GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)
Coimbatore - 641 013

Curriculum and Syllabi For
B.E. (ELECTRONICS AND COMMUNICATION ENGINEERING)
(Full Time)

2016
Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
GOVERNMENT COLLEGE OF TECHNOLOGY
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind.

MISSION

- To achieve Academic excellence through innovative teaching and learning practices.
- To enhance employability and entrepreneurship.
- To improve the research competence to address societal needs.
- To inculcate a culture that supports and reinforces ethical, professional behaviours for a harmonious and prosperous society.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION AND MISSION OF THE DEPARTMENT

VISION

The vision of ECE department is to become pioneer in higher learning and research and to produce creative solution to societal needs.

MISSION

1. To provide excellence in education, research and public service.
2. To provide quality education and to make the students entrepreneur and employable.
3. Continuous upgradation of techniques for reaching heights of excellence in a global perspective.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMME SPECIFIC OUTCOME

PSO1: Graduates will be able to understand and apply the concepts of Electronics and Communication Engineering in the field of Microelectronics, Signal processing, Communication/Networking, Embedded and VLSI Systems.

PSO2: Graduates will be able to design and utilize advanced Hardware and Software tools to analyze and implement subsystems/processes for real time applications.

PSO3: Graduates will be able to apply domain knowledge to enhance research in the field of Embedded Systems, VLSI Systems and Communication Engineering.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES

The Program Educational Objectives (PEO's) of Electronics and Communication Engineering are

PEO1: Graduates apply their knowledge of mathematics and science to identify, analyze and solve problems in the field of Electronics and develop sophisticated communication systems.

PEO2: Graduates exhibit their innovative ideas and management skills to meet the day to day technical challenges.

PEO3: Graduates embody a commitment to professional ethics, diversity and social awareness in their professional career.

PEO4: Graduates exhibit a desire for life-long learning through technical training and professional activities.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM OUTCOMES

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

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

BOARD OF STUDIES IN BASIC SCIENCES 2016-17
B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
CBCS 2016 REGULATIONS

FIRST SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16LHS1Z1	Communication Skills in English	HS	50	50	100	2	2	0	3
2	16LBS1Z2	Engineering Mathematics I	BS	50	50	100	3	2	0	4
3	16LBS103	Engineering Physics	BS	50	50	100	3	0	0	3
4	16LBS104	Applied Chemistry	BS	50	50	100	3	0	0	3
5	16LES105	Basics of Civil and Mechanical Engineering	ES	50	50	100	3	0	0	3
PRACTICAL										
6	16LBS106	Chemistry Laboratory	BS	50	50	100	0	0	4	2
7	16LES107	Workshop Practice	ES	50	50	100	0	0	4	2
		TOTAL		350	350	700				**20**

SECOND SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16LHS2Z1	Technical English	HS	50	50	100	2	2	0	3
2	16LBS2Z2	Engineering Mathematics II	BS	50	50	100	3	2	0	4
3	16LBS2Z3	Materials Science	BS	50	50	100	3	0	0	3
4	16LHS2Z4	Environmental Science and Engineering	HS	50	50	100	3	0	0	3
5	16LES2Z5	Programming in C	ES	50	50	100	3	0	0	3
6	16LES206	Electron Devices	ES	50	50	100	3	0	0	3
PRACTICAL										
7	16LBS207	Physics Laboratory	BS	50	50	100	0	0	4	2
8	16LES208	Engineering Graphics	ES	50	50	100	2	0	4	4
9	16LES2Z9	Programming in C Laboratory	ES	50	50	100	0	0	4	2
		TOTAL		450	450	900				**27**

THIRD SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16LBS3Z1	Engineering Mathematics-III	BS	50	50	100	3	2	0	4
2	16LES302	Circuit Theory	ES	50	50	100	2	2	0	3
3	16LES303	Data Structures and Algorithms using C	ES	50	50	100	3	0	0	3
4	16LES304	Digital System Design	ES	50	50	100	3	0	0	3
5	16LPC305	Electronic Circuit Design	PC	50	50	100	3	0	0	3
6	16LPC306	Signals and Systems	PC	50	50	100	2	2	0	3
PRACTICAL										
7	16LES307	Data Structures Laboratory	ES	50	50	100	0	0	4	2
8	16LPC308	Electronic Devices and Circuit Laboratory	PC	50	50	100	0	0	4	2
		TOTAL		400	400	800				**23**

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16LBS401	Random Process and Queuing Theory	BS	50	50	100	3	2	0	4
2	16LES402	Electrical Engineering and Control Systems	ES	50	50	100	3	0	0	3
3	16LPC403	Communication Theory	PC	50	50	100	3	0	0	3
4	16LPC404	Networks and Transmission lines	PC	50	50	100	2	2	0	3
5	16LPC405	Analog Integrated Circuits	PC	50	50	100	3	0	0	3
6	16LPC406	Digital Signal Processing	PC	50	50	100	2	2	0	3
PRACTICAL										
7	16LPC407	Integrated Circuits Laboratory	PC	50	50	100	0	0	4	2
8	16LPC408	Digital Signal Processing Laboratory	PC	50	50	100	0	0	4	2
		TOTAL		400	400	800				**23**

FIFTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16LPC501	Electromagnetic Fields and Waveguides	PC	50	50	100	2	2	0	3
2	16LPC502	VLSI System Design	PC	50	50	100	3	0	0	3
3	16LPC503	Digital Communication	PC	50	50	100	3	0	0	3
4	16LPC504	Microprocessor and Microcontroller	PC	50	50	100	3	0	0	3
5	16LPC505	Computer System Architecture	PC	50	50	100	3	0	0	3
6		Open Elective - I	OE	50	50	100	3	0	0	3
PRACTICAL										
7	16LEE507	Microprocessor and Microcontroller Laboratory	EEC	50	50	100	0	0	4	2
8	16LPC508	Communication Engineering Laboratory I	PC	50	50	100	0	0	4	2
		TOTAL		400	400	800				**22**

SIXTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16LPC601	Antennas and Wave Propagation	PC	50	50	100	3	0	0	3
2	16LPC602	Embedded System Design	PC	50	50	100	3	0	0	3
3	16LPC603	Computer Communication	PC	50	50	100	3	0	0	3
4	16LPC604	Wireless Communication	PC	50	50	100	3	0	0	3
5		Open Elective - II	OE	50	50	100	3	0	0	3
6		Professional Elective - I	PE	50	50	100	3	0	0	3
PRACTICAL										
7	16LPC607	Communication Engineering Laboratory-II	PC	50	50	100	0	0	4	2
8	16LPC608	VLSI system Laboratory	PC	50	50	100	0	0	4	2
9	16LEE609	Embedded System Design practice	EEC	50	50	100	0	0	4	2
		TOTAL		450	450	900				**24**

SEVENTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16LHS701	Management Theory and Practice	HS	50	50	100	3	0	0	3
2	16LPC702	Microwave and RF Engineering	PC	50	50	100	3	0	0	3
3		Open Elective - III	OE	50	50	100	3	0	0	3
4		Professional Elective - II	PE	50	50	100	3	0	0	3
5		Professional Elective - III	PE	50	50	100	3	0	0	3
6		Professional Elective - IV	PE	50	50	100	3	0	0	3
PRACTICAL										
7	16LEE707	Microwave RF and optical laboratory	EEC	50	50	100	0	0	4	2
8	16LEE708	Mini Project	EEC	50	50	100	0	0	8	4
		TOTAL		400	400	800				**24**

EIGHTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1		Professional Elective – V	PE	50	50	100	3	0	0	3
2		Professional Elective – VI	PE	50	50	100	3	0	0	3
PRACTICAL										
3	16LEE801	Project Work	EEC	50	50	100	0	0	16	8
		TOTAL		150	150	300				**14**

LIST OF PROFESSIONAL ELECTIVES

Sl. No	Course Code	Course Title	Category	Continuous Assessment Marks	End sem Marks	Total Marks	Credits			
							L	T	P	C
1	16LPEX01	Fiber Optic Communication	PE	50	50	100	3	0	0	3
2	16LPEX02	Image Processing	PE	50	50	100	3	0	0	3
3	16LPEX03	Digital Video Systems	PE	50	50	100	3	0	0	3
4	16LPEX04	Satellite Communication	PE	50	50	100	3	0	0	3
5	16LPEX05	Nano Electronics	PE	50	50	100	3	0	0	3
6	16LPEX06	MEMS	PE	50	50	100	3	0	0	3
7	16LPEX07	Microwave Integrated Circuits	PE	50	50	100	3	0	0	3
8	16LPEX08	Biomedical Instrumentation Systems	PE	50	50	100	3	0	0	3
9	16LPEX09	Foundations of Operating Systems	PE	50	50	100	3	0	0	3
10	16LPEX10	Robotics and automation	PE	50	50	100	3	0	0	3
11	16LPEX11	Digital Signal Processors and Applications	PE	50	50	100	3	0	0	3
12	16LPEX12	Information Theory and Coding	PE	50	50	100	3	0	0	3
13	16LPEX13	Network Security	PE	50	50	100	3	0	0	3
14	16LPEX14	Statistical Theory of Communication	PE	50	50	100	3	0	0	3
15	16LPEX15	Cognitive Radio Communication	PE	50	50	100	3	0	0	3
16	16LPEX16	Internet of Things & Data Analytics	PE	50	50	100	3	0	0	3
17	16LPEX17	Electronic Packaging	PE	50	50	100	3	0	0	3
18	16LPEX18	DSP with FPGA	PE	50	50	100	3	0	0	3
19	16LPEX19	RF Integrated Circuits	PE	50	50	100	3	0	0	3
20	16LPEX20	Wireless Sensor and Mesh Networks	PE	50	50	100	3	0	0	3
21	16LPEX21	Neural Networks	PE	50	50	100	3	0	0	3
22	16LPEX22	Multimedia Compression Techniques	PE	50	50	100	3	0	0	3
23	16LPEX23	Multi core Architecture	PE	50	50	100	3	0	0	3
24	*16LIEX01	Automotive Electronics	PE	50	50	100	3	0	0	3

***-INDUSTRIAL OFFERED ELECTIVE**

LIST OF OPEN ELECTIVES

Sl. No	Course Code	Course Title	Category	Continuous Assessment Marks	End sem Marks	Total Marks	Credits			
							L	T	P	C
1	16AOEX01	NanoScience and Technology	OE	50	50	100	3	0	0	3
2	16AOEX02	Material Characterizations	OE	50	50	100	3	0	0	3
3	16AOEX03	Electrochemical Technology	OE	50	50	100	3	0	0	3
4	16AOEX04	Polymer Technology	OE	50	50	100	3	0	0	3
5	16COEX05	Disaster Management and Mitigation	OE	50	50	100	3	0	0	3
6	16COEX06	Environmental Management	OE	50	50	100	3	0	0	3
7	16COEX07	Town Planning and Architecture	OE	50	50	100	3	0	0	3
8	16MOEX08	Total Quality Management for Engineers	OE	50	50	100	3	0	0	3
9	16MOEX09	Composite materials	OE	50	50	100	3	0	0	3
10	16MOEX10	Automobile Engineering	OE	50	50	100	3	0	0	3
11	16EOEX11	Renewable Energy Sources and Technology	OE	50	50	100	3	0	0	3
12	16EOEX12	Smart Grid Technology	OE	50	50	100	3	0	0	3
13	16LOEX13	Principles of Communication	OE	50	50	100	3	0	0	3
14	16LOEX14	Microcontrollers and its applications	OE	50	50	100	3	0	0	3
15	16NOEX15	Industrial Automation systems	OE	50	50	100	3	0	0	3
16	16NOEX16	Measurements and Instrumentation	OE	50	50	100	3	0	0	3
17	16SOEX17	Enterprise JAVA	OE	50	50	100	3	0	0	3
18	16SOEX18	Cyber Security	OE	50	50	100	3	0	0	3
19	16SOEX19	Network Essentials	OE	50	50	100	3	0	0	3
20	16IOEX20	Programming in Python	OE	50	50	100	3	0	0	3
21	16IOEX21	BIG Data Science	OE	50	50	100	3	0	0	3
22	16IOEX22	Object Oriented Programming using C++	OE	50	50	100	3	0	0	3
23	16BOEX23	Computational Biology	OE	50	50	100	3	0	0	3
24	16BOEX24	Biology for Engineers	OE	50	50	100	3	0	0	3
25	16BOEX25	Fundamentals of BioEngineering	OE	50	50	100	3	0	0	3

LIST OF ONE CREDIT COURSES

Sl. No	Course Code	Course Title	Category	Continuous Assessment Marks	End sem Marks	Total Marks	Credits			
							L	T	P	C
1	16LOC1Z1	Human Values I	OC	100	-	100	1	0	0	1
2	16LOCX02	Human Values and Professional Ethics	OC	100	-	100	1	0	0	1
3	16LOCX03	Yoga for youth Empowerment	OC	100	-	100	1	0	0	1
4	16LOCX04	Science of Creativity	OC	100	-	100	1	0	0	1
5	16LOCX05	Personal Leadership	OC	100	-	100	1	0	0	1
6	16LOCX06	Scripting Languages	OC	100	-	100	1	0	0	1
7	16LOCX07	Social Work	OC	100	-	100	1	0	0	1
8	16LOCX08	Android Application Development	OC	100	-	100	1	0	0	1
9	16LOCX09	Web Designing	OC	100	-	100	1	0	0	1
10	16LOCX10	LTE	OC	100	-	100	1	0	0	1
11	16LOCX11	Avionics	OC	100	-	100	1	0	0	1
12	16LOCX12	Machine Vision	OC	100	-	100	1	0	0	1
13	16LOCX13	Millimeter Wave Communication	OC	100	-	100	1	0	0	1
14	16LOCX14	Telematics	OC	100	-	100	1	0	0	1
15	16LOCX15	E-Commerce Security	OC	100	-	100	1	0	0	1
16	16LOCX16	Simulation Techniques	OC	100	-	100	1	0	0	1
17	16LOCX17	Cloud Computing	OC	100	-	100	1	0	0	1
18	16LOCX18	Design of Power Supplies	OC	100	-	100	1	0	0	1

CREDIT SUMMARY

S. No.	Subject Area	Credits per Semester								Credits Total	% of Total Credits	Total No. of subjects	AICTE Recommended Range of Credits %		Satisfied
		I	II	III	IV	V	VI	VII	VIII				MIN	MAX	
1	HS	3	3					3		9	5	3	5	10	Yes
2	BS	12	9	4	4					29	17	9	15	20	Yes
3	ES	5	15	11	3					34	19	12	15	20	Yes
4	PC			8	16	17	16	3		60	34	22	30	40	Yes
5	PE						3	9	6	18	10	6	10	15	Yes
6	OE					3	3	3		9	5	3	5	10	Yes
7	EEC					2	2	6	8	18	10	5	10	15	Yes
	TOTAL	20	27	23	23	22	24	24	14	177					
8	Non-Credit / Mandatory														

HS- Humanities and Social Science

BS- Basic Science

ES- Engineering Science

PC- Professional Core

PE- Professional Elective

OE- Open Elective

EEC- Employment Enhancement Course

IE-Industrial Elective

EEC

1. Industrial Training/Internship 1 Credit - 2 Weeks

   2 Credit - 4 Weeks

   3 Credit - 6 Weeks

2. Mini Project
3. Project

16LHS1Z1 **COMMUNICATION SKILLS IN ENGLISH** **Category : HS**

(Common to all branches)

L T P C

2 2 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To make the learners understand the usage of basic grammar in English.
- To enhance the learner's speaking skills through appropriate listening practice.
- To instill reading habits to practice communicative tasks and comprehension
- To improve the learner's writing skills through various means
- To enrich the vocabulary of learners for speaking and writing

UNIT I **6+6 Periods**

Listening - Listening to practice basic pronunciation at phonemic and word level, Listening to informal conversations of exchanging greetings and introducing oneself/others; **Speaking**-Introducing oneself, one's family / friend, speaking about one's place; **Reading**-Reading to practice stress and pause; **Writing**-Autobiographical writing, Letter to seek permission, Letter to issue certificates; **Grammar**- Use of Auxiliary Verbs, Adjectives and Adverbs; **Vocabulary**-Word formation, Synonyms and Antonyms of High frequency words.

UNIT II **6+6 Periods**

Listening-Listening to Telephone Conversations for taking and leaving messages, making enquiries; **Speaking—**Role-play activities based on real life situations, Narrating daily routines; **Reading**– skimming and scanning, Reading for comprehension with exercises; **Writing**-Advertisements and slogan writing, Imperative instructions, Definitions; **Grammar** – Tenses, Prepositions; **Vocabulary**- Commonly confused words

UNIT III **6+6 Periods**

Listening -Listening to give instructions, Making requests and responding to requests, Thanking someone and responding to thanks; **Speaking** -Group Discussion on chosen topics, Describing a simple process; **Reading**-Reading and interpreting visual material, Critical reading; **Writing** – Letter to the Editor of a Newspaper, Recommendations; **Grammar**- Impersonal Passive, Subject-verb agreement; **Vocabulary**- Collocation, Word Association

UNIT IV **6+6 Periods**

Listening-Listening to accept/refuse invitation, Listening to apologize, Listening to congratulate; **Speaking** – Debates on current social affairs; **Reading** –Reading to make inference, Paraphrasing; **Writing-** Personal letter (Inviting your friend to a function, congratulating someone on his / her success, thanking one's friends / relatives); **Grammar** – 'Wh'-questions, Modal verbs; **Vocabulary** -Single word substitutes -Use of abbreviations & acronyms

UNIT V **6+6 Periods**

Listening -Video Listening to different accents, Viewing Speeches, Viewing English songs, Viewing short films; **Speaking** -Giving impromptu talks, Making presentations on given topics; **Reading** –Extensive reading; **Writing** –Writing General Article, Writing Short Stories; **Grammar** - Common Errors in English; **Vocabulary** –Word Pairs with Repetitive meaning.

Lecture: 30 Periods Tutorial:30 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Department of English, Anna University, Mindscapes	*English for Technologists and Engineers.*	*Orient Blackswan, Chennai. 2012*
Sadanand, Kamlesh & Punitha, Susheela	*Spoken English: A Foundation Course (Part 1).*	*Orient Blackswan, Hyderabad. 2014*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Raman, Meenakshi & Sangeetha Sharma	*Technical Communication: Principles and Practice*	*Oxford University Press, New Delhi. 2011*
Vijay, Anbazhagan.J, & Jaishree.N	*Technical English-I*	*Global Publishers, Chennai, 2016*
Rizvi, Ashraf. M.	*Effective Technical Communication*	*Tata McGraw-Hill, New Delhi. 2005*
Rutherford, Andrea. J	*Basic Communication Skills for Technology*	*Pearson, New Delhi. 2001*
Redston, Chris, Cunningham, Gillie	*Face 2 Face: Elementary Student's Book*	*Cambridge University Press, New Delhi. 2009*

EXTENSIVE READING (Not for Examination)

Kalam, Abdul A.P.J	*Wings of Fire.*	*Universities Press, Hyderabad. 1999.*

Websites

1. http://www.usingenglish.com
2. http://www.uefap.com

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: The learner will be able to understand basic grammar and the learner will have sufficient command over language by training his tongue and tuning his ear through apt listening tasks.

CO2: Reading tasks will enable the learner practice phonological and linguistic aspect of learning, help comprehend and create interest in extensive reading.

CO3: The learner shall be able to write appropriately for a given context and use the right word at the right place.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	2	-	2	-	-	-	-	-	-	-	-	1	-
CO2	-	-	-	-	-	2	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
16LBS1Z1	-	-	1	-	1	1	-	-	-	1	1	-	-	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS1Z2 **ENGINEERING MATHEMATICS I** **Category : BS**

(Common to all branches)

L T P C

3 2 0 4

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To familiarize techniques of matrix algebra including properties of eigen values and eigen vectors.
- To gain the knowledge of hyperbolic functions and application problems in differential calculus.
- To familiarize with functions of several variables and Functions of two variables including extremum problems, Jacobian and Leibnitz rule of integration.
- To perform double and triple integration with relevant to surface area and volume of solid.

UNIT I MATRICES 9+6 Periods

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

UNIT II HYPERBOLIC FUNCTIONS AND DIFFERENTIAL CALCULUS 9+6 Periods

Hyperbolic and Inverse Hyperbolic functions-Identities- Real and Imaginary parts-Solving Problems using Hyperbolic functions.

Curvature and radius of curvature-Cartesian and polar coordinates- center of curvature and Evolutes- Envelopes and Evolute as envelope of normal.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+6 Periods

Functions of two variables- Taylor's theorem (statement only) and expansions-Maxima and Minima-Constrained extremum by Lagrange's multiplier method-Jacobians-Differentiation under integral sign

UNIT IV INTEGRAL CALCULUS 9+6 Periods

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

UNIT V MULTIPLE INTEGRALS 9+6 Periods

Beta and Gamma integrals and properties. Double Integrals-Change of order of integration-Double integrals in polar coordinates-Area enclosed by plane curves-Triple integrals-Volume as a triple integral-Transformation to Polar, Cylindrical and Spherical polar coordinates.

Lecture: 45 Periods Tutorial:30 Periods Practical: 0 Periods Total: 75 Periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER,YEAR OF PUBLICATION
Veerarajan T	*Engineering Mathematics for Semesters I and II*	*Tata McGraw Hill Publishing Co., New Delhi, 2015.*
Kandasamy P, Thilagavathy K and Gunavathy K	*Engineering Mathematics for I year B.E/B.Tech.*	*S.Chand& Co, Ramnagar, New Delhi, Reprint2013.*
S. Narayanan and Manicavachagom Pillai T.K.	*Calculus, Vol.I , II and III,*	*S. Viswanathan, Printers and Publishers Pvt. Ltd, Chennai, 2009.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Erwin Kreyszig	*Advanced Engineering Mathematics*	*Wiley & sons (Asia) Ltd, 10th Edition, 2015.*
Ray Wylie.C and Louis Barrett	*Advanced Engineering Mathematics*	*Tata McGraw Hill Company, New Delhi, 2004.*
Grewal B. S	*Higher Engineering Mathematics*	*Khanna Publishers, New Delhi, 43rd Edition, 2014.*
Ramana B V	*Higher Engineering Mathematics*	*Tata McGraw Hill Co. Ltd, NewDelhi, 11th Print, 2010.*
Bali N., Goyal M and Watkins C	*Advanced Engineering Mathematics*	*Firewall Media (An Imprint of Laxmi Publications Pvt Ltd), New Delhi, 7th Edition, 2009.*
Bali N.P and Goyal M	*A text book of Engineering Mathematics*	*University Science Press (An Imprint of Laxmi Publications Pvt Ltd), New Delhi,2014*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Acquire knowledge of eigen values and eigen vectors including properties through matrix theory.

CO2: Understand the hyperbolic functions and applications of differential calculus.

CO3: Acquire fluency in partial differentiation and solving problems related to maxima and minima for more independent variables.

CO4: Understand the standard types of integration and solution to various integrals.

CO5: Understand the multiple integrals and their applications to engineering problems.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	-	-	-	-	-	3	2	2	3	2	-
CO2	3	2	2	-	-	-	-	-	-	2	-	-	2	-	-
CO3	3	3	3	-	-	-	-	-	-	1	-	-	2	2	-
CO4	3	3	2	2	-	-	-	-	-	2	1	2	3	-	-
CO5	3	2	2	-	-	-	-	-	-	1	1	2	2	2	-
16LBS1Z2	3	3	2	2	-	-	-	-	-	2	1	2	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS103 **ENGINEERING PHYSICS** **Category : BS**

(Common to EEE, ECE, EIE, CSE,& IT branches) L T P C

3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology. Upon completion of this course the students will be familiar with:

Concepts, types of lasers and its applications, fibre optic principles and its applications.
Basics of properties of matter & thermal physics
Origin of quantum physics, Schrödinger's equation and applications.
Principles of acoustics, ultrasonics and their industrial applications.
Fundamentals of crystal Physics and its packing factor calculations.

UNIT I LASERS & FIBRE OPTICS 9 Periods

Introduction- Principle of laser action - characteristics of laser - Spontaneous emission and Stimulated emission –Einstein's coefficients - population inversion – methods of achieving population inversion –Optical Resonator -Types of Lasers – Principle, construction and working of Nd-YAG, CO_2, Semiconductor laser - applications of laser-Hologram

Introduction – Basic Principles involved in fiber optics- Total internal reflection – Structure of optical fiber –Propagation of light through optical fiber –Derivation for Numerical Aperture and acceptance angle - fractional index change - Classification of optical fiber based on materials, refractive index profile and Modes - Fiber optical communication links-Fiber optic sensors-displacement.

UNIT II PROPERTIES OF MATTER & THERMAL PHYSICS 9 Periods

Elasticity- Hooke's law- stress-strain diagram - Factors affecting elasticity - Bending moment - Depression of a cantilever - Young's modulus by uniform bending - I shaped girders.

Thermal expansion - thermal stress - thermal conductivity - heat conduction in solids - flow of heat through compound media - Forbe's and Lee's disc method: theory and experiment.

UNIT III QUANTUM PHYSICS AND APPLICATIONS 9 Periods

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy and temperature –Heisenberg's Uncertainty principle – verification – physical significance of a wave function- Schrödinger's Time independent and Time dependent wave equations –- Particle in a one dimensional potential well–Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM).

UNIT IV ACOUSTICS & ULTRASONICS 9 Periods

Classification of sound - loudness and intensity - Weber-Fechner law - standard intensity and intensity level - decibel - reverberation - reverberation time - sound absorbing materials - Determination of absorption coefficient - factors affecting acoustics of buildings.

Introduction - properties of ultrasonic waves - production of ultrasonic waves; Magnetostriction effect- Magnetostriction generator- Piezoelectric effect- Piezoelectric generator- Acoustic grating - Determination of wavelength and velocity of ultrasonics-cavitation - applications-ultrasonic drilling- ultrasonic welding- ultrasonic soldering and ultrasonic cleaning-Non-destructive Testing- Pulse echo system.

UNIT V CRYSTAL PHYSICS 9 Periods

Introduction – Crystalline and amorphous materials –Lattice – Unit Cell –Crystal system - Bravais lattices – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC, and HCP structures – Crystal defects – Point, line and surface defects.

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

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Arumugam M	*Engineering Physics*	*Anuradha Publishers, 2010. (Unit I , Unit III & Unit IV)*
P.K.Palanisamy	*Engineering Physics*	*Scitech Publications(India)Pvt.Ltd,2015(UnitII & UnitV)*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Avadhanulu M N and Kshirsagar P G	*A Textbook of Engineering Physics*	*S.Chand and Company Ltd, New Delhi, 2010.*
Gaur R.K. and Gupta S.L	*Engineering Physics*	*Dhanpat Rai Publishers, 2009.*
K.Rajagopal	*Engineering Physics*	*PHI Learning Private Ltd, NewDelhi, 2015.*

COURSE OUTCOMES:

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

CO1: Analyze the construction and working of Nd-YAG, CO_2, Semiconductor lasers. Explain fiber optics and classify fibers based on index profiles and modes. [Familiarity]

CO2: Acquire knowledge in properties of matter and thermal physics [Application]

CO3: Analyze the dual nature of matter using Heisenberg's Uncertainty principle, Schrodinger's time independent and dependent wave equations.[Assessment]

CO4: Apply piezoelectric detector method for industrial applications. [Usage and Assessment]

CO5: Compare crystalline and non-crystalline materials and describe the lattice structure, coordination number and packing factor for crystals.[Usage and Assessment]

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	1	1	1	1	-	-	-	1	1	-	-	-
CO2	1	1	-	-	1	1	1	-	-	-	1	1	-	-	-
CO3	1	1	-	-	1	1	1	-	-	-	1	1	-	-	-
CO4	1	1	1	1	1	1	1	-	-	-	1	1	-	-	-
CO5	1	1	1	1	1	1	1	-	-	-	1	1	-	-	-
16LBS103	1	1	1	1	1	1	1	-	-	-	1	1	-	-	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS104 **APPLIED CHEMISTRY** **Category : BS**

(Common to EEE, ECE, EIE, CSE & IT branches) L T P C

3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- The course is aimed at inculcating knowledge of applied chemistry topics which would be useful for students to understand Chemistry relevant to circuitry Engineering subjects.

UNIT I ELECTROCHEMICAL CELLS 9 Periods

Galvanic cells – redox reactions- electrodes - metal and metal ion, hydrogen electrode and calomel electrode – electrode potentials – standard oxidation and reduction potentials - Nernst equation and problems - EMF series and significance – Application of EMF measurements – equilibrium constant, solubility of sparingly soluble salt, potentiometric titration of a redox system (Fe^{2+} Vs Cr^{6+}), pH measurement using glass electrode and fluoride measurement by ISE.

UNIT II BATTERIES 9 Periods

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

UNIT III CORROSION 9 Periods

Corrosion - Spontaneity - Chemical corrosion- mechanism, nature of oxides – Pilling Bedworth rule - electrochemical corrosion – mechanism - types – galvanic and differential aeration – Galvanic series and importance – Prevention methods - design of materials, cathodic protection techniques (sacrificial anode and impressed current cathode), Inhibitors - Protective coatings - Inorganic coating - electroplating – surface preparation and plating method applied to Cr and Ni and galvanising – Organic coating- paints - constituents and functions.

UNIT IV POLYMER TECHNOLOGY 9 Periods

Polymers - definitions of monomer, polymer, functionality, degree of polymerisation – Free radical mechanism -Individual polymers - PVC, PMMA, Teflon, polyamide, poly carbonate, epoxy, polyurethane - preparation, properties and their end users - compounding of plastics - components and functions - fabrication techniques - compression, injection, extrusion and blow moulding - Conducting polymers - structures of polypyrrole, polyaniline and poly acetylene - conduction mechanism of polyacetylene only - Biodegradable polymers – polylactide, starch and cellulose.

UNIT V SILICON WAFER TECHNOLOGY 9 Periods

Silicon for IC chips - single crystal – preparation by Czechralsky and float zone processes - wafer preparation, P-N junction formation – Ion implantation, Diffusion and epitaxial growth techniques - Insulator layer by oxidation - Printing of circuits by photolithography – masking and electron beam methods - etching by chemical and electrochemical methods - metal coatings.

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

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Vairam S, Subha Ramesh	*Engineering Chemistry*	*Wiley India, 2015.*
Jain. P.C. and Monica Jain	*Engineering Chemistry*	*Dhanpat Rai Publications Pvt Ltd, New Delhi, 16th Edition, 2004.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Dara. S.S, Umarae	*Text book of Engineering Chemistry*	*S. Chand Publications, 2004.*
M.S.Tyagi	*Introduction to semiconductor materials and devices*	*Wiley India, 2011.*
Kuriakose, J.C., and Rajaram J	*"Chemistry in Engineering and Technology", Vol.1 &II*	*Tata Mc Graw Hill Publishing company, Pvt.Ltd, New Delhi, 2001.*
P. Aggarwal, Avinash Aggarwal	*Engineering Chemistry*	*Khanna Publishers, 2010.*
David Linden and Thomas Reddy	*Hand book of batteries and fuel cells", Vol.1 &II*	*Tata Mc Graw Hill, 2001.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Understand the principles of electrochemical principles such as EMF measurements, electrode potentials and apply them in experimental techniques useful for electrochemical instrumentation.

CO2: Know the knowledge about different types of batteries with the functions which find use in their society including engineering fields.

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

CO4: Know about the different types of polymeric materials, properties and fabrication which match the specific applications.

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

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	2	1	1	1	1	2	1	2	2	1	1
CO2	3	2	1	1	2	1	1	1	1	2	1	2	2	1	1
CO3	3	2	1	1	3	1	1	1	1	2	1	2	2	1	1
CO4	3	2	1	1	3	1	1	1	1	2	1	2	2	1	1
CO5	3	2	1	1	3	1	1	1	1	2	1	2	2	1	1
16LBS104	3	2	1	1	3	1	1	1	1	2	1	2	2	1	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16LES105 BASICS OF CIVIL AND MECHANICAL ENGINEERING **Category : ES**

(Common to EEE, ECE, EIE branches)

L T P C

3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To learn the manufacturing process, types, applications and testing procedures for materials used for construction
- To impart knowledge about basis of recent paradigms, and new materials
- To make the students aware of the basic fields in Civil Engineering and about the construction.
- To impart knowledge to the students in the basics of mechanical sciences.
- To impart basic knowledge on manufacturing and machining processes.

PART A : CIVIL ENGINEERING **50 Marks**

UNIT I BUILDING MATERIALS AND CONSTRUCTION 8 Periods

Stone - Properties and uses, **Bricks** - Properties and uses , **Cement** - composition, types and uses , Properties and uses of **Steel**, **Timber**, **Concrete** and its Properties.

Masonry - Brick masonry and Stone masonry.

Flooring - Various types of floor finishing for Residential, Industrial and Office buildings.

Roofing - RCC roof and Steel trusses.

UNIT II WATER SUPPLY AND SANITARY ENGINEERING 8 Periods

Water Supply Engineering – Objectives of water supply projects – necessity – sources of water – distribution of water.

Sanitary Engineering – Objectives of sanitary projects – systems of sewerage – natural methods of sewage disposal.

UNIT III IRRIGATION ENGINEERING AND TRANSPORTATION ENGINEERING 8 Periods

Irrigation Engineering – Needs of irrigation **–** purpose and functions of storage structures – Dams – parts of the dam and their functions.

Transportation Engineering - Roads **–** types- purposes - uses. Railways – gauges – components – usefulness.

PART B : MECHANICAL ENGINEERING **50 Marks**

UNIT IV ENERGY ENGINEERING 8 Periods

Working principles of impulse and reaction turbines -working principles of IC engines (CI an SI engines) – power plants – steam power plant**.**

UNIT V MANUFACTURING PROCESS 8 Periods

Basic principles of moulding- melting of metals and casting-crucible furnace and cupola-Basic principles of hand forging-mechanical power hammers-hot and cold forging process –basics of extrusion process - Basic principle of welding – manual metal arc welding -gas welding and gas cutting-brazing and soldering.

UNIT VI METAL CUTTING PROCESS 8 Periods

Lathe: Main components and their functions- basic operations of turning, facing, taper turning, and thread cutting - introduction to CNC lathe - Drilling Machine: types of drilling machines - bench, upright - main parts and their functions-reaming operations

Lecture: 48 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 48 Periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
S.C. Rangawala	*Engineering materials*	*Charotar Publishing House, New Delhi.2014.*
S.K. Duggal	*Building Materials*	*New Age International, 2012.*
M.S.Palanichamy	*Basic Civil Engineering, Third Edition*	*Tata McGraw Hill Company Limited, New Delhi,2000*
Venugopal. K	*Basic Mechanical Engineering*	*Anuradha Publications, 3rd Edition, 2010.*
Ramesh babu	*Basic Mechanical Engineering*	*VRB Publishers Pvt. Ltd, 2007.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
R.C.Smith	*Materials of Construction*	*Mc Graw Hill Publications, 1973.*
Janardhana Jha	*Engineering materials*	*Khanna Publishers, New Delhi, 1981.*
P.C.Varghese	*Building Materials*	*PHI Learning pvt. Ltd, New Delhi, 2015*
K.S.Jagadish, B.V. Venkataraman Reddy and K.S. Nanjunda Rao	*Alternative Building Materials and Technologies*	*New Age International (P) Ltd. Publishers, New Delhi.*
NPTEL Resource material	*Building Materials and Construction*	
Nagpal G.R	*Power Plant Engineering*	*Khanna Publishers, New Delhi, 2002.*
Jain R.K	*Production Technology*	*Khanna Publishers, New Delhi, 2004*
Shanmugam.G	*Basic Mechanical Engineering*	*McGraw Hill Education (India) Pvt. Ltd, New Delhi, 4th Edition, 2013.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Understand the types, basic properties, uses of basic building materials.

CO2: Understand the importance of water supply systems and disposal of sewages.

CO3: Understand the basics of irrigation and transportation engineering.

CO4: Apply the principles of mechanical engineering in their respective field of specialization.

CO5: Appreciate the importance of energy generation.

CO6: Apply the concept of manufacturing and metal cutting processes in engineering in their applications.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1
CO4	3	-	3	-	-	2	1	1	2	-	-	-	3	2	1
CO5	-	-	3	-	-	2	3	-	-	-	2	-	2	3	2
CO6	3	2	2	-	-	2	2	2	-	-	-	-	2	2	2
16LBS105	3	1	3	-	1	2	3	2	1	-	1	1	2	2	2

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS106 **CHEMISTRY LABORATORY** **Category : BS**

(Common to EEE, ECE, EIE, CSE & IT branches) L T P C

0 0 4 2

PREREQUISITES: Nil

COURSE OBJECTIVES:

- The course is aimed at imparting knowledge of experimental techniques which would be useful for students to apply the practical principles relevant conventional engineering field.

LIST OF EXPERIMENTS

1. Estimation of hardness by EDTA method
2. Estimation of chloride by Argentometric method
3. Determination of dissolved oxygen by Winkler's method
4. Conductometric titration of mixture of strong acid and weak acid using strong base
5. Potentiometric titration of ferrous iron by dichromate
6. Estimation of copper in brass by EDTA method
7. Estimation of Iron by Spectrophotometry
8. Estimation of HCl by pH titration.

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

REFERENCE BOOKS

AUTHOR NAME	**TITLE OF BOOK**	**PUBLISHER, YEAR OF PUBLICATION**
A.O. Thomas	Practical Chemistry	Scientific Book Centre, Cannanore, 2003.
Jeffery G H, Basset J. Menthom J, Denney R.C.	Vogel's Text book of quantitative analysis, 5th Edition	EBS, 1988.

COURSE OUTCOMES:

Upon completion of this practical classes, the students will be able to

CO1: Understand the nature of hardness, chloride level, pollution level using dissolved oxygen content, iron present in water and analyse them in water.

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

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	2	1	1	1	1	2	1	2	2	1	1
CO2	3	2	1	1	2	1	1	1	1	2	1	2	2	1	1
16LBS106	3	2	1	1	2	1	1	1	1	2	1	2	2	1	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES107 **WORKSHOP PRACTICE** **Category : ES**

(Common to EEE, ECE, EIE, CSE & IT branches) L T P C

0 0 4 2

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon joint and Cross-Lap joint.
- To make various welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint.

LIST OF EXPERIMENTS

1. Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet metal
2. Safety aspects in Welding, Carpentry and Foundry
3. Half lap Joint and Dovetail Joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of Sand mould for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal
7. Electrical wiring – simple house wiring
8. Plumbing

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

COURSE OUTCOMES:

Upon completion of this practical classes, the students will be able to

CO 1: Use tools and equipments used in Carpentry, Welding, Foundry and Sheet metal.

CO 2: Make half lap joint and dovetail joint in carpentry.

CO 3: Make welded lap joint, butt joint and T-joint.

CO 4: Prepare sand mould for cube, conical bush, pipes and V pulley.

CO 5: Fabricate parts like tray, frustum of cone and square box in sheet metal

CO 6: Carry out minor works/repair related to electrical wiring and plumbing.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	2	2	-	2	1	-	2	2	2	1
CO2	2	3	-	-	-	2	1	-	2	1	-	2	2	2	1
CO3	2	3	-	-	-	2	1	-	2	1	-	2	2	2	1
CO4	2	3	-	-	-	2	1	-	2	1	-	2	2	2	1
CO5	2	3	-	-	-	2	1	-	2	1	-	2	2	2	1
CO6	2	3	-	-	-	2	1	-	2	1	-	2	2	2	1
16LBS107	2	3	-	-	-	2	1	-	2	1	-	2	2	2	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LHS2Z1 **TECHNICAL ENGLISH** **Category : HS**

(Common to all branches)

L T P C
2 2 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To make learners acquire guided listening and speaking skills in both formal and informal contexts.
- To help them develop reading skills by familiarizing them with different types of reading tasks and strategies
- To make them understand advance level of grammar and equip them with writing skills needed for academic as well as workplace contexts.
- To explore the learner to Technical English and Technical Vocabulary.

UNIT I **6+6 Periods**

Listening - Listening to ask for/ give opinions, Listening to persuade/dissuade people, Listening to make complaints, Listening to transfer information; **Speaking** –Role play activities on a formal/corporate context, Delivering Welcome Address- **Reading** – Reading to infer lexical and contextual meaning; **Writing** - Effective use of SMS on Whatsapp/ Hike/ Messenger, Writing E-mails on a business context, Technical style; **Grammar** – Use of relative / reflexive pronouns, Discourse Markers; **Vocabulary**- Homonyms and Homophones

UNIT II **6+6 Periods**

Listening - Listening to express regrets/sympathy/condolences, Listening and Note-taking; **Speaking** – Addressing at an official meeting to deal with problems/ sensitive issues, Discussion on a movie with a poignant social message/ or on a recently read book; **Reading** - Reading a short story or an article from newspaper; **Writing** - Writing a review of a book/movie/music concert/sports event, Graph Description; **Grammar** – Noun/Adjective/Adverbial phrases, Cause and effect expressions; **Vocabulary** - Using phrasal verbs in sentences, Jargon

UNIT III **6+6 Periods**

Listening - Listening to a talk about using quantities, Listening to describe manner and frequency, Listening to expressions of assumptions/inference, Listening to make comparisons; **Speaking** –Making conversation to practice stress, pause, pronunciation and intonation, Introducing the chief-guest; **Reading** - Speed reading – reading passages with time limit - **Writing** – Notice, Agenda and Minutes of meetings; - Elements of Writing Technical articles – **Grammar** - Numerical expressions, Conditional clauses; **Vocabulary** - Same word used as different parts of speech, Register

UNIT IV **6+6 Periods**

Listening - Listening to talks about future events/plans, Listening to a talk about making arrangements, Listening to language of reporting, Viewing a model discussion; **Speaking** – Discussion on a formal/corporate context, Proposing vote of thanks; **Reading** - Reading the job advertisements and the profile of the company concerned; **Writing** - Process Description, Applying for a job with résumé; **Grammar** - Direct and indirect speech; **Vocabulary** - Idioms

UNIT V **6+6 Periods**

Listening – Listening to expressions of possibility, Listening to expressions of obligations, Listening to expressions of ability, Viewing model interviews; **Speaking** - Mock interview; **Reading** - Note making, Intensive reading; **Writing** – Checklist, - Feasibility / Project report; **Grammar** – Time Statements and Contracted Time Statements; **Vocabulary** – Nominal Compounds

Lecture: 30 Periods Tutorial: 30 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Department of English, Anna University. Mindscapes	*English for Technologists and Engineers.*	*Orient Blackswan, Chennai. 2012*
Sadanand, Kamlesh & Punitha, Susheela	*Spoken English: A Foundation Course (Part 2).*	*Orient Blackswan, Hyderabad. 2014*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Raman, Meenakshi & Sangeetha Sharma	*Technical Communication: Principles and Practice*	*Oxford University Press, New Delhi. 2011*
Vijay, Anbazhagan.J, & Jaishree.N	*Technical English-II*	*Global Publishers, Chennai, 2016*
Rizvi, Ashraf. M.	*Effective Technical Communication*	*Tata McGraw-Hill, New Delhi. 2005*
Herbert, A.J	*Structure of Technical English*	*The English Language Society, London. 1971*
Michigan,E.A	*Word Power and Speed Reading: English Improvement Series*	*Infinity Books, New Delhi, 2007*
Rajendrapal & Korlahalli. J.S	*Essentials of Business Communication*	*Sultan Chand & Sons*

WEBSITES

1. http://www.usingenglish.com
2. http://www.uefap.com

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: The learners will be able to speak convincingly at work place and social contexts through guided listening tasks and different genres and strategies of reading.

CO2: The learner will understand advance level of grammar and write professionally to a larger extent for workplace and general contexts.

CO3: The learners will familiarize themselves with Technical Vocabulary and Technical English.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	1	-	1	2	-	-	-	-	2	-	-	-	2
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16LBS2Z1	-	-	1	-	1	1	-	-	-	1	1	-	-	-	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS2Z2 **ENGINEERING MATHEMATICS II** **Category : BS**

(Common to all branches)

L T P C

3 2 0 4

PREREQUISITES: Basics of - trigonometry- differential and integral formulae.

Course Objectives:

- To acquire knowledge of techniques of ordinary differential equations leading to engineering problems.
- To acquire knowledge of vector Calculus with engineering applications.
- To gain standard techniques of complex variable applicable to fluid dynamics, heat conduction, and elasticity.
- To develop skill of solving transforms leading to engineering applications.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 9+6 Periods

Second and Higher order Differential Equations, Method of variation of parameters- Method of undetermined coefficients-Homogeneous equations of Euler's and Legendre's type-System of Simultaneous first order Linear equations with constant coefficients - Method of reduction of order.

UNIT II VECTOR CALCULUS 9+6 Periods

Gradient and directional derivative, Divergence and Curl – Irrotational and Solenoidal fields-Vector identities - Line, Surface and Volume Integrals – Green's Theorem in a Plane , Gauss Divergence and Stoke's Theorems (Statements only) –Verifications and Applications.

UNIT III COMPLEX DIFFERENTIATION 9+6 Periods

Functions of a Complex variable-Analytic functions- Cauchy Riemann equations and sufficient conditions (excluding proof)–Harmonic conjugates–Construction of analytic functions-Conformal mappings: $w=z+a$, az, $1/z$, z^2, e^z , sinz, cosz and Bilinear Transformation.

UNIT IV COMPLEX INTEGRATION 9+6 Periods

Cauchy's integral theorem, Cauchy's integral formula -Taylor's and Laurent's theorems (Statements only) and expansions – Poles and Residues – Cauchy's Residue theorem – Contour integration – Circular and semi circular contours with no pole on real axis.

UNIT V LAPLACE TRANSFORMATIONS 9+6 Periods

Laplace transforms- Properties and standard transforms-Transforms of unit step, unit Impulse and error functions –Transforms of periodic functions- Inverse Laplace transforms- Initial and Final value theorems- Convolution theorem (Statement only) and applications - Applications to Solution of Linear differential equations of second order with constant coefficients.

Lecture: 45 Periods Tutorial: 30 Periods Practical: 0 Periods Total: 75 Periods

TEXT BOOKS

AUTHOR NAME	**TITLE OF BOOK**	**PUBLISHER, YEAR OF PUBLICATION**
Veerarajan T	*"Engineering Mathematics" for Semesters I and II*	*Tata McGraw Hill Publishing Co., New Delhi, 2015.*
Kandasamy P, Thilagavathy K and Gunavathy K	*"Engineering Mathematics" for I year B.E/B.Tech*	*S.Chand & Co, Ramnagar, New Delhi, Reprint 2013.*
S. Narayanan and Manicavachagom Pillai T.K.	*"Calculus"-Vol.III*	*S. Viswanathan, Printers and Publishers Pvt. Ltd, Chennai, 2009.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Erwin Kreyszig	*Advanced Engineering Mathematics*	*Wiley & sons(Asia) Ltd, 10th Edition, 2015.*
Ray Wylie.C and Louis Barrett	*Advanced Engineering Mathematics*	*Tata McGraw Hill Company, New Delhi, 2004.*
Grewal B. S	*Higher Engineering Mathematics*	*Khanna Publishers, New Delhi, 43rd Edition, 2014.*
Ramana B V	*Higher Engineering Mathematics*	*Tata McGraw Hill Co. Ltd, NewDelhi, 11th Print, 2010.*
Bali N., Goyal M and Watkins C	*Advanced Engineering Mathematics*	*Firewall Media (An Imprint of Laxmi Publications Pvt Ltd), New Delhi, 7th Edition,2009.*
Bali N.P and Goyal M	*A text book of Engineering Mathematics*	*University Science Press (An Imprint of Laxmi Publications Pvt Ltd), New Delhi,2014.*

COURSE OUTCOMES:

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

CO1: Understand the kinds of differential equations and their solutions in the field of engineering.

CO2: Evaluate gradient, divergence and curl and also line, surface and volume integrals in cartesian form and simple coordinate systems and calculate integrals applying Greens, stokes and Gauss theorems.

CO3: Understand the concepts of analytic functions and conformal mappings.

CO4: Evaluate contour integrals using calculus of residues.

CO5: Apply Laplace transform methods to solve differential equations.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	2	3	3	3	2	-
CO2	3	3	2	2	-	-	-	-	-	2	-	2	3	1	-
CO3	3	3	2	3	-	2	-	-	-	2	2	2	2	1	-
CO4	3	3	2	2	-	2	-	-	-	2	2	2	3	2	-
CO5	3	3	3	3	-	3	-	-	-	2	2	3	3	2	-
16LBS2Z2	3	3	2	3	-	2	-	-	-	2	2	2	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS2Z3 **MATERIALS SCIENCE** **Category : BS**

(Common to all branches)

L T P C

3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

To enhance the fundamental knowledge in Physics and its application relevant to various streams of Engineering and Technology. Upon completion of this course the students will b familiar with :

- The properties of conducting materials.
- The application of magnetic and super conducting materials.
- Application and properties of dielectric and ferro electric materials.
- Applications and properties of Modern engineering materials.
- Nano materials and its properties.

UNIT I CONDUCTING MATERIALS 9 Periods

Introduction to Conductors – classical free electron theory of metals – Draw backs of classical theory – quantum theory - Electrical and Thermal conductivity of Metals – Derivation for Wiedeman – Franz law – Lorentz number — Fermi distribution function - effect of temperature – density of energy states – calculation of Fermi energy- carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS AND DEVICES 9 Periods

Introduction – Properties – elemental and compound semiconductors - Intrinsic and extrinsic semiconductors – properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature and carrier concentration - Electrical Conductivity – band gap determination - extrinsic semiconductors - Carrier concentration in P- type and N-type semiconductors – variation of Fermi level with temperature and impurity concentration – Hall effect- Determination of Hall Co-efficient in N type and P type Semiconductor - Applications.

UNIT III MAGNETIC AND SUPER CONDUCTING MATERIALS 9 Periods

Introduction - Origin of magnetic moment - Bohr magneton - Dia, Para, and Ferro magnetic materials - Domain theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials. Ferrites - structure and applications. - Magneto optical recording and readout – Superconductivity - Types of superconductors - BCS theory of superconductivity (qualitative) - properties- High Tc superconductors, Applications of superconductors- SQUID, Cryotron, Magnetic levitation.

UNIT IV DIELECTRICS AND FERROELECTRICS 9 Periods

Introduction to dielectric materials – Electric polarization and Dipole moment - Electrical susceptibility – dielectric constant – Various polarization mechanisms in dielectrics - electronic, ionic, orientational and space charge polarization– frequency and temperature dependence of polarization – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials - Ferro electricity –Ferro electric materials -$BaTiO_3$ – Applications- Ferro electric energy converter.

UNIT V MODERN ENGINEERING MATERIALS 9 Periods

Metallic glasses- preparation of metallic glasses - properties – applications of the metallic glasses - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy - applications of the Shape memory alloys - advantages and disadvantages of SMA - Nanomaterials-synthesis –chemical vapour deposition – Sol Gel – ball Milling – properties of nanoparticles and applications of nanoparticles – Carbon Nanotubes (CNT) – structure – properties – applications of CNTs.

lecture: 45 periods tutorial:0 periods practical: 0 periods total: 45 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
P.K.Palanisamy	*Engineering Physics–II*	*Scitech Publications (India) Pvt. Ltd 2015 (Unit I, Unit III & Unit IV)*
Dr.Jayakumar .S	*Materials science*	*R.K.Publishers,2008.(Unit II & IV)*
Dr.V.Rajendran	*Material Science*	*Tata McGraw Hill Publications, NewDelhi, 2011.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Charles P.Poole, Jr; Frank J.Owens	*Introduction to Nanotechnology*	*Wiley India, 2012.*
Gaur R.K. and Gupta S.L	*Engineering Physics*	*Dhanpat Rai Publishers, 2009.*
K.Rajagopal	*Engineering Physics*	*PHI Learning Private Ltd, New Delhi, 2015.*

COURSE OUTCOMES:

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

CO1: Analyze the properties of conducting materials. [Familiarity]

CO2: List and analyze the properties of Semiconducting materials and Devices. [Familiarity]

CO3: Identify, analyze the properties and applications of magnetic & super conducting materials. [Familiarity]

CO4: List and analyze the properties of dielectric Ferro electric materials. [Familiarity & Application]

CO5: List the properties and applications of modern engineering materials. [Familiarity & Application]

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	-	-	-	1	1	-	-	-	-	-	1	1	-
CO2	1	1	1	1	1	1	1	-	-	-	-	-	1	1	-
CO3	1	1	1	1	1	1	1	-	-	-	-	-	1	1	-
CO4	1	1	1	1	1	1	1	-	-	-	-	-	1	1	-
CO5	-	1	1	1	1	1	1	-	-	-	-	-	1	1	-
16LBS2Z3	1	1	1	1	1	1	1	-	-	-	-	-	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LHS2Z4 ENVIRONMENTAL SCIENCE AND ENGINEERING **Category : HS**

(Common to all branches)

L T P C
3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- The course is aimed at creating awareness among students and also to inseminate the critical ideas of preserving environment.

UNIT I ENVIRONMENTAL RESOURCES 9 Periods

Natural resources -Forest – benefits, over exploitation, deforestation & consequences – Water - unique features, hydrological cycle & over exploitation – Food -effect of modern agriculture, fertilizers, pesticides, eutrophication & biomagnifications - Energy resources - renewable & non-renewable resources - wind, solar and tidal - harnessing methods.

UNIT II ECO SYSTEM AND BIODIVERSITY 9 Periods

Ecology - ecosystem, physical and chemical components of ecosystem, biological components of ecosystem - forest ecosystem, desert ecosystem and pond ecosystem, Energy flow in ecosystem, nitrogen cycle and carbon dioxide cycle, food pyramid, ecological succession, Biodiversity - types, values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity – in situ – ex situ conservation.

UNIT III ENVIRONMENTAL POLLUTION 9 Periods

Air pollution, classification of air pollutants – sources, effects and control of gaseous pollutants SO_2, NO_x, H_2S, CO, CO_2 and particulates, control methods - cyclone separator and electrostatic precipitator - Water pollution - classification of water pollutants, organic and inorganic pollutants, sources, effects and control of water pollutants Soil pollution - sources, effects and control - Noise pollution - decibel scale, sources, effects and control.

UNIT IV ENVIRONMENTAL THREATS 9 Periods

Acid rain, greenhouse effect, global warming and ozone depletion, disaster management, flood, drought, earthquake and tsunami, Threats to biodiversity - destruction of habitat, habit fragmentation - hunting, over exploitation and man - wildlife conflicts, The IUCN red list categories, status of threatened species.

UNIT V SOCIAL ISSUES AND ENVIRONMENT 9 Periods

Sustainable development - sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, Pollution control Act, Wild life protection act, Forest conservation act, population growth - exponential and logistic growth, variation in population among nations, population policy, women and child welfare programs, role of information technology in human and health, HIV/AIDS - effects and preventive measures.

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

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER,YEAR OF PUBLICATION
Sharma J.P	*"Environmental Studies", 3rd Edition*	*University Science Press, New Delhi 2009.*
Anubha Kaushik and C.P. Kaushik	*"Environmental Science and Engineering", 3rd Edition*	*New age International Publishers, New Delhi, 2008.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
R.K. Trivedi	*Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards", Vol.I&II,*	*Environ Media, 2006.*
G. Tyler Miller Jr	*"Environmental Science", 10th Edition*	*Thomson Brooks/Cole Publishing, 2004.*
Gilbert M. Masters	*Introduction to Environmental Engineering and Science, 2nd Edition*	*Pearson Education, 2004.*

COURSE OUTCOMES:

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

CO1: To know about the various environmental resources, the effective utility and problems accompanied in over exploitation.

CO2: To acquire knowledge about the interaction of biosphere with environment and conservation methods of bio diversity.

CO3: To be aware of the source of various types of pollution, their ill effects and preventive methods.

CO4: To understand the environmental threats, Acid rain, Green house effect and Ozone depletion and natural disasters.

CO5: To create an idea about sustainable development and social issues.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	1	3	1	1	1	2	2	1	2	1	1	1	1	1
CO3	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1
CO4	1	1	3	1	1	1	3	3	1	2	1	1	2	1	2
CO5	2	1	2	1	1	1	3	3	1	1	1	1	2	1	2
16LBS2Z4	2	1	3	1	1	1	3	3	1	1	1	1	2	1	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES2Z5 **PROGRAMMING IN C** **Category : ES**

(Common to all branches)

L T P C

3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- The Computer and Programming fundamentals
- Data types in C and Flow control statements
- Functions, Arrays, Pointers And Strings
- Bitwise Operators, Preprocessor Directives, Structures and Unions
- Structures, List Processing, Input And Output

UNIT I COMPUTER AND PROGRAMMING FUNDAMENTALS 9 Periods

Computer fundamentals – Evolution, classification, Anatomy of a computer: CPU, Memory, I/O – Introduction to software – Generation and classification of programming languages – Compiling – Linking and loading a program – Translator – loader – linker – develop a program – software development – Introduction to OS –Types of OS – Algorithms – Structured programming concept.

UNIT II DATA TYPES AND FLOW OF CONTROL 9 Periods

An overview of C – Programming and Preparation – Program Output – Variables – Expressions, and Assignment, The use of #include, printf(), scanf() – Lexical elements, operators and the C systems – The fundamental data types – Flow of control

UNIT III FUNCTIONS, ARRAYS, POINTERS AND STRINGS 9 Periods

Functions and storage classes - 1D Arrays – Pointers – Call by reference – Relationship between Arrays and Pointers – Pointer arithmetic and element size – Arrays as function argument – Dynamic memory allocation – Strings – String handing functions – Multidimensional Arrays.

UNIT IV ARRAY OF POINTERS, BITWISE OPERATORS, PREPROCESSOR DIRECTIVES 9 Periods

Arrays of Pointers – Arguments to main () - Ragged Arrays – Functions as Arguments – Arrays of Pointers to Functions - Type qualifiers.-Bitwise operators and expressions – Masks – Software tools – Packing and unpacking – Enumeration types – The preprocessor directives.

UNIT V STRUCTURES AND UNIONS, I/O AND FILE OPERATIONS 9 Periods

Structures and Unions – Operator precedence and associativity – Bit fields – Accessing bits and bytes - Input and Output functions – File Processing Functions – Environment variables – Use of make and touch.

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

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER,YEAR OF PUBLICATION
Pradip Dey, Manas Ghosh	*Computer Fundamentals and Programming in C, Second Edition*	*Oxford University Press, 2013.*
Al Kelley, Ira Pohl	*A Book on C-Programming in C, Fourth Edition*	*Addison Wesley, 2001 .*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Stephen G. Kochan	*Programming in C-A complete introduction to the C programming language, Third Edition*	*Sams Publication, 2004.*
Yashavant P. Kanetkar	*Let Us C, 13th edition*	*BPB Publications, 2013.*
Brian W. Kernighan and Dennis Ritchie	*The C Programming Language", Second Edition*	*Prentice Hall Software Series, 1988.*
Stephen Prata	*C Primer Plus, Fifth Edition*	*Sams Publishing, 2005.*

COURSE OUTCOMES:

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

CO1: Articulate the programming environment [Familiarity]
CO2: Write algorithm for solving the given problem statement [usage]
CO3: Use right data types and flow control statement [Assessment]
CO4: Write programs using functions, arrays, pointers and strings [Usage]
CO5: Use right storage classes, preprocessor directives, bitwise operators in programs [Assessment]
CO6: Use structures, unions and files [Usage]

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	1	-	-	-	-	2	3	-	-
CO2	3	2	1	-	-	-	2	-	-	-	-	2	3	-	-
CO3	3	2	-	-	-	-	1	-	-	-	-	2	3	-	-
CO4	3	2	1	-	-	-	2	-	-	-	-	2	3	-	-
CO5	3	2	-	-	-	-	1	-	-	-	-	2	3	-	-
CO6	3	2	1	-	-	-	1	-	-	-	-	2	3	-	-
16LBS2Z5	3	2	1	-	-	-	1	-	-	-	-	2	3	-	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES206 **ELECTRON DEVICES** **Category : ES**

L T P C
3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To gain Knowledge on semiconductor Diodes.
- To learn the Principles of BJT and FET
- To study the biasing concepts for BJT and FET
- To gain knowledge on Special Semiconductor devices.

UNIT I PN JUNCTION AND SEMICONDUCTOR DIODES 9 Periods

Energy band structure of conductors, semiconductors and Insulators-Classification of semiconductors-conductivity of semiconductors-Drift and diffusion currents-Continuity Equation-Energy band structure of PN junction diode-Diode current equation-Transition or space charge capacitance-Diffusion capacitance-Effect of temperature on PN junction diodes - Diode switching characteristics - PN diodeApplications - Clippers, Clampers - Zener diode characteristics.

UNIT II BIPOLAR JUNCTION TRANSISTORS 9 Periods

Construction of PNP and NPN Transistor-Transistor current components-Eber moll's model of transistor-Transistor as an amplifier -CE, CB and CC configurations-Characteristics-current gain –bandwidth modulation- - Transistor switching characteristics-Breakdown of transistor-maximum voltage rating.

UNIT III FIELD EFFECT TRANSISTORS 9 Periods

Operation and Characteristics of JFET, FET as a Voltage variable resistor, Metal oxide semiconductor field effect transistor (MOSFET)-Enhancement and Depletion mode MOSFET-Characteristics of n-MOS and p-MOS-CMOS characteristics-Inverted T FET-Operation and Characteristics-Comparison of n Channel and p channel MOSFET-Comparison of MOSEET and JFET.

UNIT IV BIASING CIRCUITS 9 Periods

DC operating point and Load line-Q point-Bias Stability, Transistor biasing methods: Fixed bias-Collector to base bias-Self biasing-Bias compensation methods- Thermistor and sensistor compensation techniques-thermal runaway- thermal stability- FET biasing methods: Self bias-Source bias-Voltage divider bias-Biasing enhancement and depletion MOSFET.

UNIT V SPECIAL SEMICONDUCTOR DEVICES 9 Periods

Construction and Characteristics of Schottky diode-Tunnel diode and Varactor diode-SCR-TRIAC. Principles of Photo emissitivity and photo-conductivity-Construction and characteristics of LCD-LED- Photoconductive cell-photo voltaic cell-photo diode- solar cell- photo transistors-plasma display- numeric displays- optocouplers and LASER diodes.

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

TEXT BOOKS

AUTHOR NAME	**TITLE OF BOOK**	**PUBLISHER, YEAR OF PUBLICATION**
Jacob Millman, Christos Halkias & Satyabrata Jit Millman's	*Electronic Devices and Circuits, 3rd Edition*	*McGraw Hill, 2009.*
Sedra and Smith	*Microelectronics Circuits*	*Oxford, 7th Edition, 2009.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
S.Salivahanan, N.Sureshkumar and A.Vallavaraj	*Electronic Devices and Circuits, 2nd Edition*	*Tata McGrawHill, 2008.*
Allen Mottershead	*Electronic Devices and Circuits*	*Prentice Hall of India, 2008.*
Robert L.Boylestad, Louis Nashelsky	*Electronic Devices and Circuit Theory, 9th Edition*	*Pearson Education, 2006.*

COURSE OUTCOMES:

Upon completion of this course, the students will have

CO1: Knowledge on semiconductor Diodes
CO2: Knowledge on Principles of BJT and FET
CO3: Ability to design biasing circuits for BJT and FET
CO4: knowledge on Special Semiconductor devices

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	1	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	1	3	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	3	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	1	3	-	-
16LBS206	3	1	1	-	-	-	-	-	-	-	-	1	3	-	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS207 **PHYSICS LABORATORY** **Category : BS**

(Common to EEE, ECE, EIE, CSE & IT branches) L T P C

0 0 4 2

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To have a practical knowledge about the concepts behind physics and the need to apply in the emerging technology.

LIST OF EXPERIMENTS

1. Spectrometer - Diffraction Grating Normal Incidence Method
2. Air Wedge –Determination of thickness of a paper
3. Young's Modulus – Cantilever Bending - Koenig's Method
4. a. Laser - Particle size Determination
   b. Optical fiber - Determination of NA & Acceptance angle
5. Ammeter and Voltmeter Calibration – Low Range
6. Resistance of The Given Coil Of Wire – Carey Foster's Bridge
7. Determination of Band gap Energy of Semiconductor
8. Ultrasonic Interferometer - Velocity of sound & Compressibility of liquids.
9. Transistor Characteristics
10. Torsional pendulum –Determination of Rigidity Modulus & Moment of Inertia

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

COURSE OUTCOMES:

Upon completion of this practical classes, the students will be able to

CO1: Determinate of all physical properties of any matter, basic idea of calibrating electrical measuring instruments and thereby effectively using it for particular applications.

CO2: Experiment intrinsic characteristic features of electronic devices for electrical and electronic applications.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	1	1	1	1	-	-	-	-	-	1	1	-
CO2	1	1	1	1	1	1	1	-	-	-	-	-	1	1	-
16LBS207	1	1	1	1	1	1	1	-	-	-	-	-	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES208 **ENGINEERING GRAPHICS** **Category : ES**

(Common to EEE, ECE, EIE, CSE & IT branches)

L T P C
2 0 4 4

PREREQUISITES: Nil

COURSE OBJECTIVES:

- Geometrical constructions
- Orthographic projections.
- Performing section of solids and development of the same.
- Interpretation of solids.
- Pictorial view of solids

UNIT I **GEOMETRICAL CONSTRUCTIONS** **15 Periods**

Dimensioning-Lettering-Types of Lines-Scaling conventions-Dividing a given straight line in to any number of equal parts- Bisecting a given angle- Drawing a regular polygon given one side-Special methods of constructing a pentagon and hexagon- Construction of curves like ellipse, parabola, cycloid and involute using one method.

UNIT II **ORTHOGRAPHIC PROJECTIONS** **25 Periods**

Introduction to Orthographic Projection-Projection of points-Projection of straight lines with traces- Projection of planes-Conversion of pictorial views to orthographic views-Projection of solids - Auxiliary projections.

UNIT III **SECTION OF SOLIDS AND DEVELOPMENT** **20 Periods**

Section of solids- Development of surfaces

UNIT IV **INTERPENETRATION OF SOLIDS and PICTORIAL VIEWS** **20 Periods**

Cylinder and cylinder, cone and cylinder only Isometric projections - Conversion of orthographic views to pictorial views (simple objects).

UNIT V **INTRODUCTION TO AUTOCAD** **10 Periods**

Object Construction : Page layout – Layers and Line types – Creating, Editing and selecting the Geometric Objects. Viewing, Annotating, Hatching and Dimensioning the drawing –Creating Blocks and Attributes

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

REFERENCE BOOKS

AUTHOR NAME	**TITLE OF BOOK**	**PUBLISHER, YEAR OF PUBLICATION**
K.Venugopal	*Engineering Graphics*	*New Age International (P) Limited, 2015.*
Dhananjay.A.Jolhe	*Engineering Drawing*	*Tata McGraw Hill Publishing Co., 2007.*
K.V.Nataraajan	*A text book of Engineering Graphics*	*Dhanalakashmi Publishers, Chennai, 2006.*
M.B.Shah and B.C. Rana	*Engineering Drawing*	*Pearson Education, 2005.*
Luzadder and Duff	*Fundamentals of Engineering Drawing*	*Prentice Hall of India Pvt Ltd, XIth Edition, 2001.*
K.L.Narayana and P.Kannaiah	*Text book on Engineering Drawing, 2nd Edition*	*SciTech Publications (India) Pvt. Ltd, Chennai, 2009.*

COURSE OUTCOMES:

Upon completion of this practical classes, the students will be able to

CO1: Represent planes and solids as per international standards.

CO2: Generate and interpret multiple views through development, interpretation and sectional views.

CO3: Generate and interrupt orthographic views.

CO4: Generate and interrupt pictorial views and interpenetration.

CO5: Generate and interrupt perspective views.

CO6: Apply the concept of AUTOCAD in engineering graphics.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	3	3	-	-	2	-	1	3	2	-	2	2	2	-
CO2	-	-	3	-	-	2	-	1	3	2	-	2	2	2	-
CO3	-	-	3	-	-	2	-	1	3	2	-	2	2	2	-
CO4	-	-	3	-	-	2	-	1	3	2	-	2	2	2	-
CO5	-	-	3	-	-	2	-	1	3	2	-	2	2	2	-
CO6	-	3	3	3	-	2	-	1	3	2	-	2	2	2	-
16LBS208	-	3	3	1	-	2	-	1	3	2	-	2	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES2Z9 **PROGRAMMING IN C LABORATORY** **Category : ES**

(Common to all branches)

L T P C
0 0 4 2

PREREQUISITES: Nil

COURSE OBJECTIVES:

- Data types in C and Flow control statements
- Functions, Arrays, Pointers And Strings
- Dynamic memory allocation and command line arguments
- Bitwise Operators, Preprocessor Directives, Structures and Unions
- Structures, List Processing, Input And Output

PRACTICALS

EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:

1. Operators, Expressions and IO formatting
2. Decision Making and Looping
3. Arrays and Strings
4. Functions and Recursion
5. Pointers
6. Dynamic Memory Allocation
7. Structures
8. Unions
9. Files
10. Command line arguments
11. Mini Project

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

COURSE OUTCOMES:

Upon completion of this practical classes, the students will be able to

CO1: Use appropriate data types and flow control statements [Usage]
CO2: Write programs using functions, arrays, pointers and strings [Usage]
CO3: Write programs using dynamic memory allocation [Usage]
CO4: Implement programs using right storage classes, preprocessor directives, bitwise operators [Usage]
CO5: Work with command line arguments, structures, unions and files [Usage]
CO6: Develop applications using C [Usage]

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	1	-	-	1	-	-	3	3	-
CO2	3	2	1	-	-	-	1	-	-	1	-	-	3	3	-
CO3	3	2	1	-	-	-	1	-	-	1	-	-	3	3	-
CO4	3	2	1	-	-	-	1	-	-	1	-	-	3	3	-
CO5	3	2	1	-	-	-	1	-	-	1	-	-	3	3	-
CO6	3	3	3	-	2	-	3	-	-	1	-	3	3	3	-
16LBS2Z9	3	2	1	-	1	-	1	-	-	1	-	1	3	3	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS3Z1 **ENGINEERING MATHEMATICS III** **CATEGORY: BS**

(Common to all Branches)

L	T	P	C
3	2	0	4

PREREQUISITES: Nil

COURSE OBJECTIVES:

*To gain the knowledge of formation of Fourier series.
* To familiarize with Infinite and finite Fourier transforms functions.
* To be familiar with solution of first and second order differential equations.
* To acquire knowledge of techniques to solve one and two dimensional partial differential equations concerning to engineering applications.

UNIT I: FOURIER SERIES **(9+6) Periods**

Dirichlet's conditions – Full range Expansions – odd and even functions – Half range sine and cosine series – Parseval's identity on a Fourier series – Harmonic analysis.

UNIT II: FOURIER TRANSFORMS **(9+6) Periods**

Fourier integral theorem (statement only) – Infinite Fourier Transform Pair – Fourier sine and cosine transform pair – Properties – Transforms of simple functions – Parseval's identity on a Fourier transform – Finite Fourier transforms.

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS **(9+6) Periods**

Formation of partial differential equations – First order PDE – Standard types and Lagrange's type – Linear partial differential second and higher order with constant coefficients – Homogeneous and Non homogeneous types.

UNIT IV: BOUNDARY VALUE PROBLEMS **(9+6) Periods**

Method of separation of variables and Fourier series solution: One dimensional wave equation, one and two dimensional heat flow.

UNIT V: Z TRANSFORMS **(9+6) Periods**

Z transforms – properties –Inverse Z transforms – Initial and final value theorems – Convolution theorem – Formation of difference equations – solution to difference equation of second order difference equations with constant coefficients with Z transform.

TOTAL NUMBER OF PERIODS **(75) Periods**

CONTACT PERIODS:

Lecture:45 Periods Tutorial:30 Periods Practical:0 Periods Total:75Periods

Text Books:

1.Veerarajan T, "Transforms and partial differential equations" for semesters III,Tata McGraw Hill Publishing Co., New Delhi,2015.

2.Kandasamy, Thilagavathy and Gunavathy, "Engineering Mathematics" for III SEMESTER B.E/B.TECH, S.Chand&CO, Ramnagar, New Delhi, 2013.

Reference Books:

1.Grewal B.S, "Higher Engineering Mathematics" KhannaPublishers,New Delhi,43rdEdition,2014.

2.Ramana B. V, "Higher Engineering Mathematics" Tata McGraw Hill Co. Ltd., New Delhi, 11th Edition, Reprint ,2010.

3.Bali N., Goyal M, "Transforms and Partial differential equations" University Science Press, New Delhi,2010.

4.Ray Wylie C and Louis C Barrett, "Advanced Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi,6th Edition,Reprint,2014.

5.Donald.A.Mcquarrie, Mathematical methods for Scientist and Engineers,Viva Books Pvt Ltd, New Delhi, I edition ,Reprint 2015

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Understand the concept of Fourier series and its construction when discrete and continuous form is known

CO2: Acquire fluency in Fourier transforms in order to solve improper integrals.

CO3: Understand the standard and special types of partial differential equations.

CO4: Gain fluency in solving boundary values problems.

CO5: Understand the Z transforms methods to find solutions of difference equations.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	-	-	-	-	-	-	3	-	-	3	2	-
CO2	2	3	2	-	-	-	-	-	-	2	-	-	3	2	-
CO3	3	2	-	-	-	-	-	-	-	1	-	-	3	2	-
CO4	3	3	2	-	-	2	-	-	-	2	2	-	3	2	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	3	2	-
16LBS3Z1	3	3	2	-	-	1	-	-	-	2	1	-	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES302 **CIRCUIT THEORY** **CATEGORY: ES**

L	T	P	C
2	2	0	3

PREREQUISITES: 16LBS1Z2 ENGINEERING MATHEMATICS- I
16LBS2Z2 ENGINEERING MATHEMATICS- II

COURSE OBJECTIVES:

* To get an insight into the basic concepts of DC and AC circuit analysis.
*To get an insight into the transient response of the circuits
*To understand the concepts of resonance and coupled circuit

UNIT I: DC CIRCUIT ANALYSIS (6+6) Periods

Basic Components of electric Circuits- Charge, current, Voltage and Power, Voltage and Current Sources- Ohms Law-Kirchhoff's Current Law- Kirchhoff's voltage law-The single Node – Pair Circuit, series and Parallel Connected Independent Sources- Resistors in Series and Parallel- voltage and Current division- Nodal analysis-Mesh analysis.

UNIT II: SINUSOIDAL STEADY STATE ANALYSIS (6+6) Periods

Sinusoidal Steady – State analysis - Characteristics of Sinusoids-The Complex Forcing Function-The Phasor-Phasor relationship for R, L, and C, impedance and Admittance-Nodal and Mesh Analysis-Phasor Diagrams-AC Circuit Power Analysis- Instantaneous Power- Average Power-apparent Power and Power Factor- Complex Power

UNIT III: NETWORK THEOREMS AND DUALITY (6+6) Periods

Useful Circuit Analysis techniques(AC and DC) - superposition theorem , Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Compensation theorem, Reciprocity theorem, Delta-Star Conversion-Duality-Dual circuits.

UNIT IV: TRANSIENTS AND RESONANCE IN RLC CIRCUITS (6+6) Periods

Transient concepts- transient response of simple RL and RC (series and parallel) circuits- transient response of RLC(series & parallel) circuits-solution of RL,RC and RLC(series and parallel)Circuits for step input – Parallel Resonance-Series Resonance- bandwidth -Quality Factor.

UNIT V: COUPLED CIRCUITS AND TOPOLOGY (6+6)Periods

Magnetically Coupled Circuits- mutual Inductance - Linear Transformer - Ideal Transformer-Introduction to Network Topology - Trees and General Nodal analysis - Links and Loop analysis.

TOTAL NUMBER OF PERIODS (60) Periods

CONTACT PERIODS:

Lecture:30 periods Tutorial:30periods Practical:0 periods Total:60 periods

Text Books:

1.William H.Hayt, Jr.Jack E. Kemmerly, Steven M.Durbin, "Engineering Circuit Analysis", Sixth Edition, Tata McGraw-Hill Edition, 2012

2.Sudhahar.A,ShyammohanS.P,"Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill, New Delhi, Fourth Edition,2010.

Reference Books:

1.*Charles K. Alexander & Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", Sixth revised Edition, McGraw- Hill 2016.*

2.D.R.Cunningham, J.A.Stuller, "Basic Circuit Analysis", Jaico Publishing House, 2005

3.David A Bell, "Electric Circuits", Oxford University Press,2009

COURSE OUTCOMES:

Upon completion of the course, the students will have:
CO1: Exposure to components and parameters in electrical circuits
CO2: The skills to analyze electrical circuit behavior
CO3: Ability to analyze electrical circuits using Network theorems
CO4: Understanding of the transient concepts in electrical circuits
CO5: Knowledge on the concepts of resonance and coupled circuits
CO6: Knowledge on graph theory and its applications in circuit analysis

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO3	2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO4	2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO5	2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO6	2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
16LES302	2	3	3	1	-	-	-	-	-	-	-	-	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES303 DATA STRUCTURES AND ALGORITHMS USING C CATEGORY: ES

L	T	P	C
3	0	0	3

PREREQUISITES: 16LES2Z5 Programming in C

COURSE OBJECTIVES:

* To acquire and apply knowledge of linear and non-linear data structures to engineering problems
*To formulate algorithms for sorting and searching problems
*To develop algorithmic design techniques for Optimization problems

UNIT I: ALGORITHM ANALYSIS (9) Periods

Algorithm analysis – Mathematical background – Run time calculations – Logarithms in running time – List ADT-Linklists–Single, Double, Circular–Operations– Applications.

UNIT II: STACK AND QUEUES (9) Periods

Stack ADT – Implementations – Applications – Queues ADT – Array implementation of Stack and Queue – Priority Queues – Applications – Binomial queue structure - Binomial queue operations.

UNIT III: TREES (9) Periods

Binary trees – Representations - Binary tree transversal - Basic operations – Expression Trees - Balanced Trees - AVL trees - B trees – Splay – Hashing and Rehashing.

UNIT IV: SORTING AND SEARCHING (9) Periods

Sorting - Exchange sorts: Bubble sort - Quick sort - Selection and Tree sorting: Straight selection sort - Binary tree sorts – Heap sort - Insertion sorts - Merge sorts - Radix sorts - Efficiency analysis. Searching - Basic search techniques - Sequential searching - Indexed sequential search - Binary search - Tree searching.

UNIT V: GRAPHS AND ALGORITHM DESIGN TECHNIQUES (9) Periods

Graphs - Definitions and properties – Representation - Graph search methods - Applications of Depth-First search - Shortest path algorithm (Dijkstra) - Minimum spanning tree (Prim's and Kruskal's algorithms). Algorithm Design Techniques: Greedy Algorithm – Divide and Conquer – Dynamic Programming – Backtracking.

TOTAL NUMBER OF PERIODS (45)Periods

CONTACT PERIODS:

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

Text Books:

1.Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2009.

2.Yedidyah Langsam Aaron, Moshe.J.Augenstein, M.Tenenbaum, "Data Structures using C and C++", 2nd Edition ,PHI LearningPvt.Ltd, 2011.

Reference Books:

1.Jean Paul Tremblay, Paul G. Sorenson, "An Introduction to Data structures with Applications",Tata McGraw Hill Publishing Company Ltd, 2008.

2. T.H.Cormen, C.E. Leiserson, R.L. Rivest, C.Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Pvt. Ltd, 2009.

3. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles, Fifth Edition, CareerMonk Publications, International Edition, 2016.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Ability to analyze the time and space complexities and efficiency of an algorithm.
CO2: Basic knowledge of linear and non-linear data structures
CO3: Ability to apply the knowledge of linear data structures to Practical problems
CO4: Ability to apply the knowledge non-linear data structures to Practical problems
CO5: Ability to formulate algorithms for sorting and searching problems
CO6: Ability to apply the knowledge of Algorithmic design techniques for optimization problems

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	3	1	-	-	-	-	-	-	-	-	2	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-	1	2	-
CO3	1	2	-	3	1	2	-	-	-	-	-	-	-	2	-
CO4	1	2	-	2	1	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	2	1	-	-	-	-	-	-	-		2	-
CO6	1	2	-	1	1	-	-	-	-	-	-	-	1	2	-
16LES303	1	2	-	2	1	1	-	-	-	-	-	-	1	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES304 DIGITAL SYSTEM DESIGN C ATEGORY: ES

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

*To Acquire knowledge on Boolean algebra and logic circuits
*To realize combinational and sequential logic circuits using Verilog HDL
*To design and analyze Synchronous and Asynchronous digital circuits

UNIT I: BINARY CODES AND BOOLEAN ALGEBRA (9) Periods

Binary, BCD, Grey Codes - ASCII and Error Detecting Codes - Boolean Algebra - Boolean functions - Canonical and Standard Forms - Minimization of Boolean expressions - Karnaugh map minimization - Don't care conditions - Tabulation Method - Implementation of logic functions using Gates - NAND and NOR implementation- Variable entered k- map.

UNIT II: COMBINATIONAL LOGIC CIRCUITS (9) Periods

Binary Adder - Binary Subtractor - BCD Adder - Binary Multiplier - Magnitude Comparator - Multiplexer/Demultiplexer - Decoder/Encoder - Code converters - Implementation of combinational logic using MUX/Decoder - Introduction to Verilog HDL - Verilog code for Full Adder, MUX/DeMUX and Code Converters.

UNIT III: SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS (9) Periods

Latches - Flip flops - Analysis and Design of Clocked Sequential Circuits – State Reduction and State Assignment - Ripple Counters: Binary, BCD, Modulo n, Up/Down counters - Shift registers:- Universal Shift Register–Synchronous counters - Ring counter – Johnson counter - Verilog code for Flip Flops, Registers and Counters.

UNIT IV: ASYNCHRONOUS SEQUENTIAL CIRCUITS (9) Periods

Block Diagram - Modes of Operation – Analysis of Asynchronous Sequential Circuits - Design of Asynchronous Sequential Circuits - Reduction of Flow Tables - Races – Hazards- Clock skews.

UNIT V: MEMORY AND PROGRAMMING LOGIC (9) Periods

Classification of Memories - RAM organization - Memory decoding - Memory expansion - Static RAM cell - Dynamic RAM cell - ROM organization - Types of ROM - Programmable Logic Array - Programmable Array Logic - Field Programmable Gate Arrays- Flash cache.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. M. Morris R. Mano and Michael D. Ciletti, "Digital Design" 4th Edition, Pearson Education, 2011.

2. M. Morris R. Mano and Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL" 5th Edition, Pearson Education, 2013.

Reference Books:

1. Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", 2nd Edition, Tata McGraw Hill Education Pvt.Ltd., 2010.

2. A.Anand Kumar, "Fundamentals of Digital Circuits", 2nd Edition, PHI Learning Pvt.Ltd, New Delhi, 2011.

3. Charles H.Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishing House, 2006.

4. Donald D.Givone, " Digital Principles and Design", Tata Mc-Graw-Hill Publishing Company Ltd., 2003.

5. Samir Palnitkar, "Verilog HDL", Pearson Education, 2009.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: In-depth knowledge on Binary Codes and Boolean algebra
CO2: Detailed Knowledge and implementation of Combinational logic circuits
CO3: Ability to analyze and design Synchronous digital circuits
CO4: Ability to realize combinational and sequential logic circuits using Verilog HDL
CO5: Ability to analyze and design Asynchronous sequential circuits
CO6: Knowledge on different memory and programmable logic devices

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	3	1	-	-	-	-	-	-	-	1	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	-	3	1	2	-	-	-	-	-	-	-	-	-
CO4	1	2	-	2	1	-	-	-	-	-	-	-	-	3	-
CO5	2	2	-	2	1	-	-	-	-	-	-	-	-	-	-
CO6	1	2	-	1	1	-	-	-	-	-	-	-	-	-	-
16LES304	1	2	-	2	1	1	-	-	-	-	-	-	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC305 ELECTRONIC CIRCUIT DESIGN CATEGORY: PC

PREREQUISITES: 16LES206 ELECTRON DEVICES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

*To have knowledge on rectifiers and power supplies.
*To understand the frequency response of amplifiers.
*To have knowledge on feedback amplifiers, oscillators, Power amplifiers and Tuned amplifiers.

UNIT I: RECTIFIERS AND POWER SUPPLIES (9) Periods

Rectifiers-Half wave, full-wave and bridge rectifiers- Rectifiers with filters-C,L,LC and CLC filter-Voltage regulators- Classifications of Power Supplies-Over voltage protection, Switched mode power supply-Power control using SCR-Uninterrupted Power Supplies.

UNIT II: LOW FREQUENCY AND HIGH FREQUENCY RESPONSE OF AMPLIFIERS (9) Periods

Frequency response of amplifiers-BJT AC Analysis – hybrid and π equivalent models – Low frequency analysis of BJT and FET- High frequency analysis of BJT and FET - Miller effects - Midband analysis of amplifiers – Multistage frequency effects.

UNIT III: FEEDBACK AMPLIFIERS AND OSCILLATORS (9) Periods

Introduction– Basic feedback concepts – Analysis of voltage and current feedback amplifiers – Loop gain – Stability of feedback circuit – Nyquist stability criterion – Phase and gain margins – Barkhausen criterion-Design of Oscillators –RC Phase Shift, Wein bridge, Colpitts, Hartley and Crystal oscillators.

UNIT IV: LARGE SIGNAL AND TUNED AMPLIFIERS (9) Periods

Classification of large signal amplifiers-Class A, B, C, D, and AB amplifiers operation-efficiency-harmonic distortion, class- B push-pull amplifier, crossover distortion, complementary-symmetry amplifier-Unloaded and loaded Q of tank circuits, single tuned amplifiers – double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers.

UNIT V: MULTIVIBRATORS AND SWEEP CIRCUITS (9) Periods

Design of Astable, Monostable, Bistable multivibrators –Schmitt trigger –Blocking Oscillators- UJT saw tooth generator-Sweep circuits- time base generator.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

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

2.S.Salivahanan, N.Suresh Kumar and A. Vallavaraj. "Electronic Devices and Circuits",2nd edition TMH,2007.

Reference Books:

1. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", 6th Edition, Oxford University Press, *2010.*

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

3. Millman J. and Taub H., "Pulse Digital and Switching Waveforms", 2nd edition, 2007.

4. Donald .A. Neamen," Electronic Circuit Analysis and Design "–2nd Edition, TataMcGrawHill, 2009.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Ability to understand and analyze Power supplies.
CO 2: Ability to understand the frequency response of amplifiers.
CO 3: Ability to analyze Feedback amplifiers and oscillators.
CO 4: Ability to analyze Power amplifiers and Tuned amplifiers.
CO 5: Ability to Design Multivibrator circuits.
CO 6: Ability to analyze Sweep circuits.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	1	2	1	2	-	-	-	-	-	-	1	3	2	1
CO2	2	3	1	2	2	-	1	1	-	-	-	1	1	2	1
CO3	2	1	1	3	2	-	1	1	-	-	-	1	2	2	1
CO4	2	2	1	3	2	1	1	-	-	-	-	1	2	2	1
CO5	3	2	1	2	2	2	1	1	-	-	-	1	3	2	1
CO6	2	2	3	2	2	1	-	1	-	-	-	-	3	3	1
16LPC305	2	2	1	2	2	1	1	1	-	-	-	1	3	2	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC306 **SIGNALS AND SYSTEMS** **CATEGORY: PC**

L	T	P	C
2	2	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

* To analyze the Continuous Time and Discrete Time signals and systems
* To gain knowledge of Fourier and Laplace Transforms and its application in the analysis of Continuous Time Systems
* To gain knowledge of Discrete Time Fourier Transforms and Z-Transforms and its Application in the analysis of Discrete Time Systems
* To analyze state variable equations of linear time invariant Continuous and Discrete Time Systems and its matrix representation

UNIT I: INTRODUCTION TO SIGNALS AND SYSTEMS (6+6) Periods

Introduction to Continuous Time (CT) signals and Discrete Time (DT) signals - step, ramp, impulse, exponential, sinusoidal signals, Representation of DT signals by impulses- signal operations- classification of CT and DT signals –periodic and aperiodic signals, random signals, energy and power signals, even and odd signals- linear time invariant CT systems and DT systems- basic system properties: linear time invariant, causality, BIBO stability

UNIT II: ANALYSIS OF CONTINUOUS TIME SIGNALS (6+6) Periods

Fourier series analysis- spectrum of Continuous Time signals- properties of continuous time Fourier series, Fourier transform of continuous time aperiodic signals and periodic signals, properties of continuous time Fourier transform. Fourier and Laplace Transforms in signal Analysis

UNIT III: LINEAR TIME INVARIANT–CONTINUOUS TIME SYSTEMS (6+6) Periods

Differential Equation- CT system representations by differential equations -Block diagram representation-impulse response, convolution integrals- Frequency response of systems characterized by Differential Equations- Fourier and Laplace transforms in Analysis- state space representation

UNIT IV: ANALYSIS OF DISCRETE TIME SIGNALS (6+6) Periods

Baseband Sampling of CT signals- Aliasing, Reconstruction of CT signal from DT signal, Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT aperiodic signals by Discrete Time Fourier Transform (DTFT) – Properties – Z Transforms- properties.

UNIT V: LINEAR TIME INVARIANT –DISCRETE TIME SYSTEMS (6+6) Periods

Difference Equations-Block diagram representation-Impulse response-Convolution sum -DTFT and Z Transform analysis of Recursive & Non-Recursive systems – Frequency response of systems characterized by Difference –Equations-state space representation.

TOTAL NUMBER OF PERIODS (60) Periods

CONTACT PERIODS:

Lecture: 30 Periods Tutorial:30Periods Practical:0Periods Total:60Periods

Text Books:

1. Alan V.Oppenheim, Alan S.Willsky and S.Hamid Nawab, "Signals & Systems", Prentice-Hall of India, Second Edition, 2011

2. Simon Haykin and Barry Van Veen, "Signals and Systems", Wiley India, New Delhi, 2010

Reference Books:

1. H P Hsu, Rakesh Ranjan, "Signals and Systems", Tata McGraw Hill, 7th Reprint, 2010
2. Edward W. Kamen, Bonnie S. Heck, "Fundamentals of Signals and Systems Using the Web and MATLAB", Pearson Prentice Hall, 2007.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2008
4. M.J.Roberts, "Signals and Systems, Analysis Using Transform Methods and MATLAB", Tata McGraw Hill (India), 2nd Edition, 2011.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Represent basic continuous time and discrete time signals and systems.
CO2: Analyze signal properties such as periodicity, even or odd, energy or power and system properties such as causality, linearity and time invariance
CO3: Analyze and characterize continuous time signals in the Fourier transform and Laplace Transform domain.
CO4: Analyze the properties of a discrete time- signal in the Fourier transform and Z transform domain.
CO5: Characterize a continuous time system in the time domain, Fourier Transform domain and Laplace Transform domain.
CO6: Characterize a discrete time system in the time domain, Fourier Transform domain and Z transform domain

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	2	-	-	-	2	-	-	2	3	1	-
CO4	3	2	2	-	2	-	-	-	2	-	-	2	3	2	-
CO5	3	2	2	-	2	-	-	-	2	-	-	2	3	1	-
CO6	3	3	3	-	2	-	-	-	2	-	-	2	3	2	-
16LPC306	3	2	2	2	2	-	-	-	2	-	-	2	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES307 DATA STRUCTURES LABORATORY CATEGORY: ES

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVES:

* To Acquire and apply the knowledge of linear and non-linear data structures to Engineering problems
*To identify suitable data structure for real time applications
*To develop algorithmic design techniques for Optimization problems

PRACTICALS	List of Experiments I implementation of Data Structures 1.List Array 2.Linked list implementation 3.Stack implementation 4.Queue implementation• 5.Linked list implementation of Stack and Queue 6.Applications of Data structures II implementation of Searching and Sorting Algorithms 7. Binary Search tree 8. Linear search 9. Selection sort 10.Quick sort 11.Merge sort 12. Heap sort

CONTACT PERIODS:

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

Reference books:

1.Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2009.
2.Yedidyah Langsam Aaron, Moshe.J.Augenstein, M.Tenenbaum, "Data Structures using C and C++", 2nd Edition, PHI Learning Pvt.Ltd, 2011

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Ability to implement and demonstrate different data structures using C
CO2: Ability to implement and demonstrate different data structures using other data structures
CO3: Ability to apply the different data structures for various practical problems
CO4: Ability to implement and demonstrate searching algorithms
CO5: Ability to implement and demonstrate sorting algorithms
CO6: Ability to analyze the time and space complexities and efficiency of various algorithms

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	3	1	-	-	-	-	-	-	-	-	1	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	-	3	1	2	-	-	-	-	-	-	-	1	-
CO4	1	2	-	2	1	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	2	1	-	-	-	-	-	-	-	-	-	-
CO6	1	2	-	1	1	-	-	-	-	-	-	-	-	2	-
16LES307	1	2	-	2	1	1	-	-	-	-	-	-	-	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC308 ELECTRONIC DEVICES AND CIRCUIT LABORATORY CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVES:

* To study the operation of diodes and applications.
* To study the characteristics of transistors and their parameters.
* To study the characteristics of Class A, Class B and Class AB amplifier and Wave shaping circuits.
* To study the characteristics of SCR and Oscillators.

PRACTICALS	1. Study the characteristics of diode and its applications. 2. Study the characteristics of BJT and its parameters. 3. Study the characteristics of JFET, MOSFET and their parameters. 4. Study the characteristics of SCR. 5. Study the characteristics of Opto Electronic Devices. 6. Study of series and parallel resonance circuits. 7. Study the characteristics of Class A, Class B and Class AB amplifier. 8. Design Wein-Bridge and RC phase shift Oscillators and determine their frequency of Oscillations. 9. Design of Wave shaping Circuits. 10. Design of Power Supplies. * **The design experiments are simulated using Pspice and Multisim tools.**

CONTACT PERIODS:

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

Reference Books:

1.Ben G Streetman, "Solid state devices", 7th edition, Pearson Education 2014.

2. Donald A Neaman, "Semiconductor physics and devices", 4th edition. Mc Graw Hill, 2011.

3. Millman & Halkias : "Integrated Electronics", MGH. 2009.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Ability to study the characteristics of diodes and its applications.
CO 2: Ability to study the characteristics of BJT and FET.
CO 3: Ability to study the efficiency of power amplifiers.
CO 4: Ability to study the functions of push pull and complementary amplifier circuits.
CO 5: Ability to design Oscillators and wave shaping circuits.
CO 6: Ability to design Power Supplies.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	2	-	-	-	1	-	-	-	2	2	-
CO2	1	2	1	-	1	-	-	-	1	-	-	-	1	1	-
CO3	1	2	-	-	3	-	-	-	1	-	-	-	2	2	-
CO4	2	2	3	2	3	1	1	1	1	1	1	1	2	2	-
CO5	1	3	-	1	3	-	-	-	1	-	-	-	2	2	-
CO6	1	2	1	-	1	-	-	-	1	-	-	-	1	1	-
16LPC308	1	2	1	2	3	1	1	1	1	1	1	1	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LBS401 RANDOM PROCESS AND QUEUING THEORY CATEGORY: BS

L	T	P	C
3	2	0	4

PREREQUISITES: Nil

COURSE OBJECTIVES:

*To gain the knowledge of finding moment generating functions of discrete and continuous random variables
*To familiarize with first and second order stationary, ergodic, Markov processes.
*To obtain the knowledge of auto correlation, cross correlation, power spectral density and cross spectral density.
*To acquire knowledge of Autocorrelation and cross correlation functions of input and output and to understand queuing models.

UNIT I: RANDOM VARIABLES (9+6) Periods

Discrete and continuous random variables-Moments-Moment generating functions and their properties. Distributions: Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions-Functions of Random variables.

UNIT II: CLASSIFICATION OF RANDOM PROCESSES (9+6) Periods

Definition and examples-first order, second order, strictly stationary, wide sense stationary and ergodic process-Markov process-Binomial, Poisson and Normal processes-Sine wave process-Random telegraph process.

UNIT III: CORRELATION AND SPECTRAL DENSITIES (9+6) Periods

Auto correlation-cross correlation-properties-power spectral density-cross spectral density properties-Weiner Khintchine relation-Relation between cross power spectrum and cross correlation function.

UNIT IV: LINEAR SYSTEM WITH RANDOM INPUTS (9+6) Periods

Linear time invariant system –system transfer function-Linear systems with random inputs-Auto correlation and cross correlation functions of input and output-White noise

UNIT V: QUEUEING THEORY (9+6) Periods

Markovian models-Birth and Death Queuing models-Steady state results-Single and multiple server queuing models-Little's formula-M/G/1 queue

TOTAL NUMBER OF PERIODS (45+30) Periods

CONTACT PERIODS:

Lecture:45 Periods Tutorial:30Periods Practical:0 Periods Total:75Periods

Text Books:

1.VeerajanT, "Probability, and Random Processes(with queuing Theory and Queuing Networks)",McGrawHill Education(India)Pvt Ltd., New Delhi, Fourth Edition 2016.

Reference Books:

1.Trivedi, K.S, "Probability,Statistics with Reliability and Queuing and computer Science Applications", Prentice Hall of India Ltd,New Delhi,2014

2.Kandasamy P, Thilagavathy K and Gunavathy K, "Probability, Statistics and Random Processes",S.Chand and Co,Ramnagar,NewDelhi,Reprint 2013

3.Gross D, and Harris C.M., and Carl M.Harris, "Fundamentals of Queuing theory", John Wiley and Sons, New York, 1988.

4.Allen A.O., Probability, Statistics and Queuing theory with Computer Application, Elsevier, Second Edition, 2005.

5.Taha H.A., Operations Research: An Introduction, Prentice Hall of India Pvt Ltd, New Delhi, 2007

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Understand moments and moment generating functions for their mean and variance.
CO2: Acquire fluency in stationary, ergodic processes.
CO3: Understand Markov processes and spectral densities.
CO4: Understand system transfer function and linear systems with random inputs.
CO5: Understand probable values of queues with single and multi-server models.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-		-	-	-	-	-	3	2	-
CO2	2	2	-	-	-	1		-	-	-	-	-	3	2	-
CO3	2	2	-	-	-	-	1	-	-	-	1	1	3	2	-
CO4	2	2	-	-	-	-	1	-	-	-	-	1	3	2	-
CO5	2	2	2	-	1	-	1	-	-	-	1	1	3	2	-
16LBS401	2	2	1	-	1	1	1	-	-	-	1	1	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LES402 ELECTRICAL ENGINEERING AND CONTROL SYSTEMS CATEGORY: ES

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC306 SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

*To get a basic knowledge on motors and machines
*To learn about fundamental concepts of Control system modeling
*To learn the concepts of time response and frequency response analysis, stability analysis and State variable analysis of control systems.

UNIT I: DC AND AC MACHINES (9)Periods

DC Generator- Construction- Working principle- Armature reaction- Commutation- DC motors-Back emf- Performance characteristics- Alternators- Construction- Principle of operation- emf equation-phasor diagram- Synchronous motor- Applications

UNIT II: INDUCTION AND SPECIAL MACHINES (9) Periods

Three phase- Construction- Working principle- Speed-torque curve- Starting speed control- Single phase- Principle of operation- types- Applications. Stepper motor- DC and AC servomotors- AC series motor- Universal motor- Printed circuit(Disc) DC motor- Reluctance motor- Hysteresis motor- Linear induction motor.

UNIT III: CONTROL SYSTEM MODELING (9)Periods

Basic Elements of Control System - Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph.

UNIT IV: TIME RESPONSE AND FREQUENCY RESPONSE ANALYSIS (9)Periods

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors- Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots.

UNIT V: STABILITY AND STATE VARIABLE ANALYSIS (9)Periods

Stability - Routh-Hurwitz Criterion, Root Locus Technique- Construction of Root Locus-Dominant Poles- State space representation of Continuous Time systems - State equations - Transfer function from State Variable Representation - Solutions of the state equations - Concepts of Controllability and Observability

TOTAL NUMBER OF PERIODS (45)Periods

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

Text Books:

1.B.L.Theraja,"A Text Book of Electrical Technology", VolumeII, (AC & DC Machines), S.Chand & Company Ltd, New Delhi, 2004.

2.J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.

Reference Books:

1.I.J.Nagrath,D.P.Kothari,"ElectricMachines", TMH, 2003.

2.B.R.Sharma,"Electrical Machines", SatyaPrakashan Publication, 2000

3.Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition, 1995.

4.M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition ,2002.

5.Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw-Hill, 2007.

COURSE OUTCOMES:

Upon completion of the course, the students will have:
CO1: A basic knowledge on motors
CO2: A basic knowledge on special machines
CO3: Exposure to various types of motors, its applications and operation.
CO4: An in-depth learning of fundamental concepts of Control system modeling
CO 5: An in-depth knowledge of concepts of time response and frequency response analysis
CO6: An in-depth knowledge of stability analysis and State variable analysis of control systems

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	1	3
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	1	3
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	1	3
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1	3
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	1	3
CO6	3	2	2	-	-	-	-	-	-	-	-	-	3	1	3
16LES402	3	2	2	-	-	-	-	-	-	-	-	-	3	1	3

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC403 **COMMUNICATION THEORY** **CATEGORY: PC**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

* To introduce the concepts of various analog modulations and their spectral characteristics.
*To understand the properties of random process.
*To know the effect of noise on communication systems

UNIT I: AMPLITUDE MODULATION **(9)Periods**

Introduction – communication system model – Need for modulation - Amplitude Modulation -DSB-FC - Bandwidth Requirements- Power relations - Suppressed carrier systems – DSB-SC, SSB-SC - Time and Frequency domain description of AM techniques - Generation and detection of DSB-FC waves – Square-Law Modulator, Square Law Detector, Envelope Detector - Generation and detection of DSB-SC waves - Balanced Modulator, Ring Modulator, Coherent detection –Costas Loop - Generation and detection of SSB-SC waves - Phase discrimination method, Coherent detection – Vestigial Sideband Modulation - Comparison of AM systems.

UNIT II: ANGLE MODULATION **(9)Periods**

Phase and frequency modulation-Narrow Band and Wide band FM - Spectrum - FM modulation and demodulation – FM Discriminator- PLL as FM Demodulator - Transmission bandwidth.

UNIT III: RANDOM PROCESS **(9)Periods**

Random variables, Central limit Theorem, Random Process, Stationary Processes, Mean, and Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, and Transmission of a Random Process Through a LTI filter.

UNIT IV: TRANSMISSION AND RECEPTION **(9)Periods**

Classification of transmitters - Block diagram of AM broadcasting transmitters- Low Level and High Level transmitters - Pilot carrier technique - FM transmitters- Armstrong FM systems. Receivers: Classifications of receivers - Block diagram – Receiver characteristics - Tuned radio frequency receiver - Super heterodyne receiver - Merits and demerits of different receivers. Block diagram of FM receiver -Automatic frequency control - Limiters - Diversity reception techniques - TDM and FDM.

UNIT V: NOISE CHARACTERIZATION **(9)Periods**

Noise sources and types – Noise figure and noise temperature – Noise in cascaded systems. Narrow band noise – PSD of in-phase and quadrature noise –Noise performance in AM systems – Noise performance in FM systems – Pre-emphasis and de-emphasis – Capture effect, threshold effect.

TOTAL NUMBER OF PERIODS **(45)Periods**

CONTACT PERIODS:

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

Text books:

1.Simon Haykin, "Communication Systems", Wiley Publication, New Delhi, 2011.

2.Kennedy G, "Electronic Communication systems", Tata McGraw Hill, New Delhi, 2009.

Reference books:

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2006.

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

3. Wayne Tomasi, "Electronics Communications Systems Fundamentals Through Advanced", 4th Edition, Pearson Education 2002.

4. Couch.L.,"Modern Communication Systems", Pearson, 2001.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Gain knowledge on amplitude modulation.
CO 2: Acquire knowledge on angle modulation schemes.
CO 3: Apply the concepts of random process to the design of communication systems.
CO 4: Acquire knowledge on transmission and reception.
CO 5: Gain knowledge on noise sources and types.
CO 6: Analyze the noise performance of AM and FM systems.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-
CO2	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-
CO3	2	2	2	-	-	-	-	-	-	-	-	1	1	1	-
CO4	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-
CO5	2	2	2	-	-	-	-	-	-	-	-	1	1	1	-
CO6	2	2	2	-	-	-	-	-	-	-	-	1	2	2	-
16LPC403	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC404 NETWORKS AND TRANSMISSION LINES CATEGORY: PC

L	T	P	C
2	2	0	3

PREREQUISITES: 16LES302 CIRCUIT THEORY

COURSE OBJECTIVES:

*To understand the basic concepts of two port networks
*To study about network synthesis
*To familiarize the concepts of transmission lines

UNIT I: SYMMETRICAL AND ASYMMETRICAL TWO PORT NETWORKS (6+6)Periods

Symmetrical networks-Properties of L,T and Pi section types-T and pi equivalent of two port network–characteristic impedance and propagation constant-Asymmetrical networks-Image and Iterative impedances-Image transfer constant and iterative transfer constant

UNIT II: PASSIVE NETWORKS (6+6)Periods

Constant K filters – m derived filters – Composite filters – Design procedures - Series and shunt equalizer - Symmetrical and asymmetrical attenuators - T and pi sections.

UNIT III: PASSIVE NETWORK SYNTHESIS (6+6)Periods

Hurwitz polynomials–positive real functions-Driving point function synthesis–LC immitance functions-RC impedance/admittance functions-RL admittance/impedance functions-Foster and Cauerforms of RC,RL and LC networks

UNIT IV: TRANSMISSION LINE THEORY (6+6)Periods

Line parameters and transmission constants-Transmission line equation-Physical significance of the equation-Infinite line-Input and transfer impedance-Waveform distortion-Distortion less line-Loading-Reflection phenomena-Reflection loss and insertion loss-Skin and proximity effect-T and pi equivalent of transmission lines.

UNIT V: LINE AT RADIO FREQUENCIES (6+6)Periods

Parameters of open wire line and co-axial line at high frequencies – Standing waves-Standing wave ratio-Input impedance of open and short circuited lines-Relation between VSWR and reflection co-efficient-Quarter wave transformer-Single and double stub matching-Smith chart and its applications.

TOTAL NUMBER OF PERIODS (60)Periods

CONTACT PERIODS:

Lecture:30 Periods Tutorial:30 Periods Practical:0 Periods Total:60 Periods

Text books:

1.John D. Ryder, "Networks, Lines and Fields", PHI, 2nd edition, 2009.
2.Sudhahar.A, ShyammohanS.P, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill, New Delhi, Fourth Edition,2010.

Reference books:

1.S.P. Ghosh and A.K. Chakraborty, "Network Analysis and Synthesis", McGraw Hill, 1st edition 2010

2.Roy, Choudhury D., "Networks and Systems," New Age International Publishers, 2nd edition reprint , 2014

3.M.E. VanValkenburg,"Network Analysis, INDIA PEARSON,"3rd edition, 2015

4.G.S.N. Raju "Electromagnetic Field theory and Transmission lines", Pearson Education, First Edition 2005

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Exposure to two port networks
CO2: Ability to design and analyze different passive network configurations
CO3: Understanding on the concepts of network synthesis
CO4: Familiarization with transmission line phenomena
CO5: Ability to identify different types of transmission lines
CO6: Knowledge on impedance matching techniques in transmission lines

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO6	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
16LPC404	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC405 ANALOG INTEGRATED CIRCUITS CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC305 Electronic Circuit Design

COURSE OBJECTIVES:

* To introduce the basic building blocks of analog integrated circuits.
*To design the linear and non-linear circuits using operational amplifiers
*To acquire knowledge on analog multipliers and PLL, ADC, DAC and special function ICs.

UNIT I: BASICS OF OPERATIONAL AMPLIFIERS (9)Periods

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

UNIT II: APPLICATIONS OF OPERATIONAL AMPLIFIERS (9)Periods

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

UNIT III: ANALOG MULTIPLIER AND PLL (9)Periods

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

UNIT IV: ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS (9) Periods

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

UNIT V: WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS (9) Periods

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, ICL8038 function generator.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd.,4th Edition 2010.

2.Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2005.

Reference Books:

1.Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata McGraw-Hill, 2014.

2.Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 2009.

3.Michael Jacob, "Applications and Design with Analog Integrated Circuits", Prentice Hall of India, 1999.

4.William D.Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, 2006.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Acquire Knowledge on Basic building blocks of linear integrated circuits
CO 2: Design linear and non-linear applications using op-amp.
CO 3: Acquire knowledge on analog multiplier and PLL.
CO 4: Design ADC and DAC using op – amps.
CO 5: Generate waveforms using op – amp circuits and analyze special function ICs
CO 6: Design real time applications using analog ICs.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	2	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	3	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	3	2	-
CO6	3	2	2	-	-	-	-	-	-	-	-	1	3	3	-
16LPC405	3	2	2	-	-	-	-	-	-	-	-	1	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC406 DIGITAL SIGNAL PROCESSING CATEGORY: PC

L	T	P	C
2	2	0	3

PREREQUISITES: 16LPC306 SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

*To study DFT and digital filter design algorithms
*To discuss finite word length effects and multi rate signal processing
*To study the fundamentals of Digital signal processors

UNIT I: DISCRETE FOURIER TRANSFORM (6+6)Periods

DFT and its properties– FFT algorithms–IFFT-circular convolution– Overlap – add – overlap –save methods.

UNIT II: INFINITE IMPULSE RESPONSE DIGITAL FILTERS (6+6)Periods

Design of analog Butterworth and Chebyshev Filters – Frequency transformation in analog domain Design of IIR digital filters - Impulse invariance techniques, Bilinear transformation – Realization of IIR filters - Direct, cascade and parallel forms.

UNIT III: FINITE IMPULSE RESPONSE DIGITAL FILTERS (6+6)Periods

Symmetric and Anti-symmetric FIR filters – Linear phase FIR filters – FIR Design using window method– rectangular, Hamming and hanning windows – Frequency sampling method – Realization of FIR filters – Linear phase, Traversal structures-comparison of FIR and IIR filters.

UNIT IV: FINITE WORD LENGTH EFFECTS AND MULTI-RATE SIGNAL PROCESSING (6+6) Periods

Fixed point and floating point number representations – Comparison – Quantization Error - Quantization Noise Power -Finite word length effects -Signal scaling - Introduction to Multi-rate signal processing-Decimation –Interpolation –multistage implementation- Applications

UNIT V: TMS320C67X PROCESSOR (6+6) Periods

Harvard and modified Harvard architectures - architecture of TMS320C6X processors – Features of C67X processor – Internal architecture – CPU – General Purpose register files – Functional Units and operation – data paths – Control registers - Functional Units and instructions – Parallel and pipeline operations – Interrupts - Introduction to CCS.

TOTAL NUMBER OF PERIODS (60)Periods

CONTACT PERIODS:

Lecture:30 Periods Tutorial:30 Periods Practical:0 Periods Total:60Periods

Text Books:

1. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, 2007.
2. B.Venkataramani, M. Bhaskar, "Digital Signal Processor Architecture, Programming and Applications", Second Edition, 2011.

Reference Books:

1. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2008
2. E.C. Ifeachor and B.W. Jervis, "Digital signal processing – A Practical approach", Prentice Hall, 2011
3. S.K. Mitra, "Digital Signal Processing, A Computer Based approach", Tata McGrawHill, 2011 fourth international edition

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Exposure to DFT & FFT algorithms
CO2: Ability to design and realize digital IIR filters
CO3: Ability to design and realize digital FIR filters
CO4: Understanding on the finite word length effects
CO5: Exposure to Multirate signal processing and its applications
CO6: Familiarization with DSP architectural features

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	1	-	-	-	-	-	-	-	3	1	-
CO2	3	3	2	-	1	-	-	-	-	-	-	-	3	1	-
CO3	3	3	2	-	1	-	-	-	-	-	-	-	3	1	-
CO4	3	3	2	-	1	-	-	-	-	-	-	-	3	1	-
CO5	3	3	2	-	1	-	-	-	-	-	-	-	3	1	-
CO6	3	3	2	-	1	-	-	-	-	-	-	-	3	1	-
16LPC406	3	3	2	-	1	-	-	-	-	-	-	-	3	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC407 INTEGRATED CIRCUITS LABORATORY CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES: 16LES304 DIGITAL SYSTEM DESIGN

COURSE OBJECTIVES:

*To Design, Construct and Demonstrate linear IC's applications
*To Design, Construct and Demonstrate digital IC's applications

PRACTICALS	**LIST OF EXPERIMENTS** 1. Study of simple applications of op-amps(Slew rate verifications, inverting and non-inverting amplifier, Adder, Integrator and Differentiator) 2. Design and testing of comparators(magnitude comparator, zero crossing detector, peak detector) 3. Design of Schmitt trigger circuit 4. Design of Astable and Monostable multivibrator circuits using 555 timer IC 5. Design of active LPF and HPF. 6. Design and implementation of adders and subtractors 7. Design and implementation of different types of code converters 8. Design and implementation of Multiplexer and Demultiplexer using logic gates and study of IC74150 and IC74154. 9. Design and implementation of counters 10. Design and implementation of shift registers **TOTAL: 60 PERIODS**

CONTACT PERIODS:

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

Reference books:

1. D.Roy Choudhury and Shail Jain, "Linear Integrated Circuits" Tun bridge Wells, Kent : New Age Science Limited Fourth edition 2011
2. Morris Mano,"Digital Design",4th Edition, Pearson Education, 2011
3. A.Anand Kumar, "Fundamentals of Digital Circuits", 2nd Edition, PHI Learning Pvt. Ltd, NewDelhi,2011.

COURSE OUTCOMES:

Upon completion of the course, the students will have:
CO1: Ability to analyze various applications of Op-Amp
CO2: Ability to design and analyze various pulse circuits using linear IC
CO3: Familiarization with active filters realization using linear IC
CO4: Ability to construct and test arithmetic circuits
CO5: Familiarization with combinational logic circuits design and realization
CO6: Familiarization with sequential logic circuits design and realization

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO2	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO3	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO4	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO5	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO6	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
16LPC407	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC408 DIGITAL SIGNAL PROCESSING LABORATORY CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES: 16LPC306-SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

*To Develop DSP algorithms for signal processing and test them using MATLAB
*To familiarize with the usage of DSP processors
*To test the DSP algorithms using CCS

PRACTICALS	LIST OF EXPERIMENTS USING MATLAB 1. Linear and circular convolution of two sequences 2. Computation of DFT/DTFT 3. Spectral Analysis- magnitude and phase spectrum of signal using DFT 4. Computation of FFT of a signal 5. Design of FIR filters 6. Design of IIR filters – Butterworth, Tchebyshev using – Impulse invariance and Bilinear Transform USING TMS320C 54XX/67XX (using Code Composer Studio) 1. Study of various addressing modes of DSP using simple programming examples 2. Implementation of correlation and convolution 3. Sampling of input signal and display 4. Computation of FFT 5. Implementation of I/II order FIR filter 6. Implementation of I/II order IIR filter **TOTAL:60 PERIODS**

CONTACT PERIODS:

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

Reference books:

1.John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, 2009.
2.B. Venkataramani, M. Bhaskar, "Digital Signal Processor Architecture, Programming and Applications", Second Edition, 2011

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Ability to analyze convolution concepts and it's applications using MATLAB
CO2: Exposure to DFT/FFT computation algorithms and spectral estimation using MATLAB
CO3: Ability to design and test IIR/FIR digital filters using MATLAB
CO4: Familiarization with DSP starter kit programming using simple examples
CO5: Exposure to DFT/FFT computation algorithms and spectral estimation using CCS
CO6: Ability to design and test IIR/FIR digital filters using CCS

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO2	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO3	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO4	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO5	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
CO6	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-
16LPC408	3	-	3	-	2	-	-	-	2	1	-	-	3	3	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC501 ELECTROMAGNETIC FIELDS AND WAVEGUIDES CATEGORY: PC

L	T	P	C
2	2	0	3

PREREQUISITES:Nil

COURSE OBJECTIVES:

*To have in-depth knowledge on static electric and magnetic fields
*To study the behaviour of Electromagnetic waves in various medium.
*To have in-depth knowledge on waveguides and cavity resonator

UNIT I: ELECTRO STATIC FIELDS (6+6) Periods

Vector analysis- Orthogonal co-ordinate systems-Coulomb's Law-Electric field intensity-Field due to continuous Volume charge distribution-Field due to line charge-Field due to sheet of charge-Electric flux-Gauss law-Application of Gauss law- Divergence theorem-Electric scalar potential-Equipotential surface-Poisson's and Laplace equations-Capacitance of parallel plate-Capacitance of Coaxial cable-Parallel wire capacitance-Boundary conditions-Energy stored in electric field-Energy density.

UNIT II: STEADY MAGNETIC FIELDS (6+6) Periods

Biot-Savat's Law-Ampere's circuital law-Magnetic flux and flux density-Scalar and Vector potential-Force on a moving charge and differential current element-Magnetic Boundary conditions-Magnetic circuit-Faraday's law of electromagnetic inductance-Inductance and Mutual inductance-Inductance of transmission line-Energy stored in magnetic field-Energy density.

UNIT III: ELECTRO MAGNETIC WAVES (6+6) Periods

Displacement current-Maxwell's equation-Equation of continuity-Inconsistency of Ampere's law-Wave motion in free space- Uniform plane waves-Sinusoidal time variations-Conductors and Dielectrics-Propagation in good conductors and Good dielectrics-Skin effect-Polarization-Reflection and Refraction of plane waves-Reflection by a conductor –Normal and Oblique incidence-Reflection by a Dielectric-Reflection at the surface of a conducting medium-Surface impedance-Poynting Theorem- power loss in a plane conductor.

UNIT IV: GUIDED WAVES AND RECTANGULAR WAVEGUIDES (6+6) Periods

General solutions for TE and TM waves-Waves between parallel planes of perfect conductors-Velocities of wave propagation- Attenuation in parallel plate waveguide-Wave impedance of TE and TM waves in a parallel plate waveguide-Types of waveguides-Mode theory of a Rectangular waveguide(TE and TM waves)-Characteristics of TE and TM waves-Impossibility of TEM waves in rectangular waveguides-Dominant mode -Wave impedances of TE and TM waves - Characteristic impedance of a waveguide-Attenuation factor -Excitation of various modes-Quality Factor

UNIT V: CIRCULAR WAVEGUIDES AND CAVITY RESONATORS (6+6) Periods

Bessel functions-TE and TM modes in circular Waveguides-Wave impedances-Dominant mode-Field configuration- Comparison of Circular and Rectangular waveguides-Excitation of modes-Microwave cavity resonators-Rectangular and circular cavity resonators.

TOTAL NUMBER OF PERIODS (60) Periods

CONTACT PERIODS:

Lecture:30 Periods Tutorial:30 Periods Practical:0 Periods Total:60Periods

Text books:

1.William H.Hayt,"Engineering Electromagnetics", Tata McGraw-Hill,2014.

2.Edward.C.Jordan&Keith.G.Balmai,, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India,1995

Reference Books:

1. S.Baskaran, "Transmission Lines and Waveguides", Scitech Publications(India) PVT.LTD, Chennai, 2011

2. David K.Cheng, "Field and Wave Electromagnetics", Pearson Edition ,2015.

3. Umesh Shinha, "Electromagnetic Theory and its Applications", Satya Prakashan,1996.

4.Gangadhar.K.A, "Field Theory"Khanna Publishers,2002.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: In-depth knowledge on electrostatic fields.
CO2: An in-depth knowledge on steady magnetic fields.
CO3: Knowledge on energy storage devices
CO4: An knowledge on the behaviour of Electromagnetic waves in various medium.
CO5: An in-depth knowledge on waveguides
CO6: An knowledge on cavity resonators

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	2	-	-	3	-	-	-	-	3	3	2	-
CO2	1	2	1	2	-	-	1	-	-	-	-	3	3	2	-
CO3	1	1	3	2	-	-	3	-	-	-	-	3	2	3	-
CO4	2	2	1	2	-	-	2	-	-	-	-	3	3	2	-
CO5	2	2	3	2	-	-	3	-	-	-	-	3	1	2	-
CO6	1	1	1	2	-	-	1	-	-	-	-	3	3	2	-
16LPC501	2	2	3	2	-	-	3	-	-	-	-	3	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC502 **VLSI SYSTEM DESIGN** **CATEGORY: PC**

L	T	P	C
3	0	0	3

PREREQUISITES: 16LES206 Electron Devices
16LES304 Digital System Design

COURSE OBJECTIVES:

*To introduce various aspects of CMOS logic
*To examine the electrical characteristics and electronics analysis of CMOS
*To design CMOS logic networks and realize the VLSI system components

UNIT I: CMOS LOGIC DESIGN **(9) Periods**

VLSI Design Flow - Fabrication of CMOS Integrated Circuits - MOSFET Switches - Basic Logic Gates in CMOS - Complex Logic Gates in CMOS - Transmission Gate Circuits - Stick Diagram and Layout Design Rules - Layout of Basic Structures - FET sizing - Physical structure of MOSFETs - CMOS Layers

UNIT II: CHARACTERISTICS AND ANALYSIS OF CMOS LOGIC **(9) Periods**

MOS Threshold Voltage Equation - nFET Current-Voltage Equations - The FET RC Model - DC Characteristics of the CMOS Inverter - Switching Characteristics - Power Dissipation - Transient Response - Analysis of Complex Logic Gates.

UNIT III: DESIGNING HIGH-SPEED CMOS LOGIC NETWORKS **(9) Periods**

Gate delays - driving large capacitive loads - Logical effort - Advanced Logic Circuits: Pseudo-NMOS - Tri-state - clocked - dynamic and dual rail logic

UNIT IV: VLSI CLOCKING AND TESTING **(9) Periods**

VLSI clocking: CMOS clocking styles - Pipelined systems - Clock generation and distribution. VLSI testing -need for testing - manufacturing test principles - design strategies for test - chip level and system level test techniques.

UNIT V: DESIGN OF VLSI SYSTEMS **(9) Periods**

System Specifications – Structural Gate Level Modeling – Switch Level Modeling – Behavioral and RTL Modeling -Transistor Level Realization –Multiplexers - Binary Decoders – Comparators – Priority Encoders – Latches - Flip-Flops and Registers – SRAM - DRAM and Flash Memories - CMOS Clocking Styles.

TOTAL NUMBER OF PERIODS **(45)Periods**

CONTACT PERIODS:

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

Text Books:

1. Uyemura, John P, "Introduction to VLSI Circuits and Systems", Wiley & Sons, 8th Reprint 2009

2. N. Westeet. al., "CMOS VLSI Design", Third Edition, Pearson Education,2013.

Reference Books:

1. Jan M. Rabaey, "Digital Integrated Circuits: A Design Perspective", PHI, Second Edition, 2012.

2. R. Jacob Baker, "CMOS: Circuit Design, Layout, and Simulation", Wiley-IEEE, Revised Second Edition, 2008.

3. Pucknell, "Basic VLSI Design", Prentice Hall, 2006.

COURSE OUTCOMES:

Upon completion of the course, the students will have/ability to:

CO1: Realize the CMOS logic
CO2: Construct the complex logic circuits with MOSFETs
CO3: Acquire knowledge on electrical characteristics and electronic aspects of CMOS logic
CO4: Design the high-speed CMOS Logic Networks
CO5: Use the VLSI clocking styles to the system and testing principles for the device under test
CO6: Design the basic VLSI system

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	2	1	-	2	3	-	-	3	2	1	2	-
CO2	1	1	2	2	1	-	2	3	-	-	3	2	1	2	-
CO3	1	1	3	3	3	-	3	3	-	-	3	-	1	1	-
CO4	1	1	3	1	3	-	3	3	-	-	3	2	1	1	-
CO5	1	1	3	3	2	-	3	3	-	-	-	3	1	2	-
CO6	1	1	2	3	3	-	2	3	-	-	3	-	1	2	-
16LPC502	1	1	3	3	3	-	3	3	-	-	3	2	1	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC503 DIGITAL COMMUNICATION CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC403 Communication theory

COURSE OBJECTIVES:

*To equip the students with the basic concepts of pulse modulation and digital modulation techniques.
*To understand the need and basics of error control coding.
*To understand the principles of spread spectrum and its applications

UNIT I: PULSE MODULATION (9)Periods

Sampling process -PAM- Other forms of pulse modulation-Bandwidth -Noise tradeoff-Quantization-PCM-Noise considerations in PCM Systems-TDM- Digital multiplexers-Limitation and modification of PCM-Delta modulation-Linear prediction- differential pulse code modulation-Adaptive Delta Modulation

UNIT II: DIGITAL MODULATION TECHNIQUES (9) Periods

Introduction - Generation of ASK,PSK,FSK - Signal space diagram - matched filter-detection – bit error probability and Power spectra of BPSK, Differential phase shift keying - Differential encoded phase shift keying -QPSK, FSK - M-ary PSK – quadrature amplitude shift keying- Minimum shift keying –Duo binary encoding- Comparison of Digital modulation systems - Carrier and symbol synchronization

UNIT III: BASEBAND PULSE TRANSMISSION (9) Periods

Base band signal receiver – Probability of error – Optimum filter – White noise: Matched filter – Probability of error of the matched filter – Coherent reception: Correlation – Phase- shift Keying– Non-coherent detection of FSK – Differential PSK – Four phase PSK (QPSK-)- Intersymbol Interference- Nyquist's criterion for Distortionless Base band Binary Transmission- Correlative levelcoding-Baseband M-ary PAM transmission-Adaptive Equalization -Eye patterns

UNIT IV: INFORMATION THEORY AND CODING (9) Periods

Discrete messages-amount of information-average information-entropy information rate- Shannon's theorem-capacity of gaussian channel-bandwidth-S/N trade off- Source coders based on probability - Shannon Fano coding, Shannon binary coding, Huffman coding coding-parity check bit coding-block codes -coding and decoding -probability of error with coding- - Convolution codes – Cyclic codes.

UNIT V: SPREAD SPECTRUM MODULATION (9) Periods

Pseudo- noise sequences-A notion of spread spectrum -Direct sequence spread spectrum with coherent binary phase shift keying - Signal space dimensionality and processing gain -Probability of error - Frequency -Hop spread spectrum -Code Division Multiplexing.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. Taub and Schilling D, "Principles of communication systems", McGraw Hill, New Delhi, 2008

2. Simon Haykin, "Digital Communications", John Wiley & Sons, Inc. Singapore, 2011.

Reference Books:

1. Lathi B P "Modern Digital and Analog communication Systems", Oxford University Press, 2010.

2. Proakis J G, "Digital Communications", Tata McGraw Hill, New Delhi, 2008

3. Sam Shanmugam K, "Digital and Analog communication systems", John Wiley Inc., Singapore, 2008

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Knowledge on the principle of Pulse modulation techniques
CO 2: Knowledge on the principle of digital modulation techniques
CO 3: Ability to analyze Base band pulse transmission and to design the baseband pulse for ISI free transmission over finite bandwidth channels
CO 4: Ability to detect and correct the errors introduced in the channel using error control coding schemes
CO 5: Ability to analyze the BER performance of digital modulation techniques
CO 6: Knowledge on the principle of spread spectrum and its applications

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	2	-	-	-	2	-	-	2	3	1	-
CO4	3	2	2	-	2	-	-	-	2	-	-	2	3	2	-
CO5	3	2	2	-	2	-	-	-	2	-	-	2	3	1	-
CO6	3	3	3	-	2	-	-	-	2	-	-	2	3	2	-
16LPC503	3	2	2	2	2	-	-	-	2	-	-	2	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC504 MICROPROCESSOR AND MICROCONTROLLER CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: 16LES304 Digital System Design

COURSE OBJECTIVES:

*To gain knowledge about architecture and programming concepts of 8086 Microprocessor and 8051 Microcontroller
*To acquire Knowledge on peripheral interfacing concepts
*To design microprocessor and Microcontrollers based systems

UNIT I: THE 8086 MICROPROCESSOR (9) Periods

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II: 8086 SYSTEM BUS STRUCTURE (9) Periods

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

UNIT III: I/O INTERFACING (9) Periods

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

UNIT IV: MICROCONTROLLER (9) Periods

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

UNIT V: INTERFACING MICROCONTROLLER (9) Periods

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

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS

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

Text Books:

1.Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085,8086, 8051 and 8096", PHI, 2011.

2. Kenneth J.Ayala., "The 8051 Microcontroller", 3rd Edition, Thompson Delmar Learning, 2007, New Delhi.

Reference Books:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
3. A.K. Ray, K.M.Bhurchandi, "Advanced Microprocessor and Peripherals", 2nd edition, Tata McGraw-Hill, 200.
4. DoughlasV.Hall, "Microprocessors and Interfacing, Programming and Hardware",TMH,2012

COURSE OUTCOMES:

Upon completion of the course, the students will:

CO 1: Gain knowledge about architecture and programming concepts of 8086 Microprocessor
CO 2: Gain knowledge about Microprocessor Bus Structure
CO 3: Acquire Knowledge on peripheral interfacing concepts
CO 4: Gain knowledge about architecture and programming concepts of 8051 Microcontroller
CO 5: Acquire Knowledge on 8051 interfacing concepts
CO 6: Generate waveforms using 8051 Microcontroller

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	-	-	-	-	-	-	-	-	1	3	2	-
CO2	2	2	3	-	-	-	-	-	-	-	-	1	2	1	-
CO3	2	2	3	-	-	-	-	-	-	-	-	1	3	2	-
CO4	2	2	3	-	-	-	-	-	-	-	-	1	3	2	-
CO5	2	2	3	-	-	-	-	-	-	-	-	1	3	2	-
CO6	2	2	3	-	-	-	-	-	-	-	-	1	3	2	-
16LPC504	2	2	3	-	-	-	-	-	-	-	-	1	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC505 COMPUTER SYSTEM ARCHITECTURE CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES:Nil

COURSE OBJECTIVES

*To understand the basic functional units of a Digital computer system.
*To gain knowledge in controller design and memory system of a computer system.
*To get exposed to the concepts of ILP and current trends.

UNIT I: BASICS OF A COMPUTER SYSTEM DESIGN (9) Periods

Evolution of computer systems – Different layers of computer system – Complexity of computing – Design layers of a computer system – RTL structure – RISC and CISC Architectures– Amdahl's Law – Performance Metrics.

UNIT II: PROCESSING UNIT (9) Periods

Components of the Processor – Data path and Control path – Execution of a Complete Instruction – Hardwired and Micro programmed Control – Instruction Level Parallelism – Basic Concepts of Pipelining – Pipelined Implementation of Data path and Control path – Arithmetic and logic unit – Bit sliced ALU. Computer arithmetic –Multiplication algorithms: Booth multiplier, Array multiplier – Division algorithms – Decimal arithmetic unit.

UNIT III: CONTROLLER DESIGN (9) Periods

Controller functions – Control transfer – Instruction control and program control transfers – Hard wired control – Sequence counter method – Delay element method – State table method – Micro programmed control – Encoding of control signals – Micro program sequencer – Micro instruction execution – Control memory optimization.

UNIT IV: MEMORY SYSTEM (9) Periods

Memory system – Memory hierarchy – Memory array organization – Cache memories – Address mapping techniques – Associate memory : Principle of CAM – Block diagram and applications – Virtual memory: Organization and address translation schemes

UNIT V: INSTRUCTION LEVEL PARALLALISM (ILP) AND CURRENT TRENDS (9) Periods

Exploitation of ILP – Hardware and Software Approaches – Dynamic Scheduling – Speculation – Compiler Approaches – Multiple Issue Processors. – ILP and Thread Level Parallelism – Current Trends – Multicore Processors – Graphics and Computing GPUs.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.M. Morris mano, "Computer system architecture", Third edition, Pearson Education, 2008.

2.David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth Edition, Morgan Kaufmann / Elsevier, 2009.

Reference Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.

3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.

4. P. Pal Chaudhuri, "Computer organization and design", Prentice hall of India, New delhi, Third edition, 2010

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: Acquired an idea about the fundamentals of a computer system.
CO2: Acquired an in depth knowledge about the data handling in processing unit of a computer.
CO3: Imparted knowledge in the controller design of computer system architecture.
CO4: Gained knowledge about the arithmetic used in the processors.
CO5: Gained knowledge about the memory access techniques of computer system architecture.
CO6: An exposure to the current trends in concepts of Instruction level parallelism.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	3	2	-	3	-	-	-	-	-	2	-
CO2	-	3	-	-	3	2	2	-	-	-	-	-	-	3	-
CO3	-	-	-	-	3	2	1	-	-	-	-	-	-	2	-
CO4	-	3	-	-	3	1	2	-	-	-	-	-	-	2	-
CO5	-	3	-	-	3	3	3	-	-	-	-	-	-	3	-
CO6	-	-	-	-	3	3	3	-	-	-	-	2	-	2	-
16LPC505	1	3	-	-	3	2	3	1	-	-	-	1	-	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LEE507 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

CATEGORY: EEC

L	T	P	C
0	0	4	2

PREREQUISITES: 16LES304 DIGITAL SYSTEM DESIGN

COURSE OBJECTIVES

*To introduce Assembly Language Programming concepts and features
*To test arithmetic and logical operations in 8086 and 8051
*Interface different I/Os with Microprocessor

PRACTICALS	**LIST OF EXPERIMENTS** 1. Basic arithmetic and Logical operations 2. Code conversion, decimal arithmetic and Matrix operations. 3. Floating point operations, string manipulations, sorting and searching 4. Counters and Time Delay 5. Traffic light control 6. Stepper motor control 7. Digital clock 8. Key board and Display 9. Serial interface and Parallel interface 10. A/D and D/A interface and Waveform Generation 11. Basic arithmetic and Logical operations using 8051 12. Unpacked BCD to ASCII TOTAL:60 PERIODS

CONTACT PERIODS:

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

Reference Books:

1. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085, 8086, 8051 and 8096", PHI, 2011.
2. Ajay Deshmukh, " Microcontrollers : Theory and Applications", Tata McGraw Hill, 2010.

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: Implement arithmetic and logical operations in 8086
CO2: Interface different I/Os with processor
CO3: Generate waveforms using Microprocessors
CO4: Implement arithmetic and logical operations using 8051
CO5: Interface different I/Os with microcontroller
CO6: Design microprocessor and microcontroller based systems

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	-	-	-	-	-	-	1	1	1	2	2	-
CO2	2	3	2	-	-	-	-	-	-	1	1	1	2	2	-
CO3	2	3	2	-	-	-	-	-	-	1	1	1	2	2	-
CO4	2	3	2	-	-	-	-	-	-	1	1	1	2	2	-
CO5	2	3	2	-	-	-	-	-	-	1	1	1	2	2	-
CO6	2	3	2	-	-	-	-	-	-	1	1	1	2	2	-
16LEE507	2	3	2	-	-	-	-	-	-	1	1	1	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC508 COMMUNICATION ENGINEERING LABORAT CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES:16LPC403 COMMUNICATION THEORY

COURSE OBJECTIVES:

*To create an exposure to the practical aspects of amplitude modulation and demodulation techniques

*To create an exposure to the practical aspects of frequency modulation and demodulation techniques

*To realize the principles of TDM and noise spectrum measurement using MATLAB

PRACTICALS	**LIST OF EXPERIMENTS** 1. Amplitude Modulation and Demodulation. 2. AM- DSBC Generation 3. Frequency modulation and demodulation 4. Pre emphasis and De emphasis circuits. 5. Pulse modulation – PAM/PWM/PPM 6. Transistor Mixer Circuit. 7. Design and testing of IF tuned Amplifier 8. Time division multiplexing 9. Frequency Division Multiplexing 10. Implementation of AM and noise analysis using MATLAB TOTAL:60 PERIODS

CONTACT PERIODS:

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

Reference Books:

1.SimonHaykin, "Communication Systems", Wiley Publication, New Delhi, 2011.

2.Kennedy G, "Electronic Communication systems", Tata McGraw Hill, New Delhi, 2009.

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: An exposure to the practical aspects of modulation and demodulation techniques

CO2: An exposure to the practical aspects of various pulse modulation techniques

CO3: An ability to design and test IF tuned amplifier

CO4: An ability to realize the multiplexing techniques.

CO5: An ability to design RF amplifiers.

CO6: An ability to program various modulation schemes using simulation tool.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	2	1	1	1	-	2	1	1	1	2	2	2
CO2	2	3	2	2	1	1	1	-	2	1	1	1	2	2	2
CO3	2	3	2	2	1	1	1	-	2	1	1	1	2	2	2
CO4	2	3	2	2	1	1	1	-	2	1	1	1	2	2	2
CO5	2	3	2	2	1	1	1	-	2	1	1	1	2	2	2
CO6	2	3	2	2	1	1	1	-	2	1	1	1	2	2	1
16LPC508	2	3	2	2	1	1	1	-	2	1	1	1	2	2	2

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC601 ANTENNAS AND WAVE PROPAGATION CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES:16LPC501 ELECTROMAGNETIC FIELDS AND WAVEGUIDES

COURSE OBJECTIVES

*To understand the antenna fundamentals and parameters.
*To learn radiation characteristics of antenna array and different types of antennas.
*To learn measurements of antenna parameters.
*To understand characteristics of a wave propagation in free space.

UNIT I: ANTENNA FUNDAMENTALS AND PARAMETERS (9)Periods

Introduction –Types of antennas- Radiation mechanism- current distribution- radiation pattern – radiation resistance-radiation intensity- directivity- gain- antenna efficiency- beam width- bandwidth-polarization mismatch-effective aperture-Input Impedance- antenna noise temperature- far field radiation-duality theorem- Radiation from oscillating dipole, half wave dipole, folded dipole-Yagi_Uda array

UNIT II: APERTURE AND SLOT ANTENNAS (9)Periods

Radiation from rectangular apertures- Uniform and Tapered apertures-Horn antenna-Reflector antenna-Aperture blockage-Feeding structures-Slot antennas-Loop antennas-Microstrip antennas, radiation mechanism, applications-Numerical tool for antenna analysis.

UNIT III: ANTENNA ARRAYS (9) Periods

Two-element array-N element linear array-Broad side and End fire array-Phased arrays- Pattern multiplication, Binomial array-Tchebyscheff array-Planar array-Circular array-Adaptive arrays-Basic principles of antenna synthesis.

UNIT IV: BROADBAND ANTENNA (9) Periods

V antenna, Rhombic antennas- Helical antenna-spiral antenna-Log periodic antenna-Reconfigurable antenna-Dielectric antennas-Antenna measurements-Test Ranges-Measurement of gain, Radiation pattern, Polarization, VSWR.

UNIT V: WAVE PROPOGATION (9) Periods

Modes of Propagation-Structure of atmosphere-Ground wave propagation-Tropospheric propagation-Troposcatter propagation- Duct Propagation-Flat earth and curved earth concept-Sky wave propagation-Virtual height - Critical frequency - Maximum usable frequency - Skip distance- Fading - Multi hop propagation.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. Constantine A. Balanis, "Antenna Theory-Analysis and Design", 3rd edition, Wiley-India, 2010

2. John D Kraus, Ronald J Marhefka. "Antenna and Wave Propagation", 4th edition,Tata McGraw Hill,2010.

Reference Books:

1. Robert S. Elliott, "Antenna Theory and Design" Wiley-India, 2007

2. R.E.Collin, "Antennas and Radiowave Propagation", McGraw Hill,2002.

3. H.Sizun "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint,

Springer Publications, 2007.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Knowledge on Antenna fundaments and Parameters
CO 2: Ability to analyze various parameters of an antenna.
CO 3: Knowledge on antenna arrays.
CO 4: Knowledge on Broad Band Antennas.
CO 5: Ability to measure antenna parameters.
CO 6: Knowledge on wave propagation.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	-	-	1	1	2	-	1	1	-	-	2	1	-
CO2	2	3	1	2	1	1	1	-	1	1	-	-	2	1	-
CO3	2	2	3	2	3	1	1	1	1	2	1	1	2	3	1
CO4	1	1	1	1	2	-	-	-	1	1	-	-	2	1	-
CO5	1	2	1	2	2	1	-	-	-	2	-	-	2	2	-
CO6	1	1	1	1	-	-	-	-	1	1	-	-	2	1	-
16LPC601	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC602 EMBEDDED SYSTEM DESIGN CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC504 Microprocessors and Microcontrollers

COURSE OBJECTIVES:

*To learn the architecture of embedded system
*To acquire knowledge about ARM, CORTEX and RTOS.
*To learn program analysis, optimization and validation.

UNIT I: EMBEDDED HARDWARE (9) Periods

Introduction to Embedded systems - Embedded system vs general Computing system - Classification of Embedded system - Core of Embedded system – RISC vs CISC controllers -Harvard vs Von Neumann architecture – Characteristics and Quality Attributes of Embedded Systems.

UNIT II: ARM SERIES AND CORTEX PROCESSOR (9) Periods

Evolution of ARM processor architecture - Programming model - Data flow - Operating modes and Instruction sets.Interrupts in ARM and cortex - Exception Types - Fault Exceptions -The NVIC and Interrupt Control and Interrupt Behaviour.

UNIT III: RTOS BASED EMBEDDED SYSTEM DESIGN (9) Periods

Operating System Basics - Types of Operating Systems - Tasks, Processes and Threads - Multiprocessing and Multitasking - Task Scheduling-Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes.

UNIT IV: PROGRAM DESIGN AND NETWORKS (9)Periods

Model of programs – Assembly and Linking – Basic compilation techniques – Program Optimization-Analysis and optimization of execution time, power, energy, program size – Program validation and testing- Distributed Embedded Architecture – Networks for Embedded Systems - I2C, CAN Bus.

UNIT V: APPLICATIONS AND CASE STUDIES (9) Periods

Applications of Embedded systems – Case study of embedded system (using ARM/cortex) for monitoring, controlling and industrial automation–Smart Card–Engine Control Unit - Digital still camera -Video accelerator.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text books:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design",Third Edition "Morgan Kaufmann Publisher,2012.

2. Andrew N. Sloss Dominic Symes Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", 1st edition Elsevier Inc 2010.

Reference Books:

1. Joseph Yiu , "The Definitive Guide to the ARM Cortex-M" ,Second Edition Elsevier- Newness, 2014

2. Raj Kamal, "Embedded Systems Architecture, Programming, and Design". (2/e), Tata McGraw Hill, 2008.

3. K.V. Shibu, " Introduction To Embedded Systems", 1st Edition Tata McGraw, 2009.

4. David E-Simon, "An Embedded Software Primer", 1st Edition Pearson Education,2007.

COURSE OUTCOMES

Upon completion of this course, the students will have:

CO1: Exposure to basic architecture of embedded system.
CO2: Knowledge on architecture of ARM and CORTEX processor.
CO3: An ability to develop programming skill in ARM and CORTEX processor.
CO4: Exposure to basic concepts of RTOS.
CO5: Knowledge on program analysis, optimization and validation.
CO6: Exposure to applications and case studies of embedded system.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	1	-	2	-
CO3	1	2	1	-	-	-	-	-	-	-	-	-		3	-
CO4	2	-	-	-	-	-	1	-	-	-	-	2	2	2	-
CO5	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-
CO6	1	-	-	-	-	-	-	-	-	-	-	2	1	1	-
16LPC602	1	1	1	-	-	-	1	-	-	-	-	2	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC603 COMPUTER COMMUNICATION CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC403 COMMUNICATION THEORY

COURSE OBJECTIVES

*To understand the network layers.
*To familiarize the functions and protocols of each layer of TCP/IP protocol suite.
*To learn the components required to build different types of network.

UNIT I: APPLICATION LAYER (9) Periods

Evolution of Computer Networking – Layered Architecture – ISO/OSI Model – Internet Architecture (TCP/IP) – Application Layer Protocols – HTTP – FTP – Telnet – Email – DNS – Socket programming.

UNIT II: TRANSPORT LAYER (9) Periods

End to End Protocols – Connectionless Transport Protocols – User Datagram Protocol (UDP) – Reliable Data Transfer – Connection Oriented Transport Protocols - Transmission Control Protocol (TCP) - Flow Control – Congestion Control – Transport Layer Alternatives (RPC) –Real Time Transport protocol

UNIT III: NETWORK LAYER (9) Periods

Internet Protocol – IPV4 Packet Format – IP Addressing – Subnetting – Variable Length Subnet Mask(VLSM) – Classless Inter Domain Routing (CIDR) – Private Addressing – Network Address Translation – BOOTP/DHCP-ICMP – Router – Routing Principles – Distance Vector Routing– (RIP) – Link State Routing – (OSPF) – Path Vector Routing (BGP) – IPV6 – Quality of Service (QoS)

UNIT IV: DATA LINK LAYER (9) Periods

Link Layer – Framing – Addressing – Error Detection and Correction – Multiple Access Protocols – Address Resolution Protocol (ARP) – Ethernet Basics – CSMA/CD – Frame Format – Switching – Types (datagram, virtual) – Hubs, Bridges, Switches – Virtual LAN (VLAN) – Wireless LAN (IEEE 802.11) – WAN Technologies – ATM – Frame Relay – MPLS

UNIT V: DATA COMMUNICATIONS (9) Periods

Transmission – Impairments – Bandwidth Limitations – Modulation – Frequency Spectrum – Multiplexing – Encoding Techniques – Transmission Media - Copper – Fiber – Optical – Radio (wireless) – Cable Pinouts – Crossover – Straight Through – Rollover

TOTAL NUMBER OF PERIODS (45) Periods

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

Text Books:

1. Behrouz A. Forouzan and FirouzMosharraf, "Computer Networks a Top Down Approach", Tata McGraw-Hill, 1st Edition ,2011.

2. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2012

Reference Books:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2011.

2. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2014.

3. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2015

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Ability to trace the flow of information in the network.
CO2: Ability to Develop own protocol.
CO3: Ability to choose functionalities of each layer
CO4: Ability to Evaluate the protocols in network layer from QoS perspective.
CO5: Ability to choose the data link layer protocol for the networks
CO6: Ability to understand the data communication Techniques

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	1	-	-	-	-	-	-	-	-	-	3	2	1
CO2	-	-	3	1	2	-	-	-	-	-	-	-	3	2	1
CO3	1	-	3	1	2	-	-	-	-	-	-	-	3	2	1
CO4	1	2	3	1	1	-	-	-	-	-	-	-	3	2	1
CO5	1	2	3	1	-	-	-	-	-	-	-	-	3	2	1
CO6	1	2	3	1	1	-	-	-	-	-	-	-	3	2	1
16LPC603	1	2	3	1	2	-	-	-	-	-	-	-	3	2	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC604 WIRELESS COMMUNICATION CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC503 Digital Communication

COURSE OBJECTIVES

*To have knowledge on wireless channels and cellular architecture
*To have an exposure to advanced transceiver schemes and wireless standards
*To understand the concepts of diversity and Equalizers.

UNIT I: WIRELESS CHANNELS (9) Periods

Types of services-requirements for the services-technical challenges of wireless communications-noise- and interference-limited systems-wireless propagation channels-propagation mechanisms-small scale fading-large scale fading-doppler spectra and temporal channel variations- temporal dependence of fading.

UNIT II: CELLULAR ARCHITECTURE (9) Periods

Evolution of Mobile Communication- Cellular terminology- Cellular concept-Frequency reuse - Frequency management- channel assignment- hand off interference and system capacity- trunking and grade of service.

UNIT III: ADVANCED TRANSCEIVER SCHEMES (9) Periods

Structure of a wireless communication link- Principles of Spread Spectrum Techniques- FHMA, CDMA - Cellular Code Division Multiple Access Systems -OFDM principle – Transceiver implementation-frequency selective channels-Cyclic prefix, PAPR, Inter carrier interference.

UNIT IV: MULTIPATH MITIGATION TECHNIQUES (9) Periods

Diversity - Micro - and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception-Transmit diversity-Equalizers -Linear Equalizers-Decision Feedback Equalizers-Fractionally Spaced Equalizers-Blind Equalizers.

UNIT V: WIRELESS STANDARDS (9) Periods

Cognitive radio - Cognitive Transceiver Architecture , Principles of Interweaving , Spectrum Sensing, Spectrum Management , Spectrum Sharing .GSM - System Overview The Air Interface Logical and Physical Channels -IS-95 and CDMA 2000- Wi-Fi- WiMax.

TOTAL NUMBER OF PERIODS (45) Periods

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

Text Books:

1. Andreas.F. Molisch, "Wireless Communications", John Wiley , 2nd Edition- India, 2006.

2. Rappaport,T.S., "Wireless Communications", Pearson Education, 2nd Edition 2009.

Reference Books:

1. *David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.*
2. *Gordon L. Stuber, "Principles of Mobile Communication", Springer International Ltd.,3rd Edition, 2011.*
3. *Simon Haykins& Michael Moher, "Modern Wireless Communications", Pearson Education, 3rd Edition, 2007.*
4. *Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007, http://books.elsevier.com/9780123735805.*
5. *Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House,* 2000.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Knowledge on wireless channels
CO2: An in-depth knowledge on cellular architecture.
CO3: Knowledge on advanced transceiver schemes
CO4: An exposure to diversity techniques
CO5: Knowledge on equalizers
CO6: An exposure to wireless standards

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	3	2	-	-	3	-	-	-	-	3	3	2	-
CO2	2	2	3	2	-	-	3	-	-	-	-	3	3	2	-
CO3	1	1	2	2	-	-	2	-	-	-	-	3	3	2	-
CO4	2	2	3	3	-	-	3	-	-	-	-	3	3	2	-
CO5	2	2	1	2	-	-	2	-	-	-	-	3	3	2	-
CO6	1	1	3	3	-	-	3	-	-	-	-	3	3	2	-
16LPC604	2	2	3	2	-	-	3	-	-	-	-	3	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC607 COMMUNICATION ENGINEERING LABORATORY II CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES

- 16LPC503 DIGITAL COMMUNICATION

COURSE OBJECTIVES

*To learn different digital modulation schemes.
*To gain knowledge on MAC protocols
*To use simulation tools to analyze the performance of protocols

PRACTICALS	**LIST OF EXPERIMENTS** 1. Signal sampling and reconstruction 2. Pulse Code Modulation / Delta Modulation 3. Convolution coder 4. ASK,FSK,PSK schemes 5. Code Division Multiplexing 6. Study of spread spectrum system 7. Design and implementation of cyclic coder and decoder 8. Analysis of logical link control layer protocols – Stop and wait, Sliding window 9. Analysis of MAC protocols – ALOHA, SLOTTED ALOHA, CSMA, CSMA/CD, TOKEN BUS and TOKEN RING. 10. Client/Server communication using TCP / UDP Socket programming 11. Data packet scheduling, Congestion control, transmission flow control, Error Detection and Control algorithms TOTAL:60 PERIODS

CONTACT PERIODS:

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

Reference Books:

1.Simon Haykin, "Digital Communications", John Wiley & Sons, Inc. Singapore, 2011.
2. Behrouz A. Forouzan and FirouzMosharraf, "Computer Networks a Top Down Approach", Tata McGraw-Hill, 1st Edition ,2011.
3. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2012

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: An ability to analyze the concept of signal sampling and reconstruction.
CO2: An ability to implement various modulation schemes using simulation tool
CO3: Ability to implement protocols using TCP and UDP Sockets.
CO4: Ability to compare the performance of different link layer protocols using simulation tools.
CO5: Ability to compare the performance of different MAC protocols.
CO6: Ability to understand the error checking code

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO2	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO3	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO4	2	2	2	1	1	1	-	-	1	1	1	2	1	1	-
CO5	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO6	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
16LPC607	2	2	2	1	1	1	-	-	1	1	1	2	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC608 **VLSI SYSTEM LABORATORY** **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES

- 16LPC502 VLSI System Design
- 16LES304 Digital System Design
- 16LPC405 Analog Integrated Circuits

COURSE OBJECTIVES

*To learn Hardware Descriptive Language (Verilog/VHDL)
*To learn the fundamental principles of VLSI circuit design in digitaland analog domain
*To provide hands on design experience with professional design (EDA) platforms.

PRACTICALS	**LIST OF EXPERIMENTS** 1. Design Entry, Simulation and Synthesis of Combinational Logic Circuits: full adder/full subtractor/4x1 Multiplexer and Demultiplexer/ALU. 2. Design Entry, Simulation and Synthesis of Sequential Logic Circuits: flip-flops/registers/counters/memory module. 3. Logic design and implementation using state machine. 4. UART/arbiter model. 5. Functional verification of the CMOS Inverter/Universal Logic gates through schematic entry 6. Functional verification of the Transmission Gate and Multiplexer using TG. 7. Calculate gain, bandwidth and CMRR of a differential amplifier through schematic entry. Tools & Hardware: EDA tool/FPGA Kits **TOTAL:60 PERIODS**

CONTACT PERIODS:

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

Reference Books:

1. Samir Palnitkar, "Verilog HDL", Pearson, 2nd Edition, 2010.

2. Williams, John Michael, "Digital VLSI Design with Verilog, A Textbook from Silicon Valley Polytechnic Institute," 2014 Springer.

3. "Design of Analog CMOS Integrated Circuits", by BehzadRazavi, McGraw-Hill, 2001.

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: Write Verilog HDL code for basic combinational and sequential circuits.
CO2: Synthesize, Import the logic modules on FPGA Boards.
CO3: An ability to analyze the differential amplifier and logic gates through schematic entry
CO4: Think critically and creatively on digital and analog CMOSVLSI design
CO5: Exposure to new technological and development in related fields

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO2	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO3	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO4	2	2	2	1	1	1	-	-	1	1	1	2	1	1	-
CO5	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
16LPC608	2	2	2	1	1	1	-	-	1	1	1	2	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LEE609 EMBEDDED SYSTEM DESIGN PRACTICE CATEGORY: EEC

L	T	P	C
0	0	4	2

PREREQUISITES : Nil

COURSE OBJECTIVES

*This course enables the students to apply the theoretical concepts of ARM processor in real time.

PRACTICALS	**LIST OF EXPERIMENTS** The following programs are to be implemented in ARM processor: 1. To configure and control General Purpose Input/output (GPIO) port pins. 2. Interfacing 8 Bit LED and Switch. 3. Implementation of Buzzer Interface on IDE environment. 4. Display a message in a 2 line x 16 Characters LCD display. 5. Time delay demonstration using built in Timer / Counter feature on IDE environment. 6. Simple interrupt handler and setting up a timer. 7. Interfacing ADC and DAC. 8. Generation of PWM. 9. Interfacing Matrix Keypad. 10. Implementation of Real Time clock. 11. Interfacing Temperature sensor. 12. Serial Data Transfer. Mini Project using ARM processor. **TOTAL:60 PERIODS**

CONTACT PERIODS:

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

Reference Books:

1.Andrew N.Sloss Dominic Symes Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier Inc 2010.
2.JosephYiu ,"The Definitive Guide to the ARM Cortex-M" , Elsevier- Newness, 2014

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: An ability to apply programming skills in ARM processor.
CO2: Practical exposure to various ports in ARM processor.
CO3: An ability to interface ADC and DAC.
CO4: Awareness to handle interrupts and timer in ARM processor.
CO5: An exposure to real time clock and serial data transfer.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO2	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO3	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO4	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
CO5	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-
16LEE609	2	2	2	1	1	1	-	-	1	1	-	2	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LHS701 MANAGEMENT THEORY AND PRACTICE CATEGORY: HS

(Common to IBT Branch)

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES

*To gain a basic knowledge of business and management.
*To plan for effective organization
*To communicate effectively and control

UNIT I: BASICS OF MANAGEMENT THOUGHT (9)Periods

Evolution of Management, definition, Levels, Principles, Differences with administration. Roles of Managers, Social Responsibility of Business, External environment of business, management Ethics

UNIT II: PLANNING (9)Periods

Types, Steps, Management by Objectives, Strategic planning process, Decision-making- Types of decisions, Approaches to decision-making under uncertainty.

UNIT III: ORGANIZING (9)Periods

Formal, Informal organization- Span of Management- Departmentation – Line, Staff authority, Decentralization and Delegation of authority- Effective organization and organization culture.

UNIT IV: STAFFING AND LEADING (9) Periods

Systems Approach to staffing- Performance appraisal process and career strategy formulation, Leadership theories, Theories of motivation, Communication – Process, Barriers, Guidelines for effective communication – Electronic media in communication.

UNIT V: CONTROLLING (9) Periods

Process, Requirements for effective control- control techniques- Operations research for controlling, Overall and Preventive control.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. Harold Koontz, Weihrich, "Essentials of Management", Tata McGraw Hill, New Delhi, 2010

2. Tripathy.P.C, and Reddy. P.N, "Principles of Management", Tata McGraw Hill,2010

Reference Books:

1. Joseph Massie, "Essentials of Management", Prentice Hall of India, New Delhi, 2007.

2. Prasad, L.M., "Principles and Practice of Management", Sultan Chand and Sons, New Delhi, 2010

COURSE OUTCOMES

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

CO 1: Basic knowledge of business and management.
CO 2: Ability to plan for effective organization
CO 3: Ability to communicate effectively and control

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	1	1	2	2	1	-	-	-	-	1
CO2	-	-	-	-	-	2	1	1	1	1	-	-	-	2	1
CO3	-	-	-	-	-	1	1	1	-	-	-	-	-	-	1
16LHS701	-	-	-	-	-	1	1	1	2	1	-	-	-	1	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPC702 MICROWAVE AND RF ENGINEERING CATEGORY:PC

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To understand S parameters of two port networks
*To understand RF circuits and generation of Microwave signals.
*To understand the active and passive microwave devices
*To have knowledge on microwave measurements.

UNIT I: S PARAMETERS (9) Periods

High Frequency parameters - Formulation of S parameters - Properties of S parameters -Reciprocal and lossless Network - Transmission matrix - RF behavior of Resistors, Capacitors and Inductors. S parameters of microwave components.

UNIT II: RF AMPLIFIERS AND MATCHING NETWORKS (9) Periods

Characteristics of Amplifiers - Amplifier power relations - Stability considerations - Stabilization Methods - Noise Figure - Constant VSWR – Broadband - High power and Multistage Amplifiers - Impedance matching using discrete components - Two component matching Networks - Frequency response and quality factor - T and Pi Matching Networks -Micro strip Line Matching Networks.

UNIT III: PASSIVE AND ACTIVE MICROWAVE DEVICES (9) Periods

Terminations – Attenuators - Phase shifters - Directional couplers - Hybrid Junctions - Power dividers – Circulator – Isolator -mixers – single ended mixture, single balanced mixture – single pole switch - PIN diode switch - Gunn diode oscillator - IMPATT diode oscillator and amplifier -Varactor diode, Introduction to MIC.

UNIT IV: MICROWAVE GENERATION (9) Periods

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

UNIT V: MICROWAVE MEASUREMENTS (9) Periods

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

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design: Theory and Applications", Pearson Education Inc., 2011

2. David M. Pozar, "Microwave Engineering", Wiley India (P) Ltd, New Delhi, 2008.

Reference Books:

1. Thomas H Lee, "Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits", Cambridge University Press, 2004.

2. Mathew M Radmanesh, "RF and Microwave Electronics", Prentice Hall, 2000

3. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2005.

4. Robert E Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, 2005

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Knowledge on S parameters of two port networks.
CO 2: Ability to understand and analyze RF Amplifiers.
CO 3: Ability to analyze RF impedance Matching networks.
CO 4: Ability to understand the active and passive microwave devices.
CO 5: Knowledge on microwave signal generation.
CO 6: Knowledge on measurement of microwave signals.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	2	2	1	2	1	-	-	1	-	-	1	2	2	-
CO2	2	2	1	1	3	2	1	-	1	1	-	1	2	3	-
CO3	2	3	-	1	1	1	1	-	-	1	-	1	2	2	-
CO4	2	2	-	1	3	1	-	-	-	-	-	1	2	3	-
CO5	1	2	-	-	-	-	1	-	1	-	-	-	1	-	-
CO6	1	2	1	1	1	1	-	-	1	-	-	1	2	2	-
16LPC702	2	2	1	1	3	1	1	-	1	1	-	1	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LEE707 MICROWAVE RF AND OPTICAL LABORATORY CATEGORY: EEC

L	T	P	C
0	0	4	2

PREREQUISITES : Nil

COURSE OBJECTIVES

*To learn GUNN diode characteristics and Mode characteristics of Klystron tube.
*To study the various parameters of Microwave components and VSWR measurement.
*To learn Spectrum Analyzer measurement
*To learn characterization using Network analyzer, antenna radiation patterns.

	LIST OF EXPERIMENTS
PRACTICALS	1. Study of microwave components. 2. Determination of Gunn Diode Characteristics. 3. Determination of Mode Characteristics of a Reflex Klystron. 4. Measurement of VSWR and Reflection coefficient. 5. Measurement of frequency using slotted section. 6. Study the characteristics of isolator and circulator. 7. Study the characteristics of directional couplers. 8. Study the characteristics of magic tee. 9. Study the frequency response of RF filters using spectrum analyzer. 10. Characterization of RF filters using network analyzer. 11. Measurement of radiation pattern and gain of an antenna. 12. Study the characteristics of microstrips. 13. Measurement of optical fiber band width. 14. Measurement of numerical aperture of an optical fiber. 15. Measurement of Losses in optical fiber.

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

Reference Books:

1. David M..Pozar, "Microwave &RF Design of Wireless System (4th edition)", John Wiley & Sons, 2012.
2. R.E.Collin, "Foundations of Microwave Engineering", McGraw Hill, 2007.
3. Keiser G, "Optical Fiber Communications", McGraw Hill, New Delhi,2013.

COURSE OUTCOMES

Upon completion of the course, the students will have:
CO1: Ability to measure GUNN diode and Klystron Mode characteristics.
CO2: Ability to measure parameters of Microwave components.
CO3: Ability to determine VSWR and Reflection Coefficient using microwave bench.
CO4: An exposure to Spectrum Analyzer measurements.
CO5: Ability to characterize RF circuits using Network analyzer.
CO6: Ability to measure antennas radiation patterns.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	-	-	-	-	-	-	1	-	-	1	1	-	-
CO2	-	2	1	1	2	-	1	-	-	-	-	1	1	1	-
CO3	1	1	-	-	-	-	-	-	-	-	-	1	1	1	-
CO4	2	2	-	1	3	1	-	-	1	-	-	1	2	3	-
CO5	2	2	-	1	3	1	-	-	1	-	-	-	2	3	-
CO6	2	2	2	2	2	1	1	-	1	1	-	1	2	2	-
16LEE707	2	2	2	1	3	1	1	-	1	1	-	1	2	3	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LEE708 **MINI PROJECT** **CATEGORY: EEC**

L	T	P	C
0	0	8	4

PREREQUISITES : Nil

COURSE OBJECTIVES:

- To expose students to take up real time problems and challenges.
- To develop confidence to take up a project independently.
- To develop understanding of technical dissertation presentation and writing.

CONTACT PERIODS:

Lecture:0Periods Tutorial:0 Periods Practical:120Periods Total:120Periods

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: An exposure to take up real time problems and challenges.
CO2: Confidence to take up a project independently.
CO3: An understanding of technical dissertation presentation and writing.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	-	2	2	1	2	1	1	2	2	2	1	-	3
CO2	-	3	3	1	3	2	1	2	2	-	2	2	1	1	3
CO3	2	2	2	1	3	2	-	2	2	2	2	2	1	1	3
16LEE708	2	3	3	1	3	2	2	2	2	2	2	2	1	1	3

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LEE801 **PROJECT WORK** **CATEGORY: EEC**

L	T	P	C
0	0	16	8

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To expose students to take up real time problems and challenges.
*To develop confidence to take up a project independently.
*To develop understanding of technical dissertation presentation and writing.

CONTACT PERIODS:

Lecture:0Periods Tutorial:0 Periods Practical:240Periods Total:240Periods

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: An exposure to take up real time problems and challenges.
CO2: Confidence to take up a project independently.
CO3: An understanding of technical dissertation presentation and writing.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	-	2	2	1	2	1	1	2	2	2	1	-	3
CO2	-	3	3	1	3	2	1	2	2	-	2	2	1	1	3
CO3	2	2	2	1	3	2	-	2	2	2	2	2	1	1	3
16LEE801	2	3	3	1	3	2	2	2	2	2	2	2	1	1	3

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX01 FIBER OPTIC COMMUNICATION CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LES206 ELECTRON DEVICES
16LPC503 DIGITAL COMMUNICATION

COURSE OBJECTIVES

*To equip the students with the basic concepts of optical communication and optical fibers
*To understand the concepts of the optical modulation techniques and optical receivers
*To apply the fiber optic concepts for various communication systems

UNIT I: INTRODUCTION TO OPTICAL FIBERS (9) Periods

Need for optical communication. Electrical and Optical communication- Advantages and applications-Emspectrum-system model description-Selection of system components - choice of operating wavelength-System performance. Mode theory of Circular Waveguides - Overview of Modes-Key Modal concepts - Linearly Polarized Modes - Single Mode Fibers - Graded Index fiber structure.

UNIT II: FIBER OPTICAL SOURCES AND DETECTORS (9) Periods

Characteristics and requirements-Spontaneous and stimulated emission-Source classifications: Ruby, He-Nelasers, Homo & Heterostructures, Laser Diodes and LED's characteristics, Comparison and applications - Physical principles of Photodiodes, Photodetector Noise, Detector response time-Avalanche multiplication Noise - Comparison of photo detectors.

UNIT III: OPTICAL TRANSMISSION (9) Periods

Classification-Direct/Internal modulation: Analog and Digital modulation formats-External modulators: Electro-optic and Acousto–optic modulators. Fiber-optics Vs Coaxial cables-Optical fiber modes and configurations – Fiber transmission properties – Choice of wavelength for fiber – optic transmission-Cable configuration - Splices, connectors and couplers-Requirements

UNIT IV: OPTICAL RECEIVERS (9) Periods

Methods of detection process – Comparison – Basic principles of Photo diode – Avalanche photo multiplier – Receiver configurations – Pre amplifiers for detectors. Laser radar system – Fiber optic link for computers – Multichannel audio/video communication systems – Repeater/Regenerator for fiber–optic systems – power Budget and Rise-time Budget.

UNIT V: FIBER OPTIC APPLICATIONS (9) Periods

Basic networks - SONET/SDH – WDM concepts and components - Optical CDMA-Generation of optical fiber link – Introduction to Ultra High Capacity Networks – optical Networking technology inenterprise.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.*Keiser G, "Optical Fiber Communications", McGraw Hill, New Delhi, 2009.*

2.John M Senior, "Optical Fiber Communications Principles and Practice", PHI, New Delhi,2009.

Reference Books:

1. *Gower J., "Optical Communication Systems", Prentice Hall of India, New Delhi, 2nd Edition, Fifth reprint, 1995.*

2. Franz J.H. Jain V.K, "Optical Communication, Components and systems", Narosa Publications, New Delhi, 2000.

3. K. Mynbaev and Lowell L Scheiner, "Fiber Optic Communication Technology", Pearson Education Asia, New Delhi, 2001.

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: In-depth knowledge on optical fibers and optical communication systems
CO2: Knowledge on the optical sources and detectors
CO3: Understanding the principle of optical modulation techniques
CO4: Knowledge on the characteristics of optical transmission media
CO5: Exposure to optical receivers
CO6: Ability to apply the fiber optic concepts to communication systems

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	-	2	-	1	1	-	-	-	-	-	1	2	1	-
CO2	1	-	2	1	2	1	-	-	-	-	-	1	2	2	-
CO3	2	2	3	2	2	1	1	-	-	-	-	2	2	2	-
CO4	1	-	2	-	1	1	-	-	-	-	-	1	2	1	-
CO5	2	2	3	2	2	1	1	-	-	-	-	2	2	2	-
CO6	3	3	3	3	2	3	2	-	-	-	2	2	3	3	2
16LPEX01	1	2	3	2	2	1	1	-	-	-	1	2	2	2	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX02 **IMAGE PROCESSING** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES

*To understand the basics of digital imaging and image transforms
*To gain knowledge about various image processing techniques
*To apply knowledge of different image processing algorithms for real time applications

UNIT I: DIGITAL IMAGE FUNDAMENTALS (9) Periods

Digital image processing system- Elements of Visual perception- MachB and effect - Image Acquisition - Image Sensors, Vidicon and Digital Camera working principle-Image Sampling and Quantization- Pixels Relationships -Basics of Color image processing - Color Models.

UNIT II: IMAGE TRANSFORMS (9) Periods

2D transforms-Discrete Fourier Transform - Discrete Cosine Transform -Walsh, Hadamard, Slant, Haar, KLT, SVD Transforms, Discrete Wavelet transform. Properties and applications of Image Transforms.

UNIT III: IMAGE ENHANCEMENT AND RESTORATION (9) Periods

Gray level transformations - Histogram techniques -Spatial domain filters for image smoothing and sharpening - Frequency domain filters - Image restoration- Degradation model- Noise models - Mean filters - Order statistics - Adaptive filters - Inverse filtering - removal of blur caused by uniform linear motion- Wiener filtering - Unconstrained and Constrained restoration.

UNIT IV: IMAGE SEGMENTATION AND REPRESENTATION (9) Periods

Detection of Discontinuities - Edge detection-Edge linking and boundary detection-Region growing, Region splitting and Merging –Watershed algorithm - Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, Moments- Regional Descriptors.

UNIT V: IMAGE COMPRESSION (9) Periods

Need for data compression– Huffman coding - 1D, 2D Run Length Encoding-Shift codes-Arithmetic coding-Vector Quantization-Block Truncation Coding- Transform based coding–Compression standards -JPEG 2000– EZW– SPIHT-MPEG.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011.

2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.

3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.

4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

5. http://eeweb.poly.edu/~onur/lectures/lectures.html.

6. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html

COURSE OUTCOMES

Upon completion of this course, the students will have
- CO1: Understanding of Digital Image fundamentals
- CO2: Ability to apply Image Transforms to image processing applications
- CO3: Ability to develop efficient Image enhancement and Restoration algorithms
- CO4: Knowledge on Image segmentation and representation schemes
- CO5: Knowledge on basic image coding schemes and image compression standards
- CO6: Ability to implement Image Processing algorithms using MATLAB/OpenCV tools

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	3	1	-	-	-	-	-	-	-	1	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-	2	-	-
CO3	1	2	-	3	1	2	-	-	-	-	-	-	2	-	-
CO4	1	2	-	2	1	-	-	-	-	-	-	-	2	-	-
CO5	2	2	-	2	1	-	-	-	-	-	-	-	2	-	-
CO6	1	2	-	1	3	-	-	-	-	-	-	-	1	3	-
16LPEX02	1	2	-	2	1	1	-	-	-	-	-	-	2	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX03 **DIGITAL VIDEO SYSTEMS** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To provide an insight to the fundamentals of Analog and Digital Video

*To gain knowledge on the techniques for efficient representation, processing and display of video signals

*To get exposure to the applications of Digital video systems

UNIT I: DIGITAL VIDEO FUNDAMENTALS (9) Periods

Introduction to Digital video - Digital video processing - Video capturing - Analog to Digital video conversion - Analog versus Digital Video - Video sampling and interpolation- Interlaced scanning- Progressive scanning - Resolution.

UNIT II: VIDEO MODELING TECHNIQUES (9) Periods

Based on Camera – Scene – Illumination – Object- Two dimensional motion - Video processing operations-Motion detection and Estimation- Pixel based approaches-Block matching approaches- Deformable block matching approaches- Motion compensation for videos- Video Segmentation.

UNIT III: VIDEO COMPRESSION TECHNIQUES (9) Periods

Intra frame coding approaches- JPEG Compression standards - JPEG2000- MPEG-1 and MPEG-2 video compression standards-MPEG-4 and MPEG-7- Low bit rate approaches - H.261 and H.263- H.264.

UNIT IV: VIDEO DISPLAY (9) Periods

Cathode Ray Tube – working – Gamma correction- High definition television (HDTV) - LCD, LED and plasma Display.

UNIT V: APPLICATIONS (9) Periods

Video indexing, summarization, browsing, retrieval, conferencing systems- Video Surveillance Systems-Set Top Box (STB) -Direct to Home (DTH) -IP Camera, Camcorder- Network Video Recorder/ Digital Video Recorder- Digital video Broadcasting.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Al Bovik, "Essential Guide to Video Processing", Academic Press, 2009.

2.Yao Wang, Jom O Stermann, and YaOin Zhang, "Video Processing and Communications", Prentice Hall, 2002.

Reference Books:

1. A. Murat Tekalp, "Digital Video Processing", Prentice Hall, 1995.

2. Yun Q. Shi and Huifang Sun, "Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards", CRC Press, 2000.

3. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.

4. Al Bovik, "Handbook of Image & Video Processing", Academic Press, 2000.

5. Iain E. G. Richardson and Iain E. G. Richardson, " H.264 and MPEG-4 Video Compression: Video Coding for Next Generation Multimedia", John Wiley &Sons, 2003.

COURSE OUTCOMES:

Upon completion of this course, the students will have

CO1: Understanding of basics of Videos signals
CO2: Knowledge on Digital video modeling techniques
CO3: Knowledge on Compression standards and recommendations to build video systems
CO4: Exposure on Existing and Emerging video processing standards
CO5: Knowledge on Digital Video Display systems
CO6: Ability to apply the Digital Video concepts to diverse set of applications

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	3	1	-	-	-	-	-	-	-	1	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-	1	-	-
CO3	1	2	-	3	1	2	-	-	-	-	-	-	1	-	-
CO4	1	2	-	2	1	-	-	-	-	-	-	-	2	-	-
CO5	2	2	-	2	1	-	-	-	-	-	-	-	1	-	-
CO6	1	2	-	1	1	-	-	-	-	-	-	-	-	2	-
16LPEX03	1	2	-	2	1	1	-	-	-	-	-	-	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX04 SATELLITE COMMUNICATION CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC503 Digital Communication

COURSE OBJECTIVES:

*To Learn Current state and advantages of Satellite Communication.
*To understand satellite orbits and trajectories.
*To Have Knowledge on different satellite subsystems and multiple access methods.
*To understand different aspects of communication link design.

UNIT I: SATELLITE ORBITS (9) Periods

Orbital Mechanics - Orbit Equations- Kepler's Laws - Orbital Period -Orbits and their types - Orbital Spacing- look angle calculation -Satellite Launch - Propagation Delay-System Performance.

UNIT II: SATELLITE SUBSYSTEM (9) Periods

AOCS -TTC&M –Power – Transponders - Antennas -earth control-Effects of earth Perturbation-suntransit-moontransit-satellite power design -MTBF -Basic Equations -System Noise and G/T ratio – Uplink- Downlink and Design for a specified C/N ratio - GEO and LEO examples -Atmospheric and Rain effects on link performance.

UNIT III: SATELLITE LINK DESIGN (9) Periods

Link design equation -noise temperature - atmospheric effects on link design -interference effects - earth station parameters -earth space propagation effects - frequency window - free space loss - Ionospheric scintillation- telemetry -tracking and command of satellites - Digital Modulation for satellite systems - Error control requirements for satellite.

UNIT IV: SATELLITE MULTIPLE ACCESS SYSTEM (9) Periods

FDMA techniques -SCPC and CSSB systems - TDMA frame structure- burst structure- frame efficiency -super-frame - frame acquisition and synchronization -TDMA vs FDMA - burst time plan-beam hopping - satellite switched -Erlang call congestion formula - DA-FDMA -DA-TDMA

UNIT V: SATELLITE SERVICES (9) Periods

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

TOTAL NUMBER OF PERIODS (45) Periods

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

Text Books:

1.T.Pratt, C. Bostian and J.Allnutt; ―Satellite Communications, John Wiley and Sons, Second Edition, 2003.

2. D.Rody, ―Satellite Communications, McGraw-Hill Professional, Fourth Edition, 2006.

Reference Books:

1. W.L.Pritchard,H G Suyderhoud and R A Nelson, ―Satellite Communication System Engineering‖, Second edition, Prentice Hall, 1993.

2. Tri. T. Ha, ―Digital Satellite Communications, McGraw Hill, Second Edition, 1990.

3. B.N.Agarwal, ―Design of Geosynchronous Space craft, Prentice Hall, 1986.

4. M. Richharia, ―Satellite communication systems, McGraw-Hill Professional, 1999.

COURSE OUTCOMES:

Upon completion of this course the student will have:

CO 1: Knowledge on basics of Satellite Communication.
CO 2: Ability to understand satellite orbits and trajectories.
CO 3: Have Knowledge on different satellite subsystems.
CO 4: Ability to understand different aspects of communication link design.
CO 5: Knowledge on multiple access methods.
CO 6: Knowledge on important applications of satellites

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	-	-	-	1	-	1	-	-	1	2	1	-
CO2	-	-	-	1	1	-	-	-	-	-	-	-	1	1	-
CO3	2	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO4	2	1	2	2	2	1	1	-	-	1	1	1	2	2	-
CO5	2	-	-	-	2	1	1	-	-	1	1	-	2	1	-
CO6	1	-	-	-	1	1	1	-	-	-	1	-	1	1	-
16LPEX04	2	1	1	2	2	1	1	-	1	1	1	1	2	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX05 **NANO ELECTRONICS** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES:

- 16LES206 Electron Devices
- 16LPC502 VLSI System Design
- 16LBS2Z3 Material Science

COURSE OBJECTIVES

*To make students familiar with the important concepts applicable to nano electronic devices
*To understand the nano electronics, characterization and application.

UNIT I: BASICS OF NANOELECTRONICS (9) Periods

Capabilities of nano electronics - physical fundamentals of nanoelectronics: Scaling principle -limits to scaling -power constrained scaling limits - basics of information theory - basics of lithographic techniques for nanoelectronics

UNIT II: LIMITING EFFECTS (9) Periods

Replacement Technologies - Energy and Heat dissipation - Parameter spread as Limiting Effect - Limits due to thermal particle motion - Reliability as limiting factor - Final objectives of integrated chip and systems.

UNIT III: QUANTUM ELECTRON DEVICES (9) Periods

Classical to quantum physics: upcoming electronic devices - electrons in mesoscopic structure -short channel MOS transistor - split gate transistor - electron wave transistor - electron spin transistor - quantum cellular automate - quantum dot array. Principles of Single Electron Transistor (SET) - SET circuit design - comparison between FET and SET circuit design.

UNIT IV: NANOELECTRONICS WITH TUNNELING DEVICES (9) Periods

Tunneling element technology - RTD: circuit design based RTD -Nano structured LEDs -Photo detectors. Superconducting devices: Macroscopic characteristics -Macroscopic model -Super conducting switching devices -Memory cells -Flux quantum devices -Application of Superconducting devices. Molecular electronics -Nano tubes and fullerene based switches -Elementary circuits.

UNIT V: MEMORY DEVICES AND SENSORS (9) Periods

Nano ferroelectrics -Ferroelectric random access memory – Fe-RAM circuit design -Ferroelectric thin film properties and integration -Calorimetric sensors -Electrochemical cells -Surface and bulk acoustic devices -Gas sensitive FETs -Resistive semiconductor gas sensors -Electronic noses - identification of hazardous solvents and gases -Semiconductor sensor array.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Rainer Waser, "Nano electronics and Information Technology: Advanced Electronic Materials and Novel and Devices",3rd Edition, April 2012.

2.Shunri Oda and David Ferry, "Silicon Nano electronics", CRC Press, New York,2005.

Reference Books:

1.Karl Goser, Peter GlosekotterandJanDienstuhl, "Nanoelectronics and Nanosystems", Springer,New Jersey,2004.

2.Mick Wilson, Kamali Kannangara, Geoff Smith Michelle Simmons, Burkhard Raguse, Nanotechnology: Basic Science and Emerging technologies, Overseas Press India Pvt.Ltd.,2005.

3.George W. Hanson, "Fundamentals of Nano electronics", Pearson, New Delhi,2009.

COURSE OUTCOMES:

Upon completion of this course the student will have:

CO1: Knowledge on basics of nanoelectronics
CO2: Understand the concepts of Limiting effects of technologies
CO3: An exposure to the Quantum electron devices
CO4: Knowledge on Superconducting devices
CO5: Reveal the molecular electronics
CO6: Understand the memory devices and sensors

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	1	-	-	-	2	-	2	3	-	-	-	-	1	-	-
CO3	1	2	1	2	-	-	-	-	-	-	-	-	1	2	1
CO4	1	-	2	3	-	-	-	-	-	-	-	-	1	-	2
CO5	1	3	2	2	-	-	-	-	-	-	-	-	1	3	2
CO6	1	3	2	2	1	-	-	-	-	-	-	-	1	3	2
16LPEX05	1	3	2	2	2	-	1	1	-	-	-	-	1	3	2

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX06 **MEMS** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To learn the materials used in MEMS.
*To understand the MEMS fabrication process.
*To acquire knowledge on various sensors and actuators

UNIT I: INTRODUCTION **(9) Periods**

History of MicroElectro Mechanical Systems (MEMS) – MEMS Materials: Silicon and other materials - Intrinsic Characteristics of MEMS – Energy Domains and Transducers– Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II: MEMS FABRICATION **(9) Periods**

MEMS fabrication processes: Review of IC fabrication process. Micromachining: Bulk Micromachining - Dry and Wet etching - Surface micromachining - Deposition, Evaporation, Sputtering, Epitaxial growth - Deep Reaction ion etching - Advanced Lithography - LIGA process - Multi User MEMS Process.

UNIT III: SENSORS AND ACTUATORS - I **(9) Periods**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Magnetic Actuators – Micromagnetic components – Actuation using Shape Memory Alloys.

UNIT IV: SENSORS AND ACTUATORS - II **(9) Periods**

Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT V: APPLICATION CASE STUDIES **(9) Periods**

Application case studies: MEMS Scanners and Retinal Scanning Displays (RSD), Grating Light Valve (GLV), Digital Micromirror Devices (DMD), Optical switching, Capacitive Micromachined Ultrasonic Transducers (CMUT), Air bag system, Micromotors, Scanning Probe Microscopy.

TOTAL NUMBER OF PERIODS **(45) Periods**

CONTACT PERIODS:

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

Text Books:

1.Chang Liu, "Foundations of MEMS", Pearson Education Inc.,2nd edition 2006.

2.Stephen D Senturia, "Microsystem Design", Springer Publication,1st edition 2000

Reference Books:

1.Julian W.Gardner, Vijay K.Varadan, Osama O. AwadelKarim, "Micro sensors MEMS and Smart Devices", John Wiby& sons Ltd., 1st edition 2001.

2.Mohamed Gad – el – Hak, "MEMS Handbook", CRC Press, 2nd edition 2002.

3.Rai - Choudhury P. "MEMS and MOEMS Technology and Applications", PHI Learning Private Limited, 1st edition 2009

4.Sabrie Solomon, "Sensors Handbook," 2nd edition McGraw Hill, 1998.

5.Marc F Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd Edition, 2002.

6.Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture"2nd edition Tata McGraw Hill, New Delhi, 2002.

COURSE OUTCOMES:

Upon completion of this course, the students will have:

CO1: Knowledge on materials used in MEMS.
CO2: Exposure to electrical and mechanical concepts of MEMS.
CO3: Knowledge on MEMS fabrication process.
CO4: Basic knowledge on bulk and surface micromachining.
CO5: In-depth knowledge on different types of sensors and actuators.
CO6: Exposure to applications and case studies of MEMS.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	-		-	-	-	-	-	2	-	-
CO2	2	-	-	-	-	-	1	-	-	-	-	-	2	-	-
CO3	1	-	-	-	-	-	1	-	-	-	-	-	3	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	-	1	-	-	-	-	-	-	-	-	-	1	2	-
CO6	1	-	1	-	-	-	1	-	-	2	-	-	1	3	-
16LPEX06	1	-	1	-	-	-	1	-	-	1	-	-	1	3	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX07 MICROWAVE INTEGRATED CIRCUITS CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*The objective is to provide the basic concepts and techniques of Microwave Integrated Circuits.

UNIT I: INTRODUCTION (9) Periods

Introduction to Monolithic Microwave Integrated Circuits (MMICs) - their advantages over discrete circuits - materials - MMIC fabrication techniques - MOSFET fabrication - Thin film formation.

UNIT II: MICROSTRIP LINES (9) Periods

Planar transmission lines for MICs – Method of conformal transformation for microchip analysis – Concept of effective dielectric constant – Effective dielectric constant for microstrip – Losses in microstrip.

UNIT III: SLOT LINES (9) Periods

Slot Line Approximate analysis and field distribution – Transverse resonance method and evaluation of slot line impedance – Comparison with micro strip line.

UNIT IV: LUMPED ELEMENTS FOR MICS (9) Periods

Use of Lumped elements – Capacitive elements – Inductive elements and Resistive elements.

UNIT V: MICROWAVE SEMICONDUCTOR DEVICES & MICROWAVE PASSIVE COMPONENTS (9) Periods

Parametric amplifiers, tunnel diode, varactor diode, PIN diode, Gunn diode, their principle of operation, performance characteristics& applications, scattering parameter calculations of E plane-Tee, Magic Tee, Directional Coupler.

TOTAL NUMBER OF PERIODS (45)Periods

CONTACT PERIODS:

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

Text Books:

1.*Gupta KC, and Amarjit Singh, "Microwave Integrated circuits", WileyEastern,1974.*
2.Leo Young, "Advances in Microwaves", Academic Press.

Reference Books:

1. Bharathi Bhat, and S.K. Koul "stripline-like transmission lines for microwave integrated circuits, New age international, 2007.
2. Samuel. Y. Liao, "Microwave Circuit Analysis and Amplifier Design", Prentice Hall. Inc.,1987.
3. T.C.Edwards, "Foundations for Microstrip Circuit Design (2/e)", Wiley, 1992.
4. Ravender Goyal, "Monolithic MIC; Technology & Design", Artech House, 1989.

COURSE OUTCOMES:

Upon completion of this course, the students will:

CO1: Acquire knowledge about Microwave Integrated Circuits.
CO2: Gain knowledge of plannar transmission line for MIC.
CO3: Gain knowledge of slot lines for MIC.
CO4: Gain knowledge and understanding of lumped elements for MIC.
CO5: Develop understanding of the fundamentals required to design & implement Integrated Circuits operating at microwave frequencies.
CO6: Acquire knowledge about Microwave Semiconductor Devices.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	3	2	-	3	-	-	-	-	-	2	-
CO2	-	3	-	-	3	2	2	-	-	-	-	-	-	3	-
CO3	-	-	-	-	3	2	1	-	-	-	-	-	-	2	-
CO4	-	3	-	-	3	1	2	-	-	-	-	-	-	2	-
CO5	-	3	-	-	3	3	3	-	-	-	-	-	-	3	-
CO6	-	-	-	-	3	3	3	-	-	-	-	2	-	2	-
16LPEX07	1	3	-	-	3	2	3	1	-	-	-	1	-	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX08 BIOMEDICAL INSTRUMENTATION SYSTEMS CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To impart, knowledge in the field of bio medical engineering which has become a major role in the medical field.

UNIT I: BIO POTENTIAL ELECTRODES (9) Periods

Origin of bio potential and its propagation – Electrode-electrolyte interface – electrode skin interface – half-cell potential – impedance, polarization effects of electrode –non-polarizable electrodes – Types of electrodes – surface, needle and micro electrodes and their equivalent circuits – Recording problems – measurement with two electrodes.

UNIT II: ELECTRODE CONFIGURATIONS (9) Periods

Bio-signals characteristics – frequency and amplitude ranges – ECG – Einthoven's triangle, standard 12 lead system – EEG – 10-20 electrode system – unipolar, bipolar and average mode – EMG, ERG and EOG – unipolar and bipolar mode.

UNIT III: BIO AMPLIFIER (9) Periods

Need for bio-amplifier - single ended bio-amplifier – differential bio-amplifier – right leg driven ECG amplifier – Band pass filtering – isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier – Chopper amplifier –Power line interference.

UNIT IV: MEASUREMENT OF NON-ELECTRICAL PARAMETER (9) Periods

Temperature, respiration rate and pulse rate measurements – Blood Pressure – indirect methods - auscultatory method – oscillometric method – direct methods – electronic manometer – Pressure amplifiers – systolic – diastolic – mean detector circuit – Blood flow and cardiac output measurement – Indicator dilution – thermal dilution and dye dilution method – Electromagnetic and ultrasound blood flow measurement.

UNIT V: MEDICAL IMAGING SYSTEMS (9) Periods

Data acquisition systems - Analysis of ECG signals - Computerized Axial Tomography (CAT) Scanner - Ultrasonic scanner - Magnetic resonance imaging Computer based patient monitoring system -Introduction to expert system and hospital management.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical EquipmentTechnology", Pearson Education, 2004.

2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley andsons, New York, 2004.

Reference Books:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, NewDelhi, 2003.

2. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007

3. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw-Hill Publisher, 2003.

COURSE OUTCOMES:

Upon completion of this course, the students will have:

CO1: An introduction about the Electrophysiology and Bio medical transducers.
CO2: An idea about bio signal characteristics and lead systems.
CO3: An exposure to the working principles of bio amplifiers.
CO4: An idea about the measurements of non electrical parameters of human system.
CO5: Acquired knowledge about the working principle of medical imaging system.
CO6: Ability to understand and manage the medical equipments in a hospital environment.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	-	3	2	2	2	-	-	-	-	3	3	-
CO2	-	2	3	-	3	1	3	3	-	-	-	-	-	2	-
CO3	3	3	3	3	3	3	2	2	-	-	-	-	-	2	-
CO4	-	-	-	-	-	2	3	1	-	-	-	-	-	2	-
CO5	-	-	-	-	3	3	3	2	-	-	-	-	3	2	-
CO6	-	-	-	-	-	3	3	1	-	2	-	-	-	-	3
16LPEX08	3	3	3	1	3	3	3	2	-	1	-	-	3	2	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX09 FOUNDATIONS OF OPERATING SYSTEMS CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To educate the basic concepts and functions of operating system,
*To illustrate the concepts of processes, threads scheduling algorithm.
*To illustrate the concepts of memory management system.

UNIT I: OPERATING SYSTEM CONCEPTS (9) Periods

Introduction – Multi-tasking – Multi-programming – Multi-user – Multi-threading – Types of operating system – Batch operating system – Time sharing systems – Distributed OS – Network OS – Real time OS – Operating system – processes, files, shell – operating system services –Operating system- user interface – system calls and its types – OS design and implementation – virtual machines – debugging – system boot

UNIT II: PROCESS AND SCHEDULING (9) Periods

Process - Process model – Process scheduling – Scheduling criteria – Scheduling algorithms – First come first serve, Shortest job first, Priority scheduling, Round robin, Multilevel queue scheduling, – semaphores – Deadlocks: Methods for handling deadlocks – ostrich and bankers algorithm – Deadlock deduction, prevention, avoidance, recovery

UNIT III: FILE AND INPUT/OUTPUT SYSTEM (9) Periods

Types of files – Access methods – Directory structures – Allocation methods – Disk scheduling – Distributed file system – I/O hardware – I/O-application interface – Kernel – Transforming I/O request – Performance issues.

UNIT IV: MEMORY MANAGEMENT (9) Periods

Main memory – swapping – contiguous memory allocation – paging –structure of page table – segmentation – Virtual memory – demand paging – copy on write – page replacement – allocation of frames – thrashing – memory mapped files – allocating kernel memory – memory management utilities.

UNIT V: OVERVIEW OF LINUX (9) Periods

Linux: Process management, scheduling, time management and timers, The system call interface, Memory addressing, Memory management, Page cache, Kernel synchronization, Portability concerns, and debugging techniques –Features of the Linux 2.6 kernel, Preemptive kernel, Block I/O layer, and I/O schedulers

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. Silberschatz A, Galvin P and Gagne G "Operating Systems Concepts", John Wiley &Sons,New York, 2011

2. Andrew S Tanenbaum, "Operating Systems Design and Implementation", Prentice Hall of India, New Delhi, 2006

Reference Books:

1.Deitel H M, Deitel J P, David R Choffnes, " Operating Systems", Prentice Hall of India, New Delhi, 2003.

2. Robert Love, "Linux Kernel Development", Addison Wesley, Singapore, 2010.

3. Mark Russinovich, David A. Solomon, Alex Ionescu,"Windows Internals Including Windows Server 2008 and Windows Vista", Microsoft Press, 2009.

4. Gary Nutt, "Operating Systems", Addison Wesley, Singapore, 2003.

COURSE OUTCOMES:

Upon completion of this course, the students will have:

CO1: An idea about the basic functions of an operating system.
CO2: Imparted in depth knowledge about the processes and threads.
CO3: Gained knowledge about the scheduling algorithm and deadlock management.
CO4: Acquired knowledge about the memory management techniques.
CO5: Obtained knowledge about the usage of files in the operating system.
CO6: The complete knowledge in managing the operating system.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	3	-	-	-	-	-	2	-
CO2	3	2	-	-	2	3	3	3	-	-	-	-	-	3	-
CO3	-	2	-	-	2	3	3	3	-	-	-	-	-	3	-
CO4	-	3	-	3	3	3	3	3	-	-	-	-	-	3	-
CO5	-	3	-	-	1	2	2	2	-	-	-	-	-	3	-
CO6	-	-	-	-	-	3	3	3	-	-	-	-	-	-	2
16LPEX09	3	2	-	1	2	3	3	3	-	-	-	-	-	3	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX10 ROBOTICS AND AUTOMATION CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC602 Embedded System Design

COURSE OBJECTIVES:

*To gain knowledge on basics of Robotics
*To study the Manipulators, Kinematics and Path planning
*To gain knowledge on Robotic control and programming for automation

UNIT I: BASIC CONCEPTS (9) Periods

Definition and origin of Robotics -Types of Robots – Evolution of Robots -Degrees offreedom - Asimov's laws of Robotics -Dynamic stabilization of Robots.

UNIT II: POWER SOURCES AND SENSORS (9) Periods

Hydraulic, Pneumatic and Electric drives -Determination of HP of motor and gearing ratio –Variable speed arrangements -Path determination -Micro machines in Robotics -Machine vision - Ranging Laser-Acoustic -Magnetic, Fiber optic and tactile sensors.

UNIT III: MANIPULATORS, ACTUATORS AND GRIPPERS (9) Periods

Construction of manipulators -Manipulator dynamics and force control - Electronic and Pneumatic manipulator control circuits -End effectors -Types of Grippers -Design considerations.

UNIT IV: KINEMATICS AND PATH PLANNING (9) Periods

Solution of Inverse kinematics problem -Multiple solution - Jacobian work envelop –Hill Climbing Techniques -Robot programming languages

UNIT V: CASE STUDY (9) Periods

Multiple robots -Machine interface -Robots in manufacturing and non- manufacturing applications - Robot cell design -Selection of robot.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text books:

1. Mikell P. Weiss G.M., Nagel R.N. and Odraj N.G., " Industrial Robotics", McGraw-Hill Singapore, 1996.

2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998.

Reference Books:

1. Deb. S.R, Robotics Technology and flexible Automation, John Wiley, USA 1992.

2. Klafter R.D., Chimielewski T.A. and Negin M., "Robotic Engineering: An integrated approach" , Prentice Hall of India, New Delhi, 1994.

3. McKerrow P.J. ,"Introduction to Robotics", Addison Wesley, USA, 1991.

4. Barry Leatham and Jones, "Elements of industrial Robotics" , PITMAN Publishing, 1987.

5. MikellP.Groover, Mitchell Weiss, Roger N.Nagel and Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications ", McGraw Hill Book Company1986.

COURSE OUTCOMES:

Upon completion of this course, the students will have

CO1: Understanding of the basic concepts of robotics
CO2: Knowledge on Power sources and Sensors
CO3: Knowledge on Manipulators, Actuators and Grippers
CO4: Ability to solve problems in Robot kinematics and path planning
CO5: Ability to design, control and programming the Robot for automation
CO6: Ability to apply the Robotic concepts in manufacturing and non- manufacturing applications

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	-	3	1	-	-	-	-	-	-	-	1	-	-
CO2	2	2	-	2	-	-	-	-	-	-	-	-	1	-	-
CO3	1	3	-	3	1	2	-	-	-	-	-	-	1	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	2	1	-	-	-	-	-	-	-	1	-	-
CO6	2	2	-	2	1	-	-	-	-	-	-	-	1	-	-
16LPEX10	2	2	-	2	1	1	-	-	-	-	-	-	1	-	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX11 DIGITAL SIGNAL PROCESSORS AND APPLICATIONS CATEGORY:PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC406 DIGITAL SIGNAL PROCESSING
16LPC504MICROPROCESSOR AND MICROCONTROLLER

COURSE OBJECTIVES:

*To learn Digital Signal Processor architecture and it's features
* To develop programming skills using DSP processors
*To study Advanced DSP architectures and applications

UNIT I: FUNDAMENTALS OF PROGRAMMABLE DSPs (9) Periods

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

UNIT II: TMS320C5X PROCESSOR (9) Periods

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

UNIT III: TMS320C6X PROCESSOR (9) Periods

Architecture of the C6x Processor - Instruction Set - DSP Development System: Introduction – DSP Starter Kit Support Tools- Code Composer Studio - Support Files - Programming Examples to Test the DSK Tools – Application Programs for processing real time signals.

UNIT IV: ADSP PROCESSORS (9) Periods

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V: ADVANCED PROCESSORS (9) Periods

Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C67XX - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

TOTAL NUMBER OF PERIODS (45) Periods

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

Text Books:

1.B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, second edition,2011.

2.Avtar Singh and S. Srinivasan, Digital Signal Processing – "Implementations using DSP Microprocessors with Examples from TMS320C54xx", cengage Learning India Private Limited, Delhi 2012

Reference Books:

1.User guides Texas Instrumentation, Analog Devices, Motorola.

2.RulphChassaing, "Digital Signal Processing and Applications with the C6713 and C6416 DSK," A JOHN WILEY & SONS, INC., PUBLICATION, 2005

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Exposure to DSP processors architecture and features
CO2: Familiarization with DSP starter kits
CO3: Ability to write Simple assembly language programs
CO4: Knowledge on different families of DSP processors
CO5: Knowledge on DSP algorithms
CO6: Ability to test simple applications using DSP processors along with CCS

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	2	-	-	-	-	-	-	-	3	3	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	3	3	-
CO3	-	3	3	-	2	-	-	-	-	-	-	-	3	3	-
CO4	3	-	-	-	2	-	-	-	-	-	-	-	3	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO6	3	2	2	-	3	-	-	-	-	-	-	-	3	3	-
16LPEX11	3	2	2	-	2	-	-	-	-	-	-	-	3	3	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX12 INFORMATION THEORY AND CODING CATEGORY:PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC503 Digital Communication

COURSE OBJECTIVES

*To understand encoding and decoding of digital data streams.
*To be familiar with the methods for the generation of these codes and their decoding techniques.
*To understand the compression and decompression techniques in multimedia communication

UNIT I: INFORMATION ENTROPY FUNDAMENTALS (9) Periods

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II: DATA AND VOICE CODING (9) Periods

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III: ERROR CONTROL CODING (9) Periods

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolution codes

UNIT IV: COMPRESSION TECHNIQUES (9) Periods

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V: AUDIO AND VIDEO CODING (9) Periods

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2001.

2.Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002; Chapters: 3,4,5.

Reference Books:

1.Nelson, "Data Compression Book", BPB Publication 1992.

2.Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.

COURSE OUTCOMES

Upon completion of this course, the students will have the
CO 1: Knowledge on information and entropy
CO 2: Understanding of error–control coding.
CO 3: Understanding of encoding and decoding of digital data streams.
CO 4: Familiarity with the methods for the generation of these codes and their decoding techniques.
CO 5: In-depth knowledge of compression and decompression techniques.
CO 6: Knowledge of the concepts of multimedia communication.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	2	-	2	2	-	-	-	-	-	1	2	-	-
CO2	2	2	2	2	2	2	-	-	-	-	-	2	2	2	-
CO3	1	2	2	2	2	2	-	-	-	-	-	2	1	1	-
CO4	2	2	2	2	2	2	-	-	-	1	-	2	2	2	-
CO5	1	3	3	3	3	2	-	1	-	1	-	2	2	2	-
CO6	1	-	2	-	2	2	-	-	-	-	-	1	2	2	-
16LPEX12	1	2	2	2	2	2	-	1	-	1	-	2	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX13 **NETWORK SECURITY** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC603 COMPUTER COMMUNICATION

COURSE OBJECTIVES:

*To understand the basics of number theory and Galois field concepts
*To learn the symmetric and asymmetric key in crypto systems
*To gain knowledge of authentication and key management techniques

UNIT I: NUMBER THEORETIC AND ALGEBRAIC ALGORITHMS (9) Periods

Security goals- Cryptographic Attacks-Services and Mechanism - Integer Arithmetic - Modular Arithmetic – matrices – Linear congruence- Substitution ciphers – Transposition ciphers – Stream cipher - Block ciphers – Algebraic structures – GF(2n) fields.

UNIT II: MODERN SYMMETRIC KEY CIPHERS (9) Periods

Modern block ciphers – Modern stream ciphers – Data Encryption Standard – Advanced Encryption Standard – uses of modern block ciphers and stream cipher.

UNIT III: ASYMMETRIC KEY ENCIPHERMENT (9) Periods

Mathematics of Asymmetric Key cryptography – Primality Testing – Factorization – Chinese Remainder Theorem – Quadratic Congruence– Exponentiation & Logarithm – RSA crypto System, Rabin crypto System – Elliptic curve crypto Systems

UNIT IV: INTEGRITY AUTHENTICATION AND KEY MANAGEMENT (9) Periods

Message integrity – random oracle model – message authentication – Whirlpool-SHA-512 – Digital signature schemes -Entity authentication– password – challenge response – zero knowledge – Biometrics – Kerberos – symmetric key management – public key distribution – steganography.

UNIT V: NETWORK AND SYSTEM SECURITY (9) Periods

Security at the Application Layer: E-mail – PGP – S/MIME – Security at the transport layer: SSL and TLS – Security at the network layer: IPsec, Two Security Protocol – Security Association – Internet Key Exchange – ISAKMP-System Security-Worms-Viruses

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 3rd Edition, 2015.

2.W.Stallings, "Cryptography & Network Security: Principles and Practice", Prentice Hall, 6th Edition, 2013.

Reference Books:

1.Douglas R.Stlinson, "Cryptography Theory and Practice", CRC Press series on Discrete Mathematics and its application , 3rd Edition 2006.

2.Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security Private Communication in a Public World", Prentice Hall, 2nd Edition, 2002

COURSE OUTCOMES:

Upon completion of this course, the students will have the:

CO1: Knowledge and the importance of number Theory, Algebraic Algorithms and Galois field concepts
CO2: Ability to design new Modern symmetric Key Ciphers
CO3: Ability to design new Asymmetric key crypto system
CO4: Ability to develop new authentication and key management
CO5: Knowledge about the importance of security for networks
CO6: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	-	1	-	-	-	-	-	-	-	-	3	2	1
CO2	2	2	3	1	-	-	-	-	-	-	-	-	3	3	1
CO3	2	2	3	1	-	-	-	-	-	-	-	-	3	3	1
CO4	2	2	3	1	-	-	-	-	-	-	-	-	3	2	1
CO5	2	2	3	1	-	-	-	-	-	-	-	-	3	1	1
CO6	-	2	3	2	-	1	-	2	-	-	-	-	1	2	3
16LPEX13	2	2	3	1	-	1	-	1	-	-	-	-	3	2	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX14 STATISTICAL THEORY OF COMMUNICATION CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LBS401 Random Process and Queuing Theory

COURSE OBJECTIVES:

*To know the concepts of probability theory and random processes
*To acquire the basic knowledge on optimum linear filtering
*To understand the concepts of information theory and coding

UNIT I: RANDOM PROCESS (9) Periods

Review of probability Theory - Random variables - Operations on single and multiple random Variables-random process concept- stationarity - Ergodicity - First order markov process – Correlation - Auto and Cross Correlation functions - Power spectral density

UNIT II: OPTIMUM LINEAR SYSTEMS (9) Periods

I/O Relations of linear systems subjected to random inputs- Transmission of Gaussian process through linear system - Linear Mean Square filtering - Physically realizable optimum system - Matched filtering.

UNIT III: CONCEPT OF INFORMATION THEORY (9) Periods

Memory less Finite Schemes- Self information measure - Entropy function - Conditional Entropy Characteristics of Entropy function - Derivation of the noise characteristics of a channel - Mutual information - Redundancy - Efficiency and channel capacity - capacity of channels with symmetric noise structure.

UNIT IV: ELEMENTS OF ENCODING (9) Periods

Separable binary codes - Shannon - Fano encoding - Necessary and sufficient conditions for noiseless coding - Shannon's binary coding - fundamental theorem of discrete noise-less coding - Huffman's code - Gilbert Moore coding - Fundamental theorem of discrete coding in presence of noise

UNIT V: CONTINUOUS CHANNELS (9) Periods

Definitions of different entropies - Mutual information - Maximization of the entropy of a continuous random variable - Entropy maximization problems - Channel capacity under the influence of additive white Gaussian Noise- Hartley Shannon's Law - Trade - off between Bandwidth and SNR – Comparison of different modulation methods.

TOTAL NUMBER OF PERIODS (45) Periods

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

Text Books:

1. Reza F M, "An Introduction to information theory", McGraw Hill, New Delhi.2010.

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

3.Xavier and Eugene S P, "Statistical Theory of Communication", New Age international, New Delhi, 2009.

Reference Books:

1.Popoulis, "Probability, Random Variables & Stochastic Processes", McGraw Hill International Editions, New Delhi, 2002.

2.Lathi B P, "Modern Digital and Analog Communication System", Oxford University Press, New York, 2010

3.3Simon Haykin, "Communication Systems", John Wiley Higher Education, New Delhi, 2008.

4.Thomas M Cover and Thomas J A," Elements of Information Theory", John Wiley & Sons, Singapore, 2010.

COURSE OUTCOMES

Upon completion of this course, the students will have the

CO 1: An exposure to the concepts of probability theory and random processes
CO 2: In-depth knowledge of optimum linear systems for signal detection
CO 3: An exposure to the concepts of Information theory
CO4: Understanding of elements of coding for efficient noiseless communication
CO 5: Ability to apply the efficient coding technique to design noiseless communication channel
CO 6: An exposure to the concepts of entropy and channel capacity

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	1	-	2	-	-	-	-	-	1	2	-	-
CO2	3	3	3	2	2	-	-	-	-	2	-	2	2	2	-
CO3	2	2	2	1	-	2	-	-	-	2	-	2	2	-	-
CO4	2	2	2	1	2	2	2	-	-	-	-	2	2	3	-
CO5	2	3	3	2	2	2	2	-	-	-	-	2	2	3	-
CO6	1	1	2	2	1	1	-	-	-	-	-	1	1	-	-
16LPEX14	2	2	2	2	2	2	2	-	-	2	-	2	2	3	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX15 COGNITIVE RADIO COMMUNICATION CATEGORY:PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC603 COMPUTER COMMUNICATION

COURSE OBJECTIVES:

*To introduce the concept of software defined radios and their architectures
*To introduce the concept of cognitive radio communication and the components involved
*To introduce the cognitive radio architecture and the functions and issues involved in communication system design.

UNIT I: INTRODUCTION TO SOFTWARE DEFINED RADIO (9) Periods

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications

UNIT II: SDR ARCHITECTURE (9) Periods

Essential functions of the software radio, architecture goals - quantifying degrees of programmability - top level component topology - computational properties of functional components - interface topologies among plug and play modules - architecture partitions

UNIT III: INTRODUCTION TO COGNITIVE RADIOS (9) Periods

Marking radio self-aware, the cognition cycle - organization of cognition tasks - structuring knowledge for cognition tasks - Enabling location and environment awareness in cognitive radios – concepts – architecture - design considerations.

UNIT IV: COGNITIVE RADIO ARCHITECTURE (9) Periods

Primary Cognitive Radio functions - Behaviors, Components, A–Priori Knowledge taxonomy - observe – phase data structures - Radio procedure knowledge encapsulation - components of orient-plan - decide phases - act phase knowledge representation - design rules

UNIT V: NEXT GENERATION WIRELESS NETWORKS (9) Periods

The XG Network architecture - spectrum sensing, spectrum management - spectrum mobility - spectrum sharing - upper layer issues - cross – layer design.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Qusay. H. Mahmoud, "Cognitive Networks : Towards Self Aware Network", John Wiley & Sons Ltd. 2007.

2.Markus Dillinger, KambizMadani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.

Reference Books:

1.Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007

2.Joseph Mitola, "Cognitive Radio Architecture", John Wiley & Sons, 2006.

3.Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, "Cognitive Radio Communication and Networks", Elsevier, 2010

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Ability to understand the SDR concepts and benefits
CO2: Ability to understand the SDR Architecture
CO3: Ability to identify the role of Cognitive radio communication
CO4: Ability to understand the Cognitive Radio Architecture
CO5: Ability to understand the role of SDR and Cognitive radio communication in XG networks.
CO6: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	-	-	-	-	-	-	-	-	-	2	2	2
CO2	1	1	3	-	-	-	-	-	-	-	-	-	2	2	2
CO3	1	1	2	-	-	-	-	-	-	-	-	-	2	2	1
CO4	1	1	2	-	-	-	-	-	-	-	-	-	2	3	1
CO5	1	1	3	-	-	2	-	-	-	-	-	-	2	3	1
CO6	1	1	2	-	-	1	-	-	-	-	-	-	2	2	2
16LPEX15	1	1	2	-	-	2	-	-	-	-	-	-	2	2	2

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX16 INTERNET OF THINGS & DATA ANALYTICS CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC603 COMPUTER COMMUNICATION

COURSE OBJECTIVES:

*To learn about the fundamentals of Internet of Things
*To build a small low cost embedded system using Arduino/ Raspberry Pi or equivalent boards
*To apply the concept of Internet of Things in real world scenario

UNIT I: FUNDAMENTALS OF IOT (9) Periods

Introduction-Characteristics - Physical design - Protocols-Logical design - Enabling technologies - IoT levels-Domain specific IoTs - IoTvs M2M

UNIT II: IOT DESIGN METHODOLOGY (9) Periods

IoT systems management - IoT design methodology-Specifications - Integration and Application Development.

UNIT III: IOT COMPONENTS (9) Periods

Sensors and activators - Communication modules - Zigbee-RFID-Wi-Fi-Power sources.

UNIT IV: BUILDING IOT WITH HARDWARE PLATFORMS (9) Periods

Platform - Arduino/Intel Galileo/Raspberry Pi- Physical device - Interfaces - Programming - APIs/Packages - Web services.

UNIT V: CASE STUDIES AND ADVANCED TOPICS (9) Periods

Various Real time applications of IoT-Connecting IoT to cloud-Cloud storage for IoT-Data Analytics for IoT- Software & Management Tools for IoT.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.ArshdeepBahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

Reference Books:

1.Manoel Carlos Ramon, ―Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers, Apress, 2014.

2.Marco Schwartz, ―Internet of Things with the Arduino Yun, Packt Publishing,

COURSE OUTCOMES:

Upon completion of this course, the students will have the:

CO1: Ability to Design a portable IoT using Arduino/Equivalent boards and relevant protocols
CO2: Ability to Develop web services to access/control IoT devices
CO3: Ability to Deploy an IoT application and connect to the cloud
CO4: Ability to Built IoT applications for real time scenario
CO5: Ability to Analyze IoT Components
CO6: Ability to Apply IoT for various Interdisciplinary applications

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	3	1	1	1	1	-	-	-	-	-	3	3	2
CO2	1	2	3	1	1	1	1	-	-	-	-	-	2	2	2
CO3	1	1	3	1	-	-	-	-	-	-	-	-	2	2	2
CO4	1	1	3	1	1	1	-	-	-	-	-	-	3	3	2
CO5	1	1	2	1	1	1	-	-	-	-	-	-	2	3	1
CO6	1	1	3	1	2	2	-	-	-	-	1	-	3	3	1
16LPEX16	1	1	3	1	1	1	1	-	-	-	1	-	3	3	2

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX17 ELECTRONIC PACKAGING CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES:

- 16LBS2Z3 Material Science
- 16LES206 Electron Devices
- 16LES105 Basics of Civil and Mechanical Engineering

COURSE OBJECTIVES:

*To give a comprehensive introduction to the various packaging types used along with the associated same thermal, speed, signal and integrity power issues.

*To introduce the CAD tool in designing wiring boards

UNIT I: OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING (9) Periods

Definition of a system and history of semiconductors - Products and levels of packaging - Packaging aspects of handheld products - Definition of PWB - Basics of Semiconductor and Process flowchart - Wafer fabrication - Inspection and testing - Wafer packaging; Packaging evolution; Chip connection choices - Wire bonding - TAB and flip chip.

UNIT II: SEMICONDUCTOR PACKAGES (9) Periods

Single chip packages or modules (SCM) - Commonly used packages and advanced packages; Materials in packages; Thermal mismatch in packages; Current trends in packaging; Multichip modules (MCM) - types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits; Electrical Design considerations in systems packaging - Resistive - Capacitive and Inductive Parasitics - Layout guidelines and the Reflection problem - Interconnection.

UNIT III: CAD FOR PRINTED WIRING BOARDS (9) Periods

Benefits from CAD; Introduction to DFM - DFR & DFT - Components of a CAD package and its highlights - Beginning a circuit design with schematic work and component layout - DFM check list and design rules; Design for Reliability - Printed Wiring Board Technologies: Board-level packaging aspects - Review of CAD output files for PCB fabrication; Photo plotting and mask generation - Process flow-chart; Vias; PWB substrates; Surface preparation.

UNIT IV: SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS (9) Periods

SMD benefits; Design issues; Introduction to soldering - Reflow and Wave Soldering methods to attach SMDs – Solders - Wetting of solders - Flux and its properties - Defects in wave soldering - Vapour phase soldering - BGA soldering and Desoldering/Repair - SMT failures - SMT failure library and Tin Whisker - Tin-lead and lead-free solders - Phase diagrams - Thermal profiles for reflow soldering - Lead-free Alloys - Green electronics - Thermal Design considerations in systems packaging.

UNIT V: EMBEDDED PASSIVES TECHNOLOGY (9) Periods

Embedded passives - Need for embedded passives - Design Library - Embedded resistor processes - Embedded capacitors - Processes for embedding capacitors - Case study examples.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Rao R. Tummala, "Fundamentals of Microsystems Packaging", Tata McGraw Hill, NY, 1st Edition, 2001.

2.Richard.K.Ulrich, William.D.Brown, "Advanced Electronic Packaging", Wiley-IEEE Press, 2nd Edition, 2006.

Reference Books:

1. Glenn R.Blackwell, "The Electronic Packaging Handbook", CRC Press, 2000.

2.R.G. Kaduskar and V.B.Baru, "Electronic Product Design", Wiley India, 2nd Edition, 2011.

3.Walter C.Bosshart, "Printed Circuit Boards Design and Technology", TataMcGraw Hill, 1983.

4.R.S.Khandpur, "Printed Circuit Boards", Tata McGraw Hill, 1st Edition, 2005.

COURSE OUTCOMES:

Upon completion of this course, the students will have/ able to:

CO1: Design an electronic system PCB or integrated circuit.
CO2: In-Depth knowledge of electronic systems and semiconductor packages.
CO3: Identify the appropriate packaging style to be used, propose a design procedure and solution for the same.
CO4: Acquire knowledge on CAD for printed wiring boards
CO5: Understand the surface mount technology and thermal considerations.
CO6: Exposure to the concepts of embedded passive technology

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	1	1	3	1	-	-	3	2	3	1	1	1
CO2	1	1	2	1	1	-	2	-	-	2	2	2	1	1	2
CO3	1	1	2	1	1	3	1	3	-	2	2	2	1	1	2
CO4	2	2	3	2	2	-	3	-	-	-	-	-	2	2	3
CO5	2	3	3	3	3	-	-	-	-	-	3	3	2	3	3
CO6	1	1	1	2	2	-	2	-	-	3	3	3	1	1	1
16LPEX17	1	1	3	1	1	3	2	1	-	3	2	3	1	1	3

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX18 **DSP WITH FPGA** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC406 Digital Signal Processing.

COURSE OBJECTIVES:

*To have knowledge on FPGA Technology.
*To have in-depth knowledge on Computer Arithmetic.
*To acquire knowledge on Fourier transform algorithms, Digital filters and its implementation in FPGA

UNIT I: FPGA TECHNOLOGY **(9) Periods**

Overview of Digital Signal Processing (DSP) - Classification by Granularity - Classification by Technology - Benchmark for FPLs - Technology Requirements - FPGA and Programmable Signal Processors - Design Implementation - FPGA Structure - The Altera EP2C35F672C6 Case Study: Frequency Synthesizer .

UNIT II: COMPUTER ARITHMETIC **(9) Periods**

Number Representation- Binary Adders- Binary Multipliers- Binary Dividers- Floating-Point Arithmetic Implementation- Multiply-Accumulator (MAC) and Sum of Product (SOP)- Computation of Special Functions Using CORDIC- Computation of Special Functions using MAC Calls.

UNIT III: FOURIER TRANSFORMS **(9) Periods**

The Discrete Fourier Transform Algorithms- The Goertzel Algorithm, The Bluestein Chirp-z Transform, The Rader Algorithm, The Winograd DFT Algorithm- The Fast Fourier Transform (FFT) Algorithms- The Cooley–Tukey FFT Algorithm, The Good–Thomas FFT Algorithm, The Winograd FFT Algorithm, Comparison of DFT and FFT Algorithms, IP Core FFT Design.

UNIT IV: DIGITAL FILTERS **(9) Periods**

FIR - Designing FIR Filters- Constant Coefficient FIR Design- IIR- Coefficient Computation- IIR Filter Implementation- Fast IIR Filter.

UNIT V: MULTIRATE SIGNAL PROCESSING **(9) Periods**

Decimation and Interpolation- Polyphase Decomposition- Hogenauer CIC Filters- Multistage Decimator- Design of Arbitrary Sampling Rate Converters- Filter Banks- Wavelets-DWT Applications.

TOTAL NUMBER OF PERIODS **(45) Periods**

CONTACT PERIODS:

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

Text Books:

1.Uwe Meyer-Baese, "Digital Signal Processing with Field Programmable Gate Arrays" , Third Edition, Springer2007

2.Roger Woods, John McAllister, Ying Yi, "FPGA-based Implementation of Signal Processing Systems", Wiley 2008

Reference Books:

1.Kadhiem Ayob "Digital Filter Design for FPGA Engineers", create space Independent publishing platform 2014

2.Steve Kilts"Advanced FPGA Design: Architecture, Implementation, and Optimization " Wiley InterscienceAug 2007

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Knowledge on FPGA Technology
CO2: An in-depth knowledge on Computer Arithmetic.
CO3: Ability to implement Fourier transform algorithms in FPGA
CO4: An ability to design and implement Digital filters in FPGA
CO5: An ability to design and implement any arbitrary Sampling Rate Converters
CO6: An exposure to wavelets

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	3	2	-	-	3	-	-	-	-	1	3	2	-
CO2	2	2	3	2	-	-	3	-	-	-	-	1	3	2	-
CO3	1	1	3	2	-	-	2	-	-	-	-	2	3	2	-
CO4	2	2	3	2	-	-	3	-	-	-	-	1	3	2	-
CO5	2	2	3	2	-	-	1	-	-	-	-	2	3	2	-
CO6	1	1	3	2	-	-	3	-	-	-	-	1	3	2	-
16LPEX18	2	2	3	2	-	-	3	-	-	-	-	1	3	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX19 RF INTEGRATED CIRCUITS CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC702 Microwave and RF Engineering

COURSE OBJECTIVES:

*To have knowledge on lumped and distributed elements at RF frequency.
*To understand semiconductor device modeling and CMOS technology.
*To have knowledge on IC design of passive RF circuits and High frequency RF filters.
*To analyze LNA and VCO at radio frequency and design of Mixers.

UNIT I: RF ELECTRONICS (9) Periods

Lumped element concept at RF- lumped and distributed regions lower frequency analog design and microwave design versus radio frequency integrated circuit design - Impedance levels for microwave and low-frequency analog design- noise - linearity and distortion in RF Circuits - dynamic range - filtering issues

UNIT II: SEMICONDUCTOR DEVICE MODELING OF TECHNOLOGY (9) Periods

Small signal model of bipolar transistor **-** high frequency effects - noise in bipolar transistors - bipolar transistor design considerations-CMOS transistor.- impedance matching - tapped capacitors and inductors - the concept of mutual inductance - tuning a transformer - bandwidth of an impedance transformation network-quality factor of an LC resonator.

UNIT III: DESIGN OF PASSIVE CIRCUIT ELEMENTS IN IC TECHNOLOGIES (9) Periods

Technology backend and metallization in IC technologies -sheet resistance and skin effect -parasitic capacitance and inductance -current handling in metal lines-design of inductors and transformers - characterization of an inductor-layout of spiral inductors - on-chip transmission lines - high frequency measurements -on-chip passives and common De-Embedding techniques-packaging.

UNIT IV: LNA AND VOLTAGE-CONTROLLED OSCILLATORS (9) Periods

Noise in amplifiers - linearity in amplifiers - differential pair and other differential amplifiers-low voltage topologies for LNAs - temperature effects – broad band LNA design. Voltage-controlled oscillators: Analysis of an oscillator as a feedback system - The effects of Parasitics on the frequency of oscillation - phase noise - making the oscillator tunable - VCO automatic -amplitude control circuits.

UNIT V: MIXERS AND HIGH FREQUENCY FILTER CIRCUITS (9) Periods

Controlled transconductance mixer - double balanced mixer - analysis of switching modulator-mixer noise - improving isolation -single sideband mixers-alternative mixer designs - CMOS mixers. High frequency filter circuits: Integrated RF filters - linearity of the negative resistance circuits - noise effects - automatic Q tuning - frequency tuning.

TOTAL NUMBER OF PERIODS (45) Periods

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

Text Books:

1.John Rogers and Calvin Plett, "Radio Frequency Integrated Circuit Design", Artech House, Boston, 2003.

2.Radmanesh M M, " Radio Freqeuncy and Microwave Electronics, " Pearson Education, Asia, 2001.

Reference Books:

1.Less Besser and Rowan Gllmore, " Practical RF Circuit Design for Modern Wireless Systems," Vol I and II, Artech House, 2003

2.Stephan A Mass, "Non-Linear Microwave and RF circuits", Artech House, Boston, 1997.

3.FerriLosee, "RF Systems, Components and Circuits handbook", Artech house, 2005.

4.Larson L E, "RF and Microwave Circuit for Wireless Applications", Artech House, 1997.

COURSE OUTCOMES:

Upon completion of this course, the students will have:

CO 1: Knowledge on lumped and distributed elements at RF frequency.
CO 2: Knowledge on semiconductor device modeling and CMOS technology.
CO 3: Knowledge on IC design of passive RF circuits.
CO 4: Analyze LNA and VCO at radio frequency.
CO 5: Analyze and design of Mixers.
CO 6: Knowledge on High frequency RF filters.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	1	1	1	-	-	1	-	-	1	2	2	-
CO2	2	2	2	1	3	1	-	-	-	-	-	1	2	3	-
CO3	2	2	3	2	2	1	1	-	-	1	1	1	2	2	-
CO4	2	3	-	2	3	1	-	-	-	-	-	1	2	3	-
CO5	2	3	3	2	3	1	1	-	1	1	1	1	1	2	-
CO6	2	1	-	1	1	1	-	-	1	-	-	1	2	2	-
16LPEX19	2	3	3	2	3	1	1	-	1	1	1	1	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX20 WIRELESS SENSOR AND MESH NETWORKS CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC603 COMPUTER COMMUNICATION

COURSE OBJECTIVES:

*To learn about the issues in the design of wireless sensor and mesh networks
*To learn about the working of protocols in different layers of sensor and mesh networks
*To expose the students to different aspects in sensor and mesh networks

UNIT I: FUNDAMENTALS OF WSN AND WMN (9) Periods

Introduction and overview of WSN-Basic wireless sensor technology-Operating systems for WSN-Applications of WSN-Comparison between Ad hoc and mesh networks-Challenges and design issues in wireless mesh networks-Applications of WMNs.

UNIT II: TRANSMISSION LAYER AND MAC LAYER PROTOCOLS OF WSN (9) Periods

Wireless channel and communication fundamentals-Physical layer and transceiver design considerations in WSNs- Fundamentals of MAC protocols-Performance Requirements-MAC Protocols for WSNs- Schedule based Protocols- Random access based Protocols

UNIT III: ROUTING AND TRANSPORT LAYER PROTOCOLS OF WSN (9) Periods

Data dissemination and gathering- Routing challenges and routing strategies in WSNs- Routing strategies in WSN-Transport layer and QoS in wireless sensor networks-Coverage and deployment-Reliable data transport-Single packet delivery-Block delivery-Congestion control and rate control.

UNIT IV: TRANSMISSION LAYER AND MAC LAYER PROTOCOLS OF WMN (9) Periods

Adaptive coding/modulation and link adaptation - Cooperative diversity and cooperative communications - Multichannel systems - Advanced radio technologies - Design objective and challenges-Advanced MAC protocols for WMNs.

UNIT V: ROUTING AND TRANSPORT LAYER PROTOCOLS OF WMN (9) Periods

Routing in WMN-Special properties-General concepts - Routing metrics and routing protocols in WMN – Transport Layer Protocols for WMNs – Transport Protocols based on Hop-by-Hop Control-datagram Congestion Control Protocol (DCCP) for WMNs.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks-Technology, Protocols, and Applications" John Wiley & Sons, 2007.
2.Ian F. Akyildiz ,Xudong Wang , "Wireless Mesh Networks", John Wiley & Sons, 2009.

Reference Books:

1.Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.
2.Yan Zhang, JijunLuo, Honglin Hu, "Wireless Mesh Networking-Architectures, Protocols and Standards", Auerbach Publications, 2007.
3.Robert Faludi, " Building Wireless Sensor Networks", O'Reilly Media, 2011.
4.Timothy Kolaya , " Advances in Wireless Mesh Networks " , Clanrye International, 2015.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Ability to identify different issues in wireless sensor and mesh networks
CO2: Ability to analyze the Transmission and MAC Layer protocols developed for sensor networks
CO3: Ability to analyze the Transport Layer protocols developed for sensor networks
CO4: Ability to analyze the Transmission and MAC Layer protocols developed for Mesh networks
CO5: Ability to analyze the Transport Layer protocols developed for Mesh networks
CO6: Ability to analyze and apply the WSN and WMN for real time applications.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	-	-	-	-	-	-	-	1	-	-	3	2	1
CO2	-	1	3	1	-	-	-	-	-	-	-	-	3	2	1
CO3	1	1	3	1	-	-	-	-	-	2	-	-	3	2	1
CO4	1	1	3	1	-	-	-	-	-	-	-	-	3	2	1
CO5	1	1	3	1	-	-	-	-	-	-	2	-	3	3	1
CO6	1	1	2	-	-	-	-	-	-	-	-	1	3	3	3
16LPEX20	1	1	3	1	-	-	-	-	-	2	1	1	3	2	1

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX21 **NEURAL NETWORKS** **CATEGORY:PE**

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To study the structure and functions of artificial neurons
*To introduce supervised/unsupervised learning in neural networks
*To understand the role of neural networks in engineering, and cognitive modeling

UNIT I: INTRODUCTION (9) Periods

Artificial neural networks - History-Structure and function of single neuron-Weights, activation functions and bias Fundamental neuron models and learning-Neural net architectures-Learning algorithms, supervised and unsupervised -Use of neural networks - Perceptron- linear separability.

UNIT II: FEED FORWARD AND FEEDBACK NETWORKS (9) Periods

Back propagation network-Architecture -Delta rule-Weight updation for output and hidden layer - Local and global minima-practical considerations–Merits, demerits and applications-Pattern association-Associative memories-BAM-Energy theorem-Architecture and processing-Hopfield memory-Discrete and continuous -Optimization using hopfield networks.

UNIT III: SIMULATED ANNEALING AND COMPETITIVE NETWORKS (9) Periods

Annealing-Boltzman machine architecture, learning and processing-Practical considerations-Neural networks based on competition-Counter propagation network-Forward mapping CPN and complete CPN-Building blocks-Architecture, Training and data processing-Practical considerations and applications.

UNIT IV: SOM AND ADAPTIVE RESONANCE THEORY (9) Periods

Topologically organized network-Feature map classifier-Applications-Learning vector quantization-Adaptive resonance theory-Fundamentals-Basic architecture and operation-Pattern matching-ART1 network - Architecture and processing summary.

UNIT V: HANDWRITTEN CHARACTER AND SPEECH RECOGNITION (9) Periods

Neocognitron-Architecture-Data processing and performance-Spatio-temporal pattern classification-STN- Architecture-Speech recognition-SCAF-Training -Time dilation effect.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Education (Singapore) Private Limited, Delhi, 2011

2.Satish Kumar, "Neural Networks: A Classroom Approach", Second Edition Tata McGraw-Hill Publishing Company Limited, New Delhi, 2013

Reference Books:

1.Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd edition,Prentice-Hall of India, 2008.

2.Laurence Fausett, "Fundamentals of neural networks, Architectures, Algorithms and Applications", Pearson education Private Limited, Delhi, 2004.

3.Sivanandam.S.N, Sumathi.S, Deepa.S.N, "Introduction to Neural networks using MATLAB 6.0", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010, 10th reprint.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Exposure to basics of Artificial Neural Networks
CO2: Ability to solve simple problems using Feed forward and Feedback Neural networks
CO3: Knowledge on associative memories & global minima networks
CO4: Familiarization with competitive neural networks
CO5: Understanding on the concepts of adaptive resonance theory
CO6: Ability to apply the neural networks in pattern/speech recognition applications

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO6	3	2	2	-	3	-	-	-	-	-	-	-	3	1	-
16LPEX21	3	2	2	-	1	-	-	-	-	-	-	-	3	1	-

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16LPEX22 MULTIMEDIA COMPRESSION TECHNIQUES CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

*To have a complete understanding of error–control coding.
*To understand encoding and decoding of digital data streams.
*To introduce methods for the generation of these codes and their decoding techniques.
*To have a detailed knowledge of compression and decompression techniques.
*To introduce the concepts of multimedia communication.

UNIT I: MULTIMEDIA COMPONENTS (9) Periods

Introduction-Multimedia skills-Multimedia components and their characteristics-Text, Sound, images, Graphics, Animation, Video, Hardware.

UNIT II: AUDIO AND VIDEO COMPRESSION (9) Periods

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding Video compression –principles-H.261-H.263-MPEG 1, 2, and 4.

UNIT III: TEXT AND IMAGE COMPRESSION (9) Periods

Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding –source encoding -text compression –static Huffman coding dynamic coding –arithmetic coding –Lempel ziv-welsh Compression-image compression.

UNIT IV: VOIP TECHNOLOGY (9) Periods

Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service- CODEC Methods- VOIP applicability.

UNIT V: MULTIMEDIA NETWORKING (9) Periods

Multimedia networking -Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.Fred Halshall, "Multimedia Communication- Applications, Networks, Protocols and Standards",Pearson education, 2007.

Reference Books:

1.KR. Rao,Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems:Techniques,Standards, and Networks", Pearson Education 2007.

2.R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications andApplications", Pearson Education,1st Edition, 1995.

3.Tay Vaughan, "Multideai- making itwork", 7/e, TMH, 2007

4.B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.

5.Kurose and W.Ross"Computer Networking "a Top Down Approach", Pearson Education 2005.

6.Marcus Goncalves"Voice over IP Networks", McGraw hill 1999.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO 1: Gain knowledge on multimedia components.
CO 2: Acquire knowledge in Audio & Video compression.
CO 3: Gain Knowledge on Text and image compression.
CO 4: Understand encoding and decoding of digital data streams.
CO 5: Acquire knowledge on methods for the generation of codes and their decoding techniques.
CO 6: Understand the concepts of multimedia communications.

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	2	2	2	-	-	-	-	-	1	-	-	1	2	1	-
CO3	2	2	2	-	-	-	-	-	1	-	-	1	2	1	-
CO4	2	2	1	-	-	-	-	-	1	-	-	1	2	1	-
CO5	2	2	2	-	-	-	-	-	1	-	-	1	2	1	-
CO6	2	1	1	-	-	-	-	-	1	-	-	1	1	1	-
16LPEX22	2	2	2	-	-	-	-	-	1	-	-	1	2	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LPEX23 MULTI CORE ARCHITECTURE CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: 16LPC505 Computer System Architecture

COURSE OBJECTIVES:

*To understand the recent trends in the field of Computer Architecture and identify performance related parameters
*To appreciate the need for parallel processing
*To expose the students to the problems related to multiprocessing
*To understand the different types of multiprocessing techniques
*To expose the students to case studies of DSP applications

UNIT I: FUNDAMENTALS OF QUANTITATIVE DESIGN (9) Periods

Introduction to parallel computers: Instruction Level Parallelism (ILP) vs. Thread Level Parallelism (TLP); performance issues: brief introduction to cache hierarchy and communication latency. Shared memory multiprocessors: general architecture and the problem of cache coherence; synchronization primitives: atomic primitives; locks: TTS, tickets, array; barriers: central and tree; performance implications in shared memory programs.

UNIT II: MULTI PROCESSOR ARCHITECTURES (9) Periods

Chip multiprocessors: why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI;memory consistency models: SC; chip multiprocessor case studies: Intel Montecito and dual core Pentium 4, IBM power4, Sun Niagara.

UNIT III: PARALLEL COMPUTING AND OPTIMIZATION (9) Periods

Introduction to program optimization: overview of parallelism, shared memory programming; introduction to OpenMP; data flow analysis, pointer analysis, alias analysis, data dependence analysis, solving data dependence equations (integer linear programming problem); loop optimizations; memory hierarchy issues in code optimization.

UNIT IV: MULTI PROCESSING TECHNIQUES (9) Periods

Operating system issues for multiprocessing: need for pre-emptive OS, scheduling techniques: usual OS scheduling techniques, threads, distributed scheduler, multiprocessor scheduling, gang scheduling; communication between processes, message boxes, shared memory; sharing issues and synchronization, sharing memory and other structures.

UNIT V: EMBEDDED ARCHITECTURES (9) Periods

Sharing I/O devices, distributed semaphores, monitors spin locks, implementation techniques for multi-cores; case studies from applications: digital signal processing, image processing, speech processing.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1.J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan Kaufmann publishers, 2012.

2.D. E. Culler, J. P. Singh, with A. Gupta. Parallel Computer Architecture: A Hardware/Software Approach. Morgan Kaufmann publisher, 2010.

Reference Books:

1.Steven S. Muchnick. Advanced Compiler Design and Implementation. Morgan Kaufmann publishers, 1997.

2.Wolfe. Optimizing Super compilers for Supercomputers. Addison-Wesley publishers 1989.

3.Allen and Kennedy. Optimizing Compilers for Modern Architectures. Morgan Kaufmann publishers, 2001.

4.A. S. Tanenbaum. Distributed Operating Systems. Prentice Hall 1995.

5.Coulouris, Dollimore, and Kindberg. Distributed Systems Concept and Design. Addison- Wesley publishers, 2001.

6.Silberschatz, Galvin, and Gagne. Operating Systems Principles. Addison-Wesley publishers, 2008.

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: To identify the limitations of ILP and the need for multicore architectures
CO2: To discuss the issues related to multiprocessing and suggest solutions
CO3: To point out the salient features of different multicore architectures and exploit parallelism
CO4: To analyze the different types of inter connection networks
CO5: To understand the architecture of GPUs processors
CO6: An exposure on architecture of embedded processors

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	1	2	1	2	3	1	2	1	3	2	1	1	-
CO2	-	-	2	-	1	3	1	-	-	1	-	-	1	1	-
CO3	-	2	1	-	-	-	2	-	-	-	-	3	1	2	-
CO4	-	3	2	-	2	-	-	-	-	-	-	2	1	1	-
CO5	2	3	1	2	-	-	-	-	-	-	-	-	2	1	-
CO6	1	2	2	3	1	-	2	-	-	-	-	2	2	1	-
16LPEX23	3	3	2	2	1	3	2	1	1	1	1	2	1	1	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LIEX01 **AUTOMOTIVE ELECTRONICS** **CATEGORY: IE**

L	T	P	C
3	0	0	3

PREREQUISITES:

16LPC602 EMBEDDED SYSTEM DESIGN
16LES402 ELECTRICAL ENGINEERING AND CONTROL SYSTEMS

COURSE OBJECTIVES:

*To acquire in-depth knowledge on the basic electrical and electronic components used in an automotive systems
*To apply knowledge of an embedded system in automotive electronic systems
*To learn the various vehicle communication protocols

UNIT I: ELECTRONICS IN AUTOMOTIVE SYSTEMS (9) Periods

Overview of Automotive Mechanical systems- Need for Automotive Electronics System - Performance (Speed, Power and Torque) - Control (Emission, Fuel Economy, Drivability and Safety) and Legislation (Environmental legislation for pollution and safety norms) - Overview of vehicle electronic systems - Basic electrical components and their operation in an automobile- Power train subsystem(Starting systems, Charging systems, Ignition systems, Electronic fuel control) - Chassis subsystem(ABS,TCS and ESP) - Comfort and safety subsystems (Night vision, airbags, Seatbelt Tensioners, Cruise Control- Lane-departure-warning, Parking)

UNIT II: EMBEDDED HARDWARE AND SOFTWARE (9) Periods

Hardware module - Introduction to an embedded board -components - Software Module: IDE - Getting started: Creating new project, creating new files, adding files to project, compile, build, debug and simulation of a project.

UNIT III: EMBEDDED SYSTEM PROGRAMMING AND DEBUGGING (9) Periods

Embedded System Programming - Up-loaders- ISP - ROM Emulators - In-Circuit Emulators - Debug Interfaces: BDM and JTAG.

UNIT IV: EMBEDDED SYSTEM IN AUTOMOTIVE APPLICATIONS (9) Periods

Engine management systems - Gasoline/ Diesel systems, various sensors used in system - Electronic transmission control - Vehicle safety system - Electronic control of braking and traction - Body electronics - Infotainment systems - Navigation systems - System level tests - Software calibration using engine and vehicle dynamometers - Environmental tests for Electronic Control Unit - Application Control Unit - Application of Control elements and control methodology in Automotive System.

UNIT V: EMBEDDED SYSTEM COMMUNICATION PROTOCOLS (9) Periods

Introduction to control networking - Communication protocols in embedded systems - SPI, I 2C, USB - Vehicle communication protocols - Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000.

TOTAL NUMBER OF PERIODS (45) Periods

CONTACT PERIODS:

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

Text Books:

1. Denton.T, "Automobile Electrical and Electronic Systems", Edward Arnold Publishers, 4th Edition 2012.

2. Nicholas Navit, "Automotive Embedded System Handbook", CRC press, 2009.

Reference books:

1.Robert Bosch GmbH, "Automotive Handbook", John Wiley & Sons, 6th Edition, 2004.

2.Knowles.D, "Automotive Electronic and Computer Controlled Ignition Systems", Prentice Hall,1998

3.William B. Ribbens, "Learning Automotive Electronics", Newnes Publishing, 6th Edition 2003

4.Joerg Schaeuffele, Thomas Zurawka - "Automotive Software Engineering- Principles, Processes, Methods and Tools", SAE Publications,2005

COURSE OUTCOMES

Upon completion of the course, the students will have:

CO1: An in-depth knowledge of the basic electrical and electronic components used in an automotive systems
CO2: An ability to do projects using Embedded hardware and software.
CO3: An in- depth knowledge on programming and debugging skills.
CO4: An ability to apply knowledge of an embedded system in automotive electronic systems
CO5: Knowledge on various Embedded system communication protocols
CO6: Knowledge on various vehicle communication protocols

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	1	-	1	1	1	-	-	1	-	-	1	2	2	-
CO2	2	2	2	1	3	1	-	-	-	-	-	1	2	3	-
CO3	2	2	3	2	2	1	1	-	-	1	1	1	2	2	-
CO4	2	3	-	2	3	1	-	-	-	-	-	1	2	3	-
CO5	2	3	3	2	3	1	1	-	1	1	1	1	1	2	-
CO6	2	1	-	1	1	1	-	-	1	-	-	1	2	2	-
16LIEX01	2	3	3	2	3	1	1	-	1	1	1	1	2	2	-

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16AOEX01 NANOSCIENCE AND TECHNOLOGY CATEGORY: OE

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To Understand and analyze the concepts of Quantum confinement, Dimensional structures and Properties of nano systems
- To be familiar with various methods of synthesis of nano materials
- To analyze and understand the mechanical and electrical properties of nonmaterial and its applications
- To realize the importance of Nonporous materials and its applications
- To make the students to understand the fundamental aspects of properties leading to technology

UNIT I NANO SYSTEMS (9)

Size effect and properties of nanoparticles - particle size - particle shape - particle density - melting point, surface tension, wettability - specific surface area and pore size – Properties of Individual nanoparticles. Quantum confinement in 3D, 2D, 1D and zero dimensional structures -Size effect and properties of nanostructures- Top down and Bottom up approach.

UNIT II SYNTHESIS OF NANOMATERIALS (9)

Sol-Gel Process - Self assembly - Electrodeposition - Spray Pyrolysis - Flame Pyrolysis – Metal Nanocrystals by Reduction - Solvothermal Synthesis - Chemical Vapor Deposition (CVD) – Metal Orgonic Chemical Vapor Deposition (MOCVD).Ball Milling - Inert Gas Condensation Technique (IGCT) – Thermal evaporation – Pulsed Laser Deposition (PLD) – DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE) – Melt Spinning process.

UNIT III MECHANICAL AND ELECTRICAL PROPERTIES (9)

Nanoscale Mechanics - Introduction – Mechanical properties – Density Considered as an Example Property – The Elasticity of Nanomaterials – Elasticity of Bulk Nanomaterials –Plastic Deformation of Nanomaterials - The Physical Basis of Yield Strength – Crystals and Crystal Plasticity – From Crystal Plasticity to Polycrystal Plasticity.

Introduction - Energy Storage Basics - General Information: Electrical Energy Storage Devices and Impact of Nanomaterials – Batteries – Capacitors - Electrochemical Properties of Nanoscale Materials - Aerogels and Structure-Directed Mesoporous and Macroporous Solids - Nanoparticles - Nanotubes, Nanowires, and Nanorolls

UNIT IV NANOPOROUS MATERIALS (9)

Nanoporous Materials – Silicon - Zeolites, mesoporous materials – nano membranes and carbon nanotubes - AgX photography, smart sunglasses and transparent conducting oxides- Hydrophobic & Hydrophilic materials – molecular sieves – nanosponges.

UNIT V NANOTECHNOLOGY APPLICATIONS (9)

Applications of nanoparticles, quantum dots, Nanotubes and nanowires for nanodevice fabrication – Single electron transistors, coulomb blockade effects in ultra-small metallic tunnel junctions - nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors – principle of Dip Pen Lithography.

CONTACT PERIODS:

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

Reference books:

1. G. Timp. Editor, "**Nanotechnology**" AIP press, Springer-Verlag, New York, 1999
2. Hari Singh Nalwa, Editor, **"Nanostructured materials and Nanotechnology''**, Concise Edition,
   Academic Press, USA (2002).
3. Guozhong Gao, "**Nanostructures & Nanomaterials: Synthesis, Properties & Applications"**, Imperial College Press (2004).
4. K. T. Ramesh, "**Nanomaterials : Mechanics and Mechanisms"**, Springer 2009.
5. Kenneth J. Klabunde, "**Nanoscale materials in chemistry"**, John Wiley & Sons, 2001.
6. Hari Singh Nalwa, Editor, "**Hand book of Nanostructured Materials and Technology''**, Vol.1-5,
   Academic Press, USA (2000).
7. "**Hand book of Nanoscience, Engineering and Technology"** (The Electrical Engineering handbook series), Kluwer Publishers, 2002
8. N John Dinardo, Weinheim,"**Nanoscale characterization of surfaces & interfaces"**, Cambridge:
   Wiley-VCH, 2nd ed., 2000
9. G. Cao, "**Nanostructures & Nanomaterials: Synthesis, Properties &Applications"**, Imperial College Press, 2004.
10. J.George, "**Preparation of Thin Films"**, Marcel Dekker, Inc., New York. 2005.

COURSE OUTCOME

CO1 : Analyze the particle size, particle shape, particle density, Size effect and properties of nanostructures. [Familiarity]

CO2 : Acquire knowledge in various methods of synthesis of Nano materials. [Application]

CO3 : Analyze the Elasticity of Nanomaterials , Electrical Energy Storage Devices and Aerogels. [Assessment]

CO4: Acquire knowledge in Zeolites, mesoporous materials, nano membranes and carbon nanotubes. [Familiarity]

CO5: Apply various nano materials to the LED, Transistor Applications. [Usage and Assessment]

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	3	-	2	-	1	-	-	-	-	-	-	-	-	-
CO2	2	-	-	1	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	1	-	2	-	-	-	-	-	3	-	-
CO4	3	-	-	2	-	1	-	-	-	-	-	-	-	3	-
CO5	1	-	3	-	-	-	2	-	-	-	-	2	-	-	3
16AOEX01	3	3	1	2	3	1	2	-	-	-	-	1	1	1	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16AOEX02 **MATERIAL CHARACTERIZATIONS** **CATEGORY: OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To Understand and analyze the concepts of Thermo gravimetric analysis, Differential thermal analysis
- To be familiar with various methods of microscope
- To analyze and understand the working principle of SEM, FESEM, EDAX, and HRTEM
- To realize the importance of Electrical methods and its limitations
- To understand the fundamental aspects and properties of spectroscopy techniques

UNIT I THERMAL ANALYSIS (9)

Introduction – thermo gravimetric analysis (TGA) – instrumentation – determination of weight loss and decomposition products – differential thermal analysis (DTA)- cooling curves - differential scanning calorimetry (DSC) – instrumentation – specific heat capacity measurements – determination of thermo mechanical parameters .

UNIT II MICROSCOPIC METHODS (9)

Optical Microscopy: optical microscopy techniques – Bright field optical microscopy – Dark field optical microscopy - phase contrast microscopy - fluorescence microscopy - confocal microscopy - digital holographic microscopy - oil immersion objectives - quantitative metallography - image analyzer.

UNIT III ELECTRON MICROSCOPY AND OPTICAL CHARACTERISATION (9)

SEM- FESEM- EDAX,- HRTEM: working principle and Instrumentation – sample preparation – Photoluminescence – light – matter interaction – instrumentation – electroluminescence – instrumentation – Applications.

UNIT IV ELECTRICAL METHODS (9)

Two probe and four probe methods- van der Pauw method – Hall probe and measurement – scattering mechanism – C-V, I-V characteristics – Schottky barrier capacitance – impurity concentration – electrochemical C-V profiling – limitations.

UNIT V SPECTROSCOPY (9)

Principles and instrumentation for UV-Vis-IR, FTIR spectroscopy, Raman spectroscopy, ESR, NMR, NQR, ESCA and SIMS- proton induced X-ray Emission spectroscopy (PIXE) – application – mass spectroscopy.

CONTACT PERIODS:

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

Reference books

1. Stradling, R.A; Klipstain, P.C; **"Growth and Characterization of semiconductors"**, Adam Hilger, Bristol,1990.
2. Belk, J.A; **"Electron microscopy and microanalysis of crystalline materials"**, Applied Science Publishers, London, 1979.
3. Lawrence E.Murr, **"Electron and Ion microscopy and Microanalysis principles and Applications"**, Marcel Dekker Inc., New York, 1991
4. D.Kealey & P.J.Haines, **"Analytical Chemistry"**, Viva Books Private Limited, New Delhi, 2002.
5. G. Gao, **"Nanostructures and Nanomaterials"**, Imperial College Press, London, 2006
6. Y. Gogotsi, **"Nanomaterials Handbook"**, CRC Taylor and Francis, New York, 2006
7. Banwell, **"Fundamentals of Molecular Spectroscopy"**, Tata McGraw-Hill, 1994.

COURSE OUTCOME

CO1: Analyze the properties of TGA, DTA and DSC. [Assessment]
CO2: Acquire knowledge in various types of microscopes. [Familiarity]
CO3: Analyze the working principle and Instrumentation of SEM, FESEM, EDAX, and HRTEM [Familiarity]
CO4: Acquire knowledge in I-V and C-V characteristics. [Application]
CO5: Analyze the Principles and instrumentation of Spectroscopy methods. [Familiarity]

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	3	-	-	2	2	1	-	-	-	-	-	3	-	-
CO2	3	2	2	-	-	-	1	-	-	-	-	1	-	-	-
CO3	-	3	2	2	1	-	-	-	-	-	-	-	-	3	-
CO4	2	3	-	1	2	-	-	-	-	-	-	-	-	-	3
CO5	-	2	3	-	1	2	-	-	-	-	-	1	-	-	-
16AOEX02	3	3	2	2	2	2	1	-	-	-	-	1	1	1	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16AOEX03 **ELECTROCHEMICAL TECHNOLOGY** **CATEGORY:OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

* This course aims at making Mechanical Engineers know about Electrochemical principles applied in manufacturing of Chemical products, fabrication of metals, metallurgy and corrosion studies

UNIT – I **(09)**

Fundamental concepts, electron transfer, mass transfer, adsorption, electro-catalysis, phase formation in electrode reaction, assessment of cell voltage, costing of electrolytic process, performance and figure of merit. Typical cell designs. Laboratory data and scale-up.

UNIT – II **(09)**

Chlor-alkali industry-concept of brine electrolysis, chlorine cell technology, the production of NaOH. Water electrolysis, sodium chlorate, hydrogen peroxide, ozone, cuprous oxide, and synthesis of metal salt via anodic dissolution, Organic electro synthesis-dimerization of acrylonitrile, indirect electrosynthesis

UNIT – III **(09)**

The extraction, refining and production of metal–electro-winning, cementation, electro-refining, Electro-deposition of metal powders. Corrosion and its control-thermodynamics and kinetics of corrosion reactions, corrosion problems in practice, corrosion prevention and control, corrosion problems in electrolytic processing, corrosion measurement and monitoring

UNIT – IV **(09)**

Metal finishing-electroplating, electroless plating, conversion coatings, electroforming, electrochemical etching. Batteries and fuel cells-battery characteristics, battery specifications, evaluation of battery performance, battery components. Fuel cells.

UNIT – V **(09)**

Water purification, effluent treatment and recycling of industrial process stream- metal ion removal and recovery, treatment of liquors containing dissolved chromium, electrolytic method of phase separation, flue gas desulphurization, electrodialysis. Electrochemical sensor and monitoring techniques, polarographic to anodic stripping voltammetry, ion selective electrode, electrochemical biosensors.

CONTACT PERIODS:

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

Text Books

1. Derek Pletcher and Frank C Walsh, **"Industrial Electrochemistry"**, 2nd edition, Chapman & Hall, UK, 1990

2.A.T.Kuhn, **"Industrial Electrochemistry"**, Elsevier Publishers, 1972

Reference books

1. C.L. Mantell, **"Chemical Engineering Series – Industrial Electrochemistry"**, McGraw Hill Co., Inc. London, 1958

2.Ullmann's **"Encyclopedia of Industrial Chemistry"**, John Wiley & Sons, Vol.6, pp: 399 - 481, 2003.

3.Krik–"**Othmer Encyclopedia of Chemical Technology"**, 4th edition, Vol: I., Pp938 –1025 (1991)

4.N.M.Proutand J.S.Moorhouse**, "Modern Chlo-Alkali Technology"**, Vol. IV, Elsevier Applied Science, London, 1990

COURSE OUTCOMES

Students after the completion of this course:

CO 1: Students will be able to understand the electrodic processes and design cell requirements

CO 2: Students can apply the electrolysis principle in manufacture of materials required for regular use.

CO 3: Students will be able to apply their technical skill in metallurgy.

CO 4: Students will be able to acquire knowledge in all metal finishing techniques.

CO 5: Students will gain knowledge in solving the problems of corrosion of equipment and battery systems.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	3	2	2	3	1	-	-	-	-	-	-	3	-	-
CO2	1	2	3	1	3	1	-	-	-	-	-	-	-	2	-
CO3	3	1	3	2	2	3	-	-	-	-	-	-	-	2	-
CO4	2	1	1	1	2	3	-	-	-	-	-	-	2	1	-
CO5	1	2	3	1	3	2	-	-	-	-	-	-	-	2	1
16AOEX03	1	2	3	1	3	3	-	-	-	-	-	-	3	2	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16AOEX04 **POLYMER TECHNOLOGY** **CATEGORY:OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

* This course is aimed to make Mechanical Engineers apply their skills in identifying the types of polymers and their properties applicable to plastics and rubber processing

UNIT – I CHEMISTRY OF HIGH POLYMERS (09)

Monomers, functionality, degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness, polymerization methods: addition and condensation; metallocene polymers and other newer techniques of polymerization, copolymerization, block and graft copolymers, techniques for copolymerization-bulk, solution, suspension and emulsion.

UNIT – II SYNTHESIS AND PROPERTIES (09)

Commodity and general purpose thermoplastics: PE, PP, PS, PVC, Polyesters, Acrylic, PU polymers. Engineering Plastics: Nylon, PC, ABS, Fluoropolymers - Thermosetting polymers: PF, MF, UF, Epoxy, Unsaturated polyester. Natural and synthetic rubbers: Recovery of NR hydrocarbon from latex, SBR, Nitrile, CR, CSM, EPDM, IIR, BR, Silicone, TPE.

UNIT – III POLYMER TECHNOLOGY (09)

Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, cross-linking and vulcanization, Compression molding, transfer molding, injection molding, blow molding, reaction, extrusion, pultrusion, calendaring, rotational molding, thermoforming, rubber processing in two-roll mill, internal mixer.

UNIT – IV POLYMER BLENDS AND COMPOSITES (09)

Difference between blends and composites, their significance, choice of polymers for blending, blend miscibility-miscible and immiscible blends, FRP, particulate, long and short fibre reinforced composites.

UNIT – V POLYMER TESTING (09)

Mechanical-static and dynamic tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tear, resilience, impact, toughness. Conductivity-thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress cracking resistance.

CONTACT PERIODS:

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

Reference Books

1. F.W. Billmeyer, Jr., **"Textbook of polymer science"**, Wiley - Interscience, N.Y.(1971)
2. G.Odian , **"Principles of polymerization"**, , Wiley – Interscience (1981)
3. Gowarikar V.R. and others , **"Polymer science"**, Wiley Eastern (1986).
4. Fenner R.T., **"Principles of polymer processing"**, Chemical publishing N.Y. (1979)

COURSE OUTCOMES

Students after the completion of this course:

CO1: Will be able to identify different types of polymers by structure and behaviour, properties and their method of polymerisation.

CO2: Will be able to apply various processes of fabrication of plastics and rubber.

CO3: Will be able to distinguish polymer blends and composites and understand their specific applications.

CO4: Will be able to test the polymer specimens for mechanical properties applicable for various end uses.

CO5: Will be able to test the polymer specimens for electrical properties applicable for various end uses.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	1	1	2	3	-	-	-	-	-	-	2	-	-
CO2	1	1	3	2	3	1	-	-	-	-	-	-	3	1	-
CO3	2	2	1	1	2	1	-	-	-	-	-	-	-	2	-
CO4	1	1	2	2	2	3	-	-	-	-	-	-	-	2	1
CO5	-	3	1	1	3	2	-	-	-	-	-	-	-	3	-
16AOEX04	2	3	1	1	2	3	-	-	-	-	-	-	3	2	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16COEX05 DISASTER MANAGEMENT AND MITIGATION **CATEGORY:OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To give knowledge about basics of Disaster Management.
- To impart knowledge about Hazards and Vulnerability.
- To give knowledge about mitigation and preparedness.
- To teach about Response and Recovery.
- To impart knowledge about the participants involved in the disaster management activity.

UNIT - I INTRODUCTION **(08)**

Disaster throughout history, History of disaster management, Capacity by demand, UN International strategy for disaster reduction, the Hyogo framework for action, Post 2015 framework, Disaster trends.

UNIT – II HAZARDS AND RISK VULNERABILITY **(10)**

Hazard Identification and Hazard Profiling, hazard analysis, Types of hazards- Natural and technological Components of Risk- likelihood and Consequence, Trends and Computation of likelihood and Consequence. Risk Evaluation – purpose, Risk Acceptibility, Alternatives, Personnel. Political/social, Economic. vulnerability-Physical Profile, Social Profile, Environmental Profile, Economic Profile. Factors Influencing Vulnerability, risk Perception.

UNIT – III MITIGATION AND PREPAREDNESS **(08)**

Mitigation - types of mitigation ,Obstacles in mitigation, Assessment and selection of Mitigation options, Emergency response capacity as , Incorporating Mitigation into development and relief projects

Prepareness- Government Preparedness, Public Preparedness, Media as a public educator. Obstacles to public education and preparedness.

UNIT - IV RESPONSE AND RECOVERY **(09)**

Response the Emergency- Pre disaster, post disaster, Provision of water, food and shelter, volunteer management , command , control and coordination Recovery- short term and long term recovery .components of recovery- planning, coordination, information, money and supplies, allocation of relief funds, personnel. Types of recovery- Government, Infrastructure, Debris removal disposal and processing, environment, housing, economic and livelihood, individual, family and social recovery-special considerations in recovery.

UNIT – V PARTICIPANTS **(10)**

Governmental Disaster management agencies- Fire, law, emergency management, Emergency medical service, Military and other resources. Structures- local, regional, national. Bilateral assistance and its types. Types of national agencies involved in international disaster management. Political implications of bilateral assistance.

Non Governmental Organisations – operations, NGO/ Military coordination, standard of conduct. The role of Private sector and academia.

Multilateral organisations - UN agencies and progammes, Regional & International organisations. International Financial Institutions- the world bank, IMF, ADB, IADB. Special considerations.

CONTACT PERIODS:

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

Text Book

*1.Damon P. Coppola, **"Introduction to International Disaster management"**, Elsevier publication, 2015*

Reference Books

*1. Brassard, Caroline, Giles, David W., Howitt, Arnold M., **"Natural Disaster Management in the Asia-Pacific"**, Policy and Governance.*

*2. **"Disaster Management"**, Global Challenges and Local Solutions, Universities Press, 2009.*

*3. Jack Pinkowski, **"Disaster Management Handbook"**, CRC Press,January 22, 2008.*

*4. " **Disaster Management Guidelines"**, GOI-UNDP Disaster Risk Reduction Programme (2009-2012).*

COURSE OUTCOMES

CO1: Able to get knowledge about basics of Disaster management.
CO2: Able to impact knowledge about Hazards and vulnerability
CO3: Able to know about Mitigation and preparedness.
CO4: Able to attain knowledge about response and recovery.
CO5: Able to learn about the participants involved in the disaster management activity.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	1	-	-	1	1	-	1	-	-	-	-	-	-	-	1
CO2	1	3	-	2	1	2	-	-	-	-	-	1	1	-	-	1
CO3	1	1	-	-	3	2	-	-	-	-	-	1	1	-	-	1
CO4	1	2	-	1	1	2	2	-	-	-	-	-	-	-	-	1
CO5	-	2	-	1	1	2	-	-	-	-	-	-	-	-	-	1
16COEX05	1	2	-	1	1	2	1	1	-	-	-	1	1	-	-	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16COEX06 **ENVIRONMENTAL MANAGEMENT** **CATEGORY:OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PRE-REQUISITES:

16LES2Z4 Environmental Science And Engineering

COURSE OBJECTIVES:

- To understand the importance of nature and study about the water, air and soil pollution control as well as solid waste management.

UNIT – I NATURE AND SCOPE OF ENVIRONMENTAL PROBLEMS (09)

Environment and sustainable development – Natural and human environmental disturbances – Global warming –acid rain – ozone depletion – effects and control - climate change conventions – Kyoto protocol – India's efforts for Environmental protection – Public policy and role of NGO's.

UNIT – II WATER POLLUTION AND CONTROL (09)

Fresh water and its pollution – Natural processes – sources and pollutants – pollution due to industrial, agricultural and municipal wastes – effects on streams - limitations of disposal by dilution – BOD consideration in streams – Oxygen Sag Curve – Strategies for sustainable water management – Marine environment and its management – Water acts.

UNIT – III AIR AND NOISE POLLUTION (09)

Pollutant emissions - sources and sink – effects of air pollution on human health, vegetation and climate– Global effects – prevention and control of air pollution – Control of particulates – Air pollution surveys and sampling – Air quality monitoring - Air Act – Management of air pollution – Sound level – Effect of noise on people – Environmental noise control- noise pollution rules, 2000.

UNIT – IV SOLID WASTE MANAGEMENT AND SOIL POLLUTION (09)

Sources – Characteristics – Quantities – Collection methods – Processing and disposal techniques – Onsite Handling, storage and processing – sanitary landfill – Incineration and pyrolysis – Composting – aerobic and anaerobic of compositing – Recycling and reuse of solid wastes – Hazardous wastes – Definition – Sources & types only – Integrated system for waste management – The Basel convention Land use and degradation – Management problems – strategies for sustainable land management – soil pollution –wetland conservation.

UNIT – V ENVIRONMENTAL MANAGEMENT SYSTEM (09)

Terminology – installation and common motives of EMS – Environmental standards – ISO 14000 (Series) – basic principles – Environmental Audit – Environmental Impact assessment - Trade rules and environmental protection– Practices for Waste Minimisation and Cleaner Production.

CONTACT PERIODS:

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

Text Books

1. N.K.Uberoi, ***"Environmental Management",*** *Excel Books, New Delhi (2006).*

2. *Rao*, ***"Air Pollution"****, Tata McGraw-Hill Education, 01-Jun-1988*

Reference Books:

1**.** *S.Vigneshwaran,M.Sundaravadivel and D.S.Chaudhary* **, "Environmental Management"***, SCITECH Publications(India) Pvt.Ltd, Chennai & Hyderabad (2004).*

2. Technobanoglous, ***"Environmental Management"****, McGraw Hill Book Company (2006).*

COURSE OUTCOME:

CO1: Students exposed to know common issues related with environment.
CO2: Students able to know the sources, causes and effects of water pollution.
CO3: Able to attain knowledge related with air and noise pollution.
CO4: Able to understand the various management techniques of solid waste and soil Pollution.
CO5: Able to aquire knowledge on Environmental Management Systems.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	-	-	-	-	2	-	-	-	-	-	1	3	-	1
CO2	1	2	-	-	1	-	3	-	-	-	-	1	3	3	1	1
CO3	1	2	-	-	1	-	3	-	-	-	-	1	3	3	1	1
CO4	1	2	-	-	1	-	3	-	-	-	-	1	3	3	1	1
CO5	2	1	-	-	-	-	2	-	-	-	-	-	1	3	1	1
16COEX06	1	2	-	-	1	-	3	-	-	-	-	1	3	3	1	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16COEX07 **TOWN PLANNING AND ARCHITECTURE** **CATEGORY:OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

* Students are introduced the basics of Town Planning and Architecture

UNIT – I TOWN PLANNING **(09)**

History of evolution of towns - Town and environment – Planning acts – land use classification – Transportation network - Climate, humidity, wind and radiation - Surveys and Data collection - Residential neighborhoods - Industrial areas - Public Buildings - Housing and Slum clearance.

UNIT – II BUILDING RULES AND GUIDELINES **(09)**

General – Zoning regulations – Regulations regarding layouts or subdivisions – Building regulations – Rules for special types of buildings – Floor space index – minimum plot size and building front age – Open spaces – Minimum standard dimensions of building elements – Provision for lighting and ventilation – Provision for means of access – Provision for urban growth.

UNIT – III BASIC ELEMENTS OF ARCHITECTURE **(09)**

Introduction of Architecture – Definition – Mass and space visual emotional effects of geometric forms and their derivatives– The sphere, the cube, the pyramid, the cylinder and cone – The aesthetic qualities of Architecture – Proportion, scale, balance, symmetry, rhythm and axis – contrast in form – Harmony – Consideration of comfort factors acoustics, lighting, ventilation and thermal aspects.

UNIT – IV PRINCIPLES OF ORIENTATION AND PLANNING OF BUILDINGS **(09)**

General – factors affecting orientation – sun – Wind – Rain – Orientation criteria for Indian conditions – Principles governing the theory of Planning – General requirements of site and building – Functional planning of buildings.

UNIT – V ELEMENTS OF INTERIOR DESIGN **(09)**

General – Decorative Materials – Cement Bonded Board (BISON PANEL), Water proof cement paint, Industrial glazing and Roofing, unit masonry, plaster and dry wall, Wall surface materials, Effect of colour on architecture – Home furnishing– plans in rooms.

CONTACT PERIODS:

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

Text Books

1. S.C.Rangwala, ***"Elements of Town Planning"****, McGraw Hill, London, 2006.*

2. *Biswas Hiranmay*, ***"Principles of Town Planning and Architecture"****, VAYU Education of India, 2012.*

Reference Books

1. V.S.Pramar, ***"Design fundamentals and architecture"*** *Lakshmi Publishers, 2003.*

2. Hiraskar, ***"Fundamentals in town planning"*** *Khanna Publishers, 2005.*

COURSE OUTCOME:

CO1: Students will be able to know about the basics of town planning and building rules.
CO2: Students will be able to gain knowledge on building rules & regulations.
CO3: Students able to apply the architectural principles in the area of Civil Engineering.
CO4: Students will be able to do planning of various buildings.
CO5: Students will be able to understand about interior design of buildings.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	-	2	-	-	-	-	-	-	-	1	-	1	-	-
CO2	-	-	-	-	-	-	2	-	-	-	1	1	-	-	-	-
CO3	-	1	-	1	-	-	-	-	-	2	-	-	1	-	-	-
CO4	-	1	-	1	-	-	-	-	-	2	-	-	-	-	-	-
CO5	-	2	-	-	-	-	-	1	-	-	-	3	-	-	-	-
16COEX07	-	1	-	1	-	-	1	1	-	2	1	1	1	1	-	-

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16MOEX08 TOTAL QUALITY MANAGEMENT FOR ENGINEERS CATEGORY:OE

(Common to All Branches except Prodn Engineering)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES

- To impart knowledge to develop a product with the required quality at a reasonable price and to satisfy the requirements under various quality standards

UNIT - I QUALITY CONCEPTS (9)

Definition of quality, dimensions of quality, quality planning, quality costs concepts - basic concepts of total quality management, principles of TQM, leadership concepts - quality council, quality statements, strategic planning- steps in strategic planning- Deming philosophy, barriers in TQM implementation, benefits of TQM.

UNIT - II TQM PRINCIPLES (9)

Contribution of TQM Gurus - customer perception of quality - retention, employee involvement - motivation, empowerment, performance appraisal, continuous process improvement – Juran trilogy, PDSA cycle, 5S concept, kaizen, supplier partnership - supplier rating – performance measures-Malcom Balridge National Quality Award.

UNIT - III STATISTICAL PROCESS CONTROL (9)

Seven old and new tools of quality - statistical fundamentals - population and sample – normal curve - control charts for variables ,attributes and its applications- process capability - concept of six sigma.

UNIT - IV TOOLS AND TECHNIQUES (9)

Benchmarking needs and benefits - benchmarking process - quality function deployment (QFD) - house of quality - Taguchi quality loss function - total productive maintenance (TPM) - pillars of TPM - Failure Mode Effective Analysis (FMEA) - Failure rate- types of FMEA - stages of FMEA-case studies.

UNIT - V QUALITY SYSTEMS (9)

Introduction to ISO 9000 and other quality system - ISO 9001:2015 quality system – elements - implementation of quality system - documentation - quality auditing - QS 9000, ISO 14000 - concept, requirements and benefits- integrating ISO 14000 with ISO 9000 – OSHSAS 18001,Implementation of TQM in manufacturing industry.

CONTACT PERIODS:

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

Text Books

*1. Dale H.Besterfield, et al., **"Total Quality Management",** Pearson Education, 2008.*

*2. Subburaj Ramasamy, **"Total Quality Management",** Tata McGraw Hill, 2008.*

*3.Vilas S.Bagad, **"Total Quality Management",** TECHNICAL PUBLICATIONS, 2017.*

Reference Books

*1. James R.Evans & William M.Lidsay, **"The Management and Control of Quality",** Thomson Learning, 2002.*

*2. Feigenbaum.A.V. **"Total Quality Management",** McGraw-Hill, 1991.*

*3. Zeiri,**"Total Quality Management for Engineers"** Wood Head Publishers, 1991*

*4. P.N.Mukherjee**"Total Quality Management"**,PHI Publishers,2006*

*5. John.L Hradesky **"Total Quality Management Hand book"** McGraw-Hill, 1995.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: apply the principle of strategic planning, Deming philosophy and leadership concepts in industries.
CO2: apply the principle of TQM in industries.
CO3: apply the principle of statistical process control in industries.
CO4: select appropriate quality tools to meet industrial requirements.
CO5: implement appropriate quality standards for industries.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	3	-	-	2	-	-	1	1	-	1	1	2	1	2
CO2	1	3	-	-	2	-	-	1	1	-	1	1	2	1	2
CO3	1	3	-	-	2	-	-	1	1	-	1	1	2	1	2
CO4	1	3	-	-	2	-	-	1	1	-	1	1	2	1	2
CO5	1	3	-	-	2	-	1	1	1	-	1	1	2	1	2
16MOEX08	1	3	-	-	2	-	1	1	1	-	1	1	2	1	2

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16MOEX09 **COMPOSITE MATERIALS** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PRE-REQUISITES:

16LBS2Z3 Material Science

COURSE OBJECTIVES:

* To impart the fundamentals of composite materials with different reinforcement, matrix materials and comprehend the types of manufacturing methods for advance composite materials to meet various engineering requirements.

UNIT – I INTRODUCTION TO COMPOSITE MATERIALS (9)

Types and characteristics of composite materials - Mechanical behavior - Basic terminology and Manufacture of laminated fiber - Reinforced composite materials - Current and potential advantages - Applications of composite materials.

UNIT - II REINFORCEMENT AND MATRICES (9)

Different types of fibers - Properties and applications of fibers - Roll of matrix - Matrix materials, Selection of matrix -Thermoset matrix -Thermoplastic matrix, Fiber architecture – Natural Fibers.

UNIT – III DESIGN OF COMPOSITE STRUCTURES (9)

Elements of Design - Steps in design process - Elements of analysis in design - Analysis iterations - Design analysis stages - Material selection - Configuration selection - Laminate joints - Design requirements and design failure criteria.

UNIT – IV MANUFACTURING OF ADVANCED COMPOSITES (9)

Bag-Molding process - Compression molding – Pultrusion - Filament winding - Liquid composite molding processes-Resin film infusion - Elastic reservoir molding - Tube rolling - Forming methods for thermoplastic matrix composites.

UNIT - V METAL, CERAMIC AND CARBON MATRIX COMPOSITES (9)

Metal matrix composites - Manufacturing processes - Ceramic matrix composites- Mechanical properties - Manufacturing processes - Carbon matrix composites - Fabrication methods - Applications.

CONTACT PERIODS:

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

Text Books

*1. Krishnan K., Chawla **"Composite Materials Science and Engineering"**, Springer (India) Private Limited, 2011*

*2.P.K. Mallick , **"Fiber Reinforced Composite materials, Manufacturing and Design"**, CRC Press, Taylor and Francis Group, Boca Raton, London, Newyork 2010*

Reference Books

*1. A.K.Bhargava, **"Engineering Materials: Polymers, ceramics and composites"**, Pentice Hall of India Limited, 2010.*

*2. Hyer M., Stress Analysis of Fiber – **"Reinforced Composite Materials"**, Tata McGraw Hill, 1998.*

*3. Madhujit Mukhopadhyay , **"Mechanics of Composite Materials and Structures "**, Universities Press (India) Private Limited, 2009.*

*4. Robert M.Jones, **"Mechanics of Composite Materials"**, Taylor & Francis Group, 2010.*

5. Web Portal: Composite Materials {Nptel .Mechanical Engineering}

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Understand the mechanics and behaviour of reinforced composite materials for specific applications and developing composite materials for sustainability

CO2: Formulate different types of reinforcement and matrices to develop new composite material for the various application

CO3: Design and manufacture post processing methods of composite structures and capable to perform various analysis

CO4: Execute different methods of manufacturing advanced composites to meet the innovate demand in engineering.

CO5: Fabricate metal matrix, ceramic matrix and carbon matrix composite for various engineering application to meet the societal demand.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	-	-	2	2	-	-	-	1	-	3	-	1
CO2	3	2	2	2	2	-	1	-	-	-	2	-	2	2	-
CO3	2	2	2	2	-	1	2	-	-	-	1	-	1	2	-
CO4	2	2	2	1	-	3	1	-	1	-	2	-	2	1	-
CO5	1	1	-	1	-	2	1	-	-	-	-	1	2	2	-
16MOEX09	3	2	2	2	1	2	1	-	1	-	2	1	2	2	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16MOEX10 **AUTOMOBILE ENGINEERING** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- The learners are able to visualize the scope of Automobile Engineering.

UNIT - I INTRODUCTON TO AUTOMOTIVES (9)

An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Quality standards, Trends in automobile design

UNIT - II POWER SOURCE FEATURES (9)

Reciprocating Engine systems, Rotary Engine systems, Gas Turbine systems, Hybrid systems - Pollutant emissions and their control; Catalytic converter systems, Electronic Engine management systems

UNIT - III TRANSMISSION, SUSPENSION AND BRAKING SYSTEMS (9)

Clutch system, Gear box system, propeller shafting, differential, axles, wheels and tyres and Preliminaries of suspension systems

UNIT - IV AUXILIARY SYSTEMS (9)

Electrical and electronic systems, safety systems, Heating, Ventilation, and Air Conditioning (HVAC) systems, Vehicle Thermal Management System and vehicle body design features.

UNIT - V TESTS, SERVICE AND MAINTENANCE (9)

Engine Tuning, vehicle maintenance, engine and Chassis Dynamometry Pollutants and emissions Check, Wind Tunnel Tests, preliminaries of engine and vehicle testing.

CONTACT PERIODS:

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

Text Books

*1. Dr. Kirpal Singh, **"Automobile Engineering Vol. I & II"**, Standard Distributors Publishers, 2012.*

*2. R.B.Gupta, **"Automobile Engineering"** Sathya Prakashan, New Delhi, 2006.*

Reference Books

*1. William H.Crouse, **"Automotive Mechanics"**, McGraw Hill Book Co. 2004.*

*2. K.K. Ramalingam, **"Automobile Engineering – theory and Practice"** SciTech Publications, 2001.*

*3. Joseph Heinter **"Automobile Mechanics Principles and Practice"** Affiliated East West Press,1997.*

*4. Jain K.K. and Asthana. R.B, **"Automobile Engineering"** Tata McGraw Hill Publishers, New Delhi, 2002.*

*5. Heinz Heisler, **"Advanced Engine Technology"** SAE International Publications USA, 1998.*

COURSE OUTCOMES:

On completion of this course, learners will be able to:

CO1: Identify the different components in an automobile.
CO2: Clearly understand different auxiliary and transmission systems.
CO3: Explain the working of various parts like engine, transmission, clutch, brakes
CO4: Understand the environmental implications of automobile emissions
CO5: Develop a strong base for understanding future developments in the automobile industry

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	1	3	2	2	2	1	1	1	3	2	2	3
CO2	3	2	3	3	2	3	1	1	1	2	2	1	3	2	3
CO3	2	2	2	1	2	3	2	1	1	2	3	1	3	3	2
CO4	3	2	3	2	3	2	3	3	2	2	3	1	1	1	3
CO5	2	1	1	1	2	3	2	-	1	3	3	3	3	2	3
16MOEX10	2	2	3	1	2	3	2	1	1	2	3	1	3	2	3

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16EOEX11 RENEWABLE ENERGY SOURCES AND TECHNOLOGY CATEGORY:OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

- To elucidate the technologies used for generation and utilization of power from renewable energy resources.

UNIT - I SOLAR ENERGY (9)

Solar radiation, solar spectra-latitude and longitude, Declination angle, solar window, cosine law, seasonal variations, hour angle, calculation of angle of incidence, angstroms equation and constants, Photo voltaic: p-n junctions. Solar cells, PV systems, Standalone, Grid connected solar power - Types of solar thermal collectors – Flat and concentrating collectors, solar thermal applications -water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation.

UNIT - II WIND ENERGY (9)

Wind energy - Basic principle of wind energy conversion system, wind data and energy estimation, site selection, components of wind energy conversion systems, design consideration of horizontal axis wind mill- merits and limitations- application

UNIT - III BIOMASS ENERGY (9)

Biomass, sources of biomass, thermo-chemical and bio-chemical conversion of biomass - Pyrolysis, gasification, combustion and fermentation. Gasifiers – Up draft, downdraft and fluidized bed gasifier. Digesters - Fixed and floating digester biogas plants, economics of biomass power generation.

UNIT - IV OCEAN AND GEOTHERMAL ENERGY (9)

Ocean energy resources - Principles of ocean thermal energy conversion systems - ocean thermal power plants - Principles of ocean wave energy conversion and tidal energy conversion - Difference between tidal and wave power generation, Economics of OTEC.

Definition and classification of Geothermal resources, Utilization for electricity generation and direct heating, Wellhead power generating units. Overview of micro and mini hydel power generation

UNIT - V RENEWABLE ENERGY POLICIES (9)

Renewable energy policies - Feed-in tariffs, portfolio standards, policy targets, tax incentives, and biofuels mandates. International policies for climate change and energy security. Economic analysis and comparisons, Life cycle analysis, financial analysis, cost of conserved energy, and externalities. Cost assessment of supply technologies versus energy - Efficiency.

CONTACT PERIODS:

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

Text Books:

*1. Rao. S. and Dr. Pamlekar B.B, **"Energy Technology",** Khanna Publishers, Second Ed. 1997*

*2. Pai and Ramaprasad, **"Power Generation through Renewal sources",** Tata McGraw Hill – 1991*

Reference Books:

*1. Rai , G.D., "**NonConventional sources of Energy**", Khanna Publishers , IV Ed.,2009*

*2. Bansal NK, Kleeman and Meliss, M "**Renewable Energy Sources and Conversion Techniques**", Tata McGraw Hill, 1996*

*3. Roland Wengenmayr, Thomas Buhrke, **"Renewable energy: Sustainable energy concepts for the future"**, Wiley-VCH, 1st edition, 2008.*

COURSE OUTCOME:

CO1: Realize the need for utilizing the energy from clean and Sustainable energy resources.
CO2: Describe the principles of operation of the broad spectrum of renewable energy Technologies
CO3: Analyze energy technologies from a systems perspective.
CO4: Articulate the technical challenges for each of the renewable sources
CO5: Create solutions for alternate energy issues
CO6: Discuss economic, technical and sustainability issues involved in the integration of renewable energy systems

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	2	2	-	-	1	1	1	3	2	2
CO2	3	3	2	2	2	2	2	1	-	1	1	1	3	3	3
CO3	3	2	2	2	2	2	2	2	-	-	1	1	2	3	3
CO4	2	3	2	1	2	3	2	2	-	1	1	1	3	3	3
CO5	2	3	3	3	2	2	2	2	-	1	1	1	2	3	2
CO6	3	2	2	2	2	2	2	-	3	3	1	1	2	3	2
16EOEX11	3	3	2	2	2	2	2	2	1	1	1	1	3	3	3

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16EOEX12 **SMART GRID TECHNOLOGY** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

* To gain knowledge on the fundamentals of smart grid technologies, its architecture and its managements. Also the students should learn many of the challenges facing the smart grid as part of its evolution.

UNIT - I SMARTGRIDS: MOTIVATION, STAKES AND PERSPECTIVES (9)

Introduction – Information and Communication technologies serving the electrical system – Integration of advanced technologies – Definitions of SmartGrids – Objectives addressed by the SmartGrid concept – Socio-economic and environmental objectives – Stakeholders involved the implementation of the Smart Grid concept – Research and scientific aspects of the Smart Grid – SmartGrids from the customer's point of view.

UNIT - II INFORMATION AND COMMUNICATION TECHNOLOGY (9)

Data Communication, Dedicated and shared communication channels, Layered architecture and protocols, Communication technology for smart grids, standards for information Exchange, Information security for the smart grid - Cyber Security Standards - IEEE1686 - IEC62351.

UNIT - III SENSING AND MEASUREMENT (9)

Synchro Phasor Technology – Phasor Measurement Unit, Smart metering and demand side integration - Communication infrastructure and protocol for smart metering – Data Concentrator, Meter Data Management System. Demand side Integration – Services, Implementation and Hardware Support of DSI.

UNIT - IV CONTROL AND AUTOMATION (9)

Distribution automation equipment – Substation automation equipments: current transformer, potential transformer, Intelligent Electronic Devices, Bay controller, Remote Terminal Unit. Distribution management systems – SCADA: modeling and analysis tools, applications

UNIT- V REGULATION OF SMARTGRIDS AND ENERGY STORAGE SYSTEMS (9)

Regulation and Economic models – Evolution of the value chain – The emergence of a business model for smart grids – Regulation can assist in the emergence of SmartGrids – The standardization of SmartGrids - Energy Storage Technologies-Methods - Batteries, Flow Battery, Fuel Cell and Hydrogen Electrolyser, Flywheel, Super-Conducting magnetic energy storage system, Super Capacitor.

CONTACT PERIODS:

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

Text Books:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, ***"Smart Grid Technologies and applications",*** *John Wiley Publishers Ltd., 2012*

2. Nouredine Hadjsaid, JeanClaude Sabonnadiere, ***"Smart Grids****", Wiley Publishers Ltd., 2012*

3. Lars T. Berger, Krzysztof Iniewski, ***"Smart Grid applications, Communications and Security",*** *John Wiley Publishers Ltd., 2012*

Reference Books :

1. *Yang Xiao,* ***"Communication and Networking in Smart Grids",*** *CRC Press Taylor and Francis Group, Aug 2012.*
2. *Caitlin G. Elsworth,* ***"The Smart Grid and Electric Power Transmission",*** *Nova Science Publishers Inc, Aug 2010*

COURSE OUTCOME:

CO1: Develop and demonstrate the various aspects of the smart grid, including Technologies, Components, Architectures, Applications

CO2: Design a smart grid and to meet the needs of a utility, including Meeting a utility's objectives, helping to adopt new technologies into the grid

CO3: Creating a framework for knowledgeable power engineers to operate the grid more effectively

CO4: Transfer the available information from any part of the power system to centralized control centre.

CO5: Handle the smart meter, sensors and intelligent devices to measure the electrical quantity.

CO6: Control the Electrical quantity from remote place

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	1	1	2	3	1	2	2	2	3	2	3	2
CO2	1	1	2	2	2	2	2	1	2	2	2	2	2	2	3
CO3	-	-	-	2	2	2	2	2	2	2	2	3	2	2	2
CO4	1	-	-	2	2	2	3	-	2	2	2	3	2	3	3
CO5	2	-	1	2	2	2	2	-	2	2	2	2	2	2	2
CO6	1	1	2	1	2	2	1	-	2	2	2	2	2	2	2
16EOEX12	1	1	2	2	2	2	2	1	2	2	2	3	2	2	2

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16LOEX13 PRINCIPLES OF COMMUNICATION CATEGORY:OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To understand the concepts of analog communication
- To gain the fundamental knowledge of digital communication
- To be familiar with the fundamentals of satellite and optical communication

UNIT- I AMPLITUDE MODULATION (9)

Introduction to communication systems- Electromagnetic spectrum - Principle of amplitude modulation − AM envelope − frequency spectrum and bandwidth − modulation index and percentage of modulation − AM power distribution –AM generation and-detection – square law modulator- envelope detector.

UNIT - II ANGLE MODULATION (9)

Frequency modulation and phase modulation - FM and PM waveforms − phase deviation and modulation index − frequency deviation and percentage of modulation − Frequency analysis of angle modulated waves- Bandwidth requirements for Angle modulated waves – generation and detection of FM – Armstrong modulator- Foster Seely Discriminator.

UNIT - III PULSE MODULATION (9)

Sampling and Quantization – Pulse Amplitude modulation- Pulse width modulation –Pulse position modulation- Pulse code modulation- PCM transmitter and receiver - Signal to Quantization noise ratio – Differential Pulse Code Modulation − Delta modulation − Adaptive Delta modulation

UNIT - IV DIGITAL COMMUNICATION (9)

Introduction – ASK, FSK, PSK- transmitter and receiver – QPSK transmitter and receiver – M ary PSK – Error probability in PSK, FSK.

UNIT -V SATELLITE AND OPTICAL COMMUNICATION (9)

Satellite Communication Systems-Transmitter and receiver- Kepler's Law – LEO and GEO Orbits – GEO Stationary orbit-–Optical Communication Systems – Transmitter and receiver- Sources and Detectors- Types of Optical Fiber – Losses.

CONTACT PERIODS:

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

Text Books:

1. *Wayne Tomasi*, "***Advanced Electronic Communication Systems",*** 6/e, Pearson Education, 2007.
2. *Simon Haykin, "**Communication Systems**", 4th Edition, John Wiley & Sons., 2008.*

Reference Books:

1. *H.Taub, D L Schilling ,G Saha , "**Principles of Communication**"3/e,2007.*
2. *B.P.Lathi, "**Modern Analog And Digital Communication systems",** 3/e, Oxford University Press, 2007*
3. *Blake, "**Electronic Communication Systems",** Thomson Delmar Publications, 2002.*
4. *B.Sklar, "**Digital Communication Fundamentals and Applications"2/e** Pearson Education 2007.*

COURSE OUTCOMES:

Upon completion of this course, the students will have the :

CO1. Basic knowledge of amplitude modulation systems
CO2. Basic knowledge of angle modulation systems
CO3. Fundamental knowledge of digital communication systems
CO4. Understanding of digital transmission techniques
CO5. Fundamental knowledge of satellite communication system
CO6. Fundamental knowledge of optical communication system

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-
CO2	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-
CO3	2	2	2	-	-	-	-	-	-	-	-	1	1	1	-
CO4	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-
CO5	2	2	2	-	-	-	-	-	-	-	-	1	1	1	-
CO6	2	2	2	-	-	-	-	-	-	-	-	1	2	2	-
16LOEX13	2	2	2	-	-	-	-	-	-	-	-	1	2	1	-

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16LOEX14 MICROCONTROLLERS AND ITS APPLICATIONS CATEGORY:OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To gain knowledge on basics of microcontrollers
- To get exposure to programming of microcontroller 8051
- To acquire knowledge on interfacing of peripherals with 8051 and PIC microcontrollers
- To get exposure on applications of microcontrollers

UNIT - I INTRODUCTION TO MICROCONTROLLER (9)

Microprocessors and Microcontrollers – CISC and RISC - Fundamentals of Assembly language Programming – Instruction to Assembler – C Programming for Microcontrollers – Compiler and IDE – Introduction to Embedded systems - Architecture 8051 family - PIC 18FXXX – family – Memory organization

UNIT - II PROGRAMMING OF 8051 MICROCONTROLLER (9)

Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication of 8051.

UNIT - III PROGRAMMING OF PIC18FXXX MICROCONTROLLER (9)

Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication, CCP, ECCP PWM programming of PIC18FXXX.

UNIT - IV PERIPHERAL INTERFACING (9)

Interfacing of Relays, Memory, key board, Displays – Alphanumeric and Graphic, RTC, ADC and DAC, Stepper motors and DC Motors, I^2C, SPI with 8051 and PIC family.

UNIT - V MICROCONTROLLER APPLICATIONS (9)

Pulse measurement-measuring frequency, pulse width measurement -Speed control of DC Motor-Speed control of Stepper Motor-Traffic Light Controller and Washing Machine Controller.

CONTACT PERIODS:

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

Text Books:

1. Kenneth J.Ayala., **"The 8051 Microcontroller",** 3rd Edition, Thompson Delmar Learning, 2007, New Delhi.

2. John B. Peatman, "**PIC programming"**, McGraw Hill International, USA, 2005.

Reference Books*:*

1.Muhammad Ali Mazidi and Janice GillispicMazdi, "**The 8051 Microcontroller and Embedded Systems**" Pearson Education, Inc 2006.

2.John B. Peatman, "**Design with Micro controllers"**, McGraw Hill International, USA, 2005

3.James W. Stewart, **"The 8051 Micro controller hardware, software and interfacing**", regents Prentice Hall, 2003.

4.David Calcutt, Fred Cowan, Hassan Parchizadeh, "**8051 Microcontroller An Application Based Introduction"**, Elsevier Publication, 1st edition,2004.

5.Krishna Kant, "**Microprocessor and Microcontrollers**" Eastern company edition, Prentice Hall of India, New Delhi, 2007.

COURSE OUTCOMES:

Upon completion of this course the student will:

CO 1: Acquire knowledge on the basics of microcontroller
CO 2: Exposure to 8051 microcontroller Programming
CO 3: Exposure to PIC microcontroller Programming
CO 4: Able to interface peripherals with microcontrollers
CO 5: Get exposure to the applications of microcontrollers
CO 6: Able to design microcontroller based systems

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	-	-	-	-	-	-	-	-	1	1	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	2	2	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	2	2	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	2	2	2	-
CO5	2	3	2	-	-	-	-	-	-	-	-	2	2	2	-
CO6	3	3	3	-	-	-	-	-	-	-	-	2	3	3	-
16LOEX14	3	3	2	-	-	-	-	-	-	-	-	2	2	2	-

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16NOEX15 **INDUSTRIAL AUTOMATION SYSTEMS** **CATEGORY: OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES

- To elaborate the basic concept of automation and the components required for automation.
- To introduce the concept and programming of programmable logic controllers and distributed control system which is used for process automation.
- To outline the basic concepts of SCADA technology.

UNIT - I INTRODUCTION TO AUTOMATION (9)

Automation overview – requirement of automation systems – architecture of industrial automation system – power supplies and isolators –relays – switches –transducers – sensors –seal-in circuits – industrial bus systems : modbus and profibus.

UNIT - II AUTOMATION COMPONENTS (9)

Sensors for temperature – pressure – force – displacement - speed – flow- level – humidity and pH measurement. Actuators – process control valves – power electronic drives DIAC- TRIAC – power MOSFET – IGBT. Introduction to DC and AC servo drives for motion control

UNIT- III PROGRAMMABLE LOGIC CONTROLLERS (9)

PLC Hardware – PLC programming – ladder diagram – sequential flow chart – PLC communication and networking – PLC selection – PLC installation – Advantages – Application of PLC to process control industries and Robotics.

UNIT - IV DISTRIBUTED CONTROL SYSTEM (DCS) (9)

Overview of DCS – DCS hardware – DCS software configuration – DCS communication – DCS supervisory computer tasks – DCS integration with PLC and Computers

UNIT - V SCADA (9)

Introduction - Supervisory Control and Data Acquisition Systems (SCADA) – SCADA HMI Essentials – SCADA Components – SCADA Configuration and Software – HMI hardware and software.

CONTACT PERIODS:

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

Text Books

1. *John.W. Webb Ronald A Reis, "**Programmable Logic Controllers - Principles and Applications**", Prentice Hall Inc., 5th Edition, 2003.*
2. *M. P. Lukcas, "**Distributed Control Systems",** Van Nostrand Reinhold Co., 1986.*

Reference Books

1. Bela G Liptak, ***"Process software and digital networks – Volume 3",*** 4th Edition, CRC press, 2012.
2. Frank D. Petruzella, "***Programmable Logic Controllers***", 5th Edition, McGraw Hill, 2016.
3. Huges T, "***Programmable Logic Controllers***", ISA press, 1994
4. Romily Bowden, *"**HART application guide and the OSI communication foundation**",* 1999
5. Krishna Kant, "***Computer Based Industrial Control***" Second edition, Prentice Hall of India, New Delhi, 2010

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

CO1: Elaborate the basic architecture of automation systems
CO2: Describe the various sensors and actuators involved in industrial automation
CO3: Construct ladder logic diagram using PLC basic functions, timer and counter functions for simple applications
CO4: Illustrate the functionary components and supervisory control of DCS with relevant diagrams.
CO5: Describe the basics of SCADA technology

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	1	1	1	3	1	2	1	1	3	1	1
CO2	3	3	3	3	1	1	1	3	1	2	1	1	3	1	1
CO3	3	3	2	2	1	1	2	3	1	2	1	1	3	1	1
CO4	3	3	3	3	1	1	1	3	1	2	1	1	3	1	1
CO5	3	3	2	2	2	1	1	3	1	2	1	1	3	1	1
16NOEX15	3	3	2	2	1	1	1	3	1	2	1	1	3	1	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16NOEX16 MEASUREMENTS AND INSTRUMENTATION CATEGORY:OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES

- To study about the electrical parameter measuring instruments.
- To familiarize about the measurement techniques for power and energy.
- To gain knowledge about potentiometer and instrument transformers.
- To learn about the working of different analog and digital instruments.
- To study about display and recording devices.

UNIT - I MEASUREMENT OF ELECTRICAL PARAMETERS (9)

Types of ammeters and voltmeters: PMMC Instruments, Moving Iron Instruments, Dynamometer type Instruments – Resistance measurement: Wheatstone bridge, Kelvin double bridge and Direct deflection methods. Measurement of Inductance: Maxwell-Wien Bridge, Hay's bridge and Anderson Bridge - Measurement of Capacitance: Schering Bridge.

UNIT - II POWER AND ENERGY MEASUREMENTS (9)

Electro-dynamic type wattmeter: Theory and its errors – LPF wattmeter – Phantom loading – Single phase Induction type energy meter – 3 phase induction energy meter and phase measurement– Calibration of wattmeter and Energy meters – Synchroscope.

UNIT - III POTENTIOMETERS AND INSTRUMENT TRANSFORMERS (9)

D.C. Potentiometers: Student type potentiometer, Precision potentiometer – A.C. Potentiometers: Polar and Coordinate types – Applications – Instrument Transformer: Construction and theory of Current Transformers and Potential Transformers.

UNIT - IV ANALOG AND DIGITAL INSTRUMENTS (9)

Wave analyzers – Signal and function generators – Distortion factor meter – Q meter – Digital voltmeter and multi-meter – Microprocessor based DMM with auto ranging and self diagnostic features – Frequency measurement.

UNIT - V DISPLAY AND RECORDING DEVICES (9)

Cathode ray oscilloscope: Classification, Sampling and storage scopes – LED, LCD and dot matrix displays – X-Y recorders – Magnetic tape recorders –Digital Data Recording –Digital memory waveform recorder – Data loggers.

CONTACT PERIODS:

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

Text Books

1.Kalsi. H.S, "***Electronic Instrumentation***", Tata McGraw-Hill, New Delhi, 2010

2.Sawhney.A.K, "***A Course in Electrical & Electronic Measurements & Instrumentation***", Dhanpat Rai and Co., New Delhi, 2010

Reference Books

1.Northrop. R.B, *"**Introduction to Instrumentation and Measurements**",* Taylor & Francis, New Delhi, 2008.

2.Carr.J.J, *"**Elements of Electronic Instrumentation and Measurement**",* Pearson Education India, New Delhi, 2011.

3.David A.Bell, *"**Electronic Instrumentation and Measurements**",* PHI, New Delhi.

4.Copper. W.D and Hlefrick.. A.D, "***Modern Electronic Instrumentation and Measurement Technique"*** 5th Edition, Prentice Hall of India, 2002.

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

CO1: Compare the working principles, merits and demerits of different types of electrical instruments and can understand about different instruments that are used for Measurement purpose.
CO2: Understand how different bridge networks are constructed and balanced for finding the values of resistance, capacitance and inductance.
CO3: Apply knowledge of electronic instrumentation for measurement of electrical quantities.
CO4: Apply the principles and practices for instrument design and development to real world problems.
CO5: Select a suitable measuring instrument for a given application.
CO6: Pursue higher studies and do research activities in the field of measurement and instrumentation.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	3	2	3	2	1	3	2	3	3	3	2	3
CO2	3	2	2	2	3	3	3	2	3	1	3	3	3	3	2
CO3	3	3	2	3	2	3	2	1	3	2	3	3	3	3	3
CO4	3	3	2	3	2	3	2	1	3	2	3	3	3	2	3
CO5	3	3	2	3	2	3	2	1	3	2	3	3	3	2	2
CO6	3	3	2	3	2	3	2	1	3	2	3	3	2	3	2
16NOEX16	3	3	2	3	2	3	2	1	3	2	3	3	3	3	3

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16SOEX17 **ENTERPRISE JAVA** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES

Upon completion of this course, the students will be familiar with:

- Basic programming constructs in java to develop simple object oriented programs
- Enterprise Architecture types and features of Java EE platform
- JEE foundation concepts like Enterprise java bean, JSP and JSF
- Distributed Programs and methods to connect with database.
- Java Web services

UNIT- I INTRODUCTION TO JAVA (9)

Introduction to object oriented programming-Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input/Output – Files – Utility Classes – String Handling – Networking –Applet class – Event Handling.

UNIT -II INTRODUCTION TO ENTERPRISE JAVA (9)

Challenges of Enterprise application Development - Platform for enterprise Solutions – J2EE Application Scenario - J2EE Platform Technologies –J2EE Multi-Tier Architecture - J2EE Architecture Approaches - Model-View-Controller Architecture - J2EE Design Patterns - Designing the Sample Application - Choosing Application Tiers - Choosing Local or Distributed Architecture - Architecture of the Sample Application

UNIT- III ENTERPRISE JAVA FOUNDATION (9)

Enterprise Java Beans -Business Logic and Business Objects. - Enterprise Beans as J2EE Business Objects - Entity Beans - Session Beans - Message-Driven Beans -Transaction support in EJB- Security support in EJB –Java Server Pages - Directive Elements - Scripting Elements - Action Elements-Expression Language-JSP Standard Tag Library - Java Server Page Online Store – Java Server Faces - Life Cycle - Resource Management.

UNIT -IV INTERCONNECTIVITY (9)

Concept of JDBC – JDBC Driver types- Database Connection – Associating JDBC Bridge with the database – Statement Objects –Result set – Transaction Processing – RMI- Network File-Locking Server -Java Mail API and Java Activation Framework – send ,receive, retrieve and delete email message - Java Message Service – JMS Fundamentals –Components of a JMS program -JMS architecture –JMS-Based Alarm System - JNDI – Naming and Directories – Naming Operations

UNIT -V WEB SERVICES (9)

SOAP Basics – Java API for XML Messaging – Creating a SOAP Attachment – Accessing a SOAP Attachment – Universal Description, Discovery and Integration (UDDI)- UDDI Architecture – UDDI Application Programming Interface – Inquiry Application Programming Interface – Publishing Application Programming Interface –JAXR – JAXR client – Publishing a service to an XML Registry – Removing a published service from an XML Registry- WSDL – Inside WSDL- WSDL and SOAP - RESTFul Web services – REST Approach - Java API for RESTful Web service.

CONTACT PERIODS:

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

Text Books

1.Herbert Schildt, "**Java The Complete Reference**" , 9th Edition. Tata McGraw- Hill Edition. 2014.

2.Stephen Asbury and Scott R. Weiner "**Developing Java Enterprise Applications",** second edition Wiley Publishing.1999.

3.Antonio Goncalves "**Beginning Java™ EE 6 Platform with GlassFish™ 3 From Novice to Professional**" Apress 2009.

4.Jim Keogh, "**The Complete Reference J2EE** " ,Tata McGraw –Hill 2002

Reference Books

1.John Brock,Arun Gupta,GeertjanWielenga "**Java Server Programming Java EE 7 (J2EE 1.7) - Black Book**" McGraw Hill, 2015.

2.Inderjeet Singh, Beth Stearns, Mark Johnson, and the Enterprise Team "**Designing Enterprise Applications with the J2EE™ Platform**", Second Edition Addison Wesley, 2002.

COURSE OUTCOMES

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

CO1: Write simple java programs using fundamental concepts of java like control structures, inheritance, packages,interfaces,multithreaded programming and exception handling**. [Usage]**

CO2: Write java program for Networking using applets**.[Usage]**

CO3: Describe and use the client/server and distributed architectures in a programming environment**. [Usage]**

CO4: Use EJB, JSP and JFC technology in developing enterprise applications **[Usage]**

CO5: Apply Java interconnectivity techniques like JDBC, RMI, Java Mail, JMS, JNDI in developing enterprise applications**. [Usage]**

CO6: Explain the roles XML, JAXR, SOAP, WSDL and UDDI in the architecture of Web services **[Familiarity]**

CO7: Develop java program to use RESTful web services **[Assessment**].

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	1	2	-	-	-	-	1	-	-	-	1	-	-	-	-
CO2	1	1	2	1	3	-	-	1	-	-	-	1	1	3	-	1
CO3	1	1	2	1	3	-	-	1	-	-	-	2	1	3	3	1
CO4	1	1	2	1	3	1	1	1	1	1	1	2	1	3	3	1
CO5	1	1	2	1	3	-	-	1	-	-	-	2	1	3	-	1
CO6	-	1	1	-	-	-	-	-	-	-	-	1	-	3	3	3
CO7	1	1	1	1	3	-	-	1	1	1	1	2	1	3	3	3
16SOEX17	1	1	2	1	3	1	1	1	1	1	1	2	1	3	3	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16SOEX18 **CYBER SECURITY** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- Cybercrime and cyber offenses.
- Cybercrime using mobile devices.
- Tools and methods used in cybercrime.
- Legal perspectives of cybercrime.
- Fundamentals of computer forensics.

UNIT- I INTRODUCTION TO CYBERCRIME AND CYBEROFFENSES (9)

Cybercrime and Information Security - Classifications of Cybercrimes - The Legal Perspectives - Cybercrime and the Indian ITA 2000 - A Global Perspective on Cybercrimes - Plan of Attacks - Social Engineering – Cyberstalking - Cybercafe and Cybercrimes – Botnets - Attack Vector.

UNIT- II CYBERCRIME: MOBILE AND WIRELESS DEVICES (9)

Proliferation of Mobile and Wireless Devices - Trends in Mobility - Credit Card Frauds in Mobile and Wireless Computing Era – Security challenges posed by mobile devices – registry setting for mobile devices – authentication service security – attacks on mobile/cell phones – Organizational measures for handling mobiles.

UNIT -III TOOLS AND METHODS USED IN CYBERCRIME (9)

Proxy Servers and Anonymizers – Phishing - Password Cracking – Keyloggers – Spywares -Virus and Worms - Trojan Horses and Backdoors – Steganography - DoS and DDoS Attacks - SQL Injection - Attacks on Wireless Networks.

UNIT -IV CYBERCRIMES AND CYBERSECURITY: THE LEGAL PERSPECTIVES (9)

Cyberlaws- The Indian Context - The Indian IT Act - Challenges to Indian Law and Cybercrime Scenario in India - Consequences of Not Addressing the Weakness in Information Technology Act - Digital Signatures and the Indian IT Act - Amendments to the Indian IT Act - Cybercrime and Punishment.

UNIT -V UNDERSTANDING COMPUTER FORENSICS (9)

Digital Forensics - Forensics Analysis of E-Mail - Network Forensics - Forensics and Steganography - Forensics and Social Networking Sites - Challenges in Computer Forensics - Data Privacy Issues – Forensics Auditing – Antiforensics

CONTACT PERIODS:

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

Text Book

1.Nina Godbole and Sunit Belapur, **"Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives"**, Wiley India Publications, April, 2011

Reference Books

1.Robert Jones, **"Internet Forensics: Using Digital Evidence to Solve Computer Crime",** O'Reilly Media, October, 2005.

2.Chad Steel, **"Windows Forensics: The field guide for conducting corporate computer investigations"**, Wiley India Publications, December, 2006.

COURSE OUTCOMES:

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

CO1: Explain the fundamental concepts of cybercrime and cyberoffenses. **[Familiarity]**

CO2:Describe the cybercrimes occurred in mobile and wireless devices. **[Familiarity]**

CO3:Elaborate the methods used in cybercrime. **[Familiarity]**

CO4:Explain the laws for cybercrime and its respective punishments. **[Familiarity]**

CO5:Explain the forensics Analysis of E-Mail, Network and Social Networking Sites **[Familiarity]**

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	1	1	2	1	3	-	-	-	-	-	1	1	1	3	1
CO2	1	1	1	2	1	3	-	-	-	-	-	1	1	1	3	1
CO3	1	1	1	2	1	3	-	-	-	-	-	1	1	1	3	1
CO4	1	1	1	2	1	3	-	-	-	-	-	1	1	1	3	1
CO5	1	1	1	2	1	3	-	-	-	-	-	1	1	1	3	1
16SOEX18	1	1	1	2	1	3	-	-	-	-	-	1	1	1	3	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16SOEX19 **NETWORK ESSENTIALS** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- Basic taxonomy and terminology of the computer networking
- Wireless networking
- Addressing and Routing
- Routing protocols
- Troubleshooting and security issues.

UNIT -I INTRODUCTION (9)

Introduction to Computer Networks - Goals and advantages of Computer Networks - Network Topologies – Basic networking devices – Protocols – the need for a layered architecture - The OSI Model and the TCP/IP reference model – the Ethernet LAN – Home Networking – Assembling an office LAN – Testing and Troubleshooting a LAN – Physical layer cabling: Twisted pair and Fiber optics

UNIT -II WIRELESS NETWORKING (9)

Importance of Wireless Networking – IEEE 802.11 Wireless LANs – Bluetooth- WIMAX – RFIDs – Securing the Wireless LANs – Configuring a Point to Multipoint Wireless LAN – Interconnecting network LANs – Switch, Bridges and Routers. Interconnecting LANs with the router, Configuring the network interface-Auto negotiation.

UNIT -III ADDRESSING AND ROUTING FUNDAMENTALS (9)

IPv4 and IPv6 addressing – Subnet masks – CIDR blocks – configuration of a router – Console port connection - user EXEC mode – Privileged EXEC mode - Configuration of a switch – Static VLAN configuration - Spanning Tree protocol – Network Management – Power over Ethernet.

UNIT- IV ROUTING PROTOCOLS (9)

Static Vs Dynamic Routing Protocols – Distance vector Routing – Link State Routing – Hybrid Routing – Configuring RIP - Network Services – DHCP , DNS - Analyzing Internet Traffic.

UNIT -V TROUBLE SHOOTING AND NETWORK SECURITY (9)

Analyzing Computer Networks – FTP data packets – Analyzing Campus Network data traffic – Troubleshooting the router and switch interface, Troubleshooting fiber optics – Intrusion – DOS – Security software and hardware.

CONTACT PERIODS:

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

Text Books

1.Jeffrey S.Beasley Piyasat Nilkaew, "**Network Essentials**", 3rd Edition, Pearson, 2012.

2.Larry L. Peterson and Bruce S. Davie, "**Computer Networks, A Systems Approach**", Morgan Kaufmann Publishers Inc, 5th edition 2011.

Reference Books

1.Behrouz A.Ferouzan, **"Data Communications and Networking"**, 5th edition, Tata McGraw-Hill, 2012.

2.Andrew S. Tanenbaum, "**Computer networks**"s, PHI, 5th edition 2011.

3.William Stallings, "**Data and computer communication**", 10th edition, Pearson Education, 2013.

COURSE OUTCOMES

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

- **CO1:** Identify topologies and types of Computer Networks **[Familiarity]**
- **CO2:** Enumerate the layers of the OSI model and TCP/IP and Explain the functions of each layer **[Familiarity]**
- **CO3:** Identify and Compare types of cabling for data communication **[Usage]**
- **CO4:** Explain the significance of wireless networks **[Familiarity]**
- **CO5:** Configure a Wireless LAN **[Assessment]**
- **CO6:** Configure router and a switch **[Assessment]**
- **CO7:** Describe basic routing algorithms and network services. **[Usage]**
- **CO8:** Troubleshoot the router and switch interface **[Usage]**
- **CO9:** Analyze Campus Network data traffic **[Usage]**

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	3	3	3	3	-	-	-	3	3	3	3	2	3	3	2
CO2	3	3	3	3	3	-	-	-	3	3	3	3	2	3	3	2
CO3	1	1	1	1	3	-	-	-	1	1	1	3	2	3	3	2
CO4	1	3	2	-	3	-	-	-	3	2	1	3	1	3	3	1
CO5	3	3	3	2	3	-	-	-	3	3	2	3	2	3	3	2
CO6	3	3	3	2	3	-	-	-	3	2	1	3	2	3	3	2
CO7	3	3	3	3	3	-	-	-	3	3	2	3	2	3	3	2
CO8	3	3	3	2	3	-	-	-	3	2	1	3	2	3	3	2
CO9	3	3	3	2	3	-	-	-	3	3	2	3	2	3	3	2
16SOEX19	3	3	3	2	3	-	-	-	3	3	1	3	2	3	3	2

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16IOEX20 **PROGRAMMING IN PYTHON** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course the students will be Familiar with:

- Data types and variables declaration
- Control statements, Functions and the use of basic programming.
- List, dictionary and functions used in python.
- File and Exception handling.
- Object oriented programming and GUI development.

UNIT -I INTRODUCTION (9)

Introduction to Python - Setting up Python in OS – Python IDLE(write- edit- run- and save programs) – Strings - Numbers – Variables – simple I/O - Getting user input– Using String method–Converting values.

UNIT -II CONTROL STATEMENTS AND FUNCTIONS (9)

Control statements – Random number generator- Branching and loops – Range functions- Functions – User defined functions- passing parameters- return function- working with global variables and constants.

UNIT -III LISTS AND DICTIONARIES (9)

Lists – create- index- slice a list- Add and delete elements from a list- Append- Sort and reverse a list- nested sequences- Dictionaries – Create- add- delete from a Dictionary- Operations associated with pairs of data.

UNIT -IV FILES AND EXCEPTIONS (9)

Files – Read from text files- Write to text files- Read and write more complex data- Exceptions – Intercept and handle errors during program's execution.

UNIT -V OBJECT ORIENTED PROGRAMMING AND GUI (9)

Object oriented programming – Create objects of different classes in the same program- objects communication- complex object creation- derive new classes- existing class extension- override method- GUI – GUI toolkit- create and fill frames- create buttons- text entries and text boxes- create check buttons and radio buttons - case study – create a web page using GUI functionality

CONTACT PERIODS:

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

Text Books

1.Y. Daniel Liang **"Introduction to Programming Using Python",** Pearson, 2013.

2.Charles Dierbach **"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus"**, Wiley Publications, 2012.

Reference Books

1.Michael Dawson "**Python Programming for the Absolute Beginner"**, Premier Press, 2003.

COURSE OUTCOMES

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

CO1: Use various data types.[**Understand**]

CO2: Handle the arrangement of data elements in Lists and Dictionary structures.[**Analyze**]

CO3: Use control statements and functions. [**Understand**]

CO4: Handle exceptions and perform file operations**. [Understand]**

CO5: Develop application using object oriented programming and GUI. [**Analyze**]

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	1	1	-	1	1	-	-	1	-	1	1
CO2	2	1	-	1	1	-	1	1	-	-	1	-	1	1
CO3	2	2	1	2	1	-	1	1	-	-	1	-	2	1
CO4	2	2	1	2	1	-	2	2	-	-	1	-	2	1
CO5	2	2	1	2	1	-	2	2	-	-	2	1	2	1
16IOEX20	2	2	1	2	1	-	1	1	-	-	1	1	2	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16IOEX21 **BIG DATA SCIENCE** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- Big Data and its characteristics
- Technologies used for Big Data Storage and Analysis
- Mining larger data streams
- Concepts related to Link analysis and handle frequent data sets

UNIT- I THE FUNDAMENTALS OF BIG DATA (9)

Understanding Big Data-Concepts and Technology-Big Data Characteristics-Types of data-Case Study-Business Motivation and Drivers for Big Data Adoption- Planning Considerations-Enterprise Technologies and Big Data Business Intelligence- OLTP-OLAP-Extract Transform Load-Data Warehouses-Data Mart-Traditional and Big Data BI-Case Study

UNIT -II BIG DATA STORAGE AND PROCESSING (9)

Big Data Storage Concepts- Clusters-File systems and Distributed File Systems-NoSQL- Sharding - Replication -Sharding and Replication-CAP Theorem-ACID-BASE-Case Study- Big Data Processing Concepts- Parallel Data Processing-Distributed Data Processing-Hadoop-Processing Workloads-Cluster-Processing in Batch mode-Processing in RealTime mode-Case study

UNIT -III BIG DATA STORAGE AND ANALYSIS TECHNOLOGY (9)

Big Data Storage Technology: On-Disk Storage devices-NoSQL Databases-In-Memory Storage Devices-Case study, Big Data Analysis Techniques: Quantitative Analysis-Qualitative Analysis-Data Mining-Statistical Analysis-Machine Learning-Semantic Analysis-Visual Analysis-Case Study

UNIT -IV MINING DATA STREAMS (9)

The stream data model – Sampling data streams – counting distinct elements in a stream – Estimating moments. Finding similar items – Applications of nearest neighbor search – shingling of documents - similarity preservation – locality sensitive hashing- distance measures – methods for high degree similarity.

UNIT -V LINK ANALYSIS AND FREQUENT ITEMSETS (9)

Link analysis – Page rank – Efficient computation of a page rank – topic sensitive page rank – link spam –Frequent datasets – the market basket model – A-Priori algorithm – handling larger datasets in main memory –limited pass algorithm – counting frequent items in a stream

CONTACT PERIODS:

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

Text Books

1.Thomas Erl, WajidKhattak, and Paul Buhler, "**Big Data Fundamentals Concepts, Drivers & Techniques"**, Prentice Hall,2015

2.Anand Rajaraman and Jeffrey David Ullman, **"Mining of Massive Datasets**", Cambridge University Press, 2012.

Reference Books

1.Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, **"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data"**, McGraw Hill, 2011.
2.Frank J Ohlhorst, **"Big Data Analytics: Turning Big Data into Big Money",** Wiley and SAS Business Series, 2012.
3.Brian W. Kernighan and Dennis Ritchie, **"The C Programming Language",** Second Edition, Prentice Hall Software Series, 1988.
4.Stephen Prata, **"C Primer Plus**", Fifth Edition, Sams Publishing, 2005.

COURSE OUTCOMES

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

CO1: Understand the Big Data and usage in Enterprise Technologies. [Understand]
CO2: Store and Process Big Data using suitable Processing Methods[Understand]
CO3: Handle Big Data using appropriate analysis Techniques. [Analyse]
CO4: Mine larger data streams using suitable algorithms. [Understand]
CO5: Rank pages and handle large data sets efficiently [Analyse]

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	1	3	1	-	-	-	-	-	-	3	1
CO2	2	-	-	-	3	-	-	1	-	-	-	-	2	1
CO3	-	3	-	-	3	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	2	-	-	-	-	-	-	-	3	-
CO5	1	2	3	-	-	-	-	-	-	-	-	-	3	-
16IOEX21	2	3	2	1	3	1	-	1	-	-	-	-	3	1

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16IOEX22 OBJECT ORIENTED PROGRAMMING USING C++ CATEGORY:OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- Fundamentals of object oriented programming
- Classes and objects
- Concepts of overloading and type conversions
- Inheritance and Polymorphisms
- Files, templates and exception handling

UNIT -I PRINCIPLES OF OBJECT ORIENTED PROGRAMMING (9)

Basic concepts- benefits – applications of object oriented programming – beginning with C++ - tokens – expressions and control structures – C++ stream classes – Formatted and Unformatted I/O operations. Managing output with manipulators.

UNIT -II CLASSES AND OBJECTS (9)

Introduction – specifying class – defining member functions – memory allocation constructors and destructors:- parameterized- copy – default -dynamic and multiple constructors – destructors

UNIT -III FUNCTIONS AND TYPE CONVERSIONS (9)

Introduction – function prototyping call by reference – return by reference – inline function – recursion – friend function – function overloading – operator overloading – manipulation of strings using operators – type conversions

UNIT -IV INHERITANCE AND POLYMORPHISM (9)

Defining derived classes – single, multiple, multilevel, hierarchical and hybrid inheritance – virtual base classes – abstract base classes – nesting of classes - pointers – pointers to objects – this pointer – pointers to derived classes – virtual functions – pure virtual functions virtual constructors and destructors.

UNIT -V FILES AND TEMPLATES (9)

Classes for file stream operations – opening and closing a file – detecting EOF – open file modes – file pointers and their manipulations – sequential I/O operations – updating and error handling of file. Class and function template – template with multiple parameters – overloading, member function and non-type template arguments-Exception handling.

CONTACT PERIODS:

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

Text Books

1.E.Balagurusamy **"Object oriented Programming with C++"** McGraw Hill Education Ltd,6th Edition 2013.

Reference Books

1.R.Rajaram **"Object Oriented Programming and C++"** New Age International 2nd edition , 2013
2.K.R. Venugopal,Rajkumar,T. Ravishankar **"Mastering C++"** , Tata McGraw Hill Education,2nd edition, 2013
3.Yashavant P. Kanetkar**" Let us C++"** BPB Publications , 2nd edition 2003.

COURSE OUTCOMES

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

CO1: Understand the principles of object oriented programming [Understand]
CO2: Develop programs using classes and objects.[Analyze]
CO3: Use functions and type conversions in programs. [Understand]
CO4: Apply inheritance and polymorphism to develop applications. [Analyze]
CO5: Use files, templates and handle exceptions. [Understand]

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	2	2	-	2	2	-	-	2	-	2	2
CO2	2	3	3	3	2	-	2	2	-	-	2	-	3	2
CO3	2	3	3	3	2	-	2	2	-	-	2	-	3	2
CO4	2	3	3	3	2	1	2	2	-	-	2	-	3	2
CO5	2	3	3	3	2	-	2	2	-	-	2	-	3	2
16IOEX22	2	3	3	3	2	1	2	2	-	-	2	-	3	2

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16BOEX23 **COMPUTATIONAL BIOLOGY** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- Understand the basic concepts and role of computation in biological analysis
- Familiarize with sequence alignment methods
- Understand the machine learning tools used for biological analysis

UNIT -I BASICS OF BIOLOGY (9)

Biomolecules of life: Structure and Composition of DNA, RNA & Protein. Protein Structure basics-Primary, Secondary and tertiary Structure of protein

UNIT -II BIOLOGICAL DATABASES (9)

Concept of Relational database, Data archiving, Data mining, Primary databases-NCBI, EMBL, DDBJ; Structure databases-PDB

UNIT -III SEQUENCE ANALYSIS (9)

Pairwise alignment tools-Dot matrix analysis, Dynamic programming-Smith waterman and Needleman wunsch algorithm, Heuristic methods- BLAST, FASTA; Multiple sequence alignment methods-Progressive alignment(Clustal)

UNIT -IV STRUCTURE ANALYSIS AND DRUG DESIGN (9)

Protein secondary prediction-Chou fasman method, GOR method; Tertiary structure prediction-Homology modelling, Introduction to Computer aided drug design.

UNIT -V MACHINE LEARNING (9)

Genetic Algorithm, Neural networks, Artificial Intelligence, Hidden markov model -application in bioinformatics

CONTACT PERIODS:

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

Text Books

1.David W. Mount, **"Bioinformatics: Sequence and Genome Analysis"**, Cold Spring Harbor Laboratory Press, Second Edition, 2004.

2.Arthur M. Lesk, **"Introduction to Bioinformatics",** Oxford University Press, 2008.

3.Pierre Baldi, Soren Brunak , **"Bioinformatics: The machine learning approach"** MIT Press, 2001

Reference Books

1.Andrew R. Leach, "**Molecular Modeling Principles And Applications",** Second Edition, Prentice Hall, 2001.

2.Baxevanis A.D. and Oullette, B.F.F, **"A Practical Guide to the Analysis of Genes and Proteins",** 2nd ed., John Wiley, 2002

3.David L. Nelson ,Michael M. Cox , **"Lehninger Principles of Biochemistry"**, Sixth edition, Freeman, W. H. & Co. Publisher, 2012.

COURSE OUTCOMES

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

CO1: Understand basic structure of Biological macromolecules
CO2: Acquire the knowledge of biological databases
CO3: Ability to perform pair wise and multiple sequence alignment
CO4: Ability to predict the secondary and tertiary structure of proteins.
CO5: Understand the machine learning approaches in computational biology

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1	-	1	-	-	2	-	-	-	2	-	-
CO2	2	1	1	1	-	-	-	-	1	-	-	1	1	-	-
CO3	1	-	1	-	-	2	-	-	1	-	-	1	-	2	-
CO4	2	2	1	2	2	-	-	-	-	-	-	-	1	1	-
CO5	-	2	-	3	3	2	1	-	2	-	-	-	1	2	-
16BOEX23	2	2	1	1	3	2	1	-	2	-	-	1	1	2	-

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16BOEX24 **BIOLOGY FOR ENGINEERS** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

To enable the students

- To understand the basic functions of the cell and their mechanisms in transport process
- To get familiarize human anatomy and physiology
- To learn about microbes, immune system and biomolecules
- To know the concepts of applied biology

UNIT -I BASICS OF CELL BIOLOGY (9)

An Overview of cells – Origin and evolution of cells. Cell theory, Classification of cells – prokaryotic cells and eukaryotic cells. Structure of prokaryotic and eukaryotic cells and their organelles. Comparison of prokaryotic and eukaryotic cells, Transport across membranes – diffusion - active and passive diffusion.

UNIT -II BASICS OF MICROBIOLOGY (9)

Classification of microorganism, Microscopic examination of microorganisms, Structural organization and multiplication of bacteria, viruses, algae and fungi, Microorganism used for the production of penicillin, alcohol and vitamin B-12.

UNIT- III HUMAN ANATOMY AND PHYSIOLOGY (9)

Basics of human anatomy, tissues of the human body: epithelial, connective, nervous and muscular, Nervous system, Respiratory System, Circulatory system and Digestive system.

UNIT- IV BIO MOLECULES AND IMMUNE SYSTEM (9)

Introduction to Biochemistry, Classification, structure and properties of carbohydrates, proteins, lipids and nucleic acids. Innate and acquired immunity, Types of immune responses.

UNIT -V APPLIED BIOLOGY FOR ENGINEERS (9)

Overview of biosensors- glucometer applications-medicine, Microarray analysis to diagnose the cancer, Microbial production of biofuels, Applications of stem cells.

CONTACT PERIODS:

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

Text Books

1.Darnell J, Lodish H, Baltimore D, **"Molecular Cell Biology",** W.H.Freeman; 8th edition,2016

2.Pelczar MJ, Chan ECS and KreinNR**, "Microbiology"**, Tata McGraw Hill, 5th edition, New Delhi.2001.

3.WulfCruger and Anneliese Cruger, **"A Textbook of Industrial Microbiology"**, Panima Publishing Corporation, 2nd Edition, 2000.

Reference Books

1.David L. Nelson and Michael M Cox, **"Lehninger's Principles of Biochemistry"**, Macmillan Worth Publisher, 4th edition, 2004.

2.Brain R.Eggins ,**"Chemical Sensors and Biosensors"**, John Wiley & Sons, 2002

3.Anton Moser, **"Bioprocess Technology, Kinetics and Reactors"** Springer, Berlin (Verlag),1998

4.Kuby J, **"Immunology"**, WH Freeman & Co., 2000.

COURSE OUTCOMES

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

CO1:Understand the functions of cell and their structural organization
CO2:Describe the mechanisms and role of cell in immune system
CO3:Get familiarized biomolecules and human anatomy system
CO4:Illustrate the applications of microbes in industrial process
CO5:Apply the engineering concepts in biology

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	-	1	2	-	1	-	1	2	1	1	1	-
CO2	1	-	1	1	1	2	2	-	1	1	1	1	1	1	-
CO3	1	1	-	-	1	1	1	1	1	-	1	1	1	1	-
CO4	1	-	1	-	1	-	-	1	-	1	1	1	1	2	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16BOEX24	1	1	1	1	1	2	2	1	1	1	1	1	1	1	-

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16BOEX25 FUNDAMENTALS OF BIOENGINEERING CATEGORY:OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- To make the students aware of the overall industrial bioprocess.
- To understand the basic configuration and parts of a fermentor.
- To study the production of primary and secondary metabolites.
- To understand the production of modern biotechnology products.

UNIT - I INTRODUCTION TO INDUSTRIAL BIOPROCESS (9)

Fermentation - Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology - A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess.

UNIT - II FERMENTATION INDUSTRY (9)

Overview of fermentation industry, Basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes. Types of fermentation – Solid state, submerged, batch, continuous, fed batch fermentation methods.

UNIT - III PRODUCTION OF PRIMARY METABOLITES (9)

A brief outline of processes for the production of some commercially important organic acids - Citric acid, lactic acid ,acetic acid; amino acids - glutamic acid, phenylalanine; ethanol.

UNIT - IV PRODUCTION OF SECONDARY METABOLITES (9)

Study of production processes for various classes of secondary metabolites: Antibiotics: beta lactams – penicillin and cephalosporin; aminoglycosides – streptomycin; macrolides - erythromycin, vitamin - B9, B12

UNIT - V PRODUCTS THROUGH MODERN BIOTECHNIQUES (9)

Production of industrial enzymes - proteases, amylases, lipases; Production of single cell protein from wastes; biopreservatives – Bacterosin; biopolymers - xanthan gum and PHA. Industrial uses of enzymes in detergents, beverage and food.

CONTACT PERIODS:

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

Text Books

1.Peter F. Stanbury, Stephen J. Hall & A. Whitaker, **"Principles of Fermentation Technology"**, Science & Technology Books. 1995.

2.Presscott, S.C. and Cecil G. Dunn, **"Industrial Microbiology"**, Agrobios (India), 2005.

3.Casida, L.E. **"Industrial Microbiology"**, New Age International (P) Ltd, 1968.

Reference Books

1.Crueger, W and Anneliese Crueger, Biotechnology: **"A Textbook of Industrial Microbiology"**, Panima Publishing Corporation, Edition 2, 2003

2.Sathyanarayana, U., **"Biotechnology"**, Books and Allied (P) Ltd. Kolkata, 2005

3.Ratledge C and Kristiansen B. **"Basic Biotechnology"**, Cambridge University Press, second Edition, 2001.

4.Michael J. Waites. **"Industrial Microbiology:** An Introduction**"**, Blackwell Publishing, 2001.

COURSE OUTCOMES

CO1: Upon completion of the course in Bioprocess Principles graduates will be able to understand the basics of industrial bioprocess.

CO2: Explain the principle of a fermentation process and the chronological development of fermentation industry.

CO3: Understand the basic configuration of a fermentor and its ancillaries.

CO4: Learn the production of various primary and secondary metabolites.

CO5: Understand the production of biotechnological products.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	2	2	-	1	3	-	-	-	-	3	-
CO4	3	1	1	-	-	1	-	1	-	-	-	-	-	3	-
CO5	3	2	3	1	2	-	-	1	-	-	-	-	-	3	-
16BOEX25	3	3	3	2	2	2	-	1	1	-	-	-	1	3	-

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16LOC1Z1 **HUMAN VALUES I** **CATEGORY : OC**

(Common to all branches)

L T P C

1 0 0 1

PREREQUISITES: Nil

COURSE OBJECTIVES:

- Essential complementarily between 'values' and 'skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- The development of a Holistic perspective among students towards life, profession and happiness based on a correct understanding of the Human reality and the rest of existence, which forms the basis of Value based living in a natural way.
- The plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with nature.

UNIT I: **INTRODUCTION TO VALUE EDUCATION** **(5)Periods**

Introduction- Need, Basic Guidance, Content and Process for Value Education- Basic human Aspirations – Prosperity and happiness – Methods to fullfill human aspirations - Understanding and living in harmony at various levels.

UNIT II: **HARMONY IN THE HUMAN BEING** **(5)Periods**

Coexistence – Happiness and convenience – Appraisal of Physical needs – Mental and Physical health – Human relationship – Mutual Trust and Respect.

UNIT III: **ETHICS** **(5)Periods**

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue – Caring – Sharing - honesty- Courage – Empathy – Self Confidence -Ethical Human Conduct- Basis for humanistic Education, Constitution and universal order – Competence in professional ethics – Strategy for transition from the present state to Universal human order.

TOTAL NUMBER OF PERIODS **(15)Periods**

CONTACT PERIODS:

Lecture: 15 periods Tutorial: 0 periods Practical: 0 periods Total:15 periods

Text Books

1.R.R. Gaur, R. Singal, G.P. Bangaria**,"Foundation Course in Human Values and Professional Ethics"**, 2009Excel Book Private Ltd., New Delhi.

Reference Books

1.S. K. Chakraborty and Dabangshu Chakraborty, **"Human Values and Ethics: Achieving Holistic Excellence"**, ICFAI University Press, 2006.

2.A.N. Tripathy, **"Human Values"**, New Age International publishers, 2003.

3.M. Govindarajan, S. Natarajan and V.S. Senthil kumar, **"Engineering Ethics(including human values)"**, Eastern Economy Edition, Printice Hall of India Ltd., 2004.

4.E.G. Seebauer and Rober. L. Berry, **"Fundamentals of Ethics for Scientists and Engineers"**, Oxford University Press, 2000.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

CO1: Start exploring themselves, get comfortable to each other and to the teacher and start finding the need and relevance for the course.

CO2: See that their practice in living is not in harmony with their natural acceptance most of the time and able to refer to their natural acceptance to remove this disharmony.

CO3: Aware of their activities like understanding, desire,thought and selection and start finding their focus of attention at different moments.

CO4: Able to see that respect is right evaluation and only right evaluation leads to fulfillment in relationship.

CO5: Develop an understanding of the whole existence and interconnectedness in nature.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO2	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO3	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO4	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO5	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
16LOC1Z1	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3

1-LOW 2-MODERATE(MEDIUM) 3-HIGH

16LOCX02 HUMAN VALUES AND PROFESSIONAL ETHICS CATEGORY : OC

(Common to all branches) L T P C

1 0 0 1

PREREQUISITES: Nil

COURSE OBJECTIVES:

- Engineering Ethics and Human Values
- Social responsibility of an Engineer
- Ethical dilemma while discharging duties in Professional life.

UNIT I: ENGINEERING ETHICS (5) Periods

Senses of Engineering Ethics -variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's Theory – Gilligen's Theory – Consensus and contraversy – Models of Professional roles – theories about right actions – Self interest – customs and religion – uses of ethical theories – Valuing time-cooperation-commitment.

UNIT II: ENGINEERING AS SOCIAL EXPERIMENTATION (5) Periods

Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – the challenger case study - engineers as managers – consulting engineers - Moral leadership.

UNIT III: SAFETY, RESPONSIBLITIES, RIGHTS AND GLOBAL ISSUES (5) Periods

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – the three mile island and chernobyl case studies – Environmental ethics – computer ethics – weapons development – Multinational corporations – engineers as expert witnesses and advisors.

TOTAL NUMBER OF PERIODS (15)Periods

CONTACT PERIODS:

Lecture: 15 periods Tutorial: 0 periods Practical: 0 periods Total:15 periods

Text Books

1.Mike Martin and Roland Schinzinger, **"Ethics in Engineering"**, McGraw Hill, New York,1996.

2.M. Govindarajan,S. Natarajan and V.S. Senthil kumar, **"Engineering Ethics (including human values)"**, Eastern Economy Edition, Printice Hall of India Ltd., 2004.

Reference Books

1.Charles D.Fleddermann, **"Engineering Ethics"**, Pearson Education, 2004.

2.Edmund G Seebauer and Robert L. Berry, **"Fundamentals of Ethics for Scientists and Engineers"**, 2001, Oxford University Press.

3.Charles E. Harris, Michael S. Protchard and Michael J. Rabins, **"Engineering Ethics – Concepts and Cases"**, Thomson Learning, 2000.

4.John R. Boatright, **"Ethics and Conduct of Business",** Pearson Education,2003.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

CO1: Understand and appreciate Human values, exhibit self confidence and develop good character

CO2: Sense engineering ethics, professional roles and valuing time, co-operation and commitment

CO3: Understand and practise code of ethics.

CO4: Assess safety and risk and capable of doing risk benefit analysis.

CO5: Develop and exhibit moral leadership qualities in exercising Engineering Consultations without compromising envionmental, legal and ethical issues

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO2	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO3	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO4	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
CO5	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3
16LOCX02	-	-	2	-	-	3	3	3	1	-	-	-	-	-	3

1-LOW 2-MODERATE (MEDIUM) 3-HIGH

16LOCX03 YOGA FOR YOUTH EMPOWERMENT CATEGORY : OC

L	T	P	C
1	0	0	1

PREREQUISITES: **NIL**

***COURSE OBJECTIVES*:**

- **To familiarize with the various yoga**
- **To impart the knowledge asanas.**
- **To be able to analyse the benefit of yoga.**

UNIT I ASTANGA YOGA 5

Yama – Niyama – Pratipaksha Bhavanam - Aaasana: Meditative and Cultural. Pranayama – Benefits of Pranayama, Nadishuddi and Pranayama, Duration and time for Pranayama practice, Gradation of Pranayama, Yukta and Ayukta Pranayama, Nadishuddi.

UNIT II ASANAS 5

Tadasana – Trikonasana- Ekpadasana – Utkatasana – Pratnasana – Bujangasana – Chakrasana – Vajrasana – Sukasana – Savasana.

UNIT III KRIYA 5

Kriyas - Satkiriya – Neti, Dhauti, Basti, Nauli, Trataka – Jalneti – Sutraneti – Vamandauti – trataka – Kaphabhati – Moolashoodna.

TOTAL:15 PERIODS

Text Books

1. Taimini, I.K, **"Glimpses into the Psychology of Yoga",** Theosophical Publishing House, 1973.

Reference Books:

1. Iyankar B.K.S **"The path to Holistic Health",** Dorling kindusly Pvt Ltd, London, 2014

***COURSE OUTCOMES*:**

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

CO1: enable the student to have good health.
CO2: practice mental hygiene
CO3: possess emotional stability

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01							3						1
CO2							2						1
C03						1	2						1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX04 **SCIENCE OF CREATIVITY** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: **NIL**

***COURSE OBJECTIVES*:**

- To understand the neurology of creativity and creativity in physics
- To apply the creativity in engineering education

***UNIT* – I NEUROLOGY OF CREATIVITY AND ENHANCEMENT** **5**

Creativity: Definitions and Overview –Temporal lobes – Frontal Lobes – IQ Neurotransmitters - Limbic System and Creativity – Neurobiological model – Enhancing Creativity –Breaking down the big problem – developing own scientific creativity

UNIT-II CREATIVITY IN THEORETICAL PHYSICS AND CHEMISTRY **5**

Introduction - Focus on the essential to reveal the universal - Follow the equations -Analogies to develop radically new equations - Chemists and creativity - A model for in-class research experiences

UNIT-III CREATIVE ENGINEERING DESIGN: THE MEANING OF CREATIVITY AND INNOVATION IN ENGINEERING **5**

Introduction -Creativity needed in engineering design -Importance of creativity and innovation for engineers beginning in education -Creativity and meta-cognitive abilities in engineering education - Central themes specific to engineering creativity - Measurement needs for engineering creativity - Engineering creativity measures -Creative engineering design measure -Current measurement contributions - Validity - Engineering Measures - Importance of Creative Engineering Design to STEM - Creativity for increasing enrollment in STEM.

TOTAL:15 HOURS

Text Books:

1.Christine Charyton - "Creativity and Innovation among Science and Art",Springer, 2015.

Reference Books:

1. R. Keith Sawyer, "Explaining Creativity: The Science of Human Innovation", 2nd Edition, Oxford, 2014.

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have/ able to:

CO1 : Exposure to neurology of creativity and enhancement

CO2: Knowledge on creativity in theoretical physics

CO3: Creativity in engineering design

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-
C03	1	3	2	3	3	3	2	2	1	1	1	1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX05 **PERSONAL LEADERSHIP** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- This course enables the students to develop skills for personal leadership.

UNIT I INTRODUCTION

Meaning of personal leadership – Benefits of personal leadership – Aspects of effective leadership - How to find leadership - Find your Motivation - Follow your Mantra - Follow your Values - Reach your Goals - Continually Learn and Grow - Build Long-Term Relationships.

UNIT – II SKILLS AND STRATEGIES

Skill developments for practice of leadership - Traditional concepts of effective leadership - Current strategies for success in a personal business environment, and develop a personal plan to cultivate a durable, effective, personal leadership model.

UNIT – III BELIEFS, BEHAVIORS AND TOOLS

Goals and Goal Setting – Beliefs – Mental models, Growth Vs Fixed Orientation, Optimism. Behaviors – Ingredients for growth, Handling disruptive emotions, Tapping intuition. Tools – Solitude, Affirmation and Visualization, Meditation.

TOTAL:15 PERIODS

Text Books:

1. *Weiss, Joseph W. (2011) An Introduction to Leadership Diego: Bridgepoint Education, Inc.*

***Reference Books**:*

1. *Loehr& Schwartz, "ThePower of Full Engagement", Free Press 2003.*
2. *Orlick, "In Pursuit of Excellence", (4th Edition) 2008***.**

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have:

CO1: Knowledge on meaning and benefits of personal leadership.
CO2: Exposure to develop skill for practice of leadership
CO3: Knowledge on beliefs, behaviors and tools for personal leadership

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01							3								1
CO2							2								1
C03						1	2								1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX06 **SCRIPTING LANGUAGES** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: **NIL**

***COURSE OBJECTIVES*:**

- To introduce the basics of scripting languages
- To give an exposure in programming the PERL language.
- To give an exposure in programming the TCL and PYTHON languages.

UNIT - I INTRODUCTION

Scripts and Programs – Origin of Scripting – Characteristics of Scripting Languages –Uses of Scripting Languages – Web Scripting – Practical Extraction and Reporting Language(PERL)- Names and Values – Variables – Scalar Expressions – Control Structures, arrays, list, hashes, strings, pattern and regular expressions – subroutines.

UNIT – II ADVANCED PERL

Finer points of looping – pack and unpack – file system – data structures, packages, modules, objects, interfacing to the operating system – Creating Internet ware applications – Dirty Hands Internet Programming – security Issues.

UNIT – III TOOL COMMAND LANGUAGE(TCL) AND PYTHON

TCL Structure – syntax – Variables and Data in TCL –Advanced TCL –Nuts and Bolts – Internet Programming – Security Issues – C Interface – Tool kit(TK) – Visual Tool Kits – Fundamental Concepts of TK – Events and Binding – Introduction to Python language: syntax, statements, functions, Built-in-functions and Methods, Modules in python – Exception Handling – Integrated Web Applications in Python Systems – Web Application Framework.

TOTAL: 15 HOURS

Text Books:

1. *David Barron, "The World of Scripting Languages", Wiley Publications,2000.*
2. *Steve Holden and David Beazley, "Python Web Programming", New Riders Publications,2002.*

***Reference Books**:*

1. *M.Lutz, "Programming Python", Fourth edition, O'Reilly media,2010.*
2. *Larry Wall, T.Christiansen and J.Orwant, "Programming Perl", Fourth edition ,O'Reilly,2012.*
3. *Ousterhout, "Tcl and the Tk Tool kit", Pearson Education, 2009.*

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have:

CO1: An exposure to the scripting languages.

CO2: The ability to design and implement the scripting languages like PERL and python.

CO3: Gained knowledge in TCL programming and web based applications.

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	3	3	3	3	-	-	-	-	-	3	-
C03	-	-	-	-	3	3	3	3	-	-	-	-	-	3	-

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX07 **SOCIAL WORK** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: **NIL**

***COURSE OBJECTIVES*:**

- To understand the objectives, theoretical foundations and methods of social work .
- To imbibe the principles, values and ethics of professional social work.
- To impart the Social Work Education in India

Social Work

Definition, objectives and functions – Historical development of social work in India- Contexts of social work practice – Concepts related to social work – Social service, Social welfare, Social reform, Social policy, Social security, Social justice and Social development.

Theories of Social Work

Ecological Systems Theory, Psychodynamic Theory, Social Learning Theory, Anti-oppressive social work, Strengths perspective, Radical social work, Task centred approach and Gandhian Theory.

Social Work as a Profession

Philosophy, values, principles and code of ethics of professional social work – Knowledge and Skills base of social work – Tenets of the social work profession. Social Work Education in India – Evolution, Nature and content of social work education – Fieldwork.

TOTAL:15 PERIODS

Text books:

1.Chowdhry, Paul. (1992). *Introduction to social work*. New Delhi: Atma Ram and Sons

2. Bhattacharya, Sanjay. (2008). *Social work psycho-social and health aspects*. New Delhi: Deep and Deep Publications.

Reference books:

1. Compton Beulah R. (1980). *Introduction to social welfare and social work*. Illinois: The Dosery Press.

2. Cox, David and Manohar Pawar. (2006). *International social work*. New Delhi: Vistar Publications.

3. Dasguta, S. (1967). *Towards a philosophy of Social Work in India*. New Delhi: Popular Book Services

4. Desai, Murali. (2002). *Ideologies and social work (Historical and Contemporary Analysis)*, Jaipur : Rawat Publications.

5. Dubois, Brenda, Krogsrud, Karla, Micky - Third Edition. (1999). *Social work - An empowering profession.* London : Allyn and Bacon.

***COURSE OUTCOMES*:**

Upon completion of the course, the students will have:

CO1: An understanding on the concept, objectives, functions of social work

CO2: Understanding on the theoretical foundations and methods of social work.

CO3: In-depth understanding of social work education and field work practicum.

***COURSE ARTICULATION MATRIX*:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1						1	2			3	2	1
CO2			2						1	2			3	2	1
CO3			1						1	2			2	3	1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX08 ANDROID APPLICATION DEVELOPMENT CATEGORY : OC

L	T	P	C
1	0	0	1

PREREQUISITES: NIL

***COURSE OBJECTIVES*:**

- To introduce the basic Android tools.
- To provide conceptual understanding about the Android software development.
- To make the students, explore the Android applications.

ANDROID TOOLS AND BASICS

Android Software Development Kit(SDK) and Prerequisites – Components of SDK – Java type system – Idioms of Java programming – Ingredients of android application: Activities, Intents and tasks – Android application run time environment.

ANDROID SOFTWARE DEVELOPMENT

Eclipse concept and Terminology – Eclipse views and Perspectives – Java coding in Eclipse – Eclipse and Android – The Android framework – Serialization – Android GUI architecture – Fragments and Multiplatform support – Drawing 2D and 3D Graphics.

ANDROID APPLICATION

Framework for well-behaved application – Content providers – Exploring content providers – Multimedia: Playing and Recording of Audio and Video – Near Field Communication(NFC): Reading a tag, Writing to a tag, P2P mode – Gesture input.

TOTAL: 15 HOURS

Text Book:

1. *Zigurd Mednieks, Laird Dornin, G.Blake Meike, Masumi Nakamura, "Programming Android", O'Reilly media, 2nd edition, 2012.*

***References*:**

1. *Jonathan stark, Brian Jepson, Brian macdonald, "Building android apps with HTML,CSS and Java script", o'Reilly media 2010.*
2. *Marko Gargenta, "Learning Android", O'Reilly media,2nd edition 2014.*
3. *Wei-meng Lee, "Android application development cook book", Wrox, 2012.*

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have:

CO1: Acquired knowledge about the basics of Android tools.

CO2: Acquired knowledge about Android software development.

CO3: Gained knowledge about the Android applications.

***COURSE ARTICULATION MATRIX*:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	-	-	-	3	3	3	2	2	2	-	-	-	2	-
C02	-	3	-	-	3	3	-	-	-	-	-	-	-	2	-
CO3	-	-	-	-	3	3	3	3	-	-	-	-	-	3	-

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX09 **WEB DESIGNING** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- To introduce the concepts in Core Java.
- To illustrate the concepts in web designing.
- To provide conceptual understanding of server site programming.

UNIT - I INTRODUCTION TO CORE JAVA

Core JAVA- Operator, Data type, Variable, Arrays, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Event handling, Introduction to Abstract Windowing Toolkit (AWT), AWT controls, Layout managers.

UNIT – II WEB PAGE DESIGNING

HTML: List, Table, Images, Frames, Forms, CSS, Document Type Definition(DTD), XML: DTD, XML schemes, Object Models, presenting and using XML, Using XML Processors: Document Object Model(DOM) and SAX, Dynamic HTML.

UNIT – III SERVER SITE PROGRAMMING

Introduction to Active Server Pages (ASP), Introduction to Java Server Page (JSP), JSP Application Design, JSP objects, Conditional Processing, Declaring variables and methods, Sharing data between JSP pages, Sharing Session and Application Data, Database Programming using JDBC, development of java beans in JSP.

TOTAL: 15 HOURS

Text Books:

1. *Xavier, C, " Web Technology and Design" , New Age International,2013.*
2. *Margaret Levine Young, "The Complete Reference Internet", TMH ,2nd edition,2002.*

***References*:**

1. *Deitel, "Java for programmers", Pearson Education, 2nd edition,2011.*
2. *Jessica Burdman, "Collaborative Web Development", Addison Wesley publications,1999.*
3. *Horstmann, "CoreJava", Addison Wesley,2015.*
4. *Bhave, "Programming with Java", Pearson Education, 2008*

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have:

CO1: An introduction to core java and web development strategies

CO2: Acquired knowledge about the web page designing.

CO3: A depth knowledge in server site programming.

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	2	-	-	-	3	1	1	1	-	-	-	-	-	3	-
CO2	-	-	-	-	3	2	2	2	-	-	-	-	-	3	-
C03	-	-	-	-	3	1	1	1	-	-	-	-	-	3	-

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX10 **LONG TERM EVALUATION** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: **NIL**

***COURSE OBJECTIVES*:**

- To have knowledge on LTE network architecture and protocols.
- To understand the concepts of Transport Channel Processing
- To acquire knowledge on scheduling ,resource allocation, data flow and mobility management

OVERVIEW AND CHANNEL STRUCTURE OF LTE

Evolution of mobile broad band-Demand drivers for LTE-key requirements of LTE design-key enabling technologies and features of LTE-LTE network architecture-spectrum and migration plan for LTE-Radio interface protocols-Hierarchical channel structure of LTE-downlink OFDMA radio resources-uplink SC-FDMA radio resources.

TRANSPORT CHANNEL PROCESSING

Downlink Transport Channel Processing overview-down link shared channels-downlink control channels-broad cast channels-multicast channels-downlink physical signals-uplink Transport Channel Processing overview - Up link shared channels-uplink control information-uplink reference channels-random access channels-H-ARQ in downlink and uplink.

DATA FLOW ,RADIO RESOURCE MANAGEMENT AND MOBILITY MANAGEMENT

Scheduling and resource allocation- scheduling for VoIP-PDCP-MAC/RLC-Mobility management-Intercell interference coordination.

TOTAL:15 PERIODS

Text Books

1. Arunabha Ghosh, Jun Zhang , Jeffrey G. Andrews , Rias Muhamed "Fundamentals of LTE " 1st Edition by Prentice Hall
2. Christopher Cox "An Introduction to LTE: LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications " 2nd Edition

Reference Books

1. Erik Dahlman , Stefan Parkvall , Johan Skold "4G: LTE/LTE-Advanced for Mobile Broadband" 1st Edition
2. Chris Johnson "Long Term Evolution IN BULLETS", 2nd Edition
3. Martin Sauter "From GSM to LTE-Advanced: An Introduction to Mobile Networks and Mobile Broadband" 2nd Edition
4. Stefania Sesia ,Issam Toufik , Matthew Baker "LTE - The UMTS Long Term Evolution: From Theory to Practice " 2nd Edition

***COURSE OUTCOMES*:**

Upon completion of the course, the students will have:

CO1 : An in-depth knowledge on LTE network architecture and protocols
CO2 :An understanding of Downlink Transport and Uplink Transport Channel Processing
CO3: An exposure to data flow and mobility management

***COURSE ARTICULATION MATRIX*:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2			3					3	3	2	1
CO2	1	2	1	2			1					3	3	2	1
CO3	1	1	3	2			3					3	2	3	1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX11 **AVIONICS** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: **Nil**

***COURSE OBJECTIVES*:**

- To understand the basics of Avionics and Navigation systems
- To gain knowledge on Satellite navigation systems and Auto piloting

UNIT I INTRODUCTION **(5)**

Aircraft- Axes system - Parts - Importance and role of Avionics - System Interface with pilot - Aircraft state sensor systems - Navigation systems - External world sensor systems - Task automation systems. Avionics architecture evolution - Avionics Data buses.

UNIT II NAVIGATION SYSTEMS **(5)**

Radio navigation - Inertial sensors - Gyroscopes, Accelerometers, Inertial navigation systems -Block Diagram - Platform and strap down INS - Satellite Navigation – GPS.

UNIT III AIR DATA SYSTEMS AND AUTOPILOT **(5)**

Air data quantities - Altitude, Airspeed, Mach no., Vertical speed, Total Air temperature, Stall warning, Altitude warning - Autopilot - basic principles - Longitudinal and Lateral autopilot, Virtual cockpit.

TOTAL : 15 HOURS

Text books:

1. Albert Helfrick.D, “Principles of Avionics”, Avionics communications Inc.,2004
2. Collinson,R.P.G, “Introduction to Avionics”,Chapman and Hall,1996.

Reference Books:

1. Middleton,D.H, “Avionics Systems”, Longman Scientific and Technical, Longman Group UK Ltd, England, 1989.
2. Spitzer, C.R. “Digital Avionics Systems”, Prentice Hall, Englewood Cliffs, N.J.,USA 1993.
3. Spitzer, C.R, “The Avionics Handbook”, CR CPress,2000.
4. Pallet, E.H.J, “Aircraft Instruments and Integrated Systems”, Longman Scientific.1996.

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have

CO1 : Basic knowledge on Avionics and Navigation systems
CO 2: Exposure to Radio and Satellite navigation systems
CO 3: Knowledge on Air data systems and Aircraft display

***COURSE ARTICULATION MATRIX*:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
C01	2	2	1	1	1								1	2	
CO2	2	2	1	2									2	2	
CO3	1	3	2	3	1	2							1	1	

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX12 **MACHINE VISION** **CATEGORY : OC**

L	T	P	C
1	0	0	1

***PREREQUISITES:*NIL**

***COURSE OBJECTIVES*:**

- *To impart knowledge of Image processing and Machine Vision concepts*
- *To apply the learned concepts in Industrial applications and Manufacturing Engineering*

UNIT I INTRODUCTION (5)

Nature of Vision - Advantages of Machine vision - Applications of machine vision - Image acquisition principles and Devices - Various lighting techniques - Key stages in Image Processing Techniques.

UNIT II 3D AND DYNAMIC VISION (5)

3D vision basics - Photometric Stereo - Dynamic Vision - Segmentation using Motion and Moving camera Motion.

UNIT III MACHINE VISION APPLICATIONS (5)

CONSIGHT I Vision controlled Robot system - National Bureau of standards vision system - SRI Industrial vision system - Image Processing techniques - Implementation through Image Processing software - MATLAB/OPENCV.

TOTAL:15 HOURS

Text Books:

1. E.R.Davies, "Computer and Machine Vision, Theory, Algorithms and Practicalities", 4th edition, Academic Press, 2013.

***Reference Books**:*

1. Ramesh Jain, Rangachar Kasturi, Brian G. Schunck, MACHINE VISION, McGraw-Hill, Inc., ISBN 0-07-032018-7, 1995.
2. Rafel C.Gonzalez, Richard E.Woods, StevenL.Eddins, "Digital Image Processing using MATLAB", 2nd Edition, Tata McGraw-Hill Education, 2010.

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have

CO1 : Knowledge on Image processing and Machine vision concepts

CO2: Understanding of 3D and Dynamic Vision

CO3: Ability to apply Machine vision algorithms to Real time applications

***COURSE ARTICULATION MATRIX*:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
C01	**2**	**2**	**1**	**3**	**1**								**1**		
C02	**2**	**2**	**1**	**2**									**1**		
C03	**1**	**3**	**1**	**3**	**1**	**2**							1	**2**	

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX13 MILLIMETER WAVE COMMUNICATION CATEGORY : OC

L	T	P	C
1	0	0	1

PREREQUISITES: **NIL**

***COURSE OBJECTIVES*:**

- To learn the millimeter wave characteristics .
- To have in-depth knowledge on Millimeter wave transceivers.
- To study the concepts of Millimeter wave antennas.
- To understand the concepts of Advanced Beam steering and Beam Forming Technology.
- To acquire knowledge on MILLIMETER WAVE MIMO
- To study the Advanced diversity techniques

MILLIMETER WAVE CHARACTERISTICS & TRANSCEIVERS

Millimeter Wave Characteristics - Channel Performance at 60 GHz - Gigabit Wireless Communications Development of Millimeter Wave Standards - Coexistence with Wireless Backhaul

MILLIMETER WAVE TRANSCEIVERS

Millimeter wave transceivers- Millimeter Wave Link Budget - Transceiver Architecture - Transceiver Without Mixer -Receiver Without Local Oscillator - Millimeter Wave Calibration - Research Trend: Transceiver Siliconization .

MILLIMETER WAVE ANTENNAS

Path Loss and Antenna Directivity - Antenna Beam width - Maximum Possible Gain-to-Q - Polarization - Beam Steering Antenna - Millimeter Wave Design Consideration Forming Technology.

TOTAL:15 PERIODS

TEXT BOOK

1.Kao-Cheng Huang, Zhaocheng Wang, "Millimeter wave communication systems",John Wiley & Sons, Hoboken, New Jersey, 2011.

2.Millimeter Wave Wireless Communications by Theodore S. Rappaport, Robert W. Heath Jr., Robert C. Daniels and James N. Murdock 2014

REFERENCES

1.Su-Khiong Yong, Pengfei Xia and Alberto Valdes-Garcia, "60GHz Technology for Gbps WLAN and WPAN: From Theory to Practice", Wiley 2010

2.Jonathan Wells, "Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications",Artech House, 2010.

***COURSE OUTCOMES*:**

Upon completion of the course, the students will have:

CO1 : Knowledge on millimeter wave characteristics

CO2: An in-depth knowledge on Millimeter wave transceivers.

CO3:An Ability to design Millimeter wave antennas

***COURSE ARTICULATION MATRIX*:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2			3					3	3	2	1
CO2	1	2	1	2			1					2	1	2	1
CO3	1	1	3	2			3					3	2	3	1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX14 **TELEMATICS** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- To introduce the basic coding techniques in cellular communication.
- To educate the various protocols in IP telephony.
- To illustrate the concept of digital cellular system.

UNIT - I TELEPHONE SWITCHING

Evolution of telecommunication – Switching system, Dialing mechanism, Electronic switching, Digital switching system, Stored Program Control(SPC) configuration, Architectural features, Centralized and distributed SPC, Enhanced services.

UNIT – II SWITCHING NETWORKS

Single stage and multistage switching network – Blocking probability: Lee's model for three stage – Time division time switching – Combinational switch ST,TS,STS,TST stages – Limitations of conventional mobile telephone system.

UNIT – III DIGITAL CELLULAR SYSTEM AND IP TELEPHONY

GSM – Different call flow sequences in GSM – North American CDMA cellular – VOIP, Low level protocols – RTP/RTCP/UDP – Voice activity detection and discontinuous transmission – IP telephony protocols – H.323 standard – Session Initiation Protocol (SIP) – Gateway location protocol – QoS requirements – Resource reservation protocol architecture.

TOTAL: 15 HOURS

Text Books:

1. *V. S. Bagad, "Telematics" Technical publications, Pune, First edition 2009.*

***References**:*

1. *Rappaport,T.S., "Wireless Communications", Pearson Education, 2nd Edition 2009.*
2. *Simon Haykins & Michael Moher, "Modern Wireless Communications", Pearson Education, 3rd Edition,2007.*
3. *Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.*

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have:

CO1: The ability to understand the basics of telecommunication.

CO2: Acquired knowledge about the concepts of switching networks and telephony.

CO3: Acquired knowledge in the field of digital cellular system and protocols.

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	2	2	2	-	-	-	-	3	-	-
C03	-	-	-	-	3	-	-	-	-	-	-	-	3	-	-

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX15 **E-COMMERCE SECURITY** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES: **Nil**

***COURSE OBJECTIVES*:**

- This course enables the students to get exposed to various threats and issues in e-commerce security and the solutions for them.

UNIT – I INTRODUCTION **5**

Security testing of an online banking service: The online banking system, The attack. Software security analysis – Data Gathering – Preliminary investigation, On-site visit, Analysis – Kickoff meeting, Investigation, Risk mitigation. The e-commerce security environment

UNIT – II ISSUES AND THREATS **5**

Key dimensions of e-commerce security – Computer security – Classification of information assets – Basic security issues – Threats to e-commerce system: Threats to front-end system, back-end system, client-side, service-side and e-commerce transaction. Seven security threats to e-commerce site.

UNIT – III SOLUTIONS FOR SECURITY THREATS **5**

Solutions for e-commerce security system – Solutions for service-side and transaction security - Cryptography and Encryption –Public key cryptography – Digital certificates – Securing channels of communication – Developing an e-commerce security plan.

TOTAL:15 PERIODS

Text Books:

1. *Anup K. Ghosh "E-Commerce Security and Privacy", Springer science + Business Media, LLC, 2012.*
2. *Gordon E. Smith , "Control and Security of E-Commerce", John Wiley & Sons Inc, 2004.*

***Reference Books*:**

1. *Amir Manzoor, "E-Commerce: An Introduction", LAP LAMBERT Academic Publishing,2010.*
2. *Jean D'AmourHabiyaremye and Jules Miller, "E-Commerce Security Threats", GRIN Verlag publisher,2013.*

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have:

CO1: Knowledge on online banking system and its security.
CO2: In-depth knowledge on various issues and threats in security
CO3: Awareness to learn various solutions for security threats

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	1					2							2		
CO2	2						1						2		
C03						3		1					1		1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX16 SIMULATION TECHNIQUES CATEGORY : OC

L	T	P	C
1	0	0	1

PREREQUISITES: **Nil**

***COURSE OBJECTIVES*:**

- To introduce discrete-event simulation techniques, statistical analysis and random number generation
- To model real-world systems, implement the model as a computer program

UNIT I DISCRETE-EVENT SYSTEM SIMULATION 5

Simulation - Simulation of Queueing Systems - General Principles - Concepts in Discrete-event Simulation – List Processing -Simulation Software(open source)

UNIT II STATISTICAL MODELS AND ANALYSIS OF SIMULATION DATA 5

Statistical Models in Simulation – Useful Statistical Models – Discrete and Continues Distributions – Poison Process - Queueing Models- Characteristics - Simulating queuing models –Verification and Validation of Simulation Models –Calibrationof models

UNIT III RANDOM NUMBERS 5

Random-Number Generation –Techniques for Generation – Tests - Random-Variate Generation – Inverse Transform Technique – Acceptance-Rejection Technique – Special Properties.

TOTAL:15 HOURS

Text Books:

1. Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol"Discrete-Event System Simulation", 5th Edition, Prentice Hall, 2010
2. B.W. Kernighan and D.M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall, 2012

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have/able to:

CO1 : Understand discrete-event simulation techniques, statistical analysis and random number generation

CO2: Model real-world systems

CO3: Implement the model as a computer program

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	1	-	-	-	-	-	-	-	-	-	-
CO2	1	3		2	1	2	1	1	-	-	1	-
C03	-	2	1	1	2	3	-	-	3	-	2	1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX17 **CLOUD COMPUTING** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES:

- **COMPUTER COMMUNICATION**

***COURSE OBJECTIVES*:**

- To learn about the concept of cloud and utility computing.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.

UNIT I CLOUD COMPUTING AND VIRTUALIZATION **5**

Introduction to Cloud Computing –Evolution of Cloud Computing –Cloud Characteristics - Basics of Virtualization- Implementation levels of Virtualization- Virtualization structures- Tools and mechanisms- Virtualization of CPU – Memory – I/O Devices – Desktop Virtualization – Server Virtualization

UNIT II CLOUD INFRASTRUCTURES **5**

Service Oriented Architecture — NIST Cloud Computing Reference Architecture – laaS – PaaS – SaaS – Types of Clouds – Cloud Storage –Design Challenges in Cloud – Peer-to-Peer Architecture.

UNIT III PROGRAMMING MODELS **5**

Parallel and Distributed programming Paradigms – MapReduce – Hadoop – Mapping Applications – Google App Engine – Amazon AWS – Cloud Software Environments –Eucalyptus – Open Nebula – Open Stack- Cloud Security Overwiew.

TOTAL:15 PERIODS

Text Books:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach‖, Tata McGraw-Hill Education Pvt. Ltd.,1st Edition,2009

***Reference Books**:*

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 1st Edition, 2005.
2. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi ,"Mastering Cloud Computing‖", Mcgraw Hill, 1st Edition,2013.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 1st Edition, 2009.

***COURSE OUTCOMES*:**

Upon completion of the course, the students will have:

CO1: Ability to understand the cloud computing and Virtualization

CO2: Ability to Identify the architecture, infrastructure and delivery models of cloud computing

CO3: Ability to understand the Cloud Programming Models

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	1	2		1									3	1	1
CO2	1	2	2	1									3	1	1
C03	2	2	2	1	1								3	2	1

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH

16LOCX18 **DESIGN OF POWER SUPPLIES** **CATEGORY : OC**

L	T	P	C
1	0	0	1

PREREQUISITES:

- Electronic Devices

***COURSE OBJECTIVES*:**

- This course enables the students to learn the various blocks of power supply and protection circuits. It also helps them to gain practical knowledge in designing power supplies for a particular specification.

UNIT – I RECTIFIERS AND FILTERS

Design of power supply: Typical specifications, Concept of ideal power supply and Voltage regulation, Rectifier and filter design, Unregulated power supply with rectifiers and filters.

UNIT – II VOLTAGE REGULATORS

Basic shunt regulator design, Series pass transistorized regulator, Variable output voltage regulator, Overload protection circuits for regulators - Heat-sink selection - Three terminal IC regulator, Design examples of ICbased power supplies.

UNIT – III SMPS AND CASE STUDY

Switched Mode Power Supply: Types, operation, waveforms and design, transformer design for power supplies, small signal analysis of DC-DC converters and closed loop control.

Case study - Design of 5V DC power supply. Simulation and experimentation.

TOTAL:15 PERIODS

Text Books:

1. *S.Salivahanan, N.Sureshkumar and A.Vallavaraj, "**Electronic Devices and Circuits**", 2nd Edition,Tata McGrawHill, 2008.*
2. *Allen Mottershead "**Electronic Devices and Circuits**", Prentice Hall of India, 2008.*

***Reference Books**:*

1. *www.ti.com/lit/ml/slup224/slup224.pdf*

***COURSE OUTCOMES*:**

Upon completion of this course, the students will have:

CO1: An ability to use appropriate rectifiers and filters for a particular scenario.
CO2: Exposure to different types of voltage regulators.
CO3: Practical exposure to design of power supply with simulation and experimentation

***COURSE ARTICULATION MATRIX*:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3												2		
CO2	2		1	2									2		
C03	2												2		

1 - LOW 2 – MODERATE (MEDIUM) 3 – HIGH