLUTION 9

Historical trend of wireless communication – Evolution of LTE beyond 4G – 5G roadmap – Pillars of 5G – 5G architecture – IoT and context awareness in 5G internet – Networking reconfiguration and virtualization support – Mobility and QoS control- Introduction to 6G.

UNIT IV MOBILE CLOUD 9

Technology and services for future communication platforms - Mobile cloud – Mobile cloud enablers – Network coding – Potential 5G communication system architecture – Challenges in 5G communication systems

UNIT V SYSTEM ON NETWORKS 9

SON evolution for 5G mobile networks – SON in UMTS and LTE – Need for SON in 5G – Evolution towards small-cell dominant HetNets – A new SON architecture for 5G – A vision for 5G mobile – Design drivers for next-generation networks

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Fredric J. Harris and Bernard Sklar, "Digital Communications: Fundamentals and Applications", 3rd edition, Pearson Education, 2020
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley and Sons, 2015

REFERENCES:

1. Simon Haykin, Michael Moher and David Koilpillai, Modern Wireless communications, Pearson Education, 2011
2. John G. Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2nd edition, Pearson Education, 2014
3. B. P. Lathi, "Modern Digital and Analog Communication Systems", 3rd edition, Oxford University Press, 2017

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the concepts of baseband and bandpass signaling	Understand
CO2	Identify the error in data transmission using channel coding techniques	Apply
CO3	Outline the basic principles of 5G communication	Understand
CO4	Illustrate the architecture of mobile cloud enablers	Understand
CO5	Apply SON architecture for 5G implementation	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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PROFESSIONAL ELECTIVE V

		Category: PE			
U19ECP27	NANO ELECTRONICS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To study the basics of Nano technology
- To understand about carbon Nano structures and flexible electronics
- To learn about fabrication techniques and Nano sensors

UNIT I BASICS OF NANOTECHNOLOGY 9

Classification of nanostructures – Electronic properties of atoms and solids – Isolated atom, bonding between atoms, giant molecular solids, free electron models and energy bands, crystalline solids, Effects of nanometer length scale – Fabrication methods – Top down processes, bottom up processes

UNIT II FABRICATION AND PHYSICAL PROCESS 9

Fabrication techniques – Epitaxial growth of quantum wells, lithography and etching, strain induced dots and wires, quantum well width fluctuation, self-assembly techniques – Physical process – Modulation doping, quantum Hall effect – Resonant tunneling, charging effects, non–linear effects

UNIT III CARBON NANOSTRUCTURES 9

Carbon nanotubes – Structure – Single wall tubes – Multiwall tubes – Macroscopic nanotube material – Fibers – Filled tubes – Nanotube suspension – Properties – Physical, Thermal, Electronic, Magnetic and Superconducting – Applications – Drug delivery and bio sensors

UNIT IV NANOSENSORS 9

Introduction to sensor and Nano sensors – Nanoscale organization – Characterization – Perception – Nano sensors based on quantum size effects – Electrochemical sensors – Sensors based on physical properties – Nano biosensors

UNIT V FLEXIBLE ELECTRONICS TECHNOLOGY 9

Materials for flexible electronics – Degrees of flexibility – Substrates – Backplane electronics – Front plane technologies – Encapsulation – Fabrication technology – Sheets by patch processing – Web by roll to toll processing – Additive printing

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Ed Robert Kelsall, Ian Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley, 2007
2. Charles P Poole, Jr, Frank J Owens, "Introduction to Nanotechnology", John Wiley, 2006

REFERENCES:

1. T Pradeep, "Nano: The essentials–Understanding Nanoscience and Nanotechnology", TMH, 2007
2. Ed William A Goddard III, Donald W Brenner, Sergey E. Lyshevski, Gerald J Iafrate, "Hand Book of Nanoscience Engineering and Technology", 2003
3. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and BurkhardRaguse, "Nanotechnology: Basic Science and Emerging Technologies", 2002

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4. William S Wong, Albert Salleo, "Flexible Electronics: Materials and Applications", Springer, 2009
5. John E Fischer, "Nanomaterials Handbook", Taylor and Francis group, 2006

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Outline the basic concepts of Nano technology	Understand
CO2	Illustrate the different fabrication techniques in Nano electronics	Understand
CO3	Apply carbon Nano-structures in bio sensing and drug delivery applications	Apply
CO4	Examine the performance of various Nano sensors	Analyze
CO5	Explain the fundamental concepts of flexible electronics	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	1
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	1
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

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PROFESSIONAL ELECTIVE VI

U19ECP28	TESTING OF VLSI CIRCUITS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Digital Electronics, VLSI Design

COURSE OBJECTIVES:

- To understand testing and verification of faults in VLSI circuits
- To learn various fault modeling methods and BIST
- To acquire knowledge of PLA testing

UNIT I FUNDAMENTALS OF VLSI TESTING 9

Faults in logic circuits – Breaks and transistors stuck–Open and Stuck–On faults in CMOS – Controllability and Observability – Undetectable faults – Equivalent faults – Fault Detection in Logic Circuits – D algorithm – PODEM, FAN – Testing of sequential circuits

UNIT II DESIGN FOR TESTABILITY 9

Ad Hoc techniques – Scan path technique – Clocked hazard free latches – Double latch and single LSSD – Random access scan technique – Partial scan – Crosscheck – Boundary scan

UNIT III FAULT MODELING 9

Logical fault models – Fault equivalence and fault location – Single Stuck fault model – Multiple stuck fault model – Basic concepts of ATG – Random test generation – Test generation of bridging faults

UNIT IV BUILT–IN SELF–TEST 9

Test pattern generation – Output response analysis – BIST architectures – BEST, CBIST, BILBO – IDDQ testing – Design for self–test – Test pattern generation using Simulation tool

UNIT V PLA TESTING 9

PLA testing problems – Test generation algorithm for PLAs – Testable PLA designs – Evaluation of PLA test methodologies – PLA test techniques – Measures of TDMs

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Parag K. Lala, "An Introduction to Logic Circuit Testing", 2nd edition, Morgan & Claypool Publishers, 2008
2. Miron Abramovici, Melvin A.Breuer, Arthur D.Firedman, "Digital systems testing and testable design", Revised printing, IEEE press, 2005

REFERENCES:

1. Thomas Kropf, "Introduction to Formal Hardware Verification", 3rd edition, Springer Publishers,1999
2. Michael L. Bushnell and Vishwani D. Agrawal, "Essentials of Electronic Testing", 2nd edition, Springer India, 2000
3. N. Jha and S.D. Gupta, "Testing of Digital Systems", 2nd edition, Cambridge, 2003
4. Franz Schwabl, "Introduction to Formal Hardware Verification", 3rd edition, Springer Publishers, 2005

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the testing and verification of VLSI circuits	Understand
CO2	Illustrate scan architectures and fault methods using DFT	Understand
CO3	Examine the performance of various fault modeling methods	Analyze
CO4	Make use of BIST architecture for test pattern generation	Apply
CO5	Summarize different PLA testing methodologies for VLSI circuits	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	2	-	2	-	-	-	-	-	-	-	-	3
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO	2.4	2	2	-	2	-	-	-	-	-	-	-	-	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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PROFESSIONAL ELECTIVE VI

		Category: PE			
U19ECP29	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of natural language processing
- To acquire the basic knowledge about text processing and language modelling
- To learn the basics of alignment techniques

UNIT I BASICS OF NATURAL LANGUAGE PROCESSING 9

Ambiguity of language – Essential information theory – Entropy, Cross entropy, Perplexity, Mutual information – Parts of Speech – Nouns and Pronouns, words, determiners and adjectives, verbs – Phrase structure

UNIT II TEXT PROCESSING AND WORD SENSE DISAMBIGUATION 9

Regular expressions – Words – Corpora – Text normalization – Minimum edit distance – Methodological preliminaries – Supervised, dictionary based and unsupervised disambiguation

UNIT III LANGUAGE MODELLING 9

Words – Collocations – Frequency – Mean and Variance – Hypothesis testing – The t-test, Hypo testing of differences, Pearson's chi–square test, Likelihood ratios – Statistical inference – n-gram models over sparse data – Bins – Forming equivalence classes – Statistical estimators – Combining estimators

UNIT IV SEMANTICS 9

Lexical semantics – Semantic role labeling – Semantic roles – Diathesis alterations – Thematic role – The proposition bank – Frame Net – WordNet – Conditional Random Fields (CRFs) – Partial parsing

UNIT V APPLICATIONS 9

Text alignment – Aligning sentences and paragraphs – Length based methods – Offset alignment by signal processing techniques – Lexical methods for sentence alignment – Word alignment – statistical machine translation

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Christopher D. Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", Original Edition, The MIT Press Cambridge, 1993
2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", 3rd Edition, Pearson Education, 2020

REFERENCES:

1. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", 2nd Edition, CRC Press, 2010
2. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Education. 2007
3. Hobson Iane, Cole Howard, Hannes Max Hapke, "Natural language processing in action", Manning Publications, 2019
4. Roland Hauser, "Foundations of Computational Linguistics", 3rd Edition, Springer, 2013

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Explain the basic components of natural language processing	Understand
CO2	Identify the ambiguities between words	Apply
CO3	Outline the concepts of language modelling	Understand
CO4	Illustrate the semantic labelling methods	Understand
CO5	Compare various alignment techniques	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	1
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	1
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	1
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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PROFESSIONAL ELECTIVE VI

U19ECP30	NETWORK SECURITY	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Communication networks

COURSE OBJECTIVES:

- To study various cryptographic techniques and data encryption standards
- To learn about the principles of public key and authentication systems.
- To understand the security mechanisms of internet and mobile networks

UNIT I BASIC CIPHERS 9

Services, mechanisms and attacks –The OSI security architecture – Network security model – Classical encryption techniques, symmetric cipher model, substitution techniques, transposition techniques, steganography

UNIT II BLOCK CIPHERS 9

Block ciphers–Data encryption standard– Block cipher principles, block cipher modes of operation – Triple DES–Simplified advanced encryption standard– Advanced encryption standard (AES)

UNIT III PUBLIC KEY SYSTEM CIRCUITS 9

Public key cryptography, principles of public key cryptosystems – The RSA algorithm – Key management – Diffie Hellman Key exchange – Elliptic curve arithmetic – Elliptic curve cryptography– Elliptic curve digital signature algorithm

UNIT IV AUTHENTICATION SYSTEM 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function – MD5 – SHA– HMAC – CMAC – Digital signature and authentication protocols – DSS – El Gamal – Authentication applications – Kerberos– X.509 Authentication services

UNIT V INTERNET AND MOBILE SECURITY 9

Internet firewalls for trusted System – Roles of firewalls – Firewall related terminology – Types of Firewalls – Intrusion detection system – Virus and related threats – Countermeasures – Email Security, security services for e-mail – Establishing keys privacy authentication of the source – Message Integrity – Non-repudiation

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security principles and practice", 7th edition, Pearson Education, 2017
2. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security", 3rd edition, Prentice Hall of India, 2012

REFERENCES:

1. Behrouz A Ferouzan, "Cryptography & Network Security", 3rd Edition, Tata McGraw Hill, 2011
2. Man Young Rhee, "Internet Security: Cryptographic Principles, Algorithms and Protocols", Wiley Publications, 2003
3. Charles Pfleeger, "Security in Computing", Prentice Hall of India, 2009
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000

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COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Summarize various cryptographic techniques used in OSI security architecture	Understand
CO2	Explain the operations of data encryption standards	Understand
CO3	Illustrate the principles of public key cryptosystems	Understand
CO4	Analyze the performance of different authentication system methods	Analyze
CO5	Identify the threats and attacks in data networks and Mobile security	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	1	-
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)							

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PROFESSIONAL ELECTIVE VI

U19ECP31	WIRELESS ADHOC NETWORKS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Communication Networks

COURSE OBJECTIVES:

- To understand wireless ad hoc networks and its MAC protocols
- To learn various routing and transport layer protocols
- To acquire knowledge of security issues and its requirements in wireless adhoc network

UNIT I BASIC CONCEPTS AND MAC PROTOCOLS OF WIRELESS ADHOC NETWORKS 9

Cellular and ad hoc wireless networks – Applications - Issues of ad hoc wireless networks – Ad hoc wireless internet - Classification of MAC protocols - Contention based protocols with reservation mechanisms - Contention based protocols with scheduling mechanisms

UNIT II ROUTING PROTOCOLS 9

Design issues – Classification of routing protocols - Table driven routing protocols – On demand routing protocols – Temporally ordered routing algorithm, location aided algorithm, signal stability based adaptive routing protocol.

UNIT III TRANSPORT LAYER AND SECURITY PROTOCOLS 9

Design issues - Design goals - Classification of Transport layer solutions - TCP over ad hoc wirelessnetworks – Network security requirements - Issues and challenges in security provisioning - Networksecurity attacks - Key management – Secure routing

UNIT IV QUALITY OF SERVICE 9

Classifications of QoS Solutions – MAC layer solutions – Network layer solutions – Ticket based QoS routing protocol - On demand QoS routing protocol – On demand link state multipath QoS routing protocol – QoS frameworks

UNIT V ENERGY MANAGEMENT IN ADHOC WIRELESS NETWORKS 9

Need for energy management – Classification – Battery management schemes – Transmission power management schemes – System power management schemes

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad hoc Wireless Networks Architectures and Protocols", 2nd edition, Prentice Hall Professional Technical Reference, 2015
2. Holger Karl, Andreas Willig, "Protocol and Architecture for Wireless Sensor Networks", 1st edition, John Wiley publication, Jan 2011

REFERENCES:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", 2nd edition, World Scientific Publishing, 2011
2. Ozan K. Tonguz and Gianguigi Ferrari, "Ad hoc Wireless Networking", 1st edition, John Wiley, 2006
3. C.K.Toh, "Ad Hoc Mobile Wireless Networks", 1st edition, Pearson Education, 2001
4. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", 1st edition, Elsevier publication, 2004

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COURSE OUTCOMES:

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

COs	Statements	K-Level
CO1	Explain the fundamentals of wireless ad hoc networks	Understand
CO2	Illustrate the different MAC layer protocols	Understand
CO3	Summarize the routing protocols in wireless ad hoc networks	Apply
CO4	Examine the various protocols in transport layer	Analyze
CO5	Interpret the network security requirements and protocols	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

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PROFESSIONAL ELECTIVE VI

		Category: PE			
U19ECP32	OPTICAL NETWORKS	L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Wireless Communication

COURSE OBJECTIVES:

- To understand the optical components and architectures in optical communication systems
- To design the traffic models applicable for wavelength routing networks
- To study about packet switching and network management

UNIT I OPTICAL SYSTEM COMPONENTS 9

Optical transmission basics – Light propagation in optical fibers – Loss and bandwidth – Nonlinear effects – Solitons – Optical components: Couplers, Isolators, Circulators, Multiplexers and filters – Switches – Wavelength converters

UNIT II OPTICAL NETWORK ARCHITECTURES 9

Introduction to optical networks – SONET/SDH – Transport networks – Framing procedure – Multiprotocol label switching – Resilient packet ring – WDM network elements

UNIT III WAVELENGTH ROUTING NETWORKS 9

Optical layer cost trade-off – Light path topology design – Routing and wavelength assignment – Wavelength conversion – Dimensioning wavelength – Routing networks

UNIT IV ADVANCED OPTICAL NETWORKS 9

Visible light and UV communication – Li-Fi – Optical Light Emitting Diode – WOBAN – Optical Time Division Multiplexing – Synchronization – Free space optics – Radio over fiber technology

UNIT V NETWORK DESIGN AND MANAGEMENT 9

Network management functions – Optical layer services and Interfacing – Multivendor interoperability – Performance and fault management – Configuration management – Optical safety

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Rajiv Ramaswami and Kumar N. Sivarajan, Galen Sasaki "Optical Networks: A Practical Perspective", 3rd edition, Elsevier/Morgan Kaufmann, 2010
2. C.Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", 2nd edition, Prentice Hall of India, 2002

REFERENCES:

1. Biswanath Mukherjee, "Optical WDM Networks",2nd edition, Springer Science, 2006
2. Thomas E. Stern, Georgios Ellinas, Krishna Bala, "Multiwavelength Optical Networks Architecture, Design and control ", 2nd edition, Cambridge University Press, 2009
3. Govind P.Agrawal, "Fiber–Optic Communication Systems", 4th edition, John Wiley and Sons, 2012
4. Gerd Keiser, "Optical Fiber Communications", 5th edition, Mc Graw Hill Education 2013

COURSE OUTCOMES:

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

COs	Statements	K–Level
CO1	Illustrate the operation of various optical components	Understand
CO2	Explain different network architectures	Understand
CO3	Make use of routing and wavelength assignment for efficient network design	Apply
CO4	Examine the performance of various optical networks	Analyze
CO5	Summarize the management and control aspects of optical networks	Understand

COURSE ARTICULATION MATRIX

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO	2.4	2	2	-	-	-	-	-	-	-	-	-	-	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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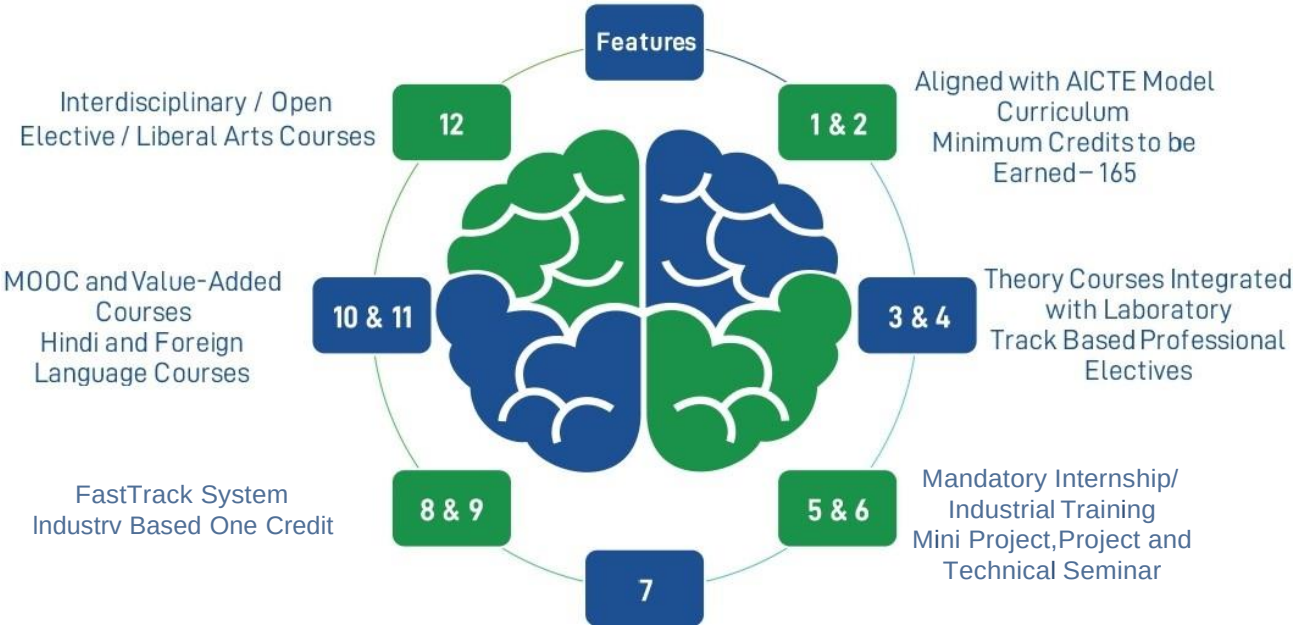
Curriculum Features



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