GOVERNMENT COLLEGE OF ENGINEERING, BARGUR

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(ACCREDITED BY NBA)

U.G. - FULLTIME B.E. CURRICULEUM & SYLLABI (REGULATIONS – 2017)



GOVERNMENT COLLEGE OF ENGINEERING, BARGUR

Krishnagiri - 635104, Tamil Nadu Phone No: 04343 266 067 Website: <u>www.gcebargur.ac.in</u>

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR DEPARTMENT OF ECE

VISION OF THE INSTITUTE

To provide world class engineers who are ethical and good citizens of our motherland

MISSION OF THE INSTITUTE

To groom the student community through learner centric quality lectures, laboratories, Library and value added training.

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR DEPARTMENT OF ECE

VISION OF THE DEPARTMENT

We envision our students to be excellent engineers not only in the field of science and technology, but also embed the greatest values of human life. Our commitment lies in producing good citizens, comprehensive knowledge seekers and remains as an asset in building a strong and developed nation.

MISSION OF THE DEPARTMENT

- To achieve the vision we should have hard working faculty who use effective teaching methodologies.
- To impart knowledge in the latest trends of technical education.
- To prepare our young students to become professionally and morally sound engineers.
- To teach global standards in production and value based living through a truthful and technical approach.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- 1. To prepare students to excel in their chosen career through holistic education
- 2. The graduates are able to apply the broad fundamental concepts in social and natural sciences, mathematics, and engineering, and the depth of knowledge gained in electronics and communication engineering, as professionals in their chosen careers.
- 3. To make students to innovatively design, simulate, develop, implement and test hardware and software components for offering solution to real life situations.
- 4. The graduates demonstrate effective communication skills, the ability to work well either individually or as part of a team, who have embraced lifelong learning values for continuous self and professional or career development.

PROGRAMME OUTCOMES (POs)

- a) an ability to apply knowledge of mathematics, science, and engineering
- b) an ability to design and conduct experiments, as well as to analyze and interpret data
- c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- d) an ability to function on multidisciplinary teams
- e) an ability to identify, formulate, and solve engineering problems
- f) an understanding of professional and ethical responsibility
- g) an ability to communicate effectively
- h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- i) a recognition of the need for, and an ability to engage in life-long learning
- j) a knowledge of contemporary issues
- k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- an ability to stay abreast of emerging technologies through modelling, analyses, design and realize systems in the areas of electronics and communication.

GOVERNMENT COLLEGE OF ENGINEERING BARGUR

Regulation – 2017

AUTONOMOUS

Curriculum for Full Time – B.E (ECE)

From the Academic Year 2017-2018 onwards

	Mandatory Induction Program							
	3 Weeks Duration							
\checkmark	Physical Activity.							
\checkmark	Creative Arts.							
\checkmark	Universal Human Values.							
\triangleright	Literary.							
\triangleright	Proficiency Modules.							
\triangleright	Lectures by Eminent People.							
\triangleright	Visits to Local Areas.							
×	Familiarization of Dept/Branch & Innovations.							

SEMESTER - I

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY						
1	17ZHS101	Communicative English I	HS	4	0	0	4
2	17ZBS102	Engineering Mathematics I	BS	3	2	0	4
3	17ZBS103	Engineering Physics I	BS	3	0	0	3
4	17ZBS104	Engineering Chemistry	BS	3	0	0	3
5	17ZES105	Programming in C	ES	3	0	0	3
6	17ZES106	Engineering Graphics	ES	2	0	4	4
PRAC	FICALS						
7	17ZES107	Programming in C Laboratory	ES	0	0	4	2
8	17ZBS108	Physics Laboratory	BS	0	0	4	2
9	17ZBS109	Chemistry Laboratory	BS	0	0	4	2
			TOTAL	18	2	16	27

SEMESTER - II

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY						
1	17ZHS201	Communicative English II	HS	4	0	0	4
2	17ZBS202	Engineering Mathematics II	BS	3	2	0	4
3	17ZBS203	Engineering Physics II	BS	3	0	0	3
4	17LPC204	Circuit Analysis	PC	3	2	0	4
5	17ZBS205	Environmental Science and Engineering	BS	3	0	0	3
6	17LPC206	Electronic Devices	PC	3	0	0	3
PRAC	FICALS						
7	17ZES207	Engineering Practices Laboratory	ES	0	0	4	2
8	17LPC208	Circuits and Devices Laboratory	PC	0	0	4	2
			TOTAL	19	4	08	25

SEMESTER-III

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY						
1	17ZBS301	Transforms and Partial Differential Equations	BS	3	2	0	4
2	17LPC302	Electronic Circuits I	PC	3	0	0	3
3	17LPC303	Digital Electronics	PC	3	0	0	3
4	17LPC304	Network Analysis and Synthesis	PC	3	2	0	4
5	17LES305	Data Structures and Object- Oriented Programming Language	ES	3	0	0	3
6	17LES306	Basic Electrical and Instrumentation Engineering	ES	3	0	0	3
PRAC	FICALS	•		•	•	•	
7	17LES307	Data Structures and Object Oriented Programming Language Laboratory	ES	0	0	4	2
8	17LPC308	Electronic Circuits Laboratory	PC	0	0	4	2
9	17LES309	Electrical Engineering Laboratory	ES	0	0	4	2
			TOTAL	18	4	12	26

SEMESTER-IV

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY						
1	17LBS401	Probability and Random Processes	BS	3	2	0	4
2	17LPC402	Analog Integrated Circuits	PC	3	0	0	3
3	17LPC403	Electronic Circuits II	PC	3	0	0	3
4	17LPC404	Electromagnetic Fields	PC	3	2	0	4
5	17ZES405	Signals and Systems	ES	3	2	0	4
6	17LPC406	Microprocessors and Microcontrollers	PC	3	0	0	3
PRAC	FICALS						
7	17LPC407	Integrated Circuits Laboratory	PC	0	0	4	2
8	17LPC408	Microprocessors and Microcontroller Laboratory	PC	0	0	4	2
			TOTAL	18	6	8	25

SEMESTER-V

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY						
1	17LPC501	Digital Signal Processing	PC	3	0	0	3
2	17LES502	Control System Engineering	ES	3	2	0	4
3	17LPC503	Analog Communication	PC	3	0	0	3
4	17LPC504	Transmission Lines and Waveguides	PC	3	0	0	3
5	17LPC505	VLSI Design	PC	3	0	0	3
6		Professional Elective I	PE	3	0	0	3
PRAC	ΓICALS						
7	17LPC507	Analog Communication Laboratory	PC	0	0	4	2
8	17LPC508	DSP and VLSI Laboratory	PC	0	0	4	2
			TOTAL	18	2	8	23

SEMESTER-VI

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY	·					
1	17LHS601	Management Theory and Practice	HS	3	0	0	3
2	17LPC602	Antenna and Wave Propagation	PC	3	0	0	3
3	17LPC603	Embedded System	PC	3	0	0	3
4	17LPC604	Digital Communication	PC	3	0	0	3
5		Open Elective	OE	3	0	0	3
6		Professional Elective II	PE	3	0	0	3
PRAC	FICALS						
7	17LPC607	Embedded System Laboratory	PC	0	0	4	2
8	17LPC608	Digital Communication Laboratory	PC	0	0	4	2
9	17ZEE609	Communication and Soft Skills Laboratory	EEC	0	0	4	2
			TOTAL	18	0	12	24

SEMESTER-VII

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY						
1	17LPC701	Microwave and RF Systems	PC	3	0	0	3
2	17LPC702	Wireless Communication	PC	3	0	0	3
3	17LPC703	Fiber Optic Communication	PC	3	0	0	3
4		Professional Elective III	PE	3	0	0	3
5		Professional Elective IV	PE	3	0	0	3
PRAC	ΓICALS						
6	17LPC706	Microwave and Optical Laboratory	PC	0	0	4	2
7	17LEE707	Project Work Phase I	EEC	0	0	4	0
			TOTAL	15	0	7	17

SEMESTER-VIII

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY						
1		Professional Elective V	PE	3	0	0	3
2		Professional Elective VI	PE	3	0	0	3
PRAC	FICALS						
3	17LEE803	Project Work and Viva Voce	EEC	0	0	12	6
			TOTAL	6	0	12	12

TOTAL NUMBER OF CREDITS :179

LIST OF ELECTIVES FOR B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
THEO	RY		I				1
1.	17LPE001	Automotive Electronic Systems	PE	3	0	0	3
2.	17LPE002	Advanced Display Devices	PE	3	0	0	3
3.	17LPE003	Statistical Theory of Communication	PE	3	0	0	3
4.	17LPE004	Spread Spectrum Techniques	PE	3	0	0	3
5.	17LPE005	Advanced Digital Signal Processing	PE	3	0	0	3
6.	17LPE006	VLSI Signal Processing	PE	3	0	0	3
7.	17LPE007	Radar Systems	PE	3	0	0	3
8.	17LPE008	Digital Image Processing	PE	3	0	0	3
9.	17LPE009	Multimedia Compression Techniques	PE	3	0	0	3
10.	17LPE010	MEMS	PE	3	0	0	3
11.	17LPE011	DSP Architectures and Programming	PE	3	0	0	3
12.	17LPE012	Nano Electronics	PE	3	0	0	3
13.	17LPE013	VLSI Testing	PE	3	0	0	3
14.	17LPE014	Network Security	PE	3	0	0	3
15.	17LPE015	Optoelectronics	PE	3	0	0	3
16.	17LPE016	Telecommunication Switching Networks	PE	3	0	0	3
17.	17LPE017	AD-HOC Networks	PE	3	0	0	3
18.	17LPE018	Wavelet Transform and Applications	PE	3	0	0	3
19.	17LPE019	Wireless Technologies	PE	3	0	0	3
20.	17LPE020	Genetic Algorithms	PE	3	0	0	3
21.	17LPE021	ASIC Design	PE	3	0	0	3
22.	17LPE022	Neural Networks	PE	3	0	0	3
23.	17LPE023	Software Defined Radio	PE	3	0	0	3
24.	17LPE024	Smart Antennas	PE	3	0	0	3
25.	17LPE025	Low Power VLSI Design	PE	3	0	0	3
26.	17LPE026	Mixed Signal Circuits and Interfacing	PE	3	0	0	3
27.	17LPE027	Digital Speech Processing	PE	3	0	0	3

28.	17LPE028	ARM System Design	PE	3	0	0	3
29.	17LPE029	Internet of Things	PE	3	0	0	3
30.	17LPE030	Analog Integrated Circuits Design	PE	3	0	0	3
31.	17LPE031	Microwave Integrated Circuits	PE	3	0	0	3
32.	17LPE032	Communication Electronic Circuits	PE	3	0	0	3
33.	17LPE033	Computer Architecture and Organization	PE	3	0	0	3
34.	17LPE034	Professional Ethics	PE	3	0	0	3
35.	17LPE035	Computer Networks	PE	3	0	0	3

ONE CREDIT THEORY COURSE

SL.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	Т	Р	С
1.	17LOC001	Value Education, Human Rights and Legislative Procedures	OOTC	1	0	0	1
2.	17LOC002	Mini Project	OOTC	0	0	1	1
3.	17LOC003	Foreign Language	OOTC	1	0	0	1

HS – Humanities and Sciences

- BS Basic Sciences
- ES Engineering Sciences
- PC Program Core
- PE Program Elective
- OE Open Elective
- EEC Employability Enhancement Course

OPEN ELECTIVES [Students should select open electives offered by other Departments]

CSE:						
S.NO	COURSE CODE	COURSE TITLE	L	Τ	P	C
1.	17SOE001	Programming in C++	3	0	0	3
2.	17SOE002	Java Programming	3	0	0	3
3.	17SOE003	Python Programming		0	0	3
4.	17SOE004	Web Designing		0	0	3
5.	17SOE005	Android Application Development	3	0	0	3

ECE:

S.NO	COURSE CODE	COURSE TITLE	L	Τ	Р	C
1.	17LOE001	Real Time Systems		0	0	3
2.	17LOE002	Wireless Sensor Networks		0	0	3
3.	17LOE003	Industrial Automation and Robotics		0	0	3
4.	17LOE004	Principles of VLSI design		0	0	3
5.	17LOE005	Applied Electronics	3	0	0	3
6.	17LOE006	Wireless Networks	3	0	0	3

EEE:

S.NO	COURSE CODE	COURSE TITLE		Т	Р	С
1.	17EOE001	Matlab Programming	3	0	0	3
2.	17EOE002	Renewable Energy Sources		0	0	3
3.	17EOE003	Energy Management and Auditing		0	0	3
4.	17EOE004	Smart Grid	3	0	0	3

MECHANICAL:

S.NO	COURSE CODE	COURSE TITLE		Т	Р	С
1	17MOE001	Disaster Management and Mitigation	3	0	0	3
2	17MOE002	Environmental Management	3	0	0	3
3	17MOE003	Composite materials	3	0	0	3
4	17MOE004	Renewable Energy Sources and	3	0	0	3
		Technology				
5	17MOE005	Intellectual Property Rights	3	0	0	3
6	17MOE006	Engineering Economics and Financial		0	0	3
		Accounting.				
7	17MOE007	Material Characterizations		0	0	3
8	17MOE008	Global Warming and Climate Change		0	0	3

CREDIT BREAK-UP (ECE)

SL. NO	SUBJECT CL AREA		CREDITS PER SEMESTER					CREDITS ACTUAL	CREDITS AICTE	% OF CREDITS	TOTAL NO. OF SUBJECTS	AICTE RECOM % OF C	MENDED REDITS		
		Ι	Π	III	IV	V	VI	VII	VIII					MIN	MAX
1.	HS	4	4				3			11	14	6.2	3	5	10
2.	BS	14	10	4	4					32	30	17.9	10	15	20
3.	ES	9	2	10	4	4				29	30	16.2	10	15	20
4.	PC		9	12	17	16	13	11		78	50	43.6	28	30	40
5.	PE					3	3	6	6	18	20	10	6	10	15
6.	OE						3			3	12	1.7	1	5	10
7.	EEC						2		6	8	20	4.4	3	10	15
8.	TOTAL	27	25	26	25	25	26	17	12	179	176	100	61		

SEMESTER-I

17ZHS101		COMMUNICATIVE ENGLISH-I	L	Т	Р	С			
	4 0								
OBJECTIVES:									
•	To deal	velop the active skills as well as the passive skills of the first ye echnology students.	ar E	ngin	eerir	ıg			
•	To he situati	p learners develop their speaking skills and speak flawlessly in ons.	real	life					
•	To help learners acquire vocabulary by the way of reading skills.								
•	To help learners enhance their listening skills which will enable them to listen to lectures and comprehend them by asking questions, seeking clarifications.								
•	• To help learners improve their writing skills by practicing dialogue writing, and writing short essays.								
UNIT I					1	2			

Listening - Short texts- Short formal and informal conversations- listening to TV and Telephonic interviews. **Speaking-** Introducing one self- exchanging personal information. Reading-Skimming and Scanning. **Writing** -Letter writing - E-mail writing. **Grammar**-introducing Tenses (Simple Present, Present Continuous, Present Perfect) Articles, **Vocabulary:** Prefix & Suffix and Compounds.

UNIT II

Listening- Listening to announcements- listening to news. Speaking – Greetings and congratulating and taking leave. Reading – Finding key information in a given text. Writing-Short narrative descriptions- dialogue writing. Grammar- Tenses (Present Perfect Continuous, Simple Past)- WH questions, Yes-No questions, Prepositions Vocabulary: Word-formation, Synonym & Antonym.

UNIT III

Listening- Listening to dialogue **Speaking** – describing a person, experience, expressing opinions. **Reading-** Reading longer text, reading science articles. **Writing-** Paragraph Writing- informal letter writing. **Grammar-** Tenses (Past continuous, Past Perfect), degrees of comparison, direct-indirect speech **Vocabulary**: One- word substitution

12

12

UNIT	YIV 12	2				
Listenin Reading objects Future)	ing- Listening to product descriptions. Speaking- describing an object- proce g- Reading comprehension. Writing- completing sentences- writing about scienti and inventions. Grammar- Tenses (Past Perfect Continuous, Sim Vocabulary: Phrasal verbs	ess. ific ple				
UNIT	Y V 12	2				
Listenin respond	ing- Listening to talks& conversations. Speaking - participating in conversations ding. Reading - Reading longer text & close reading. Writing –Creative Writing.	&				
Gramma conditio	nar- Tenses (Future Continuous, Future Perfect, Future Perfect Continuou onals Vocabulary - collocations, idioms	1s),				
	TOTAL : 60 PERIODS					
OUTC	COMES:					
•	Read articles of a general kind in magazines and newspapers.					
•	Participate effectively in informal conversations; introduce themselves and their					
	friendsand express opinions in English					
•	Comprehend conversations and short talks delivered in English					
•	Write short essays of a general kind and personal letters and emails in English.					
TEXT	Г BOOKS:					
•	• Board of Editors. Using English A Course book for undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad:2015					
REFE	ERENCES:					
1.	R. C. Jack, "Interchange Students", Book-2 New Delhi, CUP, 2015.					
2.	Bailey, Stephen. "Academic Writing: A Practical guide for students", New York, Rutledge, 2011.					
3.	Seely, John. "The Oxford guide to writing & Speaking", New York, 1998.					

ENGINEERING MATHEMATICS-I

L	Т	Р	С
3	2	0	4

OBJECTIVES:

•	To develop the use of matrix algebra techniques this is needed by engineers for practical applications
•	To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
	To familiarize the student with functions of several variables. This is needed in many

- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II SEQUI

SEQUENCES AND SERIES

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and

conditional convergence.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS

9+6

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals

UNIT IV FUNCTIONS OF SEVERAL VARIABLES

9+6

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V	MULTIPLE INTEGRALS	9+6
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9+6

9+6

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

		TOTAL : 75 PERIODS					
OUTO	OUTCOMES:						
•	Solve problems on matrices and to apply concepts of matrix theory whenever applicable in the field of engineering.						
•	Solve problems using convergence tests on sein engineering field appropriately.	quences and series and to apply them					
٠	Solve problems on differential and integral calculus and will be exposed to their applications in engineering.						
ТЕХТ	T BOOKS:						
1.	Bali N. P and M. Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.						
2.	Grewal. B.S, "Higher Engineering Mathemati Delhi, 2011.	cs", 41st Edition, Khanna Publications,					
REFE	CRENCES:						
1.	Dass, H.K., and Er. RajnishVerma, "Higher E S. Chand Private Ltd., 2011.	ngineering Mathematics",					
2.	<i>G. James, "Advanced Modern Engineering Education, 2012.</i>	Mathematics", 3rd Edition, Pearson					
3.	Peter V. O'Neil, "Advanced Engineering learning, 2012.	Mathematics", 7th Edition, Cengage					
4.	Ramana B.V, "Higher Engineering Mathem Company, New Delhi, 2008.	atics", Tata McGraw Hill Publishing					
5.	Sivarama KrishnaDas P and Rukmangadac Volume I, Second Edition, PEARSON Publishi	chari E., "Engineering Mathematics", ing, 2011.					

17ZBS	17ZBS103ENGINEERING PHYSICS I		ENGINEERING PHYSICS I	L	Т	Р	С
		Comr	non to MECH, EEE, ECE & CSE	3	0	0	3
OBJECTIVES:							
•	To develop knowledge on properties of solids						
•	To use the principles of lasers, its types and its application						
•	To make students to understand about fibre optics and its applications.						
•	To develop knowledge on thermal properties of materials						
•	• To apply principles of quantum physics in engineering field.						
UNIT I PROPERTIES OF MATTER					9		

Elasticity – Hooke's law – Stress – Types of Stresses – Strain- Types of Strain -Young's Modulus – Rigidity Modulus – Bulk Modulus –Poisson's ratio – Relationship between three elastic constants and Poisson's ration – Torsional Pendulum – Factors affecting elasticity of materials - Bending moment of a Beam – Depression of cantilever (Theory and Experiment) – Determination of Young's modulus – Uniform and non-uniform bending (Theory and Experiment).

UNIT II LASERS

Introduction to LASER – Interaction of light radiation with materials – Stimulated absorption – Spontaneous emission – Stimulated emission –Einstein's A and B co-efficient derivation – Concept of LASER – Population inversion –Pumping action – Methods for pumping action – Characteristics of LASER - Types of Lasers (Nd-YAG, He-Ne) – Industrial and medical applications of lasers.

9

9

9

UNIT III FIBRE OPTICS

Introduction – Structure of Optical Fibre – Guiding mechanism – Total internal reflection – Critical Angle – Conditions for total internal reflection – Principle and Propagation of light in Optical Fibres – Numerical aperture and acceptance angle – Types of optical fibres (Material, refractive index and mode) – their characteristics and applications – Losses associated in optical fibres.

UNIT IV THERMAL PHYSICS

Introduction to Heat flow – Modes of heat transfer (Conduction, Convection and Radiation) – Thermal conductivity – Expression for thermal conductivity – Newton's law of cooling – Linear heat flow – Heat conduction through a compound media(Series and parallel) – Lee's disk method for determination of thermal conductivity of bad conductors – Application: Heat exchangers, refrigerators.

UNIT V QUANTUM PHYSICS

theory (derivation) – Deduction of Wien's displacement law and Rayleigh-Jean's law from Planck's law – Matter waves – De-Broglie's Hypothesis – Properties of matter waves - Wave-particle duality – Wave function – Physical Significance – Schrodinger wave equation – Time dependent and time independent – Application of Schrodinger wave equation – Particle in a 1 D box.

TOTAL : 45 PERIODS

9

OUTCOMES:

•	To learn about, three types of elastic modulus and related laws
•	To learn basics of thermal conductivity of different solid materials with relevant Newton's law of cooling
•	Apply the functional knowledge of different types of lasers in their engineering applications
•	To attain the basic knowledge of fiber optics and apply in their engineering & medical applications
•	To apply the fundamental principles of quantum physics in engineering field
ТЕХТ	BOOKS:
1.	P. Mani, "Engineering physics", Dhanam Publications, 2017.
2.	G. Senthikumar, "Engineering physics", VRB Publishers
3.	A.Marikani, "Engineering Physics", PHI Learning Pvt., India 2009
REFE	RENCES:
1.	<i>R. K. Gaur and S.C. Gupta, "Engineering physics", Dhanpat Rai publications, New Delhi 2003.</i>
2.	M. N. Avadhanulu and P. G. Kshirsagar, "A text book of engineering physics", S. Chand and Company Ltd, New Delhi, 2005.
3.	K. Rajagopal, "Engineering Physics", PHI, New Delhi, 2011.
4.	P. K. Palanisamy, "Engineering Physics", SCITECH Publication, 2011
5.	M. Arumugam, "Engineering physics", Anuradha publishers

17ZBS1	104	ENGINEERING CHEMISTRY	L	Т	Р	С
		Common to EEE, ECE & CSE	3	0	0	3
OBJEC	TIVES:					
•	• To make students conversant with water parameters, boilers, need for water treatment and its merits and demerits.			er		
•	• Students ought to be aware of fundamental principles behind different electrochemical reactions, corrosion of materials and methods to prevent corrosion.					
•	To learn th application	e chemistry behind polymers, synthesis, merits, demer s in various field.	its a	nd it	S	
•	To acquire basic knowledge in renewable, non renewable and alternate energy resources and the chemical reactions involved in cell, batteries and its applications.					
•	To learn th	e working principle of various spectroscopy and its ap	plica	ntion	s.	
UNIT I	WA	TER TECHNOLOGY				9
Chararact estimation – potable water in embrittler - Demine	Chararacteristics – alkalinity and its significance – hardness (problems) - types and estimation by EDTA method – specifications of drinking water (BIS and WHO standards) – potable water treatment – boiler feed water - requirements – disadvantages of using hard water in boilers (Scales & Sludge, Boiler corrosion, Priming & Foaming, Caustic embrittlement) – water treatment – Internal treatment – external treatment – zeolite method - Demineraliztion process – desalination – reverse osmosis.					
UNIT I	UNIT II ELECTROCHEMISTRY AND CORROSION 9				9	
Electrochemistry : Electrochemical cells – reversible and irreversible cells – EMF – measurement of EMF – single electrode potential – Nernst equation (Problems) – reference electrode – standard hydrogen electrode and calomel electrode – ion selective electrode – glass electrode and measurement of pH – electrochemical series and its applications. Corrosion : Corrosion – Pilling Bedworth rule - dry corrosion and its mechanism - electrochemical corrosion and its mechanism – types (galvanic, pitting, differential aeration) – factors influencing corrosion – corrosion control methods – sacrificial anode method – impressed current method – corrosion inhibitors – protective coatings – paints – constituents – functions – metallic coatings – electroplating (Cu) and electro less plating						

(Ni).

UNIT III POLYMERS AND COMPOSITES

Polymers: Definition – classification – functionality – polymerization – degree of polymerization – types (addition, condensation, copolymerization) – mechanism (free radical) – plastics – thermoplastics and thermosetting plastics – preparation, properties and uses of individual polymers (PVC, TEFLON, Nylon-6,6, Nylon-6, PET, epoxy resin) – rubber - vulcanization of rubber – applications - Advanced polymeric materials and electronic devices – conducting and semiconducting polymers – liquid crystal properties – Den drimersand their difference from polymers.

Composites:Definition – Types polymer matrix composites – Fibre Reinforced Polymers – Applications – advanced composite materials – Physical and Chemical properties – Applications.

UNIT IV

ENERGY SOURCES AND STORAGE DEVICES

Nuclear energy – fission fusion reactions – light water nuclear reactor for power generation – breeder reactor – solar energy conversion – solar cells – wind energy – batteries: alkaline batteries – lead –acid, Ni-Cd, and Li-ion batteries – fuel cells – principles and applications – advantages and disadvantages.

UNIT V ANALYTICAL TECHNIQUES AND NANOMATERIALS

Spectroscopy: Electromagnetic spectrum - Fundamentals of spectroscopy – Instrumentation, working principle and applications of UV-Visible spectrophotometer, Atomic Absorbance Spectrophotometer, Flame photometer.

Nanomaterials: Introduction to nanotechnology in electronics - nanomaterials – fullerernescarbon nanotubes – nanowires – Electronics and mechanical properties - synthesis of nanomaterials – topdown and bottomup approach – applications of nanomaterials in electronic devices (Semiconductors, LED & OLED) – electronics and telecommunication – medicines.

TOTAL : 45 PERIODS

OUTCOMES:

•	To apply the knowledge of basic science in identifying, to formulate and to solve the Ability engineering problems.
•	Ability to analyze water borne problems faced in boilers, need for water treatment

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	and various methods and techniques for treating hard water.
•	Develop ability to understand polymerization reactions and its applications in engineering field.
•	Ability to understand the mechanism behind various types of electrochemical reactions which in turn helps in understanding the causes for corrosion and prevention methods.
•	Acquires Knowledge about energy conversion and chemical reaction taking place in nuclear, solar, wind energy, Batteries, fuel cells and its applications, merits and demerits.
•	Acquires in-depth knowledge on various nanomaterials and its applications in electronic devices. Students get basic knowledge on advanced analytical techniques.
TEX	T BOOKS:
1.	Vairam.S, Kalyani.P and Suba.R., "Engineering Chemistry", Wiley India Pvt Ltd, New Delhi, 2011
2.	Dara S.S,Umare S.S,"Engineering Chemistry", S. Chand & Company Ltd, New Delhi, 2010
REF	ERENCES:
1.	Pahari A and Chauhan B., "Engineering Chemistry", Firewall Media, New Delhi, 2010.
2.	Rao, C. N. R, Govindaraj.A, "Nanotubes and Nanowires", United Kingdom: Royal Society of Chemistry, 2005.
3.	"Advanced Polymeric Materials: From Macro- to Nano-Length Scales", edited by S.Thomas, N.Kalarikkal, MaciejJaroszewski, J. P. Jose, Apple Academic press, Canada, 2016.
4.	Jain and jain, "Engineering Chemistry", DhanpatRqai Publishing Co, 16th edition.

17ZES105

PROGRAMMING IN C

L	Т	Р	С
3	0	0	3

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OBJECTIVES:

UNIT I		INTRODUCTION	9	
•	Be familiar with programming in C.			
•	• Be exposed to the syntax of C.			
•	Learn to think logically and write pseudo code or draw flow charts for problems		ems.	
•	Be exposed to the number systems.			
٠	Learn the organization of a digital computer.			

UNIT I **INTRODUCTION**

Generation and Classification of Computers- Basic Organization of a Computer -Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm –Pseudo code – Flow Chart.

C PROGRAMMING BASICS UNIT II

Problem formulation - Problem Solving - Introduction to "C" programming -fundamentals structure of a "C" program – compilation and linking processes – Constants, Variables – Data Types - Expressions using operators in "C" - Managing Input and Output operations -Decision Making and Branching - Looping statements - solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS

Arrays - Initialization - Declaration - One dimensional and Two dimensional arrays. String-String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS

Function – definition of function – Declaration of function – Pass by value – Pass by reference -Recursion - Pointers - Definition - Initialization - Pointers arithmetic - Pointers and arrays-Example Problems.

UNIT V

STRUCTURES AND UNIONS

Introduction - need for structure data type - structure definition - Structure declaration -Structure within a structure - Union - Programs using structures and Unions - Storage classes, Pre-processor directives.

	TOTAL : 45 PERIODS
OUT	COMES:
•	Design C Programs for problems
•	Write and execute C programs for simple applications
TEX	F BOOKS:
1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2.	Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
3.	Y. P. Kanetkar, "Let Us C", BPB Publications, 2011.
4.	E.Balagurusamy, "Computing fundamentals and C Programming", TMH publishing Company, 2008.
REFI	ERENCES:
1.	B. S. Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill,2006.
2.	Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3.	Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

17ZES106

ENGINEERING GRAPHICS

OBJECTIVES

•	This course aims to introduce the concept of graphic communication, develop the drawing skills for communicating concepts, ideas and designs of engineering products.
•	To expose them to existing national standards related to technical drawings.
•	To draw the projection of simple solids like prisms, pyramids, cylinder etc.
•	To draw the development of surfaces to estimate the sheet metal requirement and to prepare sectional views of solids.
•	To develop skills in three-dimensional visualization of engineering components and to draw isometric and perspective views of simple solids.

UNIT I PLANE CURVES AND FREE-HAND SKETCHING

6+12

+Basic geometrical constructions, curves used in engineering. Conics – construction of ellipse, parabola and hyperbola by eccentricity method – drawing of tangents and normal to the above curves. Visualization concepts and free hand sketching: visualization principles –representation of three dimensional objects – layout of views- freehand sketching of multiple views from pictorial views of objects.

UNIT II

PROJECTION OF POINTS, LINES AND PLANE SURFACES

6+12

Orthographic projection – principles-principal planes-first angle projection-projection of points.Projection of straight lines inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III

PROJECTION OF SOLIDS

6+12

6 + 12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids, when the axis is inclined to both the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of prisms, pyramids, cylinders and cones in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – prisms, pyramids cylinders and cones.

UNIT VISOMETRIC AND PERSPECTIVE PROJECTIONS6+12

Principles of isometric projection – isometric scale –isometric projections of simple solids and truncated solids - prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - perspective projection of simple solids- prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

OUTC	OMES:
•	Familiarize with the fundamentals and standards of Engineering graphics
•	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
•	Draw orthographic projections of lines and plane surfaces.
•	Draw projections of solids and development of surfaces.
•	Visualize and draw isometric and perspective views of simple solids.
TEXT	BOOKS:
1.	Natrajan K.V, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012.
2.	Venugopal .K and Prabhu R.V, "Engineering Graphics", New Age International (P) Limited, 2016.
3.	Bhatt N.D and Panchal V.M, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
REFE	RENCES:
1.	N S Parthasarathy and V. Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
2.	Gopalakrishna K.R, "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2013.
3.	B.Agarwal and Agarwal C.M, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.
4.	Luzzader, Warren.J and Duff J. M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5.	Shah M.B, and Rana B.C, "Engineering Drawing", Pearson, 2nd Edition, 2009.

17ZES107

PROGRAMMING IN C LABORATORY

L	Т	Р	С
0	0	4	2

OBJECTIVES:

•	Be familiar with the use of Office software.
•	Be exposed to presentation and visualization tools.
•	Be exposed to problem solving techniques and flow charts.
•	Be familiar with programming in C.
•	Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Search, generate, and manipulate data using MS Office / Open Office.

2. Presentation and Visualization – graphs, charts, 2D, 3D.

3. Problem formulation, Problem Solving and Flowcharts.

4. C Programming using Simple statements and expressions.

5. Scientific problem solving using decision making and looping.

6. Simple programming for one dimensional and two dimensional arrays.

7. Solving problems using String functions.

8. Programs with user defined functions – Includes Parameter Passing.

9. Program using Recursive Function and conversion from given program to flow chart.

10.Program using structures and unions.

TOTAL: 60 HOURS

OUTCOMES:

٠	Apply good programming design methods for program development.
٠	Design and implement C programs for simple applications.
٠	Develop recursive programs.

PHYSICS LABORATORY

Common to MECH, EEE, ECE & CSE

OBJECTIVES

• To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids

LIST OFEXPERIMENTS : PHYSICS LABORATORY (ANY 5 EXPERIMENTS)

1.	Determination of rigidity modulus : Torsion Pendulu	m	
2.	Determination of Young's modulus by non-uniform bending method		
3.	(a) Determination of wave length and particle size us(b) Determination of acceptance angle in an optical f	ing LASER ibre	
4.	Determination of thermal conductivity of a bad cond	uctor – Lee's Disc method	
5.	Determination of velocity of sound and compressibility of fluid – Ultrasonic interferometer		
6.	Determination of wavelength of mercury spectrum –	Spectrometer grating	
7.	Determination of band gap of a semiconductor		
		TOTAL: 60 HOURS	
OUTCOMES:			
• After the course, the student will be able to apply principles of elasticity, optical and thermal properties for engineering applications.			

CHEMISTRY LABORATORY

Common to MECH, EEE, ECE & CSE

OBJECTIVES:

- To make students conversant with hands on water parameter analysis.
- To make the student to acquire practical skills in the corrosion in metals.
- To acquaint the students with the determination of molecular weight of a polymer by Ostwald viscometer.
- To make the student acquire practical skills in analytical instruments.

LIST OFEXPERIMENTS :

- 1. Determination of total hardness of given water sample by EDTA method.
- 2. Determination of alkalinity in given water sample.
- 3. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- 4. Conductometric titration using mixture of acids and strong base.
- 5. Determination of strength of in given hydrochloric acid using pH meter.
- 6. Estimation of sodium present in water using flame photometer.
- 7. Estimation of Zn present in effluent using Atomic Absorption Spectroscopy(AAS)
- 8. Corrosion experiment weight loss method
- 9. Estimation of iron content of the given solution using potentiometer meter.
- 10. Estimation of iron content of the given sample using Spectro photometer (thiocyanate method).

TOTAL: 60 HOURS

OUTCOMES:

• The students will be outfitted with hands-on knowledge in the qualitative and quantitative chemical analysis of water quality related parameters, corrosion studies, heavy metal analysis, etc.

REFERENCES:

1.	Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R, "Vogel's Textbook of practical organic chemistry", LBS Singapore, 1994.
2.	Jeffery G.H, Bassett J, Mendham J and Dennyvogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edition Longman, Singapore publishers, Singapore, 1996.
3.	Kolthoff I.M, Sandell E.B et al, "Quantitative chemical analysis", Mcmillan, Madras, 1980.
4.	D. R. Palleros, "Experimental organic chemistry", John Wiley & Sons, Inc, New York, 2001.

SEMESTER-II

17ZHS201		COMMUNICATIVE ENGLISH-II	L	T	Р	С
			4	0	0	4
OBJEC	OBJECTIVES:					
•	• To make learners acquire listening and speaking skills in both formal and informal contexts.					
•	• To help them develop their reading skills by familiarizing them with different types of reading strategies.					
•	To equip them with writing skills needed for academic as well as workplace contexts.					
•	• To make them acquire language skills at their own pace by using e-materials and language lab components.					
•	• To help them give a short extempore speech and also make them participate in debates.					
UNIT I	[1	.2
Listening – Listening to different types of conversation and answering questions. Listening to						
announcements at railway station , airports, etc. Speaking - Comments on topics like						
weather. Turn taking - Closing a conversation (excuses, general wish, positive comment,						
thanks); Reading – Extensive reading; Writing – purpose statements – extended definitions –						
issue- writing instructions - checklists-recommendations-; Grammar- impersonal passive						
voice, numerical adjectives ; Vocabulary – Homonyms, Homophones.						

UNIT II

Listening – Listening to situation based dialogues; **Speaking** – Conversation practice in real life situations, asking for directions, giving directions, Discussing various aspects of a film, or a book. Welcome address, Vote of Thanks, special address on special topics. **Reading** – reading a short story or an article from newspaper. **Writing** –writing a review/ summary of a story / article. **Grammar** –. concord, compound words

UNIT III

Listening – Listening to the conversation – Understanding the structure of conversations. **Speaking** – Conversation skills with a sense of stress, intonation, pronunciation and meaning – seeking information – expressing feelings, **Reading** – speed reading – reading passages with time limit - skimming; **Writing** – Minutes of meeting – writing summary after reading articles from journals; **Grammar**- Cause and effect expressions; **Vocabulary** – Words used as nouns and verbs without any change in spelling

UNIT IV

12

12

Listening – Viewing model interviews (face-to- face, telephonic and video conferencing); **Speaking** – role play practice in telephone skills – listening and responding, asking questions – note taking – passing on messages, Role play and mock interview for grasping interview skills; **Reading** – Reading the profile of the company concerned – scanning; **Writing** – Applying for a job – cover letter – resume preparation – vision, mission and goals of the candidate; **Grammar**- reported speech **Vocabulary** – Idioms and their meanings.

UNIT V

12

Listening– Viewing a model group discussion ; **Speaking** – Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions- mind mapping technique; **Reading** – Note making skills –making notes from books, or any form of written materials – Intensive reading; **Writing** – Types of reports / Project report – report format – recommendations/ suggestions -.**Grammar** – Use of Clauses; **Vocabulary** – Collocation; fixed and semi-fixed expressions.

TOTAL : 60 PERIODS

OUTCOMES: Read technical texts and write area specific texts effortlessly. Listen and comprehend lectures and talks in their area of specialization successfully. • Speak appropriately and effectively in varied formal and informal contexts. • Write reports and winning job applications. **TEXT BOOKS:** Board of Editors. Using English A Course book for undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad:2016 **REFERENCES:** 1. Comfort, Jeremy, et al, "Speaking Effectively : Developing speaking skills for Business Englis", Cambridge University Press, Cambridge Reprint, 2011. 2. D.P.Kiranmai and *R*.*Geetha* . "Basic *Communication* Skills. Foundation", Books: 2013. 3. Means, L. Thomas and E. Langlois, "English & Communication For Colleges", CengageLearning, USA, 2007 4. Redston, Chris & G.Cunningham, "Face2Face (Pre-intermediate student's Book & Workbook)", Cambridge University Press, New Delhi, 2005.

17ZBS202	ENGINEERING	MATHEMATICS-II
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L	T	Р	С
3	2	0	4

OBJECTIVES:

•	To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
•	To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines
•	To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
•	To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I

VECTOR CALCULUS

9+6

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

UNIT II

ORDINARY DIFFERENTIAL EQUATIONS

9+6

9+6

9+6

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III	LAPLACE TRANSFORMS	
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Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV

ANALYTIC FUNCTIONS

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+k, kz, 1/z, z2, ez and bilinear transformation.

UNIT VCOMPLEXINTEGRATION9+6Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's

integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

OUTCOMES:

•	Solve problems on vector calculus and to apply them in any other field theory related subjects.		
•	Solve differential equations and will be exposed to their applications in various fields of engineering.		
•	Solve problems on Laplace transforms and will be able to use Laplace transform in finding solutions of differential and integral equations and other engineering applications.		
•	Solve complex integration problems and will be exposed to various applications of analytic functions and conformal mapping in engineering.		
TEXT BOOKS:			
1.	Bali N. P and M. Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd, 2011.		
2.	Grewal.B.S, "Higher Engineering Mathematics", 41 st Edition, Khanna Publications, Delhi, 2011.		
REFERENCES:			
1.	Dass H.K, and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand Private Ltd, 2011.		
2.	G.James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.		
3.	P.V. O.Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.		
4.	Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.		
5.	SivaramaKrishnaDas P and Rukmangadachari E, "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.		

	203	ENGINEERING FILISICS II	L	I	I	C
Com		non to MECH, EEE, ECE & CSE	3	0	0	3
OBJEC	CTIVES:					
•	To describe the properties of conducting material.					
•	To understand the theory of semi-conducting materials and basic electron devices					
•	To get the knowledge about properties of magnetic materials.					
•	To understand the polarization process in dielectric materials and their temperature, frequency dependence and the causes of dielectric breakdown.					
•	To acquire some exciting prospects of modern engineering materials.					

ENCINEEDINC DUVSICS II

UNIT I

17705202

ELECTRICAL PROPERTIES OF MATERIALS

Conductors – Classification of conducting materials – Ohm's Law – Electrical conductivity – Relation between current density, drift velocity and mobility – Classical free electron theoryof metals – Expression for electrical conductivity of a metal – Thermal conductivity – Expression for thermal conductivity of a metal – Wiedemann – Franz law – success and failuresof classical free electron theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states.

UNIT II SEMICONDUCTOR PHYSICS

Introduction – Intrinsic semiconductor – Energy band diagram – Direct and indirect semiconductors –Carrier concentration in an intrinsic semiconductors (derivation) – Extrinsic semiconductors – Carier concentration in n-type & p-type semiconductors –Hall effect – Determination of Hall coefficient (Theory) – Application of Hall effect.

UNIT III MAGNETIC PROPERTIES OF MATERIALS

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Magnetization – Magnetic flux – Magnetic flux density – Intensity of Magnetisation – Magnetic field intensity – magnetic permeability – magnetic susceptibility – Magnetic field and induction – Types of magnetic materials – Microscopic classification of magnetic materials – Ferromagnetism : origin and exchange interaction – Domain theory- Hard and soft magnetic materials – Magnetic storage devices – Hard disk.

Superconductivity: Properties – Type I and Type II Superconductors- BCS theory of Superconductivity – Application of Superconductors - SQUID

UNIT IV DIELECTRIC PROPERTIES OF MATERIALS

General properties of Dielectric materials – Electrical susceptibility – Dielectric constant – Electronic, ionic, orientational and space-charge polarization – Frequency and Temperature dependence of Polarisation– Internal field – Claussius – Mosotti relation (derivation) – Dielectric breakdown – Dielectric loses – Use of dielectric materials (capacitor and transformer) - Ferroelectricity and its applications..

UNIT V MODERN ENGINEERING MATERIALS

Metallic glasses – Properties of metallic glasses – Shape memory alloys (SMA) – Preparation, properties and applications of Shape memory alloys (SMA) – Characteristics of Shape memory alloys – Characteristics, properties of Ni-Ti alloy, application, advantages and disadvantages of shape memory alloys (SMA) – Nanomaterials – Different forms of nanomaterials – Preparations –Pulsed Laser Deposition, Chemical Vapour Deposition and Applications.

TOTAL : 45 PERIODS

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OUTCOMES:				
•	To explore knowledge about free electron theory and density of states of conducting materials with related laws.			
•	Students are able to compare intrinsic and extrinsic semiconductor, density of electrons and holes calculation, Hall effect with applications and basic semiconductor devices.			
•	To learnt comparatively about different type of magnetic materials, superconducting materials and apply in their engineering field.			
•	To attain the functional knowledge of different types of dielectric materials, polarization mechanism and their qualitative engineering applications.			
•	To know more about preparation of modern engineering materials and materials suitability for their own engineering field.			
TEXT BOOKS:				
1.	P. Mani, "Engineering physics", Dhanam Publications, 2011.			
2.	G. Senthil kumar, "Engineering physics", VRB Publishers.			
3.	A.Marikani, "Engineering Physics" PHI Learning Pvt., India 2009.			
4.	Wahen M. A, "Solid state physics: Structure and properties of materials", Narosa publishing house, 2009			
REFERENCES:				
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1.	R.K. Gaur and S.C. Gupta, "Engineering physics", Dhanpat Rai publications, New Delhi 2003.			
2.	M.N.Avadhanulu and P. G. Kshirsagar, "A text book of engineering physics" S.Chand and Company, Ltd, New Delhi 2005.			
3.	K. Rajagopal, "Engineering Physics", PHI, New Delhi, 2001.			
4.	M. Arumugam, "Engineering physics", Anuradha publishers.			

17LPC204		CIRCUIT ANALYSIS	L	Т	Р	С	
					0	4	
OBJEC	OBJECTIVES:						
•	To un laws	nderstand the concept of circuit elements lumped circuits, wave and network reduction	eforr	ns, c	circui	it	
•	To solve the electrical network using mesh and nodal analysis by applying network theorems					ork	
•	• To understand the concept of resonance in Series and parallel circuits and to know the basic concepts of coupled circuits					w	
•	• To analyze the transient response of series and parallel A.C. circuits and to solve problems in time domain using Laplace Transform						
•	• To analyze the parameters of two-port network.						
UNIT I		BASIC CIRCUITS ANALYSIS AND NETWORK			9-	+6	

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

UNIT II	NETWORK	THEOREMS	FOR	DC	AND	AC	9+6
	CIRCUITS						

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

UNIT III RESONANCE AND COUPLED CIRCUITS

9+6

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

UNIT IV TRANSIENT ANALYSIS

Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation.

UNIT V TWO P

TWO PORT NETWORKS

9+6

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

OUTCO	OMES:
•	Ability analyse electrical circuits
•	Ability to apply circuit theorems
•	Ability to design resonance and coupled circuits.
•	Evaluate the transient response of AC and DC circuits.
•	Ability to understand two-port networks.
TEXT B	BOOKS:
1.	W. H. Hayt, Jr. J. E. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016.
2.	J. Edminister and M. Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint ,2016.
3.	Sudhakar. A and Shyam M.SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.
REFER	ENCES:
1.	C. K. Alexander, M. N.O. Sadiku, "Fundamentals of Electric Circuits", Fifth Edition, McGraw Hill, 9th Reprint, 2015
2.	A.B.Carlson, "Cicuits: Engineering Concepts and Analysis of Linear Electric Circuits", Cengage Learning, India Edition 2nd Indian Reprint, 2009
3.	A. H.Robbins, W. C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1st Indian Reprint, 2013.
4.	Chakrabati .A, "Circuits Theory (Analysis and synthesis)", Dhanpath Rai & Sons, New Delhi, 1999.
	·,

9+6

17ZBS205

ENVIRONMENTAL SCIENCE AND ENGINEERING

OBJEC	CTIVES:					
•	To finding and implementing scientific, technological, economic and political solutions to environmental problems.					
•	To study the	nterrelationship between living organism and environmen	t.			
•	To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.					
•	To study the dynamic processes and understand the features of the earth's interior and surface.					
•	To study the integrated themes and biodiversity, natural resources, pollution control and waste management.					
					1	•

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d)aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values –Biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts –endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situconservation of biodiversity. Field study of common plants, insects, birds. Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION& HEALTH RISK

10

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere -formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO2, NOX, CO and HC) (b) Water pollution : Physicaland chemical properties of terrestrial and marine water and their environmental significance; Waterquality parameters – physical, chemical and biological;

absorption of heavy metals - Water treatmentprocesses. (c) Soil pollution - soil waste management: causes, effects and control measures ofmunicipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclearhazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III

NATURAL RESOURCES

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land

resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins – Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill /mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products –environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). Enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods ,earthquake, cyclone and landslides. Public awareness.

UNIT V

HUMAN POPULATION AND THE ENVIRONMENT

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Population growth, variation among nations – population explosion – family welfare programme –environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

		TOTAL : 45 PERIODS				
OUT	OUTCOMES:					
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.						
•	Ability to apply the knowledge of environmental science in identifying, to formulate and to solve the environmental problems.					
•	Public awareness of environmental function is at infant	stage.				
•	Ignorance and incomplete knowledge has led to miscor	ceptions.				
•	Development and improvement in std. of living has led to serious environmental disasters.					
•	Acquires Knowledge about environmental laws.					
•	Acquires in-depth knowledge on population expl environmental management.	osion and role of IT in				
TEXT	T BOOKS:					
1.	G. M.Masters, "Introduction to Environmental En edition, Pearson Education, 2004.	gineering and Science", 2nd				
2.	B. Joseph, "Environmental Science and Engineerin Delhi,2006.	g", Tata McGraw-Hill, New				
REFF	CRENCES:					
1.	R.K. Trivedi, "Handbook of Environmental Laws, R andStandards", Vol. I and II, Enviro Media.	ules, Guidelines, Compliances				
2.	Cunningham, W.P. Cooper, T.H. Gorhani, "Enviror Publ. House, Mumbai, 2001.	nmental Encyclopedia", Jaico				
3.	D.S. Sengar, "Environmental law", Prentice hall of Ind	lia PVT LTD, New Delhi,2007.				
4.	Rajagopal,R, "Environmental Studies-From Crisis to C 2005.	Cure", Oxford University Press				

ELECTRONIC DEVICES

L	Т	Р	С
3	0	0	3

OBJECTIVES:

•	To understand the physical construction and working of Semiconductor diodes.
•	To understand the construction and working of BJTs.
•	To understand the construction and working FETs.
•	To understand the special semiconductor devices.
•	To understand the operation of power and display devices.

UNIT I

SEMICONDUCTOR DIODE

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

UNIT II BIPOLAR JUNCTION TRANSISTORS

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid - π model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS

JFETs – Drain and Transfer characteristics-Current equations-Pinch off voltage and its significance-MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET-Characteristics – Comparison of MOSFET with JFET

UNIT IV SPECIAL SEMICONDUCTOR DEVICES

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Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Schottky barrier diode-Zener diode-Varactor diode – Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V	POWER DEVICES AND DISPLAY DEVICES	9
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UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

TOTAL : 45 PERIODS

OUTCO	OMES:
•	Explain the operation and characteristics of Diode.
•	Explain the operation and characteristics BJT and FET.
•	Describe the equivalence circuits of BJT and FET.
•	Study of special semiconductor devices.
•	Study of power and display devices.
TEXT B	OOKS:
1.	D. A Neaman, "Semiconductor Physics and Devices", Fourth Edition, Tata Mc GrawHill Inc, 2012.
2.	J.Millman and C.C.Halkias,"Electronic Devices and Circuits", McGraw Hill,1998.
3.	Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", Third Edition, Tata McGraw-Hill, 2008.
REFER	ENCES:
1.	R. Boylestad and L. Nashelsky, "Electron Devices and Circuit Theory", PearsonPrentice Hall, 10th edition, July 2008.
2.	R.S.Sedha, "A Text Book of Applied Electronics", S. Chand Publications, 2006.
3.	Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.
4.	Streetman, "Solid State Electronic Devices", PHI, 7 th edition, 2015.

17ZES207		ENGINEERING PRACTICES LABORATORY	L	Т	Р	С
			0	0	4	2
OBJE	CTIVE	ES				
•	Fo train	the students in safety handling of tools, equipment and mach n and basic carpentry exercises.	ineri	es, j	olum	bing
•	Fo impa netal an	rt skill in fabricating simple components using basic machining d metal joining process like welding, soldering, etc.	; pro	cess	es, s	heet
•	Fo expo equipme	se them in house wiring, basic electrical circuits and Electronic ents.	con	npor	ents	and
GROU	P A (0	CIVIL & MECHANICAL)				
CIVIL	ENG	INEERING PRACTICE				
LIST (OF EX	PERIMENTS:				15
1.	Plumb	Ding Works:				
	(a) S	tudy of pipeline joints, its location and functions: valves, taps, co educers, elbows in household fittings.	oupli	ings	, unio	ons,
	(b) S	tudy of pipe connections requirements for pumps and turbines.				
	(c) F	reparation of plumbing line sketches for water supply and sewag	ge wo	orks		
	(d) H	Iands-on-exercise: Basic pipe connections – Mixed pipe material	l con	inect	ion -	_
	Pipe connections with different joining components.Demonstration of plumbing requirements of high-rise buildings.				g	
2.	Carpe	entry using Power Tools only:				
	(a) S	tudy of the joints in roofs, doors, windows and furniture.				
	(b) H	Iands-on-exercise: Wood work, joints by sawing, planning and c	uttin	ıg.		
MECH	IANIC	CAL ENGINEERING PRACTICE				
LIST (OF EX	PERIMENTS:			-	15
1.	Weldi	ng:				
	(a) F	reparation of butt joints, lap joints and T- joints by Shielded met	al ar	c w	eldin	g.
	(b) C	Bas welding practice				
2.	Basic	Machining:				
	(a) S	imple Turning and Taper turning				

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	(b) Drilling Practice			
3	. Sheet Metal Work:			
	(a) Forming & Bending:			
	(b) Model making – Trays and funnels.			
	(c) Different type of joints.			
4	. Machine assembly practice:			
	(a) Study of centrifugal pump			
	(b) Study of air conditioner			
GRO	UP B (ELECTRICAL & ELECTRONICS)			
I. EL	ECTRICAL ENGINEERING PRACTICES	15		
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.			
2.	Fluorescent lamp wiring.			
3.	Stair case wiring			
4.	Measurement of electrical quantities – voltage, current, power & power factor	in RLC		
	circuit.			
5.	Measurement of energy using single phase energy meter.			
6.	Measurement of resistance to earth of an electrical equipment			
II. EI	ECTRONICS ENGINEERING PRACTICE	15		
1.	Study of Electronic components and equipments –Resistor, colour codingmeasure	ement of		
	AC signal parameter (peak-peak, rms period, frequency) using CRO.			
2.	Study of logic gates AND, OR, EX-OR and NOT			
3.	Generation of Clock Signal			
4.	Soldering practice – Components Devices and Circuits – Using general purpose I	PCB		
5.	Measurement of ripple factor of Half Wave and Full Wave Rectifier.			
	TOTAL : 60 PERIODS			
OUT	COMES:			
•	Fabricate carpentry components and pipe connections including plumbing wo	rks.		
•	Use welding equipments to fabricate permanent joints by welding and als perform basic machining operations.	o can		
•	Fabricate electrical and electronics circuits			

CIRCUITS AND DEVICES LABORATORY

L T P C 0 0 4 2

OBJECTIVES:

•	To analyze the characteristics PN, Zener diode, design rectifiers with and without filters
•	To understand the working of RL,RC and RLC circuits
•	To verify Network theorems.
•	To analyze transistor characteristics
•	To study frequency response of amplifiers, measure frequency, phase of signals

LIST OF EXPERIMENTS:

- 1. Characteristics of PN Junction Diode.
- 2. Zener diode Characteristics & Regulator using Zener diode.
- 3. Common Emitter input-output Characteristics.
- 4. Common Base input-output Characteristics.
- 5. FET Characteristics.
- 6. SCR Characteristics.
- 7. Clipper and Clamper & FWR.
- 8. Verifications of Thevenin's & Norton theorem.
- 9. Verifications of KVL & KCL.
- 10. Verifications of Super Position Theorem.
- 11. Verifications of Maximum Power Transfer & Reciprocity theorem.
- 12. Determination of Resonance Frequency of Series & Parallel RLC Circuits.
- 13. Transient analysis of RL and RC circuits.

TOTAL : 60 PERIODS

OUTCOMES:		
•	Analyze the characteristics of basic electronic devices.	
•	Design RL, RC and Resonance circuits.	
•	Verify KVL & KCL.	
•	Verify Thevenin's, Norton theorem and Super Position Theorems.	
•	Analyze the characteristics of clipper, clamper and FWR.	

SEMESTER-III

17ZBS301		TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	Р	С
			3	1	0	4
OBJECT	IVF	ES:				
•	• To introduce Fourier series analysis which is central to many applicati engineering apart from its use in solving boundary value problems.			tions	s in	
•	• To acquaint the student with Fourier transform techniques used in wide var situations.		ariety	y of		
•	• To introduce the effective mathematical tools for the solutions of p differential equations that model several physical processes and to devel transform techniques for discrete time systems.			par velop	rtial p Z	
UNIT I]	PARTIAL DIFFERENTIAL EQUATIONS			9-	+6
Formation of of first ord differential homogeneo	Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations - Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.				ะร เป h	
UNIT II]	FOURIER SERIES				+6
Dirichlet's series – Ha Harmonic a	Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.				.e —	
UNIT III		APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS				6
Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).					ıl o	
UNIT IV	FOURIER TRANSFORMS				9-	+6
Statement of transforms Parseval's i	Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.					
UNIT V	UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS		9-	+6		
Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.			d of			
TOTAL : 75 PERIODS						

OUTCOMES:				
•	The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.			
TEXT BO	DOKS:			
1.	Veerarajan. T, "Transforms and Partial Differential Equations", Second reprint, Tata Mc Graw Hill Education Pvt. Ltd, New Delhi, 2012.			
2.	Grewal.B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.			
3.	Narayanan.S,Manicavachagom.P.T.K and Ramanaiah.G, "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd,1998.			
REFERE	NCES:			
1.	Bali.N.P and M. Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.			
2.	Ramana.B.V, "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2008.			
3.	G. James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.			
4.	<i>E. Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.</i>			
5.	Ray W.C and Barrett.L.C, "Advanced Engineering Mathematics", Sixth Edition, Tata Mc Graw Hill Education Pvt Ltd, New Delhi, 2012.			
6.	Datta.K.B, "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.			

17LPC302	ELECTRONIC CIRCUITS I	T	P	С	
	3	0	0	3	
OBJECTIV	ES:				
• To	learn about biasing of BJTs and MOSFETs				
• To	design and construct amplifiers				
• To	construct amplifiers with active loads				
• To	study high frequency response of all amplifiers				
• To	make the students learn about working of IC MOSFET amplifiers				
UNIT I	BIASING OF DISCRETE BJT AND MOSFET			9	
DC Load line, operating point, Various biasing methods for BJT-Design-Stability-I compensation, Thermal stability, Design of biasing for JFET, Design of biasing MOSFET					
UNIT II	BJT AMPLIFIERS			9	
Small signal Common col Darlington An	Analysis of Common Emitter-AC Loadline, Voltage swing lactor and common base amplifiers – Differential amplifiers plifier-Bootstrap technique - Cascaded stages - Cascade Amplifier	imi - C	tation CMR	1s, R-	
UNIT III JFET AND MOSFET AMPLIFIERS 9					
Small signal Common sour JFET Source f	Small signal analysis of JFT amplifiers- Small signal Analysis of MOSFET and JFET, Common source amplifier, Voltage swing limitations, Small signal analysis of MOSFET and JFET Source follower and Common Gate amplifiers, - BiMOS Cascode amplifier				
UNIT IV FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS				9	
Low frequency and Miller effect, High frequency analysis of CE and MOSFET CS amplifier, Short circuit current gain, cut off frequency – $f\alpha$ and $f\beta$ unity gain and Determination of bandwidth of single stage and multistage amplifiers					
UNIT V IC MOSFET AMPLIFIERS					
IC Amplifiers- IC biasing Current steering circuit using MOSFET- MOSFET current sources- PMOS and NMOS current sources. Amplifier with active loads - enhancement load, Depletion load and PMOS and NMOS current sources load- CMOS common source and source follower- CMOS differential amplifier- CMRR.					
	TOTAL : 45 PERIODS				

OUT	COMES:
•	Design biasing network for transistor amplifiers.
•	Analyze the small signal equivalent circuits of transistors.
•	Design a simple amplifier circuits using transistors.
•	Analyze the frequency response of transistor amplifiers.
•	Explain IC amplifiers.
TEXT	BOOKS:
1.	Donald .A.N, "Electronic Circuit Analysis and Design", 3rd Edition, Tata Mc Graw Hill, 2006.
2.	Millman.J. and Halkias C.C, "Integrated Electronics", Mc Graw Hill, 2009.
3.	Adel .S. S and Kenneth C. S, "Micro Electronic Circuits", 7th Edition, Oxford University Press, 2017.
REFF	CRENCES:
1.	D. A.Bell, "Electronic Devices and Circuits", Oxford Higher Education Press, 5th Editon, 2008.
2.	B.Razavi, "Design of Analog CMOS Integrated Circuits", Tata Mc Graw Hill, 2007.
3.	G.Hurst, L.Meyer, "Analysis and Design of Analog Integrated Circuits", 5thEdition, Willey ,2009.
4.	D.Schilling and C.Belove, "Electronic Circuits", 3rd Edition, Mc Graw Hill, 1989.

DIGITAL ELECTRONICS

L	Т	Р	С
3	0	0	3

OBJECTIVES:

•	To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions			
•	To introduce the methods for simplifying Boolean expressions			
•	To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits			
•	To introduce the concept of memories and programmable logic devices.			
•	To illustrate the concept of synchronous and asynchronous sequential circuits			

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES

9

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Minimization Techniques: Boolean postulates and laws – De- Morgan's Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions – Quine - Mc Cluskey method of minimization. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations-Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates.

UNIT II COMBINATIONAL CIRCUITS

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation – Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table – State minimization –State assignment - Excitation table and maps-Circuit implementation -Modulo–n counter, Registers – shift registers - Universal shift registers

UNIT IV MEMORY DEVICES

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle -Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL)

UNIT V SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS

9

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Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits. Design of Combinational and Sequential circuits using VERILOG.

TOTAL: 45 PERIODS

OUTCOMES:

•	Analyze different methods used for simplification of Boolean expressions.
•	Design of Combinational circuits.
•	Design of synchronous and asynchronous sequential circuits.
•	Describe the characteristics of memory devices.
•	Design simple digital logic circuits using verilog.
ТЕХТ	BOOKS:
1.	M. M. Mano, "Digital Design: with an introduction to the Verilog HDL", 5th Edition, Pearson Education, New Delhi, 2014.
2.	C.Roth, "Digital systems Design using Verilog", 1st Edition, Centage, 2016.
3.	D. P.Leach , A. P. Malvino and G.Saha, "Digital Principles and Applications", 8th Edition, TMH, 2014.
REFE	RENCES:
1.	J. F. Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2.	S. C.Lee, "Digital Circuits and Logic Design", PHI, 1984.
3.	J.M.Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
4.	T. L. Floyd, "Digital Fundamentals", 11th Edition, Pearson Education, 2018.

17LPC304 NETWORK ANALYSIS AND SYNTHESIS

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OBJECTIVES:

٠	To make the students capable of analyzing any given electrical network.
•	To make the students learn how to synthesize an electrical network from a given impedance admittance function.
٠	To make the students capable of understanding any electrical one port network.
٠	To synthesize two ports networks.
•	To make the students capable of understanding and synthesizing equalizers.

UNIT I

NETWORKS

Review of two port networks – Networks: Functional classification of networks – Electrical characteristics of symmetric and asymmetric networks – Image transfer constant – Iterative impedance – Iterative transfer constant – Insertion loss – Characteristics of passive four terminal network – T network – Π network – relation between Z₀ of symmetrical Π and T networks – L section – Half section – Ladder and lattice network – Bridged T network – Twin T network – Matching networks.

UNIT II DESIGN OF FILTERS, ATTENUATORS AND EQUALIZERS

9+6

9+6

Theory of T and Π sections - filter fundamentals - Constant K Lowpass and Highpass filters - M - Derived filters - Composite filters - Bandpass and Band Elimination Filters - crystal and lattice filters - cross-over filters- Butterworth and Chebyshev approximations - synthesis of low pass filters - Magnitude and frequency normalization - synthesis of high pass, band pass and band stop filters through frequency transformation - Symmetrical and Asymmetrical attenuator pads- Balanced and Unbalanced attenuators – Inverse networks - Equalizers.

UNIT III REALIZABILITY AND IMMITANCE FUNCTIONS

9+6

Causality, Stability - Hurwitz polynomial - positive real functions - properties of LC, RC and RL driving point functions. Synthesis of one port networks: Basic synthesis procedure of driving point functions - synthesis of LC, RC and RL driving point functions - Foster and Cauer forms.

UNIT IV	SYNTHESIS OF ONE PORT NETWORKS)+6
51 6		

RLC one terminal pairs - Minimum positive real function - Brune's method of- Bott-Duffin - Gewertz method - characteristics of symmetric networks - iterative, image and characteristic impedances - image transfer constant - propagation constant- Insertion loss - Reactance matching.

9+6 UNIT V SYNTHESIS OF TWO PORT NETWORK Properties of -Y12 and Z12 -LC ladder development - RC ladder development - Series and parallel realization : restriction on Z12 - residue condition - Cauer's network realization -Symmetrical lattice and constant resistance network: Impedence equations for lattice unloaded lattice design - constant resistance lattice - Bartlett's Bisection theorem constant resistance Bridged T and ladder networks. **TOTAL** : 75 PERIODS **OUTCOMES:** Analyze different matching networks. Design of filters and equalizers. • Analyze R, L, C networks. • Design of one port networks. • Design of two port networks. **TEXT BOOKS:** F. F.Kuo, "Network Analysis and Synthesis", Second Edition, Wiley International, 1. 2006. Van Valkenburg M.E, "Introduction to Modern Network Synthesis", Wiley Eastern, 2. 1986. Aatre V.K, "Network Theory and Filter Design", Wiley Eastern, 1985. 3. **REFERENCES:**

1.	ShyamMohan S.P, Sudhakar. A, "Circuits and Network Analysis &Synthesis", Tata McGraw Hill, 2007.
2.	R.R.Singh, "Electrical Networks", 1 st edition, Mcgraw Hill, 2008
3.	B. D.O Anderson and S.Vangpanitlerd, "Network Analysis And Synthesis: A Modern Systems Theory Approach", Dovar publications, 2006.
4.	U. Sinha "Network Analysis and Synthesis", Satya Prakashan Publishers, 2005.
5.	G.K.Mithal, "Network Analysis", Khana publications, 1988.

17LES305		DATA STRUCTURES AND OBJECTED ORIENTED PROGRAMMING	D OBJECTED L AMMING			С	
	3				0	3	
OBJE	CTIV	ES:					
٠	To be	e familiar with the object oriented programming concepts					
•	To ur	nderstand the concepts of inheritance, polymorphism and overloa	ading	5			
•	To in	npart the basic concepts of data structures and algorithms					
•	To be	e familiar with the Linear and non Linear Data Structures concer	ots				
•	To ur	nderstand concepts of searching and sorting techniques					
UNIT	[BASIC CONCEPTS OF OOPS			9		
Principle Control	es of C Structu	Dbject Oriented Programming - Beginning with C++ - Tokens ares – Functions in C++ - Classes and Objects – Constructors an	, Ex d De	pres stru	sions ctors	3,	
UNIT	II	OVERLOADING , INHERITANCE AND POLYMORPHISM			9	9	
Operator virtual fu	overl	oading and function overloading - Inheritance: extending classes, polymorphism – Manipulating Strings.	ses -	Poi	inters	3,	
UNIT	III	LINEAR DATA STRUCTURES			9		
Abstract impleme expression	Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists – Stack ADT – Queue ADT - Evaluating arithmetic expressions.						
UNIT IV NON LINEAR DATASTRUCTURES			9				
Trees – Binary Trees – Binary tree representation and traversals – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search - Connected components.					.S —		
UNIT	UNIT V SORTING AND SEARCHING			9			
Inserion –Linear	sort – search	Merge sort – Quick sort – Radix sort – shell sort- Bubble sort – – Binary Search.	Sele	ectio	n soi	t	
TOTAL : 45 PERIODS							

OUTC	OMES:
•	Explain the concepts of Object oriented programming.
•	Write simple applications using C++.
•	Discuss the different methods of organizing large amount of data.
TEXT	BOOKS:
1.	E.Balagurusamy, "Programming in C++", 4th Edition. (Unit I & II)
2.	M. A. Weiss, "Datastructures using C++", 3rd Edition, Addition Wesley.(Unit III ,IV,V)
REFER	RENCES:
1.	B.Trivedi, "Programming with ANSI C++:A Step-By-Step approach", Oxford University Press, 2010.
2.	Goodrich, Michael. T, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", 7th Edition, Wiley, 2004.

17LES306

BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING

OBJE	CTIVES:						
•	To impart knowledge on construction, principle of operation and performance of DC Machines.						
•	To impart k Transformer	nowledge on construction, principle of operation and persons.	form	ance	e of		
•	To impart k Induction M	nowledge on construction, principle of operation and per-	form	ance	e of		
•	To impart knowledge on construction, principle of operation and performance of Synchronous and Special Machines.						
•	To understand the working principle of various Electrical measuring instruments.						
UNIT I DC MACHINES						9	

Introduction –DC generators- Constructional Features–Principle of operation- EMF Equation – Types and Characteristics of DC generators –DC motors - Principle of Operation–Types and Characteristics of DC motors –Starting and Speed Control – Losses and Efficiency –Applications.

UNIT II TRANSFORMERS

Introduction - Single phase transformer construction and principle of operation –Types-EMF equation–No load and Load characteristics – Equivalent Circuit –Voltage Regulation –Losses-Efficiency –OC and SC tests -AutoTransformers –Three Phase Transformers – Applications.

UNIT III	INDUCTION MACHINES

Principle of operation of three-phase induction motors – Construction –Types – Torque Slip Characteristics –Equivalent circuit– Starting and Speed Control–Single phase Induction motors: Construction– Double revolving field theory –Types– Applications.

UNIT IV SYNCHRONOUS AND SPECIAL MACHINES

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Alternator-Constructional details–working principle–EMF Equation – Voltage regulation by EMF and MMF methods. Synchronous motor: Working principle - Starting methods – Torque equation – Characteristics. Special Machines: Stepper Motor – Brushless DC Motor - Reluctance Motor – Universal Motor.

UNIT V ELECTRICAL INSTRUMENTS AND MEASUREMENTS

Absolute and Secondary instruments-Electrical Principle of operation-Standards and errors-Essentials of indicating instruments- Moving Coil and Moving Iron Ammeters and Voltmeters– Wattmeter and Energy meter–Measurement of R, L and C parameters: Wheatstone, Anderson, Schering and Wien bridges –Transducers – Classification of Transducers: Resistive, Inductive, Capacitive, piezoelectric, photoelectric and Hall effect.

TOTAL : 45 PERIODS

9

OUTCOMES: Understand the construction and principle of operation of DC Machines. • Understand the construction and principle of operation of Transformers. • Understand the construction and principle of operation of Induction Machines. • Understand the construction and principle of operation of Synchronous and Special Machines. Understand the construction and principle of operation of Electrical measuring instruments. **TEXT BOOKS:** D.P. Kothari and I.J. Nagarath, "Basic Electrical and Electronics Engineering", 1. McGraw Hill Education (India) Private Limited, Third Reprint, 2016. B.L. Theraja and A.K.Theraja, "A Text Book of Electrical Technology", Vol-I 2. and II, S. Chand & Co, 2014. S.K.Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson India, 3. 2011. **REFERENCES:** Toro ,"Electrical Engineering Fundamental", Pearson Education, New Delhi, 1. 2015. R.Prasad, "Fundamentals of Electrical engineering", Prentice Hall of India, 2006. 2.

17LES307

DATA STRUCTURES AND OBJECTED ORIENTED PROGRAMMING LABORATORY

OBJECTIVES: • Understand the fundamentals of object oriented concepts. • Be able to write a C++ program to solve various problems. • Be able to choose appropriate data structures to solve the problems. • To develop skills to design and analyze simple linear and non linear data structures • To Gain knowledge in practical applications of data structures

LIST OF EXPERIMENTS

- 1. Programs on C++ basic concepts.
- 2. Programs on pointers.
- 3. Program to implement single, multiple, multilevel, hybrid and hierarchical inheritance.
- 4. Program constructors, constructor overloading, destructors
- 5. Programs on Function overloading, Operator overloading.
- 6. Programs on string manipulation
- 7. Program on singly linked list using array based implementation and list implementation
- 8. Program for Doubly linked list using array based implementation and list implementation
- 9. Program for Circular linked list using array based implementation and list implementation
- 10. Program for Linear queue using array and list based implementation
- 11. Program for Circular queue using array and list based implementation.
- 12. Program to convert infix to postfix notation
- 13. Program to implement binary search tree.
- 14. Program to evaluate arithmetic expression.
- 15. Program to implement linear search and binary search.
- 16. Program to implement merge sort, quick sort, insertion sort, shell sort, selection sort, radix sort.

TOTAL : 60 PERIODS

OUTCOMES:				
•	Know the concept of C++ and pointers.			
•	Implement Arrays, Linked list and searching algorithm.			
REFER	ENCES:			
1.	S. Arora, "Practical world of C++", DhanpatRai & CO (Pvt)Ltd.			
2.	Spoken-tutorial.org.			

ELECTRONIC CIRCUITS LABORATORY

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OBJECTIVES:

•	To gain hands on experience in designing analog and digital circuits.
•	To learn simulation software used in circuit design.
•	To learn the fundamental principles of amplifier circuits
•	To understand Bias in Amplifier circuits
•	To differentiate Darlington Amplifier, differential Amplifiers.
•	To study the characteristic of source follower
	•

LIST OF ANALOG EXPERIMENTS

- 1. Regulated power supplies.
- 2. Frequency Response of CE, CC and CS amplifiers.
- 3. Frequency Response of Multistage amplifiers.
- 4. Cascode and Cascade amplifier.
- 5. Differential Amplifiers- Transfer characteristic, CMRR Measurement.
- 6. Spice Simulation of BJT and FET amplifiers.

LIST OF DIGITAL EXPERIMENTS

- 1. Study of Logic IC families.
- 2. Design and implementation of code converters using Logic gates.
- 3. Design and implementation of Digital arithmetic circuits using Logic gates and Spice simulation.
- 4. Design and implementation of Encoder and Decoder using signal selector and distributor circuits.
- 5. Design and implementation of Synchronous and Asynchronous counters.
- 6. Implementation of SISO, SIPO, PISO and PIPO shift registers.

TOTAL :60 PERIODS

OUTCOMES:				
•	Design simple regulated power supplies.			
•	Design single stage and multistage amplifiers.			
•	Analyze amplifiers and digital circuits using spice simulation.			
•	Design digital arithmetic circuits using logic gates.			
•	Design digital sequential circuits using logic gates.			

ELECTRICAL ENGINEERING LABORATORY

						_			
OBJE	CTIVES:								
•	To expose experimental	the students to the skill.	operation	of DC	Generators	and	give	th	iem
•	To expose th skill.	To expose the students to the operation of DC motors and give them experimental skill.							
•	To expose the skill.	e students to the oper	ation of Tra	nsformer	s and give th	nem e	xperi	mer	ntal
•	To expose t experimental	he students to the skill.	operation of	of Induc	tion motors	and	give	th :	iem
•	To utilise ins	truments for measurir	ng electrical	variables	s and parame	ters.			
LIST (OF EXPER	MENTS							
 Characteristics of Separately excited DC generator Characteristics of Self excited DC generator (shunt and series) Speed control of DC Shunt motors Load test on DC motors OC and SC test of Single phase Transformers Load test on transformer (Single Phase and three phase) Load test of Induction motor (single phase and three phase) Regulation of three phase alternator (EMF and MMF Methods) Measurements of R, L and C using Bridges Study of DC and Induction Motor starters. Study of Transducers. 									
				ТОТ	AL : 60 PH	ERIC)DS		
OUTC	OMES:								
•	Analyse the	e performance Charac	teristics of l	DC Gene	erators.				
•	Analyse the	e performance Charac	teristics of l	DC Moto	ors.				
•	Analyse the	e performance Charac	cteristics of	Fransfor	ners.				
•	Analyse the	e performance Charac	teristics of I	Induction	Motors.				
•	Utilize inst	ruments for measurin	g electrical	variables	and paramet	ters.			

SEMESTER-IV

17LBS401		PROBABILITY AND RANDOM PROCESSES	L	Т	Р	C
			3	1	0	4
OBJEC	TIV	ES:				
•	To provide the necessary basic concepts in probability and random processes for applications such as random signals, linear systems etc in communication engineering.				for tion	
UNIT I	JNIT I RANDOM VARIABLES			9+6		
Discrete a Binomial,	Discrete and continuous random variables – Moments – Moment generating function Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.		ons - 1s.	_		
UNIT II		TWO - DIMENSIONAL RANDOM VARIABLES	•		9-	+6
Joint distr Linear reg	ibuti ressi	ons – Marginal and conditional distributions – Covariance – C on – Transformation of random variables.	orre	latio	n an	d
UNIT II	Ι	RANDOM PROCESSES			9+	6
Classification process.	tion -	– Stationary process – Markov process - Poisson process – Ran	dom	tele	grap	h
UNIT IV CORRELATION AND SPECTRAL DENSITIES			9-	+6		
Auto corr density – (elati Cros	on functions – Cross correlation functions – Properties – P s spectral density – Properties.	'owe	er sp	ectra	ıl
UNIT V		LINEAR SYSTEMS WITH RANDOM INPUTS			9-	+6
Linear time invariant system – System transfer function – Linear systems with randor inputs – Auto correlation and Cross correlation functions of input and output.			ndor	n		
		TOTAL : 60 PER	101	DS		
OUTCO	DMI	ES:				
•	The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.			n O		
TEXT B	800	OKS:				
1.	Ibe.O.C, "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.			r,		
2.	Peebles. P.Z., "Probability, Random Variables and Random Signal Principle Tata Mc Graw Hill, 4th Edition, New Delhi, 2016.		ples'	",		

REFE	REFERENCES:		
1.	Yates. R.D and Goodman. D.J, "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd, Bangalore, 2012.		
2.	Stark. H, and Woods. J.W, "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Asia, 2002.		
3.	Miller. S.L and Childers. D.G, "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.		
4.	H.Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata Mc Graw Hill Edition, New Delhi, 2004.		
5.	Cooper. G.R, Mc Gillem. C.D, "Probabilistic Methods of Signal and System Analysis", 3rd Indian Edition, Oxford University Press, New Delhi, 2012.		

ANALOG INTEGRATED CIRCUITS

L	Т	Р	С
3	0	0	3

OBJECTIVES:

UNIT I		INTRODUCTION AND CIRCUIT CONFIGURATION	9	
•	To gain knowledge of special purpose ICs.			
•	Τc	To study the performance of convertors and filters.		
•	To design the various non-linear applications of op-amps.			
•	To	To design the various linear applications of op-amps.		
•	То	To study the characteristics and internal circuit of op-amps.		

OF LINEAR IC

Op Amp characteristics, Ideal versus Practical, Building Blocks of Op amp, Current sources, Current mirror, analysis of difference amplifier-Derivation of transfer characteristic, Analysis with active load, circuits for improving input impedance, level translator, output stage. Op Amp Specifications: input bias current, offset current, offset voltage, bandwidth, Gain Bandwidth product, frequency compensation and slew rate.

UNIT II LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIER

9

Linear circuits using operational amplifiers and their analysis: virtual ground, Inverting and non-inverting modes; adder, subtractor, difference amplifier; common mode rejection ratio (CMRR), Differentiator, Integrator, V to I converter and I to V converter, Instrumentation Amplifier, sine wave Oscillators, Log and Antilog amplifiers.

UNIT IIINON LINEAR APPLICATIONS OF OPERATIONAL9AMPLIFIERS AND ANALOG MULTIPLIER

Precision rectifier, Comparator, Application of comparator, Schmitt trigger, Multivibrators, Triangular wave generator. Analysis of four quadrant (Gilbert cell) and variable transconductance multiplier, DC analysis of Gilbert multiplier cell, Application of Gilbert cell as complete analog multiplier, modulator and phase detector.

UNIT IV DAC, ADC, ACTIVE FILTERS

Analog switches, High speed Sample and Hold circuit. DAC techniques: Weighted Resistor, R-2R ladder, Inverted R-2R ladder, and ADC techniques: Flash type, Counter type, Successive approximation, Single slope and Dual slope. DAC and ADC specifications - Linearity, accuracy, Monotonicity, Settling time and stability,555 timer IC, Applications: Astable and Monostable operation, Active filters: First order, second order and higher order Low pass and high pass and band pass filter, Butterworth Filters.

UNIT V PLL AND IC VOLTAGE REGULATOR

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Voltage controlled Oscillator, PLL and Closed loop analysis of PLL, Applications of PLL: Frequency translation, AM, FM and FSK modulators and demodulators, Frequency

synthesizers. Voltage regulator ICs: Linear and switched mode types, Switched capacitor filters, Frequency to voltage converter

TOTAL : 45 PERIODS

OUTCOMES:

٠	Understand the basic characteristics of Op-Amp.
•	Analyze and design Op-Amp based circuits for various applications
٠	Analyze and design differential amplifiers and current sources.
•	Analyze the performance of ADC, DAC and Filters.
•	Have the knowledge of special purpose ICs such as PLL, 555, 723 etc.,

TEXT BOOKS:

1.	D. R. Choudhry, S. Jain, "Linear Integrated Circuits", 5th Edition, New Age	
	International Pvt. Ltd, 2018.	
2.	Gray and Meyer, "Analysis and Design of Analog Integrated Circuit", 4th	
	Edition, Wiley International, 2009	
3.	R. A. Gayakwad, "OP-AMP and Linear IC's", 4th Edition, Prentice Hall /	
	Pearson Education,2001.	
4.	Millman.J. and Halkias.C.C, "Integrated Electronics", 2nd Ediiton, McGraw-	
	Hill, 2001.	
REFERENCES:		

1.	J.M. Jacob, "Applications and Design with Analog Integrated Circuits", 4th Edition, Prentice Hall of India, 1996.
2.	W. D.Stanely, "Operational Amplifiers with Linear Integrated Circuits", 4th Edition, Pearson Education, 2004.
3.	S. Smith, "Micro Electronic Circuits", 5th Edition, Oxford University Press, 2004.

4. S.Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata McGraw-Hill, 2002.

ELECTRONIC CIRCUITS II

L	Т	Р	С
3	0	0	3

OBJECTIVES:

UNIT I		FEEDBACK AMPLIFIERS	9	
•	Τc	To understand the analysis and design of time base generators.		
•	To analyze the performance of multivibrators.			
•	Тс	To understand the analysis and design of tuned amplifiers.		
•	Тс	To understand the analysis and design of oscillators.		
•	To understand the advantages and methods of analysis of feedback amplifiers.			

General Feedback Structure – Properties of negative feedback – Basic Feedback Topologies – Feedback amplifiers – Series – Shunt, Series – Series, Shunt – Shunt and Shunt – Series Feedback – Determining the Loop Gain – Stability Problem – Nyquist Plot – Effect of feedback on amplifier poles – Frequency Compensation.

UNIT II OSCILLATORS

Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude, General form of an Oscillator, Analysis of LC oscillators - Hartley, Colpitts, Clapp, Franklin, Armstrong, Tuned collector oscillators, RC oscillators - phase shift – Wienbridge - Twin-T Oscillators, Frequency range of RC and LC Oscillators, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal oscillators, frequency stability of oscillators.

UNIT III TUNED AMPLIFIERS

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

UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS

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RC & RL Integrator and Differentiator circuits – Storage, Delay and Calculation of Transistor Switching Times – Speed-up Capacitor - Diode clippers, Diode comparator -Clampers. Collector coupled and Emitter coupled Astable multivibrator – Monostable multivibrator - Bistable multivibrator - Triggering methods for bistable multivibrator -Schmitt trigger circuit.

UNIT V BLOCKING OSCILLATORS AND TIMEBASE GENERATORS

UJT saw tooth waveform generator, Pulse transformers – equivalent circuit – response applications, Blocking Oscillator – Free running blocking oscillator - Astable Blocking Oscillators with base timing – Push-pull Astable blocking oscillator with emitter timing, Frequency control using core saturation, Triggered blocking oscillator – Monostable blocking oscillator with base timing – Monostable blocking oscillator with emitter timing, Time base circuits - Voltage-Time base circuit, Current-Time base circuit – Linearization through adjustment of driving waveform.

TOTAL : 45 PERIODS

9

OUTCOMES:

•	Design and analyze feedback amplifiers.
•	Design LC and RC oscillators.
•	Analyze performance of tuned amplifiers.
•	Design and analyze multivibrators and wave shaping circuits.
•	Design and analyze blocking oscillators and time base generators.
TEXT	BOOKS:
1.	Sedra and Smith, "Micro Electronic Circuits", Sixth Edition, Oxford University Press, 2011.
2.	R. L. Boylestad and L. Nasheresky, "Electronic Devices and Circuit Theory", 10 Edition, Pearson Education / PHI, 2008
3.	D. A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008.
REFE	RENCES:
1.	Millman .J and Taub .H, "Pulse Digital and Switching Waveforms", 1 st Edition, TMH, 2000.
2.	Millman and Halkias. C, "Integrated Electronics", TMH, 2007.
3.	A. Mottershed, "Electronic devices and circuits", 18 th reprint, PHI,2006.
4.	D.L.Schilling & C.Belove, "Electronic Circuits: Discrete and Integrated", (3 Edition, McGraw Hill, 1989.

ELECTROMAGNETIC FIELDS

L T P C 3 2 0 4

OBJECTIVES:

UNIT I		STATIC ELECTRIC FIELD	9+6
•	To	o study various magnetic forces and materials.	
•	To	how about conductors and dielectrics	
•	To	b learn the Maxwell's equation and time varying fields	
•	To	o understand the basic concepts of magnetic field	
•	То	o understand the basic concepts of electric field	
	_		

Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT II CONDUCTORS AND DIELECTRICS

9+6

Conductors and dielectrics in Static Electric Field, Current and current density, Continuity equation, Polarization, Boundary conditions, Method of images, Resistance of a conductor, Capacitance, Parallel plate, Coaxial and Spherical capacitors, Boundary conditions for perfect dielectric materials, Poisson's equation, Laplace's equation, Solution of Laplace equation, Application of Poisson's and Laplace's equations.

UNIT III STATIC MAGNETIC FIELDS

Biot -Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity for straight and circular conductors, Ampere's Circuital Law, Point form of Ampere's Circuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.

UNIT IV MAGNETIC FORCES AND MATERIALS

9+6

9+6

Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions involving magnetic fields, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance, Basic expressions for self and mutual inductances, Inductance evaluation for solenoid, toroid, coaxial cables and transmission lines, Energy stored in Magnetic fields.

UNIT V TIME VARYING FIELDS AND MAXWELL'S EQUATIONS

9+6

Fundamental relations for Electrostatic and Magnetostatic fields, Faraday's law for Electromagnetic induction, Transformers, Motional Electromotive forces, Differential form

of Maxwell's equations, Integral form of Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and their solutions, Poynting's theorem, Time harmonic fields, Electromagnetic Spectrum.

TOTAL : 75 PERIODS

OUTC	COMES:				
•	Analyze field potentials due to static electric fields.				
•	Explain how materials affect electric and magnetic fields.				
•	Analyze the relation between the fields under time varying situations.				
•	Analyze field potentials due to static magnetic field				
•	Discuss the principles of propagation of uniform plane waves.				
TEXT	BOOKS:				
1.	W. H.Hayt and J. A.Buck., "Engineering Electromagnetics", 7 th Edition,Tata McGraw-Hill Publishing Ltd, 2006.				
2.	Sadiku MH, "Principles of Electromagnetics", 4 th Edition,Oxford University Press Inc, New Delhi, 2009				
3.	D. K Cheng, "Field and Wave Electromagnetics", 2 nd Edition, Pearson Education Inc, Delhi, 2004.				
REFE	RENCES:				
1.	G.S.N.Raju, "Electromagnetic Fields", Pearson Education India, 2012.				
2.	J.D Kraus and D.A Fleisch, "Electromagnetics with Applications", Mc Graw Hill Book Co, 2005.				
3.	K.E Longman and S. V Savov, "Fundamentals of Electromagnetics", Prentice Hall of India, New Delhi, 2006.				
4.	<i>A. Pramanic, "Electromagnetism", 1st Edition, Prentice Hall of India , New Delhi, 2006.</i>				
17ZES40	5 SIGNALS AND SYSTEMS	L	Τ	Р	C
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		3	2	0	4
OBJECT	IVES:				
•	To understand the basic properties of signal & systems and the various methods of classification				ods
•	• To learn Laplace Transform &Fourier transform and their properties				
•	• To know Z transform & DTFT and their properties				
•	• To characterize LTI systems in Continuous Time domain and various Transform domains			orm	
•	To characterize LTI systems in Discrete Time domain and various Transform				

n Discrete Time domain and various Transform domains

CLASSIFICATION OF SIGNALS AND SYSTEMS UNIT I

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

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS

9+6

9+6

Fourier series analysis-spectrum of Continuous Time (CT) signals- Fourier and Laplace Transforms in CT Signal Analysis - Properties.

9+6 UNIT III LINEAR TIME INVARIANT- CONTINUOUS TIME **SYSTEMS**

Differential Equation-Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in Analysis of CT systems.

UNIT IV	ANALYSIS OF DISCRETE TIME SIGNALS	9+6		
Baseband Sampling - DTFT – Properties of DTFT - Z Transform – Properties of Z Transform.				
UNIT V	LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS	9+6		
Difference Equations-Block diagram representation-Impulse response - Convolution sum-				

Discrete Fourier and Z Transform Analysis of Recursive & Non-Recursive systems.

TOTAL : 75 PERIODS

OUTC	COMES:
•	Analyze the properties of signals & systems.
•	Apply Laplace transform, Fourier transform.
•	Apply Z transform and DTFT in signal analysis.
•	Analyze continuous time LTI systems using Fourier and Laplace Transforms.
•	Analyze discrete time LTI systems using Z transform and DTFT.
TEXT	BOOKS:
1.	A. V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", 2 nd Edition,Pearson, 2008.
2.	S. Haykin, B.V. Veen., "Signals & Systems",2 nd Edition, John Wiley & Sons(ASIA) Pvt Ltd, 2004.
3.	B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
REFE	RENCES:
1.	R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
2.	J.A Stuller, "An Introduction to Signals and Systems", Thomson, 2007.
3.	H P HSU, "Signals and Systems", 2 nd edition, Mc.Hill.education, 2017
4.	M.J.Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", Tata McGraw Hill, 2007.

MICROPROCESSORS AND MICROCONTROLLERS

OBJECTIVES:

•	To understand fundamental operating concepts behind microprocessors and microcontrollers.
•	Appreciate the advantages in using RISC microprocessors / microcontrollers in engineering applications
•	Design microprocessor based solutions to problems.
٠	Understand Low-Level and Embedded C Programming.
•	Apply this knowledge to more advanced structures.

UNIT I MICROPROCESSOR- 8086

Register Organization -Architecture-Signals-Memory Organization-Bus Operation- I/O Addressing-Minimum Mode ,Maximum Mode-Timing Diagram-Interrupts-Service Routines–I/O and Memory Interfacing concepts.

UNIT II RISC ARCHITECTURE AND PROGRAMMING

12

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Addressing Modes-Instruction format-Instruction set-Assembly language programs in 8086. RISC architecture – The ARM Cortex M0 (nuvoTon- Nu-LB-LUC140)architecture - ARM organization and implementation – Introduction to ARM Programming Register –Nested Vector Interrupt Configuration and Instruction Set - The thumb instruction set Basic ARM ALP (32-bit arithmetic operations, sorting technique, sum of series).

UNIT III INTERFACING DEVICES

Programmable Peripheral Interface (8255) - Programmable Interval Timer (8254)-Programmable Interrupt Controller (8259A) - Programmable DMA Controller (8257) -Programmable Communication Interface (8251A) – Programmable Keyboard and Display Controller (8279).

UNIT IV MICROCONTROLLER-8051

7

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Register Set-Architecture of 8051 microcontroller- I/O and memory addressing- Interrupts-Instruction set- Addressing modes.

UNIT V INTERFACING OF 8051 USING EMBEDDED C PROGRAMMING

10

Timer-Serial Communication-Interrupts Programming-Interfacing to External Memory-Introduction to Embedded C Programming -Basic techniques for reading & writing from I/O port pins. Interfacing 8051 to ADC, LCD, Keyboard and stepper motor using Embedded C.

TOTAL : 45 PERIODS

OUT	COMES:
•	Design and implement programs on RISC.
•	Design Memory Interfacing circuits and I/O interfacing.
•	Design and implement programs on 8086 microprocessor.
•	Design and implement programs on 8051 microcontroller.
•	Design interfacing of 8051 microcontroller.
TEXT	T BOOKS:
1.	M. A.Mazidi and J. G. Mazidi, "The 8051 - Microcontroller and Embedded systems", 7th Edition, Pearson Education, 2004
2.	D.V.Hall, "Microprocessor and Interfacing : Programming and Hardware", Revised 2nd edition, McGraw Hill, 1992.
3.	A. N. Sloss, D. Symes, C. Wright and J. Rayfield, "ARM System Developer's Guide, Designing and Optimizing System Software",1 st Edition, Elsevier, 2004
REFF	CRENCES:
1.	D. Seal, "ARM Architecture Reference Manual", 2 nd Edition, Pearson Education, 2001.
2.	K.J.Ayala, "8051 Microcontroller Architecture, Programming and Applications", 3rd edition, Thomson, 2007.
3.	M. J. Pont, "Embedded C", Addison Wesley, 2002.
4.	Ray.K and Bhurchandi.K.M, "Advanced Microprocessors and Peripherals – Architectures, Programming and Interfacing", Tata McGraw Hill, 2002 Reprint
5.	nuvoTon Cortex M0 (Nu-LB-NUC100/140) Driver and Processor Reference Manual; <u>www.nuvoton.com</u>

INTEGRATED CIRCUITS LAB

L	Т	Р	С
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OBJECTIVES:

•	To learn the fundamental principles of amplifier circuits.

- To understand the characteristics of oscillators.
- To apply Op-Amp in linear and non-linear applications.
- To understand the characteristics of Op-Amp.
- To use PSPICE software for circuit design.

LIST OF EXPERIMENTS

Design, Simulation & implementation as follows

USING DISCRETE COMPONENTS

- 1. Current series and shunt, Voltage series and shunt Feedback Amplifiers
- 2. Wein bridge Oscillators
- 3. Class C Single Tuned Amplifier and UJT Relaxation Oscillator
- 4. Collector Coupled Astable Multivibrator
- 5. Collector Coupled Monostable Multivibrator and Fixed Bias Bistable Multivibrator

USING OP-AMP

- 1. Inverting and Non-Inverting Amplifiers and Voltage follower
- 2. Adder, Subtractor, Difference amplifier, Integrator, Differentiator
- 3. Instrumentation Amplifier
- 4. Active 2nd Order Butterworth Filters
- 5. Multivibrators and Schmitt Trigger using Op-Amp and 555 timer

USING SIMULATION

- 1. Wein bridge Oscillators
- 2. Collector Coupled Astable Multivibrator

TOTAL: 60 PERIODS

OUTCOMES:

•	Construct, troubleshoot amplifier circuits in the laboratory with proper use of test equipment.
•	Construct, troubleshoot oscillator circuits in the laboratory with proper use of test equipment.
•	Design and analyze active filters.
•	Design and construct multivibrators using op-amp and timer.
•	Carry out performance evaluations of electronic circuits using PSPICE simulation tool.

MICROPROCESSORS AND MICROCONTROLLERS LAB

OBJECTIVES:

•	To demonstrate programming proficiency using the various addressing modes of the microprocessor.
•	To apply knowledge of the microprocessor's internal registers and operations by use of a PC based microprocessor simulator.
•	To interface the processor to external devices.
•	To demonstrate programming proficiency using data transfer instructions of the microprocessor.
•	To apply programming proficiency in code converters.

LIST OF RECOMMENDED EXPERIMENTS

PART-A: GENERAL PURPOSE PROGRAMMING EXERCISES

1. Addition, Subtraction, Multiplication and Division.

2. Arithmetic Array manipulation (Finding the maximum value in an array, Sorting of data, Finding number of positive / negative elements in a block of data).

3. Code Convertors (BCD-to-Hex conversion and Hex-to-BCD conversion, Binary-to-

ASCII and ASCII-to-Binary conversion).

4. Square Root of a given data.

5. LCM

6. GCD

PART-B: INTERFACING WITH APPLICATION BOARDS (8051, ARM Cortex M0 {Nu-LB-NUC140})

1. Transfer data serially between two kits (Study of 8253/8251) and 8279 Keyboard & display using 8051 controller.

2. Seven segment display and LCD Display using 8051 using ARM Cortex board.

3. Traffic light and Real Time Clock using ARM Cortex board.

4. 8259 programmable interrupt controller and 8257/8237 DMA controller.

5. 8 bit ADC and 8 bit DAC using ARM Cortex board

6. Stepper motor control using 8051 controller.

TOTAL:60 PERIODS

OUTCOMES:		
•	Write ALP Programs for fixed and Floating Point and Arithmetic	
•	Interface different I/Os with processor	
•	Generate waveforms using Microprocessors	
•	Execute Programs in 8051	
•	Explain the difference between simulator and Emulator	

SEMESTER-V

17LPC501		DIGITAL SIGNAL PROCESSING	L	Т	Р	С
			3	0	0	3
OBJE	CTIVE	S:				
•	To intra associa	oduce signals, systems, time and frequency domain concepts an ted mathematical tools those are fundamental to all DSP techni	d the	e		
•	To lear	n discrete Fourier transform and its properties				
•	To kno finite in	w the characteristics of IIR and FIR filters learn the design of in npulse response filters for filtering undesired signals	nfini	te ar	nd	
•	To und	erstand Finite word length effects				
•	To stuc	ly the concept of Multirate and adaptive filters				
UNIT	[DISCRETE FOURIER TRANSFORM			ļ	9
Discrete Convolu Algorith	Signals tion - 1 ms, Dec	and Systems- A Review – Introduction to DFT – Properties of Filtering methods based on DFT – FFT Algorithms –Dec imation in frequency Algorithms	f DF imat	T – ion	Circu in ti	ular ime
UNIT	Π	IIR FILTER DESIGN			ļ	9
Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPI HPF, BPF, BRF) filter design using frequency translation.			lter PF,			
UNIT III FIR FILTER DESIGN			9			
Structure techniqu Blackma Filters: H	Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window, Bartlett Window, Blackmann Window), Frequency sampling techniques – Finite word length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.					
UNIT	UNIT IV FINITE WORDLENGTH EFFECTS			9	9	
Fixed po Roundin error - C off and c	Fixed point and floating point number representations – ADC –Quantization- Truncation and Rounding errors - Quantization noise – coefficient quantization error – Product quantization error - Overflow error – Round off noise power - limit cycle oscillations due to product round off and overflow errors – Principle of scaling					
UNIT	UNIT V DSP APPLICATIONS			9	9	
Introduction to DSP processors - Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization.			ı, f			
TOTAL : 45 PERIODS						

OUTC	OMES:	
•	Apply DFT for the analysis of digital signals & systems	
•	Analyze IIR and FIR filters	
•	Illustrate the finite Word length effect on filters	
•	Design the Multirate Filter	
•	Apply Adaptive Filters to equalization	
TEXT	BOOKS:	
1.	J.G.Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.	
2.	S.K.Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, Fourth Edition ,2013.	
3.	A.V.Oppenheim and R.W.Schafer (with J. Processing. 3rd.Edition,. Prentice-Hall, 2010 Signal	
REFERENCES:		
1.	A. Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.	
2.	L.T.J.Jiang, "Digital Signal Processing Fundamentals and Applications", 2nd Edition, Academic Press, 2013.	
3.	S. W.Smith, "Digital Signal Processing : A Practical Guide for Engineers and Scientists" Demystifying Technology Series, Nownes.	

CONTROL SYSTEMS ENGINEERING

L	Т	Р	С
3	2	0	4

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OBJECTIVES:

•	Ability to model electrical and non electrical system, and determine transfer function for stability analysis
•	Analyze the stability of transfer function in time domain and design controller.
•	Analyze the stability of transfer function in frequency domain and design controller.
•	Analyze the steady state error and transient response improvement in compensator design.
•	Use state space model to analyze the controllability and observ ability of the system

UNIT I INTRODUCTION

Transfer Function of Electrical systems - Mathematical modelling of Non electrical System: mechanical, thermal, and hydraulic systems – Electrical Analogy of mechanical system - Block diagram reduction technique – Signal flow graph analysis

UNIT II TIME DOMAIN ANALYSIS

Time response of First and second-order systems – Time domain Specifications - Steady-state errors and error constants – PID controllers – Stability analysis in time domain - Routh stability criterion – Root Locus Method.

UNIT III FREQUENCY DOMAIN ANALYSIS

Correlation between time & frequency response – Frequency domain specifications – Bode Plot and Polar plots – M and N Circles –Stability in frequency domain – Nyquist plot –

Nyquist stability criterion.

UNIT IV COMPENSATOR DESIGN

Introduction to compensators– Lead, Lag and Lead–Lag compensators – Design of lead, lag and lead–lag compensators using root locus – Design of lead, lag and lead–lag compensators using bode plot.

UNIT VSTATE SPACE ANALYSIS9

Concepts of State space analysis – State models for linear continuous time functions – Diagonalization of transfer function – State equations and solution – controllability & observability – State space representation for Discrete time systems.

OTAL: (45L+15T)	60 PERIODS
0	TAL: (45L+15T)

OUTC	OMES:				
•	Classify the large component system into single block for electrical and non electrical system.				
•	Categorize the controllers for compensating steady state errors and improve their stability in time domain.				
•	Determine the controllers for improving their stability in frequency domain.				
•	Compare different types of compensators.				
•	Evaluate state controller and observer in state space model.				
TEXT	BOOKS:				
1.	J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.				
2.	M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.				
REFE	REFERENCES:				
1.	Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.				
2.	B.C.Kuo, "Automatic control systems", Prentice Hall of India, 7 th Edition, 1995.				
3.	M.Gopal, "Digital Control and State Variable Methods", 2nd Edition, TMH, 2007.				
4.	Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.				
5.	J.J.D'azzo & C.H.Houpis, "Linear control system analysis and design", Tata McGrow-Hill, Inc., 1995.				
6.	R. C. Dorf & R. H. Bishop, "Modern Control Systems", Addidon – Wesley, 1999.				

ANALOG COMMUNICATION

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OBJECTIVES:

- To introduce the concepts of various analog modulations and their spectral characteristics.
 Recognize the sampled description of an analog signal, its spectral properties, the basic types of practical sampling and interpolations and its use in analog pulse modulations.
 Identify the limiting factors in an analog communication system the quantifying
 - Identify the limiting factors in an analog communication system, the quantifying measures and the compensating procedures, including linear equalization systems, and systems with nonlinear distortion.
 - To understand the properties of random process.
 - To know the effect of noise on communication systems.
 - To study the limits set by Information Theory.

UNIT I AMPLITUDE MODULATION

Generation and detection of AM wave-spectra-DSBSC, Hilbert Transform, Pre-envelope & complex envelope - SSB and VSB –comparison -Super heterodyne Receiver.

UNIT II ANGLE MODULATION

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

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 NOISE

Noise Characteristics: 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.

UNIT V INFORMATION THEORY

Entropy - Discrete Memory less channels - Channel Capacity -Hartley - Shannon law - Source coding theorem - Huffman & Shannon - Fano codes.

TOTAL : 45 PERIODS

OUTC	OMES:		
•	Generate AM communication systems.		
•	Develop Angle modulated communication systems		
•	Apply the concepts of Random Process to the design of Communication systems		
•	Analyze the noise performance of AM and FM systems		
•	Analyze Source and Error Control Coding.		
TEXT	BOOKS:		
1.	S. Haykin, "Communication Systems", 5th edition, John Wiley & Sons (Mar. 16th, 2009)		
2.	J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems",2 nd Edition Pearson Education 2014.		
3.	B.P.Lathi, "Modern Digital and Analog Communication Systems", 4 th Edition, Oxford University Press 2017.		
REFERENCES:			
1.	<i>Taub and Schilling.</i> , " <i>Principles of Communication Systems</i> ", 2nd edition Mcgraw Hill, 1994.		
2.	K. G., Bernard Davis "Electronic Communication Systems", McGraw Hill 3rd Edition reprint, 2008.		
3.	Couch.L., "Modern Communication Systems", Pearson, 2001.		
4.	Roddy and Coolen.," Electronic Communication ", 4th Edition PHI,2007.		
5.	<i>H P Hsu, Schaum Outline Series - "Analog and Digital Communications" TMH 2006.</i>		

17LPC504	TRANSMISSION LINES AND WAVE GUIDES	L	Т	Р	C	
		1	•	•	2	

•	To be able to design appropriate transmission lines and waveguides to guide the electromagnetic waves, as well as using the lines as circuit elements.
•	To introduce the various types of transmission lines and to discuss the losses associated.
•	To give through understanding about impedance transformation and matching.
•	To use the Smith Chart in problem solving.
•	To visualize the mathematical description of the field orientations so as to understand polarization concepts, polarization of various radio waves and devices.
•	To impart knowledge on filter theories and waveguide theories.

UNIT I

TRANSMISSION LINE THEORY

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in ZO - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II HIGH FREQUENCY TRANSMISSION LINES

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Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES

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

UNIT IV GUIDED WAVES

Waves between the parallel planes: Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, Characteristics of TM, TE and TEM waves – Attenuation in parallel plane guides – Wave Impedance.

UNIT	VWAVEGUIDES AND CAVITY RESONATORS9				
Rectangular waveguide: TM, TE and TEM waves, Dominant mode-cut-off frequency in waveguides – Impossibility of TEM Waves in waveguide.					
Circula wavegui	r waveguide: TM, TE and TEM waves, Dominant mode-cut-off frequency i ides – Impossibility of TEM Waves in waveguide.	in			
Resonat	tors: Rectangular and Circular Cavity resonators.				
	TOTAL : 45 PERIODS				
OUTC	COMES:				
•	Discuss the propagation of signals through transmission lines.				
•	Analyze signal propagation at Radio frequencies.				
•	Discuss about impedance transformation and matching and to utilize Smith chart is problem solving	in			
•	Explain radio propagation in guided systems.				
•	Utilize cavity resonators.				
TEXT	BOOKS:				
1.	J.D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2010.				
2.	E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.				
3.	G.S.N Raju "Electromagnetic Field Theory and Transmission Lines", Pearson Education, First edition 2005.				
4.	"Foundations for Microwave Engineering", R.E.Collins, McGraw-Hill,II n edition,2001	ıd			
REFERENCES:					
1.	G.Sashibhusana Rao, "Electromagnetic field theory and transmission lines", Wile series.	ey			
2.	F. A. Benson & T. M. Benson, "Field Waves and Transmission Lines", Springe Science.	er			
3.	P. C. Magnusson, G.C. Alexander, Vijai K. Tripathi, Andreas Weisshaar, "Transmission Lines and Wave Propagation", CRC Press.				

17LPC505		VLSI DESIGN	L	Т	Р	С
			3	0	0	3
OBJE	CTIV	ES:				
•	To study MOS circuit realization of the various building blocks common to an microprocessor or digital VLSI circuit.			any		
•	To us and r	nderstand architectural choices and performance tradeoffs invol ealizing the circuits in CMOS technology.	ved	in d	esign	ing
•	Knov micro	vledge of digital systems for a variety of applicat ocomputers and special purpose computing systems.	ions	, iı	nclud	ling
•	To u Semi trans	inderstand the static and dynamic behaviour of MOSFET conductor Field Effect Transistors) and the secondary effect stor model.	s (N cts c	Aeta of th	l Ox ie M	ide IOS
•	To un affec	nderstand the consequence of scaling down the dimensions of the total to	ransi	istor	s and	l its
•	Use meth perfo	different analysis and verification tools, implementation odologies and testability techniques that will enable them rmance and efficient digital systems.	an to	d s desi	yntho gn h	esis igh
•	To un the is	nderstand transistor circuit level design and realization for digit sues involved.	tal oj	pera	tion	and
UNIT	UNIT I MOS TRANSISTOR PRINCIPLE				9	9
NMOS of CMC inverter	and PM OS circ scaling	MOS transistors, Process parameters for MOS and CMOS, Elecutes and device modelling, Scaling principles and fundamenta g, propagation delays, Stick diagram, Layout diagrams	ctric al liı	al pı nits,	coper CM	ties IOS
UNIT	II	COMBINATIONAL LOGIC CIRCUITS			9	9
Example Transmi principle	Examples of Combinational Logic Design, Elmor's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles					
UNIT III		III SEQUENTIAL LOGIC CIRCUITS			9	
Static ar architect Asynchr	nd Dyn ture ar ronous	amic Latches and Registers, Timing issues, pipelines, clock str ad memory control circuits, Low power memory circuits, S design	ategi yncł	ies, I nron	Mem ous	ory and
UNIT	IV	DESIGNING ARITHMETIC BUILDING BLOCH	KS		9	9
Data pata adders, a	th circ	uits, Architectures for ripple carry adders, carry look ahead addulators, Multipliers, dividers, Barrel shifters, speed and area trade	ders, e off	Hig	gh sp	eed

UNIT	V	VERILOG HDL	9		
Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate level switch level modelling, Design hierarchies, Behavioural and RTL modelling, Test benches, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.					
		TOTAL : 45 PERIODS			
OUTC	OME	CS:			
•	Expla	ain the basic CMOS circuits.			
•	Expla	ain the basic CMOS process technology.			
•	Discu	uss the techniques of chip design using programmable devices.			
•	Evaluate the digital system using Hardware Description Language.				
•	Analyze the Verilog HDL codes.				
TEXT	BOO	OKS:			
1.	J.Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.				
2.	N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993				
3.	J.Bhasker:" Verilog HDL primer", BS publication,2001				
REFE	RENG	CES:			
1.	R.Jac Simu	cob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layo lation", Prentice Hall of India 2005	out and		
2.	A.Pu Hall	cknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, F of India, 2007.	Prentice		
3.	J.Wil	liams, J. Michael, "Digital VLSI Design with Verilog", Springer.			

ANALOG COMMUNICATION LABORATORY

OBJECTIVES:

•	Analyze and specify the fundamental parameters of a communication system.
•	Evaluate the advantages and disadvantages of communications systems, from the point of view analog modulations
•	To strengthen the ability to identify and apply the suitable modulation techniques for the given real world problem
•	To gain knowledge in practical applications of communication systems
•	To write and execute programs in MATLAB to implement various modulation techniques.

• To study the basic of PSPICE which are used to simulate the circuit operations.

LIST OF EXPERIMENTS:

Using Hardware:

- 1. Frequency division multiplexing and demultiplexing
- 2. Amplitude modulation and demodulation: DSB, SSB
- 3. Frequency modulation and demodulation
- 4. Phase modulation and demodulation
- 5. Pre-emphasis and De-emphasis
- 6. Balanced Modulator

Using Software:

- 1. Amplitude modulation and demodulation using MATLAB
- 2. Frequency modulation and demodulation using MATLAB
- 3. Phase modulation and demodulation using MATLAB
- 4. Noise generation and Cancellation using MATLAB
- 5. Shannon-Fano coding algorithm and Huffman coding algorithm using MATLAB
- 6. Amplitude Modulation using Pspice

TOTAL : 60 PERIODS

OUTCOMES:

•	Simulate end-to-end Communication Link
•	Simulate & validate the various functional modules of a communication system
٠	Generate the analog communication system waveforms using hardware
•	Analyze the analog modulation and noise generation using MATLAB
٠	Analyze the amplitude modulation using Pspice.

17LPC508		DSP & VLSI LAB	L	Т	Р	С
			0	0	4	2
OBJE	CTIV	ES:				
٠	To in	nplement Linear and Circular Convolution				
٠	To implement FIR and IIR filters					
٠	To de	emonstrate Finite word length effect				
•	To le	arn Hardware Descriptive Language(Verilog /VHDL)				
•	To learn the fundamental principles of VLSI circuit design in digital and analog domain					
MATL	AB F	EXPERIMENTS				
1. I 2. S 3. F	Linear Spectru FIR filt	and Circular Convolutions & correlation Im Analysis using DFT er design				

- 4. IIR filter design
- 5. Study of various addressing modes
- 6. Convolution and Wave pattern generation

VLSI EXPERIMENTS

HDL based design entry and simulation of

- 1. Adders and Multipliers.
- 2. Multiplexers and Demultiplexers, Encoders and Decoders
- 3. Code converters
- 4. Shift registers and counters
- 5. FIR Filter
- 6. Implementation of Adders and Counters

TOTAL : 60 PERIODS

OUTCOMES:

•	Carry out simulation of DSP systems.
٠	Analyze Finite Word Length Effect on DSP systems.
٠	Analyze the Convolution, Correlation, analog and digital filters using MATLAB.
٠	Write HDL code for basic as well as Advanced Digital Integrated Circuits.
٠	Synthesize Place and Route the Digital IPs.

SEMESTER-VI

17LHS601	MANAGEMENT THEORY AND PRACTICE	L	Т	Р	С	
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OBJECTIV	ES:					
• To enal and pri organiz	ble the students to study the evolution of Management, to stunciples of management and to learn the application of the ation	dy ti prin	he fu ciple	uncti es in	ons an	
• To Une strategy	lerstand the principles of organization structure and desig , technology, organizational culture.	n; e	nvir	onm	ent,	
• To enal understa	ble the concepts of various organization theories which enal and, predict, and influence organizational design/structure and d	ble i level	mana opm	agers ent.	to	
• To ider respons	tify the complex issues faced by managers in the area of e ibility in organizational development.	thic	s an	d so	cial	
• To link	organizational design to global business strategies and practices	5.				
UNIT I	UNIT IINTRODUCTION TO MANAGEMENT AND ORGANIZATIONS9					
Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.						
UNIT II	PLANNING			9)	
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – Planning premises – Strategic Management – Planning Tools and						

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

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UNIT III ORGANISING

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

UNIT IV DIRECTING

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

UNIT V CONTROLLING

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

TOTAL	•	45	PERIODS
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OUTCOMES:

•	To have clear understanding of managerial skills, roles and have same basic knowledge on international aspect of management
•	Identify environmental issues as they impact management and develop strategies to adapt to these environments.
•	Prepare organization structure and design the job.
•	Identify, discuss and/or describe various theories related to the development of leadership skills, motivation techniques, teamwork and effective communication.
•	To Work effectively as a team member through group projects, case studies and problem analysis
ТЕХТ	S BOOKS:
1.	S.P. Robbins & Mary Coulter, "Management", 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.
2.	JAF Stoner, Freeman R.E and D.R Gilbert "Management", 6th Edition, Pearson Education, 2004.

REFERENCES:

1.	S. A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
2.	R.Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3.	H.Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
4.	Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

17LPC	602	ANTENNA AND WAVE PROPAGATION	L	Т	Р	C	
	1		3	0	0	3	
OBJEC	TIV	ES:	<u> </u>				
• 7	Fo un	derstand the fundamentals of antenna					
• 7	Го be	familiar with aperture and slot antenna					
• 7	Го lea	rn about antenna arrays					
• 7	Го be	exposed to special antennas					
• 7	Fo kn	ow the fundamentals of radio wave propagation					
UNIT I		FUNDAMENTALS OF ANTENNA			9		
Band wid Antenna r UNIT I	Band width, Beam width, Input Impedance. Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole.UNIT IIAPERTURE AND SLOT ANTENNAS9						
Radiation antenna,	from Ape	rectangular apertures, Uniform and Tapered aperture, Horn an arture blockage, Feeding structures, Slot antennas, Micro	itenn strip	a , F ant	Refle enna	ctor s –	
UNIT I	I mecr II	ANTENNA ARRAYS			9		
N elemen Phased ar	nt line rays,	ear array, Pattern multiplication, Broadside and End fire arra Adaptive array, Basic principle of antenna Synthesis-Binomial	ay – array	Cor , Ya	ncept gi ar	t of ray	
UNIT I	V	SPECIAL ANTENNAS			9		
Principle antennas- Measuren	of fro Reco nents:	equency independent antennas –Spiral antenna, Helical anten onfigurable antenna, Active antenna, Dielectric antennas, An Gain, Radiation pattern, Polarization, VSWR.	na, I itenn	Log a Pa	perio	odic eter	
UNIT V	7	PROPAGATION OF RADIO WAVES			9		
Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept Sky wave propagation – Virtual height, critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation.							
		TOTAL : 45 PER	ΙΟΙ	DS			

OUTCO	OMES:
•	Understand the fundamentals of antenna and radiation from a current element.
•	Analyze the aperture antennas slot antennas.
•	Analyze the antenna arrays.
•	Analyze the special antennas such as frequency independent antennas and antenna measurements.
•	Evaluate the various types of wave propagation.
TEXT B	BOOKS:
1.	J.D Kraus," Antennas for all Applications", 3rd Edition, Mc Graw Hill, 2005.
2.	C.A.Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 2006.
3.	R.E.Collin,"Antennas and Radiowave Propagation", Mc Graw Hill 1985.
REFER	ENCES:
1.	E. C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2006
2.	R.Chatterjee, "Antenna Theory and Practice" Revised Second Edition New Age International Publishers, 2006.
З.	S. Drabowitch, "Modern Antennas" Second Edition, Springer Publications, 2007.
4.	R.S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.
5.	H.Sizun "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint, Springer Publications, 2007.

EMBEDDED SYSTEM

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OBJECTIVES:

•	To study the different types of embedded processors.
•	To understand about the I/O devices
•	To deal with RTOS and system design techniques.
•	To Implement small programs to solve well-defined problems on an embedded platform
•	To Develop familiarity with tools used to develop in an embedded environment

UNIT I INTRODUCTION TO EMBEDDED PROCESSORS

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Introduction to Embedded Computing, Issues and Challenges in Embedded system Design, Trends: SC, custom designed chips, configurablede signed chips, configurable processors and multi-core processors. Embedded processor architecture: General concepts, instruction sets, Levels in architecture, Functional description-hardware/software trade-off Introduction to RISC architecture, Pipelining, Instruction issue and execution, Instruction formats, Addressing modes, Data alignment and byte ordering, Introduction to VLIW and DSP processors.

UNIT II

I/O DEVICES AND BUSES

I/O Devices:- Types and Examples of I/O devices, Synchronous, Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices:- SPI, UART, Parallel Port Devices - Timer and Counting Devices - Serial Communication using: 'I2C', 'USB','CAN'- Advanced I/O Serial high speed buses: ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT III EMBEDDED PROGRAMMING IN C, C++

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Programming in assembly language (ALP) vs High Level Language - C Program Elements:-Macros and functions, Use of Date Types, Structure, Pointers, Function Calls - Concepts of Embedded Programming in C++:- Objected Oriented Programming, Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory needs.

UNIT IV

REAL TIME OPERATING SYSTEMS

Definitions of process, tasks and threads – Inter Process Communication:- Shared data problem, Use of Semaphore(s), Priority Inversion Problem and Deadlock Situations, Message

Queues, Mailboxes, Pipes, Virtual (Logical) Sockets, Remote Procedure Calls (RPCs) -Operating System Services:- Goals, Structures, Kernel, Process Management, Memory Management, Device Management - Real Time Operating System - RTOS Task scheduling models:- Co-operative Round Robin Scheduling, Cyclic Scheduling with Time Slicing.

UNIT V SYSTEM DESIGN TECHNIQUES

9

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design. Design Examples:- Telephone PBX- System Architecture, Ink jet printer -Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes.

TOTAL : 45 PERIODS

OUTCOMES:

•	Understand the basic of embedded processors
•	Categorize the different input-output devices.
٠	Create the embedded programming in C & C++.
٠	Be exposed to real time operating systems.

• Design real time systems.

TEXT BOOKS:

1.	Rajkamal, "Embedded Systems Architecture, Programming and Design", TATAMcGraw-Hill, First reprint Oct. 2003
2.	W.Wolf, "Computers as Components: Principles of Embedded Computing SystemDesign" – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint, 2001.

3. S. Heath, "Embedded Systems Design", Second Edition-2003, Newnes,

REFERENCES:

1.	D.E.Simon, "An Embedded Software Primer, Pearson Education Asia", First IndianReprint 2000.
2.	F.Vahid and T.Givargis, "Embedded Systems Design – A unified Hardware/Software Introduction", John Wiley, 2002.
3.	M. Barr, "Programming Embedded Systems in C and C++", O"Reilly
4.	J.Catsoulis, "Designing Embedded Hardware", O"Reilly

17LPC604		DIGITAL COMMUNICATION	L	Т	Р
3				0	0
OBJEC	ΓIV	ES:			
• To	o kn	ow the principles of sampling & quantization			
• To	o stu	dy the various waveform coding schemes			
• To	o lea	rn the various baseband transmission schemes			
• To	o un	derstand the various Band pass signalling schemes			
• To	o kn	ow the fundamentals of channel coding			
UNIT I		SAMPLING & QUANTIZATION			9
Low pass quantizatio TDM Com	samı on - (npari	bling – Aliasing- Signal Reconstruction-Quantization - Uniform quantization noise - Logarithmic Companding of speech signal- son with FDM -Digital Multiplexers.	1 & n - PCI	ion- M –	
UNIT II		WAVEFORM CODING			9
Prediction LinearPred	filte lictiv	ering and DPCM - Delta Modulation - ADPCM & ADM prove Coding.	incip	les-	
UNIT II	UNIT III BASEBAND TRANSMISSION				9
Properties BipolarNR Pulse shap	Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – BipolarNRZ - Manchester- ISI – Nyquist criterion for distortionless transmission – Pulse shaping –Correlative coding – M-ary schemes – Eye pattern – Equalization.				
UNIT IV	UNIT IV DIGITAL MODULATION SCHEME				9
Geometric BPSK, BF	Rep FSK,	bresentation of signals - Generation, detection, PSD & BER of C MSK& QPSK - QAM - Carrier Synchronization - Structure	Cohe of N	rent Ion-	

С

conerent Receivers -Principle of DPSK.			
UNIT V	V ERROR CONTROL CODING		9
Channel codin Convolutional	g theorem - Linear Block codes - Hat codes - Viterbi Decoder - RS codes- Tre	mming codes - Cyclic codes - ellis codes and Turbo codes.	
		TOTAL : 45 PERIODS	

OUT	COMES:			
•	Know the concepts of sampling and its application in multiplexing of PCM systems.			
•	Apply base band transmission schemes.			
•	Design and implement band pass signalling schemes.			
•	Analyze the spectral characteristics of band pass signalling schemes and their noise performance .			
•	Differentiate and apply error control coding in digital communication.			
ТЕХЛ	BOOKS:			
1.	S. Haykin, "Digital Communications", John Wiley, 2005			
2.	J.G Proakis, "Digital Communication", 4th Edition, Tata Mc Graw Hill Company, 2001.			
3.	B. Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition Pearson Education, 2009			
REFE	REFERENCES:			
1.	B.P.Lathi, "Modern Digital and Analog Communication Systems" 3rd Edition, Oxford University Press 2007.			
2.	H P Hsu, Schaum Outline Series - "Analog and Digital Communications", TMH 2006			
3.	R.G. Gallager, "Principles of Digital Communication", Cambridge.			
4.	A. J. Viterbi, Jim K. Omura, "Principles of Digital Communication".			

EMBEDDED SYSTEM LABORATORY

L	Т	Р	С
0	0	4	2

OBJECTIVES:

•	Learn the working of ARM processor
•	Understand the Building Blocks of Embedded Systems
•	Learn the concept of memory map and memory interface
•	Know the characteristics of Real Time Systems
٠	Write programs to interface memory, I/Os with processor

EMBEDDED SYSTEM EXPERIMENTS

- 1. Flashing of LEDS
- 2. Interfacing LED brightness control using PWM.
- 3. Interfacing of DC motor and its speed control.
- 4. Interfacing real time clock and serial port.
- 5. Interfacing Keyboard and LCD
- 6. Interfacing EPROM and Interrupt.
- 7. Implementation of Mail Box in RTOS
- 8. Interrupt performance characteristics of ARM and FPGA
- 9. Interfacing ADC and DAC
- 10. Stepper motor control using microcontroller
- 11. Implementing Zigbee Protocol with ARM.
- 12. Study of UART ,I2C, SPI protocols.

TOTAL: 60 PERIODS

OUTCOMES:		
•	Write programs in ARM for a specific Application	
•	Interface memory and Write programs related to memory operations	
•	Interface A/D and D/A convertors with ARM system	
•	Analyse the performance of interrupt	
٠	Write programmes for interfacing keyboard, display, motor and sensor.	

DIGITAL COMMUNICATION AND NETWORKS LABORATORY

OBJECTIVES:

•	To visualize the effects of sampling and TDM
•	To implement PCM & DM
•	To implement FSK, PSK and DPSK schemes
•	To learn to implement the different protocols
•	To be familiar with socket programming.
•	To be familiar with the various routing algorithms

LIST OF EXPERIMENTS:

Using Hardware:

- 1. Sampling and TDM
- 2. Line Coding
- 3. PAM, PPM, PWM, PCM
- 4. Delta Modulation And Demodulation
- 5. Direct Sequence Spread Spectrum System
- 6. ASK, FSK and PSK generation using hardware and MATLAB
- 7. Observation of signal constellations of BPSK, QPSK, QAM Schemes
- 8. Link simulation using SDR.

Using Network:

- 1. Sliding window protocol for Go-back-N
- 2. TCP congestion control technique
- 3. Socket programming
- 4. Implementation of STAR, BUS, Ring topology

TOTAL:	60	PERIODS

OUTCOMES:				
•	Simulate end-to-end Communication Link			
•	Demonstrate their knowledge in base band signalling schemes through implementation of ASK, FSK, PSK and DPSK			
•	Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system			
•	Simulate & validate the various functional modules of a communication system			
•	Familiar with various routing algorithm.			

17ZEF	E609	COMMUNICATION AND SOFT SKILLS- LABORATORY BASED	L	Т	Р	С
			0	0	4	2
OBJECTIVES:						
•	To develop their communicative competency in English with specific reference to their speaking and listening.					
•	To enhance their ability to communicate effectively in interviews.					
•	To strengthen their prospects of success in competitive examinations.					
•	• To Strengthen a good command over of the language proficiency.					
•	• To comprehend a different types of accent and use them in their communication					
UNIT I		LISTENING AND SPEAKING SKILLS			1	2

Conversational skills (formal and informal)- group discussion – making effective presentations using computers, listening/ watching interviews, conversations, documentaries. Listening to lectures, discussions.

UNIT II READING AND WRITING SKILLS

Reading different genres of tests ranging from newspapers to creative writing. Writing job applications - cover letter- resume- e-mails- memos- reports. Writing abstracts- summaries-interpreting visual texts

12

12

12

UNIT IIIENGLISH FOR NATIONAL AND INTERNATIONAL
EXAMINATIONS AND PLACEMENTS12

International English Language Testing System (IELTS)- Test of English as a Foreign Language (TOEFL)- Civil Service(Language related)- Verbal Ability- Articulation of sounds-intonation.

UNIT IV INTERVIEW SKILLS

Different types of Interview format- answering questions- offering information- mock interviews- body language(paralinguistic features)-

UNIT V

SOFT SKILLS

Motivation- emotional intelligence-Multiple intelligences- managing changes- time

management-leadership straits- team work- career planning- creative and critical thinking.				
	TOTAL : 60 PERIODS			
OUTCOMES :				
•	Apply the knowledge for developing intellectual skills			
•	Know the English for national and international examinations			
•	Understand the various interview formats			
•	Apply the emotional and critical thinking			
REFERENCES:				
1.	Craven, Miles. "Listening Extra-A resource book of multi-level skills active Cambridge University Press, 2004.	tie"s.		
2.	Seely, John. "The Oxford guide to writing & Speaking". New Delhi: C University Press,2004	xford		

SEMESTER-VII

17LPC701		MICROWAVE AND RF SYSTEMS	L	Т	Р	С
			3	0	0	3
OBJE	CTIV	ES:	<u> </u>			
•	• To inculcate understanding of the basics required for circuit representation networks.				n of	RF
•	• To deal with the issues in the design of microwave amplifier.					
•	• To instil knowledge on the properties of various microwave components.					
•	• To impart knowledge about the microwave generation.					
•	To in	npart knowledge about microwave measurement techniques.				
UNIT	I	TWO PORT NETWORK THEORY			9	9
Review of intere- matrix, l	of Lov connec RF beh	w frequency parameters: Y parameters and ABCD parameters tion of Two port networks, Reciprocal and lossless Networ aviour of Resistors, Capacitors and Inductors.	, Dif k, T	ffere	nt ty smiss	pession
UNIT	Π	RF AMPLIFIERS AND MATCHING NETWORI	KS			9
Characte Stabiliza Multista matchin	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					
UNIT	UNIT III PASSIVE AND ACTIVE MICROWAVE DEVICES		9	9		
Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal and Schottky diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier						
UNIT	IV	MICROWAVE GENERATION				
High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Cylindrical Magnetron Oscillator Backward wave Crossed field amplifier and oscillator.						
UNIT	UNIT V MICROWAVE MEASUREMENTS				9	
Measuring Instruments : Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.						
	TOTAL : 45 PERIODS					

OUTCOMES:					
•	Ability to analyze two port networks.				
•	Ability to analyze the multi- port RF networks and RF transistor amplifiers.				
•	Ability to analyze active & passive microwave devices & components used in Microwave communication systems.				
•	Ability to create Microwave signals and design microwave amplifiers.				
•	Ability to analyze Microwave signal and parameters.				
TEXT	TEXT BOOKS:				
1.	S. Y Liao, "Microwave Devices & Circuits", Prentice Hall of India, 2008.				
2.	R.Ludwig and P. Bretshko, "RF Circuit Design", Second Edition, Pearson Education, Inc., 2009.				
3.	A.Das and S. K Das, "Microwave Engineering", Second Edition, Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2010.				
REFE	REFERENCES:				
1.	D. M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India (P) Ltd, New Delhi, ,2011.				
2.	<i>R.E. Colin, "Foundations for Microwave Engineering", Second Edition , John Wiley & Sons Inc, 2005</i>				
3.	M. M. Radmanesh, "RF and Microwave Electronics", Prentice Hall, 2000.				
4.	T. H. Lee, "Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits", Cambridge University Press, 2018.				

WIRELESS COMMUNICATION

L	Т	Р	С
3	0	0	3

OBJECTIVES:

•	To introduce the characteristic of wireless channel.		
٠	To educate about the various cellular architectures.		
•	To educate the concepts behind various digital signalling schemes for fading channels.		
٠	To impart knowledge about Be familiar the various multipath mitigation techniques.		
٠	To impart knowledge about the various multiple antenna systems.		

UNIT I WIRELESS CHANNELS

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

UNIT II CELLULAR ARCHITECTURE

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity-trunking & grade of service – Coverage and capacity improvement.

UNIT III DIGITAL SIGNALING FOR FADING CHANNELS

9

9

9

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix

UNIT IV MULTIPATH MITIGATION TECHNIQUES

9

Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

UNIT V MULTIPLE ANTENNA TECHNIQUES

9

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL : 45 PERIODS

OUTCOMES:			
•	Ability to characterize wireless channels.		
•	Ability to design and implement various signalling schemes for fading channels.		
•	Ability to design a cellular system.		
•	Ability to compare multipath mitigation techniques and analyze their performance.		
•	Ability to design and implement systems with transmit/receive diversity and MIMO systems and analyze their performance.		
TEXT BOOKS:			
1.	T.S. Rappaport, "Wireless communications", Second Edition, Pearson Education, 2010.		
2.	A.F. Molisch, "Wireless Communications", John Wiley – India, 2010.		
3.	D. Tse and P. Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.		
REFERENCES:			
1.	<i>R.</i> Van Nee and R.Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.		
2.	U. Dalal, "Wireless Communication", Oxford University Press, 2009.		
3.	V.Garg, "Wireless Communications and networking", First Edition, Elsevier 2007.		
4.	J. Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.		
17LPC703

FIBER OPTIC COMMUNICATION

L	Т	Р	С
3	0	0	3

OBJECTIVES:

•	To facilitate the knowledge about optical fiber sources and transmission techniques					
•	Γο educate about different losses in optical fibers.					
•	To impart knowledge about digital signalling.					
•	Γο explore the trends of optical fiber measurement systems.					
•	To enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical CDMA.					

UNIT I INTRODUCTION TO OPTICAL FIBERS

9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link-- Total internal reflection-Acceptance angle –Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

UNIT II SIGNAL DEGRADATION OPTICAL FIBERS

9

9

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength

UNIT III DIGITAL SIGNALING FOR FADING CHANNELS

Direct and indirect Band gap materials-LED structures -Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling.

UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS

9

Fundamental receiver operation, Signal to Noise ratio, Detector response time, Pre amplifiers, Error sources – Receiver Configuration– Probability of Error – Quantum limit.Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.

UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION

9

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –-Link Power budget -Rise time budget- Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA system – Solitons – Optical CDMA – Ultra High Capacity Networks.

	ŋ	TOTAL : 45 PERIODS					
OUTC	COMES:						
•	Ability to analyze the various optical fiber modes and configurations.						
•	Ability to analyze various signal degradation f	factors associated with optical fiber.					
•	Ability to analyze various optical sourc communication system.	es and their use in the optical					
•	Ability to analyze optical detectors and the system.	ir use in the optical communication					
•	Ability to analyze the digital transmission and performance.	d its associated parameters on system					
TEXT	BOOKS:						
1.	G. Keiser, "Optical Fiber Communication" 4th 2010.	Edition, Mc Graw -Hill International,					
2.	J. M. Senior, "Optical Fiber Communication 2010.	", Third Edition, Pearson Education,					
3.	J.Gower, "Optical Communication System", Prent	ice Hall of India, 2001.					
REFE	RENCES:						
1.	Ramaswami, Sivarajan and Sasaki "Optical Kaufmann, 2009.	Networks", Third Edition, Morgan					
2.	J.Senior, "Optical Communication, Principles Hall of India, 2008.	and Practice", 3rd Edition, Prentice					
3.	G.P. Agrawal, " Fiber-optic communication Sons, 2011.	systems", 3rd Edition, John Wiley &					
4.	<u>S.Kumar, M. Jamal Deen</u> , " Fiber Optic C Applications", John Wiley & Sons, 2014.	Communications: Fundamentals and					

17LPC706

MICROWAVE AND OPTICAL LABORATORY

OBJECTIVES:

- To verify the characteristics of various microwave sources.
- To verify the characteristics of various optical sources.
- To determine S matrices of various passive microwave components.
- To find the gain and radiation pattern of various microwave antennas
- To measure various microwave parameters.

LIST OF EXPERIMENTS

- 1. Characteristics of Gunn diode Oscillator.
- 2. Characteristics of Reflex Klystron.
- 3. S-Matrix of Directional Coupler and Magic Tee.
- 4. Guide wavelength and frequency measurement
- 5. VSWR and Frequency Measurement.
- 6. Radiation Patten of Horns, Parabolic and Helical antenna.
- 7. Measurement of Numerical aperture and optical losses of optical fiber.
- 8. Digital Transmission through fiber optic link.
- 9. Characteristics of LED and LASER.
- 10. Characteristics of Photo Diode.
- 11. Mode Characteristics of single mode and multimode fiber.
- 12. Eye diagram analysis of optical fiber.

		TOTAL : 60 PERIODS
OUTC	OMES:	
٠	Ability to test microwave components.	
٠	Ability to test characteristics of optical source	ces.
٠	Ability to perform microwave and optical m	easurements
٠	Ability to analyze the performance of simple	e optical link.
٠	Ability to analyze the radiation of pattern of	antenna.

17LEE707

PROJECT PHASE I

L	Т	Р	С
0	0	4	0

OBJECTIVES:

•	To develop the ability to solve a specific problem right from its identification till the successful solution of the same.
•	To impart knowledge about how to perform literature review.
•	To make the students to work in teams and improve their analytical skills.
•	To train the students in preparing project reports.
•	To train the students to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The work includes problem identification, initial set up and material collection. Demonstration is not required. The progress of the project is evaluated based on three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external examiner and the internal examiners constituted by the Head of the Department

	TOTAL : 60 PERIODS				
OUTCOMES:					
•	Ability to analyze complex engineering problems.				
•	Ability to apply appropriate engineering techniques.				
•	Ability to develop innovative approaches and creative solutions by utilizing a systematic approach.				
•	Ability to prepare high quality engineering documents and present a clear and coherent presentation.				
•	Ability to work collaboratively to plan and execute project work on scientific basis and technologies within the engineering discipline.				

SEMESTER-VIII

17LEE	PROJECT WORK AND VIVA VOCE	L	Т	Р	С			
		0	0	12	6			
OBJE	OBJECTIVES:							
•	To develop the ability to solve a specific problem right from its identification till the successful solution of the same.							
٠	To impart knowledge about how to perform literature review.							
٠	• To make the students to work in teams and improve their analytical skills.							
٠	To train the students in preparing project reports.							
•	To train the students to face reviews and viva voce examination.							

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

	TOTAL : 60 PERIODS				
OUTCOMES:					
٠	Ability to analyze complex engineering problems.				
٠	Ability to apply appropriate engineering techniques.				
•	Ability to develop innovative approaches and creative solutions by utilizing a systematic approach.				
•	Ability to prepare high quality engineering documents and present a clear and coherent presentation.				
•	Ability to work collaboratively to plan and execute project work on scientific basis and technologies within the engineering discipline.				

ELECTIVES

17LPE001			AUTOMOTIVE ELECTRONIC SYSTEMS	L	Т	Р	С
				3	0	0	3
OBJEC	OBJECTIVES:						
•	To pr Electi	ovio roni	de a comprehensive knowledge of fundamental of Autom	otive			
•	To impart knowledge on sensors and actuators.						
•	To in	trod	luce the phenomenon of electronic fuel injection.				
•	To ed	luca	te about electronic ignition systems.				
•	To ed	luca	te about digital engine control system.				
UNIT I		FU	UNDAMENTAL OF AUTOMOTIVE ELECTI	RON	ICS	5	9
Current tro electronic control.	ends in engine	n ma e m	odern Automobiles- Open loop and closed loop systems anagement- Electronic management of chassis system	- Con - Veł	npon nicle	ents mot	for tion
UNIT II		SE	INSORS AND ACTUATORS				9
Introduction angle posi sensor, flo	on, bas tion se w sens	sic s nsoi sor]	sensor arrangement types of sensors such as - oxygen s rs - Fuel metering / vehicle speed sensor and detonation se Throttle position sensors, solenoids, stepper motors, relays	senso ensor s.	rs (- Alt	Cran Cran	k e
UNIT II	Ι	EL SY	LECTRONIC FUEL INJECTION AND IGNIT	ΓΙΟΙ	N		9
Introduction point fuel	on Fee	dba on,]	ck carburettor systems (FBC) Throttle body injection an Fuel injection systems, injection system controls.	d mu	lti-po	ort o	r
UNIT IV	V	EL	LECTRONIC IGNITION SYSTEMS				9
Introduction their princi	on Adv ple of c	anta pera	ages of electronic ignition systems. Types of solid state ignit ation Contactless electronic ignition system, Electronic spark t	ion sy iming	ostem cont	s and rol.	b
UNIT V D		IT V DIGITAL ENGINE CONTROL SYSTEM 9					
Open loop and closed loop co enrichment - Deceleration leaning control system Exhaust emission		lose lera thau	d loop control systems Engine cranking and warm up control tion leaning and idle speed control Distributor less ignition - In the st emission control engineering.	ol Ao ntegra	ccele	ration ration	n e
	TOTAL : 45	PER	IOI	DS			

OUTC	OMES:
•	Ability to apply the fundamentals of automotive electronics.
•	Ability to design sensors and actuators.
•	Ability to analyze electronic fuel injection and ignition system.
•	Ability to analyze electronic ignition system.
•	Ability to design and Implement a digital engine control system.
TEXT	BOOKS:
1.	W.B.Ribbens, "Understanding Automotive Electronics ", 7th Edition, Butterworth, Heinemann Woburn, 2012.
2.	T. Weather Jr and C. CHunter, "Automotive Computers and Control System ". Prentice Hall Inc., New Jersey, 1984
3.	T.Mellard, "Automotive Electronics", First Edition, Elsevier, 1987.
REFE	RENCES:
1.	W.H .Crouse, " Automobile Electrical equipment ", McGraw Hill Book Co Inc., New York, Third Edition, 1986.
2.	R.N. Brady, "Automotive Computers and Digital Instrumentation". A reston Book. Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
3.	Bechtold., " Understanding Automotive Electronic ", SAE Publication, 1998.
4.	A.P. Young and L.Griffths, "Automobile Electrical Equipment", English Language Book Society and New Press, 1999.

17LPE002			ADVANCED DISPLAY DEVICES	L	Т	Р	С
				3	0	0	3
OBJEC	TIVE	ZS:			I		<u> </u>
•	To st	udy	the basics of display devices				
•	To ur	nder	stand the basics of head mounted display devices.				
•	To ec	luca	te about MIMS and LCD displays.				
•	To in	npai	t knowledge on emissive displays.				
•	To ur	nder	stand the various types of modern display devices.				
UNIT I		IN	TRODUCTION				9
Introducti and advar	on to ced dis	disp spla	plays-Requirements of displays-Display technologies, y technologies-Technical issues in displays.	CR	Γ, Fla	t pan	el
UNIT I	[HI	EAD MOUNTED DISPLAY				9
Head more light emit	unted d ting dis	lispl spla	lays. Displays less than and greater than 0.5 m diagonys.	nal. I	Low p	ower	and
UNIT I	I	TF	T, MIMS, LCD				9
Operation	of TF	Ts a	nd MIMS. LCDs, Brightness. Types of LCD displays.			J	
UNIT I	V	EN	AISSIVE DISPLAYS			9	
Emissive and perfor	display rmance	ys, <i>1</i> e.	ACTFEL, Plasma display and Field emission displays	, ope	rating	princ	iple
UNIT V	r	ΤŊ	PES OF DISPLAYS				9
Types of I	Display	ys: 3	BD, HDTV, LED, Touch screen.			1	
			TOTAL: 45	5 PI	ERIC	DDS	
OUTCO)MES	5:					
•	Abilit	y to	analyze technical requirements of different types of d	ispla	y syste	ems.	
•	Abilit	y to	analyze the various low power display system.				
•	Abilit	y to	analyze the operation of TFTs and LCD display.				
•	Abilit	y to	analyze the various kinds of emissive displays.				
•	• Ability to evaluate the recent advancements in the display device technology.						

TEXT	BOOKS:
1.	L.W. Mackonald & A.C. Lowe, "Display Systems, Design and Applications", Wiley,2003.
2.	E.H. Stupp & M. S. Brennesholtz, "Projection Displays", Wiley, 2008.
3.	P. A. Keller, "Electronic Display Measurement: Concepts, Techniques, and Instrumentation", Wiley-Interscience, 1997.
REFER	RENCES:
1.	Y. A.Ono, "Electroluminescent Displays", World Scientific Publishers, 2000.
2.	S. Matsumoto, "Electronic display devices ", First Edition, Wiley publications, 1990.
3.	D. Keyang, S. Tson Wu, "Fundamentals of liquid crystal devices", Second Edition, John Wiley &Sons, 2014.
4.	J. Pankove, "Display Devices", Springer, 1980.

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STATISTICAL THEORY OF COMMUNICATION

L T P C 3 0 0 3

OBJECTIVES:

•	To presents a unified approach to the problem of detection and estimation theory.
•	To study about random processes
•	To learn about detection of signals.
•	To deal with the estimation of continuous waveforms.
•	To know the various linear estimation methods.

UNIT I CLASSICAL DETECTION AND ESTIMATION THEORY

9

UNIT II REPRESENTATIONS OF RANDOM PROCESSES

9

Deterministic functions: Orthogonal representations – Random process characterization – Homogeneous Integral equations and Eigen functions – Periodic processes – Infinite time interval: Spectral decomposition – Vector Random processes.

UNIT III DETECTION OF SIGNALS – ESTIMATION OF SIGNAL PARAMETERS

9

Detection and Estimation in White Gaussian and Non-White Gaussian noise – Signals with unwanted parameters: The Composite hypothesis problem – Multiple channels – Multiple parameter estimation.

UNIT IV ESTIMATION OF CONTINUOUS WAVEFORMS

9

9

Derivation of Estimator equations – A Lower bound on the mean square estimation error – Multidimensional waveform estimation – Non random waveform estimation.

UNIT V LINEAR ESTIMATION

Properties of Optimum processors – Realizable Linear filters: Stationary processes, Infinite past: Wiener filters – Kalman-Bucy filters – Linear Modulation: Communications context – Fundamental role of the Optimum linear filter.

TOTAL: 45 PERIODS

OUTC	OMES:
•	Ability to develop decision and estimation theories.
•	Ability to analyze different representations of random processes.
•	Ability to analyze the detection and estimation of signals.
•	Ability to analyze the estimation of continuous waveforms.
•	Ability to design linear estimation methods.
TEXT	BOOKS:
1.	P. Eugene Xavier, "Statistical theory of Communication", New Age International Ltd. Publishers, New Delhi, 2007
2.	Y.W. Lee "Statistical theory of communication", Literary Licensing LLC, 2013.
3.	David Middleton, "An Introduction to Statistical Communication Theory", Wiley, 1996.
REFEF	RENCES:
1.	B.R. Levin, "Statistical communication theory and its applications", MIR Publishers, Moscow, 1982
2.	C. W.Helstrom, "Statistical theory of signal detection", Second edition, Elsevier.
3.	R. M.Fano, "Transmission of information a statistical theory of communication", IT ,Press.
4.	I. Ravi Kumar, "Comprehensive. Statistical Theory of Communication," Lakshmi Publications, 2001.

17LPE004	SPREAD SPECTRUM TECHNIQUES	L	Т	Р	С			
		3	0	0	3			
OBJECTIVES:								

٠	To know the generations of mobile communication.
•	To know the principles of Spread Spectrum
•	To learn the various Optical CDMA codes.
•	To learn the various Optical CDMA techniques
•	To understand the Optical CDMA architectures

UNIT I GENERATIONS OF MOBILE COMMUNICATIONS

9

Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, TD-CDMA, TD-SCDMA, IS-95, IMT-2000: Third generation Mobile Communication Systems, W-CDMA, CDMA-2000, EDGE.

UNIT II SPREAD SPECTRUM CONCEPTS

9

9

Spread Spectrum Modulation- 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 –Maximum length and Gold codes.

UNIT III OPTICAL CDMA

Introduction; Optical CDMA codes - Construction of Coherent and Incoherent Codes, Performance Analysis and Comparison of Coherent and Incoherent Codes, Advanced Incoherent Codes, Information Capacity of Fiber-Optical CDMA Systems, Advanced Coding Techniques for Performance Improvement.

UNIT IV COHERENT AND INCOHERENT OPTICAL CDMA SYSTEMS

9

Introduction, Coherent OCDMA Approaches, Subsystem Technologies, Code Selection for SPC-OCDMA, OCDMA Network Architectures for SPC-OCDMA - WHTS System Architecture, Technologies for WHTS OCDMA.

UNIT V OPTICAL CDMA ARCHITECTURES

9

Hybrid Multiplexing Transmission System, Photonic Gateway: Multiplexing Format Conversion, OCDMA/WDM Virtual Optical Path Cross Connect, Optical CDMA network architectures and applications-Local Area Networks.

TOTAL: 45 PERIODS

OUTC	OMES:
•	Ability to analyze the spread spectrum concepts.
•	Ability to analyze about 3 G technologies.
•	Ability to analyze different CDMA approaches.
•	Ability to analyze with the concepts of optical CDMA.
•	Ability to analyze about CDMA architecture.
TEXT	BOOKS:
1.	S. Haykin, "Digital Communications", John Wiley, 2005
2.	P.E.Clint Smith. and D. Collins, "3G Wireless Networks", 2nd Edition, Tata McGraw Hill, 2007.
3.	P. R. Prucnal, "Optical Code Division Multiple Access- Fundamentals and Applications", Taylor & Francis Ltd; Har/Cdr edition, 2005.
REFEF	RENCES:
1.	G.C. Yang & W. C. Kwong, "Prime Codes with Applications to CDMA Optical and Wireless Networks", Artech House, 2002.
2.	V. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805:, 2007
3.	D. Torrieri, "Principles of Spread-Spectrum Communication Systems", Springer, 2004
4.	<i>R.Pandya, "Mobile and Personal Communication systems and services", PHI, New Delhi, 2003.</i>

17LP	E005	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	Р	C		
			3	0	0	3		
OBJECTIVES:								
•	• To bring out the concepts related to stationary and non-stationary random signals							
•	To emp	To emphasize the importance of true estimation of power spectral density						
•	To intro predicti	duce the design of linear and adaptive systems for to on	filtering	and li	near			
•	To educ	cate various adaptive filters.						
•	To intro	duce the concept of wavelet transforms in the conte	ext of in	nage p	rocess	sing.		
UNIT I	D	ISCRETE-TIME RANDOM SIGNALS				9		
Discrete Autocorre Density, processes	random elation ar Spectral , ARMA,	process – Ensemble averages, Stationary a d Autocovariance properties and matrices, White Factorization, Innovations Representation and Pro AR and MA processes.	nd erg e noise, ocess, l	odic Powe Filterin	proce er Spe ng ran	esses, ectral idom		
UNIT I	I S	PECTRUM ESTIMATION				9		
Bias and method, I	Consister Parametric	cy, Periodogram, Modified periodogram, Blackma c methods of spectral estimation, Levinson-Durbin	n-Tuke recursio	y meth n.	nod, W	elch		
UNIT I	II L	INEAR ESTIMATION AND PREDICTION	ON			9		
Forward prediction	and Back	ward linear prediction, Filtering - FIR Wiener fil usal and causal IIR Wiener filters, Discrete Kalman	ter- Fil ⁻ filter.	tering	and 1	inear		
UNIT I	V A	DAPTIVE FILTERS				9		
Principles LMS alg cancellers	s of adap gorithm – s.	tive filter – FIR adaptive filter – Newton's Steep Adaptive noise cancellation, Adaptive equalized	est dester, and	cent a Adaj	lgorith ptive	nm – echo		
UNIT V	7 W	AVELET TRANSFORM				9		
Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.								
		TOTAL	: 45 H	PERI	ODS			
OUTCO	DMES:							
•	Ability t	o analyze about different random processes.						
	Ability to analyze the parametric methods for power spectrum estimation.							

•	Ability to analyze various filtering and prediction methods.					
•	Ability to analyze adaptive filtering techniques using LMS algorithm. and the applications of adaptive filtering.					
•	Ability to analyze the wavelet transforms.					
TEXT	BOOKS:					
1.	M.H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, Indian Reprint, 2007.					
2.	J. G.Proakis, D. G. Manolakis, "Digital Signal Processing", Pearson, Fourth 2007					
3.	A. V.Oppenheim, R. W. Schafer, and J. R. Buck. "Discrete-Time Signal Processing", 2nd ed. Prentice Hall					
REFER	RENCES:					
1.	S. J. Orfanidis, "Optimum Signal Processing, An Introduction", Mc Graw Hill, 1990.					
2.	D.F. Mix, "Random Signal Processing", Prentice Hall, 1995.					
3.	J. H. McClellan et al. "Computer-Based Exercises for Signal Processing Using MATLAB® 5", Prentice Hall, 1998.					
4.	Crochiere, E.Ronald and R. Lawrence Rabiner. "Multirate Digital Signal Processing", Prentice Hall, 1983.					

17LP	17LPE006VLSI SIGNAL PROCESSINGLT		Р	С			
	3 0		0	3			
OBJEC	TIVES	:	-	•		<u></u>	
•	To und	erstand the various VLSI architectures for digital si	gnal pro	cessing	•		
•	To kno filter st	w the techniques of critical path and algorithmic str ructures.	ength re	duction	in th	ne	
•	To stud	To study the performance parameters, viz. area, speed and power.					
•	To edu	cate about pipelined digital filters.					
•	To stud	ly various low power DSP architectures.					
UNIT I	Ι	NTRODUCTION				9	
Overview Implemen	of DS tation	P – FPGA Technology – DSP Technology	requiren	nents -	- De	esign	
UNIT I	[N	IETHODS OF CRITICAL PATH REDU	CTIO	N		9	
Binary A (SOP) –Pi	dders – ipelining	Binary Multipliers – Multiply-Accumulator (MA and parallel processing – retiming – unfolding.	C) and	sum o	f pro	oduct	
UNIT II	I A N	LGORITHMIC STRENGTH REDUCTI IETHODS AND RECURSIVE FILTER I	ON DESIG	N		9	
Fast conv filters des	olution-p ign.	pipelined and parallel processing of recursive and a	daptive	filters	– fas	t IIR	
UNIT I	V D	DESIGN OF PIPELINED DIGITAL FILT	TERS			9	
Designing redundant	g FIR fil arithme	ters – Digital lattice filter structures – bit level at the scaling and round-off noise.	arithmet	ic arch	itectu	ire –	
UNIT V	S A	YNCHRONOUS ASYNCHRONOUS PII ND PROGRAMMABLE DSP	PELIN	ING		9	
Numeric s design- p and low p	Numeric strength reduction – synchronous – wave and asynchronous pipelines – low power design– programmable DSPs – DSP architectural features/alternatives for high performance and low power.						
TOTAL : 45 PERIOD						DS	
OUTCO	DMES:						
•	Ability	to analyze critical paths in digital circuits.					
•	Ability	to analyze pipelining and parallel processing in dig	tal circu	its.			

•	Ability to design pipelined digital filters.
•	Ability to analyze different pipelining methods.
•	Ability to analyze about low power DSP architectures.
TEXT	BOOKS:
1.	K. K.Parhi, "VLSI Digital Signal Processing Systems, Design and Implementation", John Wiley, Indian Reprint, 2007.
2.	S.Y.Kuang, H.J. White house and T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1995.
3.	U. Meyer Baese, "Digital Signal Processing with Field Programmable Arrays", Springer, Second Edition, Indian Reprint, 2007.
REFEF	RENCES:
1.	E.E. Swartzlander, "VLSI Signal Processing Systems", Kluwar Academic Publishers.
2.	M.A. Bayoumi, "VLSI Design Methodologies for Digital Signal Processing Architectures", Springer Science.
3.	Bayoumi, Magdy, Swartzlander, Ear, "VLSI Signal Processing Technology", Springer Series.
4.	KJR Liu., "High-Performance VLSI Signal Processing Innovative Architectures and Algorithms, Systems Design and Applications," Wiley-IEEE Press, 1997.

17LPI	E 007	RADAR SYSTEMS	L	Т	Р	C
			3	0	0	3
OBJEC	OBJECTIVES:					
•	To understand the basics of radar.					
•	• To apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars				also	
•	• To refresh principles of antennas and propagation as related to radars.					
•	To study different types of transmitters and receivers used in radar.					
•	To understand principles of navigation, in addition to approach and landing aids as related to navigation					

UNIT I INTRODUCTION TO RADAR EQUATION

9

Introduction- Basic Radar - Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar - Detection of Signals in Noise-Probability Density Functions-Probabilities of Detection and False Alarm- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters-System losses.

UNIT II MTI AND PULSE DOPPLER RADAR

9

Introduction to Doppler and MTI Radar- Doppler Filter Banks - Digital MTI Processing -Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar - Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).

UNIT III DETECTION OF SIGNALS IN NOISE

9

Matched –Filter Receiver –Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - Signal Management - Propagation Radar Waves - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters -Frequency-Scan Arrays **Radar Transmitters and Receivers -** Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays

UNIT IV RADIO DIRECTION AND RANGES

9

Introduction - Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR .

UNIT V SATELLITE NAVIGATION SYSTEM

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment -Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) The Doppler Effect - Beam Configurations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation -Accuracy of Doppler Navigation Systems. Inertial Navigation - Principles of Operation -Navigation Over the Earth – Components of an Inertial Navigation System - Accuracy of Inertial Navigation Systems-The Transit System - Navstar Global Positioning System (GPS)

TOTAL: 45 PERIODS

9

OUTCOMES: Understand the basics of radar. • Understand about MTI and Doppler radar technique. • Derive and discuss the Range equation and the nature of detection. Explain principles of navigation, in addition to approach and landing aids as related to navigation Describe about the navigation systems using the satellite. **TEXT BOOKS:** 1. M. I. Skolnik," Introduction to Radar Systems", 3rd Edition, Tata Mc Graw-Hill, 2003. 2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.3. Paul A. Lynn, "Radar Systems", Macmillan New Electronic Series, Springer, 1987. **REFERENCES:** 1. P. Z. Peebles:, "Radar Principles", John Wiley, 2004 2. J.C. Toomay, "Principles of Radar", 2nd Edition, PHI, 2004 3. B. R. Mahafza, "Radar Systems Analysis and Design using MATLAB", Chapman & Hall / CRC Press, 2000. 4. S. Quegan, S.Kingsley, "Understanding Radar Systems", Scitech Publishing, 1999.

17LPE008	DIGITAL IMAGE PROCESSING	L	Т	Р	С
		3	0	0	3

OBJECTIVES:

UNIT I	DIGITAL IMAGE FUNDAMENTALS	9
•	To understand the basics of image representation.	
•	To be familiar with wavelets and image segmentation techniques.	
•	To be familiar with image restoration and segmentation techniques.	
•	To be exposed simple image processing techniques.	
•	To Learn digital image fundamentals.	

UNIT I **DIGITAL IMAGE FUNDAMENTALS**

Introduction - Origin - Steps in Digital Image Processing - Components - Elements of Visual Perception - Image Sensing and Acquisition - Image Sampling and Quantization -Relationships between pixels - color models.

UNIT II **IMAGE ENHANCEMENT**

Spatial Domain: Gray level transformations - Histogram processing - Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters

UNIT III IMAGE RESTORATION AND SEGMENTATION

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities-Edge Linking and Boundary detection - Region

UNIT IV WAVELETS AND IMAGE COMPRESSION

based segmentation- Morphological processing- erosion and dilation.

9

9

9

9

Wavelets – Subband coding - Multiresolution expansions - Compression: Fundamentals Image Compression models - Error Free Compression - Variable Length Coding - Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

UNIT V **IMAGE REPRESENTATION AND RECOGNITION**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments - Boundary description - Shape number - Fourier Descriptor, moments- Regional Descriptors - Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

		TOTAL: 45 PERIODS				
OUTC	OMES:					
•	Discuss digital image fundamentals.					
•	Apply image enhancement techniques.					
•	Apply image restoration and segmentation techniqu	ies				
•	Use image compression and segmentation Technique	les.				
•	Represent features of images					
TEXT	TEXT BOOKS:					
1.	R. C. Gonzales, R. E. Woods, "Digital Image Education, 2010.	Processing", Third Edition, Pearson				
2.	A. Jain, "Fundamentals of Digital Image Proce 2011.	ssing", PHI Learning Pvt. Ltd.,				
3.	W.K.Pratt, "Digital Image Processing", John	Willey, 2002.				
REFER	RENCES:					
1.	R. C. Gonzalez, R.E. Woods, S. L. Eddins, MATLAB", Third Edition Tata Mc Graw Hill P	"Digital Image Processing Using vt. Ltd., 2011.				
2.	M.K. Pakhira, "Digital Image Processing and PHI Learning Pvt. Ltd., 2011.	Pattern Recognition", First Edition,				
3.	http://eeweb.poly.edu/~onur/lectures/lectures.h	etml.				
4.	http://www.caen.uiowa.edu/~dip/LECTURE/lec	ture.html				

17LPE009	•	MULTIMEDIA COMPRESSION TECHNIQUES	L	Т	Р	C
3 0					0	3
OBJECT	IVES:		1			
• 1	To have	a complete understanding of error-control coding.				
•]	To under	rstand encoding and decoding of digital data streams.				
•] t	To introduce methods for the generation of these codes and their decoding techniques.					
•]	To have	a detailed knowledge of compression and decompress	sion tec	hnique	es.	
• 1	To introduce the concepts of multimedia communication.					
UNIT I	Μ	ULTIMEDIA COMPONENTS				9
Introduction sound, imag	- Mult es, grap	timedia skills - Multimedia components and their c hics, animation, video, hardware.	haracte	ristics	- T	ext,
UNIT II	A	UDIO AND VIDEO COMPRESSION				9
Audio com coding-code MPEG 1, 2,	pression excite and 4.	n-DPCM-Adaptive PCM –adaptive predictive cod d LPC-perpetual coding Video compression –prin	ing-line nciples-	ear Pr H.261	edict -H.2	tive 63-
UNIT III	TI	EXT AND IMAGE COMPRESSION				9

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

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

9

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 : 45 PERIODS

OUTC	OMES:
•	Describe various multimedia components.
•	Analyze audio and video compression techniques.
•	Describe the text and image compression techniques.
•	Analyze the VOIP technology.
•	Design multimedia networking.
TEXT	BOOKS:
1.	R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education Ranjan Parekh, "Principles of Multimedia", TMH 2007.
2.	F. Halshall ,"Multimedia communication - Applications, Networks, Protocols and Standards", Pearson Education, 2007.
3.	T.Vaughan, "Multimedia: Making it work", 7th Edition, TMH ,2008.
REFER	RENCES:
1.	W. Effelsberg, "Video Compression Techniques", Elsevier.
2.	M.Goncalves, "Voice over IP Networks", Mc Graw hill, 1999.
3.	K.R. Rao,Z. S. Bojkovic, D.A. Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education, 2007.
4.	Kurose and W.Ross "Computer Networking "a Top Down Approach", Pearson Education, 2005

17LP	E010	MEMS	L	Т	Р	С
			3	0	0	3
OBJEC	TIVES	:				
•	To deal	with MEMS and micro fabrication				
•	To lear	n the electrical and mechanical properties of MEMS	materia	als		
•	To und	erstand sensing and actuation				
•	To stud	y about bulk and micromachining				
•	To kno	w the various polymers and optical MEMS				
UNIT I	II N	NTRODUCTION TO MEMS AND IICROFABRICATION				9
fabrication Points of o	n process considera	- Silicon based MEMS processes- New material and ation for processing.	l fabrica	ation pr	ocess	sing-
UNIT II	E E C	LECTRICAL AND MECHANICAL PRO F MEMS MATERIALS	PER	ΓIES		9
Conductivity of semiconductors, crystal plane and orientation, stress and strain – definition – Relationship between tensile stress and strain- mechanical properties of Silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam- deflection of beam-longitudinal strain under pure bending- Spring constant, torsional deflection, intrinsic stress, resonance and quality factor Piezo resistive sensors- piezo resistive sensor material					on – ilms, on of insic al	
UNIT II	I S	ENSING AND ACTUATION				9
Electrosta tactile sen sensors-A	tic sensin nsor para ctuators-	ng and actuation-Parallel plate capacitor – Application llel plate actuator- comb drive. Thermal sensing a Applications Inertial, flow and infrared senso	on-Inert and Act rs - st	tial, pre tuations ress in	ssure -The flex	and rmal xural

cantilever and membrane- Application-Inertial, pressure, flow and tactile sensor. Piezoelectric sensing and actuation- piezoelectric material properties-quartz-PZT-PVDF –ZnO-Application-Inertial, Acoustic, tactile, flow-surface elastic waves Magnetic actuation- Micro magnetic actuation principle- Deposition of magnetic materials-Design and fabrication of magnetic coil.

UNIT IV

BULK AND SURFACE MICROMACHINING

9

Anisotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), Isotropic wet etching, Basic surface micromachining process- structural and sacrificial material, stiction and antistiction methods, Foundry process.

UNIT V POLYMER AND OPTICAL MEMS

Polymers in MEMS- polymide-SU-8 Liquid crystal polymer(LCP)-PDMS-PMMA-Parylene-Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors. Optical MEMSpassive MEMS optical components-lenses-mirrors-Actuation for active optical MEMS.

9

		TOTAL: 45 PERIODS
OUTC	OMES:	
•	Analyze MEMS and micro fabrication.	
•	Describe the different properties of MEMS materia	ıls.
•	Describe the concept of sensing and actuation.	
•	Explain bulk and surface machining.	
•	Utilize polymer and optical MEMS.	
TEXT	BOOKS:	
1.	C. Liu, "Foundations of MEMS", Pearson Inter	national Edition, 2006.
2.	S. D. Senturia, "Microsystem Design", Kluwar	Academic Publishers,2002.
3.	T. Hsu, "MEMS and Microsystems Des Engineering", 2 nd Edition, John Wiley and Sons,	ign, Manufacture and Nanoscale 2008.
REFEI	RENCES:	
1.	G. M. Rebiz, "RF MEMS Theory, Design Sons, 2003	and Technology", John Wiley &
2.	C. P. Poole, F.J. Owens, "Introduction to Na 2003.	notechnology" John Wiley & Sons,
3.	J. W.Gardner, V.K. Varadhan, "Microsensors Wiley & sons,2001.	, MEMS and Smart Devices", John
4.	R. Layton, T. M. Adams, "Introductory MEN Springer series.	<i>IS</i> Fabrication and Applications",

17LP	E011	DSP ARCHITECTURES AND PROGRAMMING	L	L T P C		C
			3	0	0	3
OBJEC	TIVES	:				
•	To kno	w about popular DSP processor				
•	To stud	ly the various DSP devices				
•	To fam	iliarize on DSP programming				
•	To und	erstand the concepts of adaptive filtering				
•	To deal	with Sharc processor				
UNIT I	I	NTRODUCTION TO DSP PROCESSOR				9
(VLIW) - Memory I	CPU Da nterface	ata Paths and Control - Timers - Internal Data/ Prog ,Difference between fixed and floating point process	ram Mei ors.	mory -	Exte	rnal
UNIT II	[D	SP DEVICES				9
DSP devi DMA, Ha	ces beyo rdware in	ond the core, TI C6xxx EVM memory configuration nterfacing and I/O control, System management and	n, wait control.	state g	enera	tor,
UNIT II	I P	ROGRAMMING				9
Programm Instruction (Compiler	ning - L ns, Asse r, Assem	inear and Circular Addressing Modes, Assembly embler directives Code Composer Studio - Co bler, Linker) - Code Composer Studio Debug Tools -	code for ode Ge – Simula	rmat, ' neratio tor.	Гуреs on To	of ools
UNIT I	V A	DAPTIVE FILTERING				9
Adaptive Properties processors	filtering of ada	Introduction to adaptive filters, adaptive filter struptive filters, Applications, Adaptive filtering in	ictures a C using	and alg g float	gorith ing-p	ms, oint
UNIT V	S	HARC DIGITAL SIGNAL PROCESSOR				9
Sharc Dig Blackfin (Interrupts Interface -	gital Sigr one of th - Inter - Link Po	nal Processor: A popular DSP from Analog Device nem) - Architecture - IOP Registers - Peripherals - Sy mal/External/Multiprocessor Memory Space - Morts.	s - Shar ynchrono Iultiproc	rc/ Tig ous Sen eessing	er Sh rial Po - F	arc/ ort - Iost
		ΤΟΤΑ	L:45	PER	IOD	S

OUTC	OMES:
•	Describe about DSP Processor.
•	Analyze the different DSP devices.
•	Write DSP programs for different applications.
•	Explain the adaptive filtering and its applications.
•	Utilize Sharc DSP processor.
TEXT	BOOKS:
1.	N. Dahnoun, "Digital Signal Processing Implementation Using the TMS320C6000DSP Platform", 1st Edition, 2000.
2.	T.J. Terrel and L. Shark, "Digital Signal Processing - A Student Guide",1 st Edition; Macmillan Press Ltd.
3.	D. J Defatta J, Lucas J. G & Hodkiss W. S, "Digital Signal Processing: A System Design Approach", 1st Edition, John Wiley.
REFER	RENCES:
1.	N. Dahnoun, "Digital Signal Processing Implementation Using the TMS320C6000DSP Platform", 1st Edition, 2000.
2.	<i>R.</i> Chassaing, "DSP Applications using 'C' and the TMS320C6X DSK", 1 st Edition, 2002.
3.	A. Bateman, I. Paterson-Stephens, "The DSP Handbook – Algorithms, Applications and Design Techniques", Pearson Education.
4.	S. M Kuo, W. S Gan, "Digital Signal Processors Architectures, Implementations and Applications", Pearson Education.

17LP	E012	NANO ELECTRONICS	L	Т	Р	С
		·	3	0	0	3
OBJEC	TIVES	:	1	I		
•	To be f	amiliar with the important concepts applicable to sma	ll electi	onic d	levice	s.
•	To be f	amiliar in the fabrication process.				
•	To stuc	ly the characteristic of different electronic equipments	•			
•	To lear	n the different nano electronic devices.				
•	To be f	amiliar the application of nano electronics.				
UNIT I	I	IMITATIONS OF CMOS				9
in materia Ferro elec	als – Str etric FET	uctures of MOS devices: SOI MOSFET, FINFETS, s.	Dual (Gate N	40SF	ET,
UNIT I	I N	1ICRO AND NANO FABRICATION				9
Optical L epitaxy –	ithograp Nano lit	ny – Electron beam Lithography – Atomic Lithograp nography.	ohy – N	Aolecu	ılar bo	eam
UNIT I	п с	CHARACTERIZATION EQUIPMENTS				9
Principles Microscop	s of Elec	ron Microscopes – Scanning Electron Microscope –	Transm	nission	Elect	ron
	pe -Aton	ic Force Microscope – Scanning Tunneling Microsco	pe.			1011
UNIT I	pe -Atom V N	ic Force Microscope – Scanning Tunneling Microscope	pe.			9
UNIT I Resonant Quantum	pe -Atom V N tunnelir logic –N	ic Force Microscope – Scanning Liceuon Microscope IANO DEVICES – I g diodes – Single electron devices – Josephson ju Iolecular electronics.	pe.	– Sir	ngle F	9 Flux
UNIT I Resonant Quantum UNIT V	v N tunnelir logic – N	ANO DEVICES – I g diodes – Single electron devices – Josephson ju IORNO DEVICES – I	pe.	– Sir	ngle F	9 Flux 9
UNIT I Resonant Quantum UNIT V Quantum CNTFET Junctions	v N tunnelir logic – M v N comput , Applic , SpinFE	IANO DEVICES – I g diodes – Single electron devices – Josephson ju lolecular electronics. IANO DEVICES – II ing: principles – Qrbits – Carbon nanotubes (Ch ation of CNT - Spintronics: Principle, Spin valv Ts, MRAM.	nction NT) : ves, M	– Sir Chara agnetic	ngle F cterist c Tur	9 Flux 9 tics, nnel
UNIT F Resonant Quantum UNIT V Quantum CNTFET Junctions	v N tunnelir logic –N Comput , Applic , SpinFE	ANO DEVICES – I g diodes – Single electron devices – Josephson ju lolecular electronics. ANO DEVICES – II Ing: principles – Qrbits – Carbon nanotubes (Ch ation of CNT - Spintronics: Principle, Spin valv Ts, MRAM. TOTAL	pe. Inction NT) : Yes, M	– Sir Chara agnetic	ngle H cterist c Tur IOD	9 Flux 9 iics, inel S
UNIT T Resonant Quantum UNIT V Quantum CNTFET Junctions	v N tunnelir logic – M Comput , Applic , SpinFE	ANO DEVICES – I g diodes – Single electron devices – Josephson ju lolecular electronics. JANO DEVICES – II ing: principles – Qrbits – Carbon nanotubes (CP ation of CNT - Spintronics: Principle, Spin valv Ts, MRAM. TOTAL	nction NT) : zes, M	– Sir Chara agnetic PER	ngle F cterist c Tur IOD	9 Flux 9 iics, nnel S
UNIT I Resonant Quantum UNIT V Quantum CNTFET Junctions OUTCO	pe -Atom V N tunnelir logic –M V N comput , Applic , SpinFE DMES: Describe	ANO DEVICES – I g diodes – Single electron devices – Josephson ju lolecular electronics. ANO DEVICES – II ing: principles – Qrbits – Carbon nanotubes (Ch ation of CNT - Spintronics: Principle, Spin valv Ts, MRAM. TOTAL the limitations of CMOS	pe. inction NT) : yes, M y : 45	– Sir Chara agnetio	ngle F cterist c Tur IOD	9 Flux 9 ics, nnel S
UNIT F Resonant Quantum UNIT V Quantum CNTFET Junctions OUTCC	pe -Atom V N tunnelir logic –N V N comput , Applic , SpinFE DMES: Describe Analyze	ANO DEVICES – I g diodes – Single electron devices – Josephson ju lolecular electronics. IANO DEVICES – II ing: principles – Qrbits – Carbon nanotubes (Cf ation of CNT - Spintronics: Principle, Spin valv Ts, MRAM. TOTAL the limitations of CMOS the micro and nano fabrication techniques.	pe. inction NT) : ves, Ma	– Sir Chara agnetic	ngle F cterist c Tur IOD	9 Flux 9 fics, nnel S

•	Work with characterization equipments
•	Be exposed to nano devices
•	Understand application of nanoelectronics.

TEXT BOOKS:

1.	M. Ratner and D. Ratner, "Nanotechnology : A Gentle Introduction to the Next Big Idea", Pearson education, 2003.
2.	S. G. Tan and M. B. A. Jalil, "Introduction to the Physics of Nanoelectronics", Woodhead Publishing.
3.	V. V. Mitin, V. A. Kochelap, M. A. Stroscio,"Introduction to Nanoelectronics Science, Nanotechnology, Engineering and Applicances", Cambridge University press.
REFER	RENCES:
1.	M. Baldo, "Introduction to Nanoelectronics"
2.	T. Heinzel, "A Microscopic Electronics in Solid State Nanostructure", Wiley- VCH.
3.	R. Waser (Ed.), "Nano electronics and information technology", Wiley- VCH, Edition II, 2005.
4.	M. Wilson, K. Kannangara, G. Smith, M Simmons and B. Raguse "Nanotechnology – (Basic Science and Emerging Technologies)", Overseas Press.

17LPE013			VLSI TESTING	L	Т	Р	С
				3	0	0	3
OBJEC	OBJECTIVES:						
• To know the various types of faults and also to study about fault det dominance						etecti	on,
•	• To know the various fault models.						
•	Tol	know th	e concepts of the test generation methods-DFT-BIST.				
•	Точ	understa	and the fault diagnosis methods.				
•	To u	ndersta	nd fault diagnosis of various digital circuits.				
UNIT I		TEST	TING AND FAULT MODELLING				9
Models - simulatio	-Fault on –De	detection lay moo	on – Fault Location – Fault dominance – Logic simul dels – Gate Level Event – driven simulation.	atior	1 —]	Гурея	s of 9
Test gene – Test ge	eratior nerati	for cor	mbinational logic circuits – Testable combinational log equential circuits – design of testable sequential circuits	gic c	ircui	t des	ign
UNIT III DESIGN FOR TESTABILITY					9		
Design for design-s	or Tes system	stability level D	– Ad-hoc design – generic scan based design – clas DFT approaches.	sica	l sca	in ba	sed
UNIT I	V	SELF	F – TEST AND TEST ALGORITHMS				9
Built-In s	self-To	est – tes	st pattern generation for BIST – Circular BIST – BIST gn – Test Algorithms – Test generation for Embedded	T Ar RAN	chite	cture	es –
1 Cotable	Memo	bry Desi			1s.		
UNIT	Memo	FAUI	LT DIAGNOSIS		1s.		9
UNIT V Logical I Circuits-	V Level 1 - Self-6	FAUI Diagnos	L T DIAGNOSIS sis – Diagnosis by UUT reduction – Fault Diagnosis fo g design – System Level Diagnosis.	or Co	1s. ombi	natio	9 onal

OUTCOMES:					
•	Identify faults in digital circuits.				
•	Identify different test models.				
•	Interpret different design for testability.				
•	Describe test generation and test algorithms.				
•	Explain fault diagnosis for digital circuits.				
ТЕХЛ	SBOOKS:				
1.	M.Abramovici, M.A.Breuer and A.D. Friedman, "Digital systems Testing and Testable Design", Jaico Publishing House, 2002				
2.	P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 1997.				
REFE	CRENCES:				
1.	M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Springer Series, 2005.				
2.	A.L.Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall, 1 st edition, 1999.				
3.	T. W. Williams, "VLSI Testing", Elsevier Science Ltd, 1986.				
4.	L.T.Wang, C.W. Xiaoqing Wen, "VLSI Test Principles and Architectures: Design for Testablity", Morgan Kaufmann series, 2006.				

17LPE014	NETWORK SECURITY	L	Т	Р	С
	3 0				3
OBJECTIV	'ES:				
• To	deal with the basic concepts of network security				
• To	To study the advanced block ciphers				
• To scl	• To deal with various public key cryptosystems and message authen schemes				
• To	To understand the various network security schemes				
• To	know the fundamentals of system security				
UNIT I	INTRODUCTION TO NETWORK SECURITY				9
Security Serv Techniques-S	ces, Mechanisms and attacks – Network Security Model-Class eganography – Data Encryption Standard (DES).	sical	En	crypt	tion
UNIT II	ADVANCED BLOCK CIPHERS				9
Block cipher symmetric Blo	nodes operation-IDEA, BlowFish, RC5, CAST-128-Characterist ock ciphers-Key Distribution.	tics	of a	dvan	ced
UNIT III PUBLIC KEY CRYPTOSYSTEMS & MESSAGE AUTHENTICATION					9
Principle-RSA	algorithm-Diffie Hellmen Key Exchange-Message Auther	ntica	tion	coc	les-
MAC-HASH algorithm.	function-Principle of MD5, SHA-1 and HMAC algorithms-D	Digit	al S	ignat	ure
UNIT IV	NETWORK SECURITY				
Kerbros-X.50	Public key certificate format-PGP-IPSec-SSL-SET.				
UNIT V	UNIT V SYSTEM SECURITY				9
Intrusion Detection-Password management-Malicious software-Viruses and countermeasures- Firewall Types and Configurations.					
	TOTAL : 45 PERIODS				

OUTCO	MES:
•	Explain different network security services and attacks.
•	Describe different advanced block cipher methods.
•	Describe different public key cryptosystems and message authentication schemes.
•	Describe malicious attacks in system.
•	Explain various firewall types and configurations.
TEXT B	OOKS:
1.	W.Stallings, "Cryptography and Network Security", 4 th Edition, Pearson Education, New Delhi, 2009.
2.	B. A. Forouzan, "Cryptography and Network Security", Mcgraw Hill education,3 rd Edition,2015.
3.	C. Kaufman,R. Perlman and M. Speciner, "Network Security:Private communication in a public world", 2nd Edition,Prentice Hall of India, New Delhi, 2003.
REFERI	ENCES:
1.	<i>P. W. Singer, A. Friedmanm, "Cybersecurity and Cyberwar what everyone needs to know", Oxford University Press, 1st Edition, 2014</i>
2.	O. Kyas, "Internet Security", Cengage Learning, 1997.
3.	J. M. Kissa, "Guide to Computer Network Security", Springer series,2 nd Edition,2013.
4.	<i>R. Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident detection and response ", no starch press, 1st Edition, 2013.</i>

17LPE015		OPTOELECTRONICS	L	Т	Р	С
			3	0	0	3
OBJECTIVES:						
•	To ur	derstand the basics of solid state physics.				
•	To understand the basics of display devices.					
•	To know the operation of LED and LASER					
•	To understand the optical detection devices.					
•	To ur	derstand the design of optoelectronic integrated circuits.				
UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS						9
Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.						
UNIT I	UNIT II DISPLAY DEVICES AND LASERS				9	
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.						
UNIT I	II	OPTICAL DETECTION DEVICES				9

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes ,Detector Performance ,Photo transistor ,LASCR.

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UNIT IV OPTOELECTRONIC MODULATOR

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.

		TOTAL : 45 PERIODS
OUTCO	MES:	
•	Describe various light emitting mechanism	18.
•	Explain the operation of light emitting and	light amplifying semiconductors.
•	Describe various light detection process.	
•	Define and compare different optical mode	ilators.
•	Explain opto integrated circuits.	
TEXT B	OOKS:	
1.	P. Bhattacharya "Semiconductor Opto Electro	nic Devices", Pearson,2 nd Edition, 2017.
2.	J.Singh, "Opto Electronics – As Introduction t International Edition, 1998	o Materials and Devices", Mc Graw-Hill
3.	S.O.Kasap, "Optoelectronics and Photonic Kindersley India,1 st Edition,2009.	s: Principles and Practices",Darling
REFERI	ENCES:	
1.	<i>S C Gupta, "Opto Electronic Devices and Edition, 2015.</i>	Systems", Prentice Hal of India,2 nd
2.	J. Wilson and J.Haukes, "Opto Electronics Edition, 1995.	<i>s</i> – <i>An Introduction</i> ", <i>Prentice Hall</i> , 2 ^{<i>nd</i>}
3.	<i>E.Rosencher, B. Vinter, "Optoelectronics", Edition,2002.</i>	Cambridge University Press, 1 st
4.	M.A. Parker, "Physics of Optoelectronics" Edition, 2005.	, CRC Taylor and Francis,1 st

17LPE016

COMMUNICATION SWITCHING NETWORKS

OBJECTIVES:

UNIT I		MULTIPLEXING	9
•	To k	now the fundamentals of traffic analysis	
•	To l	earn about digital subscriber access	
•	To u	inderstand about network synchronization control and management	
•	To k	now the various digital switching schemes	
٠	To s	tudy the different multiplexing methods	

UNIT I

MULTIPLEXING

Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing: Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Biphase, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings, SONET/SDH: Multiplexing Overview, Frame Formats, Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4 Payload Mapping, Optical Standards, Networks. Rings: Unidirectional Path-Switched Ring, Bidirectional Line-Switched Ring.

UNIT II DIGITAL SWITCHING

Switching Functions, Space Division Switching, Time Division Switching, two dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Elements of SS7 signaling.

UNIT III NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT

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Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

UNIT IV

DIGITAL SUBSCRIBER ACCESS

ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line,
VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

UNIT V

TRAFFIC ANALYSIS

Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues.

TOTAL : 45 PERIODS

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OUTCOMES:

•	Explain different multiplexing methods.
•	Describe digital switching methods and Switching systems.
•	Describe network synchronization control and management schemes.
•	Explain different types of digital subscriber access.
•	Analyze traffic in telecommunication networks

TEXT BOOKS:

1.	J. Bellamy, "Digital Telephony", John Wiley, 2006, 3rd Edition, 2006
2.	Viswanathan. T., "Telecommunication Switching System and Networks", Prentice Hall of India Ltd,2 nd Edition,2015.
3.	J.E Flood, "Telecommunications Switching, Traffic and Networks", Pearson,1 st Edition,2011.

REFERENCES:

1.	R.A.Thomson, "Telephone switching Systems", Artech House Publishers, 1 st Edition, 2000
2.	W. Stalling, "Data and Computer Communications", Pearson, 10 th Edition, 2014.
3.	T.N.Saadawi, M.H.Ammar, A.E.Hakeem, "Fundamentals of Telecommunication Networks", Wiley Series, 1994.
4.	W.D. Reeve, "Subscriber Loop Signaling and Transmission Hand book", Wiley- IEEE Press(Telecomm Handbook Series), 1 st Edition, 2000.

AD-HOC NETWORKS

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OBJECTIVES:

 Understand the design issues in Ad Hoc Networks. Learn the different types of MAC protocols. Be familiar with different types of Ad Hoc routing protocols. Be exposed to the security issues in Ad Hoc networks. Learn the concept of Cross Layer Optimization. 	UNIT I	FUNDAMENTALS	9
 Understand the design issues in Ad Hoc Networks. Learn the different types of MAC protocols. Be familiar with different types of Ad Hoc routing protocols. Be exposed to the security issues in Ad Hoc networks. 	٠	Learn the concept of Cross Layer Optimization.	
 Understand the design issues in Ad Hoc Networks. Learn the different types of MAC protocols. Be familiar with different types of Ad Hoc routing protocols. 	٠	Be exposed to the security issues in Ad Hoc networks.	
 Understand the design issues in Ad Hoc Networks. Learn the different types of MAC protocols. 	٠	Be familiar with different types of Ad Hoc routing protocols.	
• Understand the design issues in Ad Hoc Networks.	•	Learn the different types of MAC protocols.	
	٠	Understand the design issues in Ad Hoc Networks.	

Introduction – Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio Propagation Mechanisms – Characteristics of the Wireless Channel – IEEE 802.11a–b Standard – Origin of Ad hoc Packet Radio Networks – Technical Challenges – Architecture of PRNETs – Components of Packet Radios – Ad hoc Wireless Networks – What is an Ad Hoc Network? Heterogeneity in Mobile Devices – Wireless Sensor Networks – Traffic Profiles – Types of Ad hoc Mobile Communications – Types of Mobile Host Movements – Challenges Facing Ad hoc Mobile Networks – Ad hoc wireless Internet.

UNIT II

AD-HOC ROUTING PROTOCOLS

Introduction – Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table–Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source–Initiated On–Demand Approaches – Ad hoc On– Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) –Location–Aided Routing (LAR) – Power–Aware Routing (PAR) – Zone Routing Protocol (ZRP).

UNIT III MULTICAST ROUTING IN AD-HOC NETWORKS

Introduction – Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols – Classifications of Multicast Routing Protocols – Tree–Based Multicast Routing Protocols– Mesh–Based Multicast Routing Protocols – Summary of Tree and Mesh based Protocols – Energy–Efficient Multicasting – Multicasting with Quality of Service Guarantees – Application – Dependent Multicast Routing – Comparisons of Multicast Routing Protocols.

UNIT IV TRANSPORT LAYER SECURITY PROTOCOLS

Introduction – Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks – Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks – Classification of Transport Layer Solutions – TCP over Ad hoc Wireless Networks – Other Transport Layer Protocols for Ad hoc Wireless Networks – Security in Ad Hoc Wireless Networks – Network Security Requirements – Issues and Challenges in Security Provisioning – Network Security Attacks – Key Management – Secure Routing in Ad hoc Wireless Networks.

UNIT V QOS AND ENERGY MANAGEMENT

Introduction – Issues and Challenges in Providing QoS in Ad hoc Wireless Networks – Classifications of QoS Solutions – MAC Layer Solutions – Network Layer Solutions – QoS Frameworks for Ad hoc Wireless Networks Energy Management in Ad hoc Wireless Networks– Introduction – Need for Energy Management in Ad hoc Wireless Networks – Classification of Energy Management Schemes – Battery Management Schemes – Transmission Power Management Schemes – System Power Management Schemes.

TOTAL : 45 PERIODS

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OUTCOMES:

•	Define fundamentals of Ad-hoc Networks.
٠	Classify different routing protocols in Ad-hoc Networks.
•	Describe multicast routing and transport layer security protocols.
٠	Discuss QOS requirement in Ad-hoc Networks.
٠	Discuss Energy management requirement in Ad-hoc Networks.
TEXI	BOOKS:
1.	C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
2.	Subir Kumar Sarkar, T.G. Basavaraju, C. Puttamadappa, "Ad Hoc Mobile Wireless Networks Principles, Protocols and Applications" Second Edition CRC Press.
REFE	CRENCES:
1.	C. K. Toh, "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall, PTR, 2001.
2.	Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000
3.	Mohapatra, Prasant, Krishnamurthy, Srikanth, "Ad Hoc Networks Technologies and Protocols" Springer Publications.
4.	Nabendu Chaki, Shilbhadra Dasgupta, Soumitra Banerjee "Mobile Adhoc Network and Wireless Communication" Alpha Science International Limited.

WAVELET TRANSFORMS AND APPLICATIONS

OBJECTIVES:

•	To study the basics of signal representation and Fourier theory
•	To understand Multi Resolution Analysis and Wavelet concepts
•	To study the wavelet transform in both continuous and discrete domain
•	To understand the design of wavelets using Lifting scheme
٠	To understand the applications of Wavelet transform

UNIT I FUN

FUNDAMENTALS

Vector Spaces – Properties– Dot Product – Basis – Dimension, Orthogonality and Orthonormality – Relationship Between Vectors and Signals – Signal Spaces – Concept of Convergence – Hilbert Spaces for Energy Signals- Fourier Theory: Fourier series expansion, Fourier transform, Short time Fourier transform, Time-frequency analysis.

UNIT II

MULTI RESOLUTION ANALYSIS

Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General Orthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

UNIT III

CONTINUOUS WAVELET TRANSFORMS

Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM

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Filter Bank and Sub Band Coding Principles – Wavelet Filters – Inverse DWT Computation by Filter Banks – Basic Properties of Filter Coefficients – Choice of Wavelet Function Coefficients – Derivations of Daubechies Wavelets – Mallat's Algorithm for DWT – MultiBand Wavelet Transforms Lifting Scheme- Wavelet Transform Using Polyphase Matrix Factorization – Geometrical Foundations of Lifting Scheme – Lifting Scheme in Z – Domain.

UNIT V		APPLICATIONS	9	
Wavele Coding Functio	Wavelet methods for signal processing- Image Compression Techniques: EZW–SPHIT Coding – Image Denoising Techniques: Noise Estimation – Shrinkage Rules – Shrinkage Functions –Edge Detection and Object Isolation, Image Fusion, and Object Detection.			
TOTAL : 45 PERIODS				
OUT	COME	ES:		
•	Define	e vector spaces and signal spaces.		
•	Descri	ibe multiresolution of wavelet transform.		
•	Descri	ibe Continuous and Discrete wavelet transforms.		
•	Use w	vavelet transform for simple signal processing application.		
•	Define	e various image compression techniques.		
TEXT	Г BOO	DKS:		
1.	Rao R	M and A S Bopardikar, "Wavelet Transforms Introduction to theory and		
	Applications", Pearson Education, Asia, 2000.			
2.	L.Pras CRC I	L.Prasad & S.S.Iyengar, "Wavelet Analysis with Applications to Image Processing", CRC Press, 1997.		
REFF	EREN	CES:		
1.	J. C. C Applic	Goswami and A. K. Chan, "Fundamentals of wavelets: Theory, Algorith cations", WileyInterscience Publication, Wiley , 1999.	ems and	
2.	M. Ve	M. Vetterli, J. Kovacevic, "Wavelets and subband coding", Prentice Hall, 1995.		
3.	S. G. 2000.	S. G. Mallat, "A wavelet tour of signal processing", 2 nd Edition Academic Press, 2000.		
4.	4. Soman K P and Ramachandran K I, "Insight into Wavelets From Theory to practice Prentice Hall", 2004.		ractice,	

7LPE019 WIRELESS TECHNOLOGIES

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OBJECTIVES:

•	To learn various generations of wireless and cellular networks
•	To study about fundamentals of 3G Services, its protocols and applications
•	To study about evolution of 4G Networks, its architecture and applications
•	To study about WiMAX networks, protocol stack and standards
•	To Study about Spectrum characteristics & Performance evaluation

UNIT I INTRODUCTION

Introduction: History of mobile cellular systems, First Generation, Second Generation, Generation 2.5, Overview of 3G & 4G, 3GPP and 3GPP2 standards.

UNIT II 3G NETWORKS

3G Networks: Evolution from GSM, 3G Services & Applications, UMTS network structure, Core network, UMTS Radio access, HSPA – HSUPA, HSDPA, CDMA 1X, EVDO Rev -0, Rev-A, Rev-B, Rev-C Architecture, protocol stack.

UNIT III 4G LTE NETWORKS

4G Vision, 4G features and challenges, Applications of 4G, 4G Technologies – Multi carrier modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation and Coding with Time-Slot Scheduler, Bell Labs Layered Space Time (BLAST) System, Software-Defined Radio, Cognitive Radio.

UNIT IV WIMAX NETWORKS

WiMax: Introduction – IEEE 802.16, OFDM, MIMO, IEEE 802.20.

UNIT V SPECTRUM & PERFORMANCE

Spectrum for LTE-Flexibility-Carrier Aggregation-Multi standard Radio base stations-RF requirements for LTE-Power level requirements-Emission requirements-Sensitivity and Dynamicrange-Receiver susceptibility. Performance Assessment-Performance Evaluation.

OUTCOMES:			
•	Understand with the latest 3G/4G and WiMAX networks and its architecture.		
•	Apply the various protocols and standards in various layers in Wireless networks.		
•	Analyze the wireless network environment for any application using latest wireless protocols and standards		
•	Analyze the performance of networks		
•	Apply the benefits of WiMax networks		
•	Evaluate various diversity schemes in LTE		
TEXT B	OOKS:		
1.	V. Garg, "Wireless Communications and Networking", Elsevier, Morgan kufmann publisher 2007		
2.	"Introduction to 3G Mobile Communication", Juha Korhonen, Artech House, (www.artechhouse.com), Jan 2003, ISBN-10: 1580535070.		
3.	"4G LTE/LTE – Advanced for Mobile Broadband", Erik Dahlman, Stefan Parkvall, Johan Skold, Academic Press 2011.		
REFERI	ENCES:		
1.	"3G Evolution HSPA and LTE for Mobile Broadband, Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming", Academic Press, Oct 2008, ISBN-10: 0123745381.		
2.	"UMTS Mobile Communication for the Future, Flavio Muratore", John Wiley & Sons Ltd, Jan 2001, ISBN-10: 0471498297		
3.	"HSDPA/HSUPA for UMTS, Harri Holma and Antti Toskala", John Wiley & Sons Ltd, May 2006, ISBN-10: 0470018844.		
4.	Savo G.Glisic, "Advanced Wireless Networks- 4GTechnologies", Wiley, 2006		
5.	Magnus Olsson, Catherine Mulligan, "EPC and 4G packet network", Elsevier 2012.		

17LPE020		GENETIC ALGORITHMS	L	Т	Р	С
3 0						3
OBJECT	IV	ES:				
•	To tutor the basics of Genetic algorithm.					
•	To learn about genetic algorithm in VLSI.					
•	• To understand hybrid genetic					
•	To	deal with power estimation in genetic algorithm.				
•	То	understand global routing.				
UNIT I		INTRODUCTION				9
Introduction	, G	A Technology-Steady State Algorithm-Fitness Scaling-Inversion	on		<u> </u>	
UNIT II GENETIC ALGORITHM FOR VLSI					9	
GA for VLS technology, -Multiway F	GA for VLSI Design, Layout and Test automation-partitioning- automatic placement, routing technology, Mapping for FPGA -Automatic test generation-Partitioning algorithm Taxonomy -Multiway Partitioning					
UNIT III HYBRID GENETIC			9			
Hybrid genetic – genetic encoding-local improvement-WDFR-Comparison of Cas-Standard cell placement-GASP algorithm-unified algorithm.						
UNIT IV	UNIT IV GLOBAL ROUTING		9			
Global routi work-test ge	Global routing-FPGA technology mapping-circuit generation-test generation in a GA frame work-test generation procedures.					
UNIT V	UNIT V POWER ESTIMATION				9	
Power estim encoding- fi	Power estimation-application of GA-Standard cell placement-GA for ATG-problem encoding- fitness function-GA vs Conventional algorithm.					
		TOTAL : 45 PER	ΙΟΙ	DS		

OUTC	OUTCOMES:			
•	Apply the basics of Genetic algorithm.			
•	Understand the genetic algorithm in VLSI.			
•	Remember about hybrid genetic.			
•	Evaluate about global routing.			
•	Analyse the power estimation in genetic algorithm.			
TEXT	BOOKS:			
1.	Pinaki Mazumder, E.MRudnick, "Genetic Algorithm for VLSI Design, Layout and test Automation", Prentice Hall, 1998.			
2.	Randy L. Haupt, Sue Ellen Haupt, "Practical Genetic Algorithms" Wiley – Interscience, 1977.			
REFE	RENCES:			
1.	Ricardo Sal Zebulum, Macro Aurelio Pacheco, Marley Maria B.R. Vellasco, Marley Maria Bernard Vellasco "Evolution Electronics: Automatic Design of electronic Circuits and Systems Genetic Algorithms", CRC press, 1st Edition Dec 2001.			
2.	John R.Koza, Forrest H.Bennett III, David Andre, Morgan Kufmann, "Genetic Programming Automatic programming and Automatic Circuit Synthesis", 1st Edition, May 1999.			

17LPE021ASIC DesignLTP			Р	C		
	3 0					3
OBJECT	IV	ES:				
•	То	study the design flow of different types of ASIC.				
•	To familiarize the different types of programming technologies and logic devices.					
•	То	learn the architecture of different types of FPGA.				
•	To inc	gain knowledge about partitioning, floor planning, placem cluding circuit extraction of ASIC	ent	and	rou	ting
•	То	understand the design issues of SOC				
UNIT I	0	VERVIEW OF ASIC AND PLD				9
Types of Technologi Logic Devi	Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices: ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs					
UNIT II		ASIC PHYSICAL DESIGN				9
System pa measureme - special ro	System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing: global routing - detailed routing - special routing - circuit extraction – DRC				and ting	
UNIT III	[LOGIC SYNTHESIS, SIMULATION AND TEST	IN	3		9
Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.						
UNIT IV		FPGA				9
Field Progr mapping fo and their sp	Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance					
UNIT V		SOC DESIGN				9
Design Methodologies – Processes and Flows - Embedded software development for SOC – Techniques for SOC Testing – Configurable SOC – Hardware / Software co design Case						

studies	:Digital camera, Bluetooth radio / modem, SDRAM and USB
	TOTAL : 45 PERIODS
OUT	COMES:
•	Analyze programming technologies and logic devices.
•	Analyze partitioning and routing
•	Design and test digital circuits.
TEXT	F BOOKS:
1.	M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 1997
2.	S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications, 1994.
REFE	CRENCES:
1.	John V.Oldfield, Richard C Dore, Field Programmable Gate Arrays, Wiley Publications 1995.
2.	P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994.
3.	Parag.K.Lala, Digital System Design using Programmable Logic Devices, BSP, 2003.
4.	S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, Kluwer Pubin, 1992.

	17LPE022NEURAL NETWORKSLTH				Р	C
			3	0	0	3
OBJE	CTIV	ES:				
•	To stu	dy the Basics of Neural Networks				
•	To stu	ndy about Perception Network				
•	• To understand the Applications of Neural Network					
•	To stu	ndy about Hopfield Models				
•	To un	derstand the application of neural networks				
UNIT	I	INTRODUCTION TO NEURAL NETWORKS				9
Neural J Perceptro	process on, del	sing, learning and Adaptation, Neural Network Learning R ta, widrow – hoff, correlation, winner – take – all, outstar learn	ules ing	– I rules	Hebb	ian,
UNIT	[]	PERCEPTRON AND BACK PROPAGATION				9
		ALGORITHM				
Single L training Combine	ayer P algorit ed bacl	ALGORITHM erceptions – Multi player Feed forward Networks – Error back hm, problems with back propagation, Boltzmann training, Cauc k propagation / Cauchy training.	prop chy t	bagat rain	tion ing,	
Single L training Combine	ayer P algorit ed bacl	ALGORITHM erceptions – Multi player Feed forward Networks – Error back hm, problems with back propagation, Boltzmann training, Cauch k propagation / Cauchy training. HOPFIELD MODELS	prop chy t	pagat	ion ing,	9
Single L training Combine UNIT Hopfield Network	ayer Pe algorit ed bacl III I netwo	ALGORITHM erceptions – Multi player Feed forward Networks – Error back hm, problems with back propagation, Boltzmann training, Cauc k propagation / Cauchy training. HOPFIELD MODELS orks, Recurrent and Bi-directional Associative Memories, Cou icial Resonance Theory (ART)	prop chy t	pagat rain Proj	tion ing,	9 tion
Single L training Combine UNIT Hopfield Network	ayer Pe algorit ed bacl III I netwo c, Artif	ALGORITHM erceptions – Multi player Feed forward Networks – Error back hm, problems with back propagation, Boltzmann training, Cauch k propagation / Cauchy training. HOPFIELD MODELS orks, Recurrent and Bi-directional Associative Memories, Cou icial Resonance Theory (ART) APPLICATIONS OF NEURAL NETWORKS	prop chy t	pagat rain Proj	ion ing,	9 tion 9
Single L training Combine UNIT Hopfield Network UNIT Applicat salesman	ayer Palgorit ed bacl III I netwo a, Artif IV ions of n probl	ALGORITHM erceptions – Multi player Feed forward Networks – Error back hm, problems with back propagation, Boltzmann training, Cauch k propagation / Cauchy training. HOPFIELD MODELS orks, Recurrent and Bi-directional Associative Memories, Cou icial Resonance Theory (ART) APPLICATIONS OF NEURAL NETWORKS f neural networks – Handwritten digit and character recognition em, Neuro controller – inverted pendulum controller	prop chy t inter	Proj	tion ing, pagat	9 tion 9
Single L training Combine UNIT I Hopfield Network UNIT I Applicat salesmar	ayer Pe algorit ed bacl III I netwo c, Artif IV ions of n probl	ALGORITHM erceptions – Multi player Feed forward Networks – Error back hm, problems with back propagation, Boltzmann training, Cauch k propagation / Cauchy training. HOPFIELD MODELS orks, Recurrent and Bi-directional Associative Memories, Cou icial Resonance Theory (ART) APPLICATIONS OF NEURAL NETWORKS f neural networks – Handwritten digit and character recognition em, Neuro controller – inverted pendulum controller EXPERT SYSTEM FOR MEDICAL DIAGONO	prop chy t inter	Proj	ion ing, pagat ng	9 tion 9 9
Single L training Combine UNIT I Hopfield Network UNIT I Applicat salesmar UNIT I Applicat	ayer Palgorit ed bacl III I netwo a, Artif IV ions of probl V ions o ystems	ALGORITHM erceptions – Multi player Feed forward Networks – Error back hm, problems with back propagation, Boltzmann training, Cauch k propagation / Cauchy training. HOPFIELD MODELS orks, Recurrent and Bi-directional Associative Memories, Cou icial Resonance Theory (ART) APPLICATIONS OF NEURAL NETWORKS f neural networks – Handwritten digit and character recognition em, Neuro controller – inverted pendulum controller EXPERT SYSTEM FOR MEDICAL DIAGONO f neural networks - cerebellar model articulation controller, R for Medical Diagnosis.	prop chy t inter	Proj	ion ing, pagat ng emat	9 tion 9 9 ics,

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OUTCOMES :				
•	Obtain the theoretical knowledge about Neural Networks			
•	Understand the concepts of perceptron networks			
•	Gain knowledge about hopfield models			
•	Acquire the knowledge about the applications of Neural Network.			
•	Acquire the knowledge about expert system used in the field of Medical diagnosis			
TEXT B	OOKS:			
1.	Introduction to artificial Neural System, S.M.Zurada, Jaico Publishing House (1992)			
REFER	ENCES:			
1.	Neural Computing – Theory and Practice, Philip D.Wesserman, Van Nostrand Rein Hold, New York (1989)			
2.	Neural Networks and Fuzzy Systems, Bart Kosko, Prentice Hall, NJ, (1992)			

17LPE023	SOFTWARE DEFINED RADIO

L	T	Р	С
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OBJECTIVES:

•	To know the basics of the software defined radios.	
•	To gain knowledge about SDR architecture.	
•	To learn the design of the wireless networks based on the cognitive radios	
•	To analyze cognitive radio architecture.	
•	To understand the concepts of wireless networks and next generation networks	

UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO

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Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

UNIT II SDR ARCHITECTURE

Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules

UNIT III INTRODUCTION TO COGNITIVE RADIOS

Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

UNIT IV COGNITIVE RADIO ARCHITECTURE

Cognitive Radio - functions, components and design rules, Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio

Architecture on Software defined Radio Architechture.

UNIT V NEXT GENERATION WIRELESS NETWORK

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The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

OUTCO	MES:
•	Describe the basics of the software defined radios.
•	Analyze the architecture of SDR
•	Design the wireless networks based on the cognitive radios
•	Analyze the architecture of Cognitive radio
•	Explain the concepts behind the wireless networks and next generation networks
TEXT B	OOKS:
1.	Joseph Mitola III,"Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
2.	Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
3.	Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
4.	Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.
REFERI	ENCES:
1.	Simon Haykin, "Cognitive Radio: Brain –Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005.
2.	Hasari Celebi, Huseyin Arslan, "Enabling Location and Environment Awareness in Cognitive Radios", Elsevier Computer Communications, Jan 2008.
3.	Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
4.	Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.
5.	Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, "Cognitive Radio Communication and Networks", Elsevier, 2010.

17LPE0	24	SMART ANTENNAS	L	Т	Р	С
		3	0	0	3	
OBJEC	ΓIV	ES:				
•	To be familiar with the Types of Smart Antenna Systems					
٠	To learn the benefits of smart antenna technology.					
٠	Gain an understanding and experience with smart antenna environments and implementation					
•	To learn the fundamentals of beam forming.					
•	To learn different channel suppression and processing models.					
UNIT I		INTRODUCTION TO SMART ANTENNAS				9

Need for Smart Antennas, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Mutual Coupling Effects

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UNIT II DOA ESTIMATION FUNDAMENTALS

Introduction The Array Response Vector, Received Signal Model, The SubspaceBased Data Model, Signal Autocovariance Matrices ,Conventional DOA Estimation Methods, Conventional Beamforming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation ,The MUSIC Algorithm, The ESPRIT Algorithm, Uniqueness of DOA Estimates.

UNIT III BEAMFORMING FUNDAMENTALS

The Classical Beamformer-Statistically Optimum BeamformingWeight Vectors, The Maximum SNR Beamformer, The Multiple Sidelobe Canceller and the Maximum, SINR Beamformer- Minimum Mean Square Error (MMSE),Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beamforming, The Least Mean-Square (LMS) Algorithm, The Recursive LeastSquares (RLS) Algorithm.

UNIT IV

SPACE TIME PROCESSING

Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beamforming, Intersymbol and Co-Channel Suppression, ISI Suppression, CCI Suppression, Joint ISI and CCI Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Single-User Data Rate Limits, MultipleUsers Data Rate Limits, Data Rate Limits Within a Cellular System, MIMO in Wireless Local Area Networks.

UNIT V SMART ANTENNAS FOR MOBILE STATIONS

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Introduction -Multiple-Antenna MS Design, Combining Techniques, Selection (Switched) Diversity, Maximal Ratio Combining, Adaptive Beamforming or Optimum Combining, RAKE Receiver Size, Mutual Coupling Effects, Dual-Antenna Performance Improvements, Downlink Capacity Gains

TOTAL :45 PERIODS

OUTCOMES:

٠	Explain the various types of radiation pattern and concept of radiation
•	Write about the radiation from a current element.
•	Analyze the antenna arrays, aperture antennas.
•	Outline the algorithm used in smart antennas.
•	Learn about special antennas such as frequency independent and broad band and micro strip antennas.

TEXT BOOKS:

1.	Constantine A. Balanis, Panayiotis I. Ioannides, Introduction to Smart Antennas Morgan & Claypool Publishers
-	

2.	Ahmed El Zooghby, Smart Antenna Engineering, Artech House
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REFERENCES:

1.	M.J. Bronzel, Smart Antennas, John Wiley, 2004
2.	T.S.Rappaport & J.C.Liberti, Smart Antennas for Wireless Communication, Prentice Hall (PTR), 1999.
3.	R.Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Kluwer, 2001
4.	Tapan K. Sarkar, Michael C. Wicks, Magdalena Salazar-Palma, Robert J. Bonneau, "Smart Antennas" Wiley series.

LOW POWER VLSI DESIGN

L	Т	Р	С
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OBJECTIVES:

- Analyze the low voltage device modelling, low voltage, low power VLSI • CMOS circuit design To introduce various strategies and methodologies for designing low power circuit . and systems. Low voltage design styles with increasing emphasis on leakage power, . interconnects, reliability. Identify the power reduction techniques based on technology independent and . technology dependent Power dissipation mechanism in various MOS logic style. Identify suitable techniques to reduce the power dissipation
 - Design memory circuits with low power dissipation.

UNIT I POWER DISSIPATION IN CMOS

Hierarchy of limits of power - Sources of power consumption - Physics of power dissipation in CMOS FET devices- Basic principle of low power design.

UNIT II POWER OPTIMIZATION

Logical level power optimization - Circuit level low power design - Circuit techniques for reducing power consumption in adders and multipliers.

UNIT III DESIGN OF LOW POWER CMOS CIRCUITS

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Computer Arithmetic techniques for low power systems - Reducing power consumption in memories - Low power clock, Interconnect and layout design - Advanced techniques - Special techniques.

UNIT IV POWER ESTIMATION	POWER ESTIMATION	UNIT IV
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Power estimation techniques - Logic level power estimation - Simulation power analysis - Probabilistic power analysis.

UNIT V	SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER	9
Synthesis for L	ow power - Behavioural level transforms- Software design for low power	r.

OUTCOMES:		
•	Knowledge on the sources of power dissipation and principles of low power VLSI design.	
•	Ability to design and analyze low power CMOS circuits.	
•	An in-depth knowledge of power estimation and optimization techniques.	
•	Ability to synthesis low power circuits.	
•	Design and implementation of various structures for low power applications.	
TEXT BOOKS:		
1.	K.Roy and S.C. Prasad, "Low Power CMOS VLSI Circuit Design", Wiley, 2000.	
2.	D .Soudris, C.Pignet, C.Goutis, "Designing CMOS Circuits for Low Power", Kluwer, 2002.	
3.	A.P.Chandrakasan and R.W. Broadersen, "Low power digital CMOS design", Kluwer Academic Publishers, 2002.	
REFE	RENCES:	
1.	J.B. Kuo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley 1999.	
2.	G. Yeap, "Practical low power digital VLSI design", Kluwer, 1998.	
3.	A.Bellaouar, M.I. Elmasry, "Low power digital VLSI design", Kluwer, 1995.	
4.	J.B. Kuo, S. Lin, "Low voltage SOI CMOS VLSI Devices and Circuits", J.Wiley and sons, 2001.	

MIXED SIGNAL CIRCUITS AND **INTERFACING**

OBJECTIVES: Analyze the principles of analog and mixed-signal IC design in CMOS • technologies. To gain the knowledge of primitive cells, biasing, op-amp designs, switched capacitor A/D & D/A converters and clock generation systems for digital and mixed signal. To gain a basic knowledge of sampling circuits and Sample & Hold architectures. • Analyzing CMOS based switched capacitor circuits. • To analyze MOSFET based power amplifiers. • UNIT I **BASIC SAMPLING CIRCUITS** Introduction to data conversion and processing - Analog switches - High and low level analog multiplexers - analog multiplexer IC - Sample and hold circuits - MOS - Comparison of diode and MOS switches - Improvements in MOS switch performance. UNIT II SAMPLE AND HOLD ARCHITECTURES Open loop architecture - closed loop architecture - multiplexed input architecture - switched capacitor architecture - current mode architecture.

UNIT III DIGITAL TO ANALOG CONVERTER ARCHITECTURE

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Basic principles of digital to analog conversion - general considerations - performance metrics - reference multiplication and division - switching functions in resistor ladder DACs, current steering DACs, capacitor DACs, Binary- thermometer code conversion

UNIT IV ANALOG TO DIGITAL CONVERTER ARCHITECTURE

General considerations - performance metrics - Successive approximation ADC, Pipelined ADC, Flash Converters, Sigma delta ADC.

UNIT V **CMOS POWER AMPLIFIERS**

MOSFET based Class A, B, AB, C and D Power Amplifiers -characteristics analysis.

OUTCOMES:		
•	Basic knowledge of sampling circuits and Sample & Hold architectures	
٠	In-depth knowledge of digital to analog and analog to digital architectures	
٠	Ability to analyze MOSFET based power amplifiers	
٠	Understand the concepts of CMOS	
•	Understand to design a complete mixed signal system that includes efficient data conversion.	
TEXT BOOKS:		
1.	B. Razavi, "Principles of Data Conversion System Design", John Wiley & Sons, 2011.	
2.	S. Natarajan, "Microelectronics Analysis & design", McGraw Hill 2006.	
3.	R.Gregorian, G.C.Temes, "Analog MOS Integrated Circuit for signal processing", John Wiley & Sons, 2011.	
REFERENCES:		
1.	<i>R. J Baker, "CMOS Mixed Signal Circuit Design", Wiley Interscience, 2nd Edition, 2009</i>	
2.	B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2005.	
3.	D.A. Johns and K. Martin, "Analog Integrated Circuit Design", Wiley India, 2008.	
4.	Baker, Li, Boyce, "CMOS: Circuit Design, layout and Simulation", PHI, 2003.	

DIGITAL SPEECH PROCESSING

L	Т	Р	С
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OBJECTIVES:

•	Deep understanding of human speech generation system, feature extraction from speech signals, digital coding of speech, and recognition of speech or speaker by a computer.
٠	To gain the fundamentals of Speech Coding and transmission this is mainly concerned with man-to man voice communication.
•	To analyze the fundamentals of Speech Synthesis this deals with machine-to-man communication.

- Understanding the fundamentals of Speech Recognition this is related to man-tomachine communication.
- To gain the basic knowledge of text-to-speech synthesis

UNIT I INTRODUCTION

The Speech Chain, Applications of Digital Speech Processing, Phonetic Representation of Speech, Models for Speech Production, Hearing and Auditory Perception

UNIT II SPEECH ANALYSIS

Short-Time Analysis of Speech, Homomorphic Speech Analysis, Linear Predictive Analysis

UNIT III DIGITAL SPEECH CODING

Sampling and Quantization of Speech, Digital Speech Coding, Closed-Loop Coders, Open-Loop Coders, Frequency-Domain Coders, Evaluation of Coders

UNIT IV TEXT TO SPEECH SYNTHESIS METHODS

Text Analysis, Evolution of Speech Synthesis Systems, Unit Selection Methods, TTS Applications, TTS Future Needs

UNIT V AUTOMATIC SPEECH RECOGNITION

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Building a Speech Recognition System, The Decision Processes in ASR, Representative Recognition Performance, Challenges in ASR Technology

TOTAL : 45 PERIODS

OUTCOMES :

•	To understand the role of DSP in speech communication
•	To understand the methods of representing the speech in digital form.
• .	Acquire knowledge about automatic synthesis and recognition of speech
•	Analyze the coding technique

•	Analyse the impact of sampling in the frequency domain (i.e., aliasing in the time domain).
•	Analyse the impact of sampling (both down and up sampling) in the time domain, and the resulting aliasing or imaging in the frequency domain.
TEXT	BOOKS:
1.	L. Rabiner and B.H. Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2.	T. F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.
3.	B. Gold and N. Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.
REFE	RENCES:
1.	D.Jurafsky and J. H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.
2.	F.Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997
3.	S.W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing, 1997.

4. C.Becchetti and L. P.Ricotti, "Speech Recognition", John Wiley and Sons, 1999.

ARM SYSTEM DESIGN

L	Т	Р	С
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OBJECTIVES:

•	To teach the architecture of general AVR processor
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- To teach the architecture and programming of 8/16 bit RISC processor
- To teach the implementation of DSP in ARM processor
- To discuss on memory management, application development in RISC processor
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the subject for improved employability skills

UNIT I ARM MICROCONTROLLER ARCHITECTURE

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Architecture – memory organization – addressing modes – I/O Memory – EEPROM – I/O Ports – SRAM –Timer –UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing.

UNIT II ARM ARCHITECTURE AND PROGRAMMING

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Arcon RISC Machine – Architectural Inheritance – Core & Architectures -- The ARM Programmer's model -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Coprocessors. Instruction set – Thumb instruction set – Instruction cycle timings

UNIT III ARM APPLICATION DEVELOPMENT

Introduction to DSP on ARM – Filter –Exception Handling – Interrupts – Interrupt handling schemes Firmware and boot loader – Example: Standalone - Embedded Operating Systems – Fundamental Components – Example- ARM Cortex M0 NUVOTON Processor.

UNIT IV MEMORY PROTECTION AND MANAGEMENT

Protected Regions-Initializing MPU, Cache and Write Buffer-MPU to MMU-Virtual Memory-Page Tables-TLB-Domain and Memory Access Permission-Fast Context Switch Extension.

UNIT V DESIGN WITH ARM MICROCONTROLLER

Assembler Rules and Directives- Simple ASM/C programs- Hamming Code- Division-

Negation Simple Loops –Look up table- Block copy- subroutines.

OUTC	OMES:
•	The learning process delivers insight into various embedded processors of RISC architecture / computational processors with improved design strategies.
•	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.
•	Evaluate the memory protection techniques
•	Understand the design of ARM microcontroller
•	Students will develop more understanding on the concepts ARM Architecture, programming and application development.
TEXT	BOOKS:
1.	A.N.Sloss, D. Symes and C. Wright "ARM System Developer's Guide : Designing and Optimizing System Software", First edition, Morgan Kaufmann Publishers, 2004.
2.	S.Furber, 'ARM system on chip architecture', Addision Wesley,2010.
3.	D.Seal, "ARM Architecture Reference Manual" Second Edition, Addison-Wesley Professional, 2001.
REFE	RENCES:
1.	T. Martin, 'The Insider's Guide To The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd.,
2.	D. V. Gadre 'Programming and Customizing the AVR microcontroller', McGraw Hill 2001
З.	W. Hohl, 'ARM Assembly Language' Fundamentals and Techniques, 2009.
4.	J. D. Bakos, "Embedded Systems ARM programming and optimization", Morgan Kaufmann Publishers.

17LPE029		INTERNET OF THINGS	L	T	Р	С
			3	0	0	3
OBJE	CTIV	ES:				
•	To St	udy about Internet of Things technologies and its role in real tir	ne a	ppli	catio	ns
•	To fa	miliarize the accessories and communication techniques for IO	Г			
•	To fa	miliarize the different platforms and Attributes for IOT				
•	To bu	ild a small low cost embedded system using Raspberry Pi and	Ardı	ino.		
•	To ap	ply the concept of Internet of Things in the real world scenario.				
UNIT	[FUNDAMENTALS OF IOT			ļ)
Introduc technolo	tion-C gies –	naracteristics-Physical design - Protocols – Logical desi IOT Levels – Domain Specific IOT'S – IOT vs M2M.	gn	– I	Enabl	ing
UNIT	II	IOT DESIGN METHODOLOGY			9)
IOT sys Applicat	stems ion De	management – IOT Design Methodology – Specifications velopment.	Inte	egrat	ion	and
UNIT	UNIT IIIBUILDING IOT WITH RASPBERRY PI9)	
Physical	device	e – Raspberry Pi Interfaces – Programming – APIs / Packages –	Weł	o ser	vices	
UNIT IV BUILDING IOT WITH GALILEO/ARDUINO			ļ)		
Intel Ga	lileo G	en2 with Arduino- Interfaces - Arduino IDE – Programming - A	PIs	and	Hack	S
UNIT V CASE STUDIES and ADVANCED TOPICS			ļ)		
Various Real time applications of IOT- Connecting IOT to cloud – Cloud Storage for IOT – Data Analytics for IOT – Software & Management Tools for IOT						
Data An	Real t alytics	ime applications of IOT- Connecting IOT to cloud – Cloud St for IOT – Software & Management Tools for IOT	orag	ge fo	or IO	1 -
Data An	Real t alytics	ime applications of IOT- Connecting IOT to cloud – Cloud St for IOT – Software & Management Tools for IOT TOTAL : 45 PER	orag	ge fo	or IO	1 -
Data An	Real t alytics OME	Torran applications of IOT- Connecting IOT to cloud – Cloud St for IOT – Software & Management Tools for IOT TOTAL : 45 PER	orag	ge fo	or IO	I —
OUTC	Real t alytics OME Desig	Ime applications of IOT- Connecting IOT to cloud – Cloud St for IOT – Software & Management Tools for IOT TOTAL : 45 PER S: on a portable IOT using Arduino / equivalent boards and releva	orag IOI	ge fo DS	or IO	I —
OUTC	Real t alytics OME Desig Deve	Ime applications of IOT- Connecting IOT to cloud – Cloud St for IOT – Software & Management Tools for IOT TOTAL : 45 PER S: In a portable IOT using Arduino / equivalent boards and relevation lop web services to access/control IOT devices.	orag	ge fo DS	or IO	
OUTC	Real t alytics OME Desig Deve Deplo	Ime applications of IOT- Connecting IOT to cloud – Cloud St for IOT – Software & Management Tools for IOT TOTAL : 45 PER S: In a portable IOT using Arduino / equivalent boards and relevation lop web services to access/control IOT devices.	IOI	ge fo	or IO	I —
OUTC • •	Real t alytics OME Desig Deve Deplo Analy	Ime applications of IOT- Connecting IOT to cloud – Cloud St for IOT – Software & Management Tools for IOT TOTAL : 45 PER S: In a portable IOT using Arduino / equivalent boards and relevation lop web services to access/control IOT devices. Ioy an IOT application and connect to the cloud. I/ze applications of IOT in real time scenario.	orag	ge fo	or IO	

TEXT	BOOKS:
1.	A. Bahga, V.Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
2.	H. Chaouchi, "The Internet of Things Connecting objects to the web", Wiley, 2017.
3.	Raj Kamal, "Internet of Things Architecture and Design Principles", Tata Mcgraw Hill, 2017.
REFE	RENCES:
1.	M.C.Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
2.	M. Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
3.	A.McEwen, H. Cassimally, "Designing the Internet of Things", Wiley Publications, 2013.
4.	S. Greengard, "The Internet of Things", MIT press, 2015.

17LPE030	ANALOG INTEGRATED CIRCUIT DESIGN	L	Т	Р	С

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OBJECTIVES:

•	To study MOS devices modelling and scaling effects.
•	To familiarize the design of single stage and multistage MOS amplifier and analysis their frequency responses.
•	To study the different design parameters in designing voltage reference and OP-AMP circuits.
•	To study the different types of current mirrors and to know the concepts of voltage and current reference circuits.
	The second sector dimension of the tanda officiant land in sector signal devices

• Enhance understanding of the trade-offs involved in analog circuit design.

UNIT I

MOSFET METRICS

Simple long channel MOSFET theory – SPICE Models – Technology trend, Need for Analog design - Sub-micron transistor theory, Short channel effects, Narrow width effect, Drain induced barrier lowering, Sub-threshold conduction, Reliability, Digital metrics, Analog metrics, Small signal parameters, Unity Gain Frequency, Miller's approximation

UNIT II SINGLE STAGE AND TWO STAGE AMPLIFIERS

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Single Stage Amplifiers – Common source amplifier with resistive load, diode load, constant current load, Source degeneration Source follower, Input and output impedance, Common gate amplifier - Differential Amplifiers – differential and common mode response, Input swing, gain, diode load and constant current load - Basic Two Stage Amplifier, Cut-off frequency, poles and zeros

UNIT III FREQUENCY RESPONSE OF SINGLE STAGE AND TWO STAGE AMPLIFIERS

Frequency Response of Single Stage Amplifiers – Noise in Single stage Amplifiers – Stability and Frequency Compensation in Single stage Amplifiers, Frequency Response of Two Stage Amplifiers, – Noise in two stage Amplifiers – Stability, gain and phase margins, Frequency Compensation in two stage Amplifiers, Effect of loading in feedback networks

UNIT IV CURRENT MIRRORS AND REFERENCE CIRCUITS

Cascode, Negative feedback, Wilson, Regulated cascode, Bandgap voltage reference, Constant Gm biasing, supply and temperature independent reference, curvature compensation, trimming, Effect of transistor mismatch in analog design

UNIT V OP AMPS

Gilbert cell and applications, Basic two stage OPAMP, two-pole system response, common mode and differential gain, Frequency response of OPAMP, CMFB circuits, slew rate, power supply rejection ratio, random offset, systematic offset, Noise, Output stage, OTA and OPAMP circuits - Low voltage OPAMP

	TOTAL : 45 PERIODS
OUTC	OMES:
•	To design MOS single stage, multistage amplifiers and OP-AMP for desired frequencies.
•	Analyze Stability, frequency response and Noise in MOS amplifiers.
•	Remember the concepts of current mirror circuits.
•	Quantify the noise contributions of various structures on an IC
•	Understand the basics of OP-AMP.
TEXT	BOOKS:
1.	B. Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2000
2.	P. R.Gray, R. G. Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley Student edition, 5th edition, 2009.
3.	J. Michael Jacob, "Applications and Design with Analog Integrated circuits", Second Baker, PHI, 1996.
REFE	RENCES:
1.	P. E.Allen, "CMOS Analog Circuit Design", Oxford University Press, 2013
2.	D. Harris, N. Weste, "CMOS VLSI design : A Circuits and Design Perspective", Pearson.
3.	<i>RBaker, "CMOS: Circuit Design, Layout , and Simulation", Wiley Student Edition,</i> 2009
4.	D.A. Jones, K. W Martin Tony Chan Carusone, "Analog Integrated Circuit Design" Wiley, 2013

MICROWAVE INTEGRATED CIRCUITS

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OBJECTIVES:

UNIT I		INTRODUCTION TO MICROWAVE CIRCUITS	9
•	To	e learn design of microwave IC and measurement technique.	
•	To	o discuss different types of mixers and control circuits.	
•	To	o understand amplifiers and oscillators.	
•	To	be familiar in two port matching networks and filter design.	
•	To	e learn basic knowledge of microwave circuits.	

Definitions – Frequency Bands – Lumped versus Distributed Circuits - Behavior of finite length transmission lines – General Characteristics of PC Boards – Transmission Lines on PC Boards – Passives made from Transmission Lines – Resonators - Combiners, Splitters and Couplers

UNIT II MATCHING NETWORKS AND FILTER DESIGN

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Circuit Representation of two port RF/Microwave Networks: Low Frequency Parameters, High Frequency Parameters, Transmission Matrix, ZY Smith Chart, Design of Matching Circuits using Lumped Elements, Matching Network Design using Distributed Elements, Filter design.

UNIT III AMPLIFIERS AND OSCILLATORS

Amplifiers: Stability considerations in active networks – Gain Consideration in Amplifiers – Noise Consideration in active networks – Broadband Amplifier design – Low Noise Amplifier Design, Oscillators: Oscillator versus Amplifier Design – Oscillation conditions – Design and stability considerations of Microwave Transistor Oscillators.

UNIT IV MIXERS AND CONTROL CIRCUITS

Mixer Types – Conversion Loss – SSB and DSB Mixers – Design of Mixers: Single Ended Mixers – Single Balanced Mixers - Sub Harmonic Diode Mixers ,Microwave Diodes , Phase Shifters – PIN Diode Attenuators

UNIT V MICROWAVE IC DESIGN AND MEASUREMENT TECHNIQUES

Microwave Integrated Circuits – MIC Materials- Hybrid versus Monolithic MICs – Multichip Module Technology - Fabrication Techniques, Miniaturization techniques, Introduction to SOC, SOP, Test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques.

OUTO	COMES:
•	To know the recent techniques in MIC technology
•	To design and assess the performance of various planar configurations
•	Acquire knowledge about Microwave Integrated Circuits
•	Develop understanding of the fundamentals required to design & implement Integrated Circuits operating at microwave frequencies
•	Gain knowledge and understanding of amplifiers and oscillators
ТЕХТ	BOOKS:
1.	T. H.Lee, "Planar Microwave Engineering", Cambridge University Press, 2004.
2.	M. M. Radmanesh, "Radio Frequency and Microwave Electronics", Pearson Education, II Edition, 2002.
3.	"Microwave Transistor Amplifiers – Analysis and Design", Prentice Hall, II Edition, New Jersy,1996.
REFE	CRENCES:
1.	R. Goyal, "Monolithic MIC; Technology & Design", Artech House, 1989.
2.	Gupta K.C. and A. Singh, "Microwave Integrated Circuits", John Wiley, New York, 1975.
3.	Hoffman R.K. "Handbook of Microwave Integrated Circuits", Artech House, Boston, 1987.
4.	U. L. Rohde and David P.N., " RF / Microwave Circuit Design for Wireless Applications", John Wiley, 2000.
5.	C. Gentili, "Microwave Amplifiers and Oscillators", North Oxford Academic, 1986.
6.	S. Y. Liao, "Microwave Circuit Analysis and Amplifier Design", Prentice Hall. Inc., 1987.

COMMUNICATION ELECTRONIC CIRCUITS

OBJECTIVES:

	To understand different types of assillators and modulation systems
•	To understand unterent types of oscinators and modulation systems.
•	To analyze and design of filters and tuned amplifier.
•	To get basic knowledge of types of power amplifiers.
•	To learn PLL and synthesizer.
•	To discuss various microwave devices and components.

UNIT I OSCILLATORS AND MODULATION SYSTEMS

Oscillators: Principle, types-RC,LC,crystal oscillator, frequency stability. Modulation: Analog and digital modulation techniques.

- UNIT II FILTERS AND TUNED AMPLIFIER
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Passive and active filter, First order and second order low pass and high pass filter, Band pass filter, Switched capacitor filter, Notch filter, Selecting components for filter, Testing filter response. Tuned circuits

UNIT III POWER AMPLIFIER

Transistor characteristics, small signal voltage amplifier, power amplifier types, power and efficiency calculation, integrated circuit power amplifier, radio frequency power amplifier, measurement.

UNIT IV PHASE LOCKED LOOPS AND SYNTHESIZERS

Phase locked loop elements, compensation, Integrated phase locked loops, PLL design using HCC4046B, frequency synthesis.

UNIT V MICROWAVE DEVICES AND COMPONENTS

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Phase delay, propagation velocity, propagation constant, secondary constant, transmission line distortion, wave reflection, reflection coefficient, SWR, wave guide characteristics, microwave passive components-directional coupler, waveguide junction, cavity resonator, probes, circulators and isolators, microwave active devices- solid state devices, microwave tubes, multicavity magnetrons.

TOTAL : 45 PERIODS

OUTCOMES:		
•	Acquires knowledge about oscillators and modulation systems	
•	Design filters and tuned amplifiers	
•	Implement different types of power amplifiers	
•	Gain knowledge about phase locked loops and synthesizers	
•	Develop understanding of the fundamentals required to design & implement microwave devices and components	
TEXT BOOKS:		
1.	A. Leven,"Telecommunication Circuits and Technology", Butterworth Heinemann Ltd, 2000.	
2.	D. O. Peterson, K. Mayaram, "Analog Integrated Circuits for Communication Principles, Simulation and Design" Second Edition, Springer, 2010.	
3.	C. Drentta, "Modern Communications Receiver Design and Technology", Artech House, 2010.	
REFE	CRENCES:	
1.	Sedra and Smith, "Micro Electronic Circuits", Sixth Edition, Oxford University Press, 2011.	
2.	B.S. Sonde, "System Design using Integrated Circuits", 2nd Edition, New Age Pub,2001.	
3.	S. R. Bullock, "Transceiver and system design for digital communication" 3rd Edition, Scitech Publishing.	
4.	M. M Radmanesh, "RF and Microwave Electronics", Prentice Hall, 2000.	

COMPUTER ARCHITECTURE AND ORGANIZATION

OBJECTIVES:

•	To make students understand the basic structure and operation of digital computer.
•	To understand the hardware-software interface.
•	To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
•	To expose the students to the concept of pipelining.
•	To familiarize the students with hierarchical memory system including cache memories and virtual memory.
•	To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

UNIT I OVERVIEW & INSTRUCTIONS

Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.

UNIT II ARITHMETIC OPERATIONS

ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

UNIT III PROCESSOR AND CONTROL UNIT

Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

UNIT IV PARALLELISM

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors

UNIT V MEMORY AND I/O SYSTEMS

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

TOTAL : 45 PERIODS

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OUTCOMES :		
•	Design arithmetic and logic unit	
•	Be familiar with the addressing modes and instructions set	
•	Design and analyze pipelined control units	
•	Evaluate performance of memory systems.	
•	Understand parallel processing architectures.	
TEXT	T BOOKS:	
1.	D. A. Patterson and J. L. Hennessey, "Computer organization and design', Morgan Kauffman / Elsevier, Fifth edition, 2014.	
2.	W.Stallings "Computer Organization and Architecture", Seventh Edition, Pearson Education, 2006	
3.	V. P. Heuring, H. F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.	
REFF	CRENCES:	
1.	V.C. Hamacher, Z. G. Varanesic and S. G. Zaky, "Computer Organisation", VI th edition, Mc Graw-Hill Inc, 2012.	
2.	Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.	
3.	J.P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.	
4.	http://nptel.ac.in/	

PROFESSIONAL ETHICS

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OBJECTIVES:

UNIT I	HUMAN VALUES	9
•	To learn global issues	
•	To appreciate the rights of others.	
•	To instil Moral and Social Values and Loyalty	
•	To create an awareness on Engineering Ethics	
•	To create an awareness about Human Values, to instill Moral and Social Valuend Loyalty	es

UNIT I **HUMAN VALUES**

Morals, values and Ethics - Integrity - Work ethic - Service learning - Civic virtue -Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time - Cooperation - Commitment - Empathy - Self confidence - Character - Spirituality -Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II

ENGINEERING ETHICS

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy -Models of professional roles - Theories about right action - Self-interest - Customs and Religion – Uses of Ethical Theories.

UNIT III

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics - A Balanced Outlook on Law.

UNIT IV

SAFETY, RESPONSIBILITIES AND RIGHTS

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Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V

GLOBAL ISSUES

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors - Moral Leadership -Code of Conduct - Corporate Social Responsibility.
OUTO	OUTCOMES:		
•	To apply ethics in society.		
•	Discuss the ethical issues related to engineering.		
•	Realize the responsibilities and rights in the society.		
•	Understand the nature of professional responsibility and be able to identify the ethical elements in decisions		
•	Be able to address and resolve problems arising from questionable practice		
TEXT	TBOOKS:		
1.	M.W. Martin and R. Schinzinger, "Ethics in Engineering", Tata Mc Graw Hill, New Delhi, 2003.		
2.	Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.		
3.	E. G. Seebauer and R. L. Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.		
REFE	CRENCES:		
1.	C. B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.		
2.	C. E. Harris, M. S. Pritchard and M.J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.		
3.	J. R .Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.		
4.	L.P. Hartman and J. Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education India Pvt. Ltd.,New Delhi ,2013.		
5.	World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011.		

17LPE035		COMPUTER NETWORKS	L	Т	Р	C
			3	0	0	3
OBJECTIVES:						
•	• To know about the concepts of Data communication and networks					
•	• To impart knowledge on ISO-OSI model and different protocols.					
•	То	o understand different routing techniques				
•	То	b learn TCP and Qos of network.				
•	То	get knowledge about application layer				
UNIT	Ί	FUNDAMENTALS & LINK LAYER				9
Buildin Networ control	ng a ne rk softw	twork – Requirements - Layering and protocols - Internet A are – Performance ; Link layer Services - Framing - Error De	Arch tecti	itect on -	ure Flov	- V
UNIT	II	MEDIA ACCESS & INTERNETWORKING				9
Media and bri	access o dging –	control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetoo Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP).	th -	Swit	chin	g
UNIT	III	ROUTING				9
Routing Multica	g (RIP, ast – ado	OSPF, metrics) – Switch basics – Global Internet (Areas, dresses – multicast routing (DVMRP, PIM).	BC	θP, I	[Pv6]),
UNIT IV TRANSPORT LAYER		TRANSPORT LAYER				9
Overview of Transport layer - UDP - Reliable byte stream (TC - Flow control - Retransmission – TCP Congestion control - C RED) – QoS – Application requirements.		ransport layer - UDP - Reliable byte stream (TCP) - Connection - Retransmission – TCP Congestion control - Congestion avoid Application requirements.	n ma ance	nage (DI	emer ECbi	ıt t,
UNIT	' V	APPLICATION LAYER				9
Traditie Service	onal apj es – DN	plications -Electronic Mail (SMTP, POP3, IMAP, MIME) – S - SNMP.	HTI	TP –	We	b
	TOTAL : 45 PERIODS					
OUT	COME	CS:				
•	Identi	fy the components required to build different types of network	s.			
•	Choos	e the required functionality at each layer for given application	•			

•	Identify solution for each functionality at each layer.
•	Trace the flow of information from one node to another node in the network.
•	Use appropriate network tools to build network topologies
ТЕХЛ	T BOOKS:
1.	L. L. Peterson, B. S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
2.	B. A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.
3.	A. S. Tanenbaum, "Computer Networks", Fifth Edition, Pearson Education, 2013.
REFE	CRENCES:
1.	J. F. Kurose, K. W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2.	N. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3.	Y. Lin, R. Hwang, F. Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
4.	O.Bonaventure, "Computer networking: Principles, Protocols and Practices", Sayler foundation, 2011.

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ONE CREDIT THEORY COURSE

17LOC001	VALUE EDUCATION, HUMAN RIGHTS AND LEGISLATIVE PROCEDURES	L	Т	Р	С		
	1 0						
OBJECTIV	OBJECTIVES:						
• T o	• To create awareness, conviction &commitment to values for improving the quality of the life through education, and for advancing social and human well being.						
• T	o develop interaction between society and educational institution	s.					
• T	o be familiar in character and competency.						
• T	o learn the basic knowledge of human rights.						
• T	o act according to legislative procedure ,rights and duties of educ	atio	n.				
UNIT I	VALUES AND SELF DEVELOPMENT				3		
Social Values And Non-Mon inculcation of truthfulness, C Love for Natur	Social Values And Individual Attitudes, Work Ethics Indian Vision of Humanism: Moral And Non-Moral Valuation, Standards and Principles. Value Judgments Importance of inculcation of Values: Sense of Duties, Devotion, Self-Reliance, Confidence, Concentration, truthfulness, Cleanliness, Honesty, Power of Faith, National Unity/Integration, Patriotism, Love for Nature, Discipline.				l of 1, 1,		
UNIT II PERSONALITY AND BEHAVIOUR DEVELOPMENT					3		
Soul and Scie Discipline, pur from anger, di Happiness Vs. Cooperation, D	Soul and Scientific attitude, God and Scientific Attitude, Positive thinking, Integrity and Discipline, punctuality, Love and Kindness, Appreciating and Avoiding fault finding, free from anger, dignity of labor, universal brotherhood and religious tolerance, true friendship, Happiness Vs. Suffering love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best, Preserving nature.				d e), d		
UNIT III CHARACTER AND COMPETENCY			3				
Science vs. Go Reincarnation Role of Wom Studying Effect	Science vs. God, holy books vs. Blind faith, Self-Management and Good Health Science of Reincarnation Equality, Nonviolence, Humility Role of women in Economy and Society, Role of Women in Science and Technology Mind your Mind, Self-Control, Honesty, Studying Effectively.						
UNIT IV	HUMAN RIGHTS				3		

Jurisprudence of Human Rights: nature and Definition Universal protection of Human Rights Regional Protection of Human Rights National Level protection of Human Rights, Human Rights and Vulnerable groups.

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LEGISLATIVE PROCEDURES

Indian Constitution, Philosophy Fundamental Right and Duties Legislature, Executive and Judiciary Constitution and Functions of Parliament Corporate Laws: Laws Relating to Companies – Public and Private.

TOTAL : 15 PERIODS

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OUTCOMES

•	Inculcate the core Values of education
•	Trigger their social behaviour and Personality
•	Civilize in the societal settings
•	Understand legislative procedures.
•	Adopt moral behaviour and act accordingly.
ТЕХТ	BOOKS:
1.	Chakraborty, S.K., "Values and Ethics for organizations: Theory and Practice", Oxford University Press, New Delhi, 2001
2.	Kapoor, S.K., "Human Rights under International Law and Indian Law", Prentice Hall of India, New Delhi, 2002.
3.	Thakar, V., "A scientific Outlook on the Integration through Education", Vimal Prakashan Trust, Ahmedabad, 2009.
REFE	RENCES:
1.	Basu, D. D., "Indian Constitution", Oxford University Press, New Delhi, 2002
2.	Frankena, W. K., "Ethics", Prentice Hall of India, New Delhi, 1990
3.	M.Theodor, "Human Rights and International Law Legal Policy Issues", Vol. 1 and 2, Oxford University Press, New Delhi, 2000.
4.	A.N.Tripathi., "Human values", New age international" 2009.

17LOC002

MINI PROJECT

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GUIDELINES:

- 1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
- 2. The mini project may be a complete hardware and software or a combination of hardware and software.
- 3. Mini Project should cater to a small system required in laboratory or real life.
- 4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
- 5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
- 6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
- 7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
- 8. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
- 9. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

		TOTAL : 30 PERIODS
OUTO	COMES:	
•	Conceive a problem statement either from rigoror requirements raised from need analysis.	ous literature survey or from the
•	Design, implement and test the prototype/algorit problem.	hm in order to solve the conceived
•	Write comprehensive report on mini project wor	k.

17LOC003		FOREIGN LANGUAGE	L	Т	Р	С	
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OBJECTIVES:							
•	То	understand basics of German language.					
•	• To demonstrate grammar and vocabulary.						
•	То	learn situational conversations and practice drills.					
UNIT I		INTRODUCTION TO GERMAN LANGUAGE				3	
Introduction responding to etc., if spoke	to o ev n sl	German alphabets, phonetics and pronunciation, Un veryday queries like instruction, questions, short telephone m owly and clearly.	derst essa	andi ges,	ng requ	and ests	
UNIT II		GRAMMAR & VOCABULARY			,	7	
Parts of spee verbs and ver and comman form. nouns expression an	ch, rb c ds, , v nd p	articles, word order or syntax, demonstratives & interrog conjugation, adjectives, adverbs, comparisons, giving and re- potential and conditionals, possessive, direct indirect speed erbs tenses-past and present, adjectives, adverbs, expres- phrases.	ative ceivi ch, v ssion	es, c ng, varic s of	requ us o tim	ers, ests ther ie ,	
UNIT III		SITUATIONAL CONVERSATIONS AND PRACTICE DRILLS				5	
Self-introduc objects, time hospital, ask practice.	Self-introduction, numbers, day and date, time, location and presence, possession of objects, time expressions and their usage, visiting people, accepting and receiving objects, hospital, asking direction, asking price of objects. Video and audio- clips for listening and practice.						
		TOTAL : 15 PER	IOI	DS			
OUTCOM	IES	S:					
• Read	• Read articles of a general kind in magazines and newspapers.						
• Parti frien	• Participate effectively in informal conversations; introduce themselves and their friends and express opinions in German						
• Com	pre	hend conversations and short talks delivered in German					
• Writ	• Write short essays of a general kind and personal letters and emails in German.						

REFF	CRENCES:
1.	Funk, Hermann/Kuhn, "Christina: Studio 21. A1. Das Deutschbuch", Cornelsen Schulverlage, 2013
2.	Buscha, Anne/Szita, "Szilvia: A Grammatik. Übungsgrammatik Deutsch als Fremdsprache", Schubert Verlag, 2010
3.	Lernspaß mit Mogeln und Quartett, "Karin: Sprech- und Grammatikspiele DaZ/DaF", , AOL Verlag ,2012
4.	Dreke, Michael/Lind, "Wolfgang: Wechselspiel. Interaktive Arbeitsblätter für die Partnerarbeit im Deutschunterricht", Langenscheidt, 2000

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ECE

17LOE001		REAL TIME SYSTEMS	L	Т	P	C
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OBJECTIVES:						
•	To ex	spose the students to the fundamentals of Real Time systems				
•	To te	ach the fundamentals of Scheduling and features of programming	ng L	angı	lages	8
•	To st	udy the data management system for real time				
•	To in	troduce the fundamentals of real time communication				
•	To te	ach the different algorithms and techniques used for real time s	yster	ns		
UNIT I	[INTRODUCTION			ļ	9
Introduct classes - Tolerant	tion – - Task Sched	Issues in Real Time Computing – Structure of a Real Time Assignment and Scheduling – Task assignment – Mode ch Juling.	Sys ange	tem s ar	– T nd Fa	'ask ault
UNIT I	Ι	PROGRAMMING LANGUAGES AND TOOLS			ļ	9
Programming Languages and Tools – Desired language characteristics – Data typing Control structures – Multitasking – Low level programming – Task Scheduling – Timi Specifications – Programming Environments – Run – time support.				g – iing		
UNIT I	II	REAL TIME DATABASES			9	9
Real time Databases – Basic Definition, Real time Vs General Purpose Databases, M Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control iss Disk Scheduling Algorithms, Maintaining Serialization Consistency – Databases for H Real Time Systems.			lain Jes, lard			
UNIT IV FAULT TOLERANCE AND RELIABILTY		9	9			
Real – Time Communication – Fault Tolerance Techniques – Fault Types – Fault Detection. Fault Error containment Redundancy – Data Diversity – Reversal Checks – Integrated Failure handling.				ion. lure		

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy – Software error models. Clock Synchronization – Clock, A Nonfault – Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

EVALUATION TECHNIQUES

UNIT V

9

TOTAL : 45 PERIODS

OUT	COMES :
•	Understand the basics of the real time systems.
•	Analyse the programming languages and tools.
•	Remember the real time database.
•	Evaluate real time communication between devices
•	Evaluate different fault tolerant techniques.
TEXT	T BOOKS:
1.	C.M. Krishna, Kang G. Shin, "Real – Time Systems", McGraw – Hill International Editions, 1997.
2.	Rajib Mall, "Real-time systems: theory and practice", Pearson Education, 2007
3.	Peter D.Lawrence, "Real Time Micro Computer System Design – An Introduction", McGraw Hill, 1988.
REFF	CRENCES:
1.	Stuart Bennett, "Real Time Computer Control – An Introduction", Prentice Hall of India, 1998.
2.	S.T. Allworth and R.N.Zobel, "Introduction to real time software design", Macmillan, 2nd Edition, 1987.
3.	R.J.A Buhur, D.L Bailey, "An Introduction to Real – Time Systems", Prentice – Hall International, 1999.
4.	Philip.A.Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 3rd Edition, April 2004

17LOE002		WIRELESS SENSOR NETWORKS	L	Т	Р	С
			3	0	0	3
OBJEC	ГIV	ES:				
•	Un	derstand the overview of sensor networks.				
•	Lea	rn the different types of sensor networks architecture.				
•	Be	familiar with networking sensors				
•	Be	exposing to the infrastructure establishment in sensor networks				
•	Lea	rn the platforms and tools of wireless sensor networks.				
UNIT I		OVERVIEW OF WIRELESS SENSOR NETWO	RK	5		9
Challenges Networks.	s fo	Wireless Sensor Networks, Enabling Technologies For	Wire	eless	Ser	isor
UNIT II		ARCHITECTURES			9	9
Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Node Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.				es , 'ork		
UNIT III		NETWORKING SENSORS				9
Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks- S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.						
UNIT IV	7	INFRASTRUCTURE ESTABLISHMENT				9
Topology Tasking ar	Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.					isor
UNIT V	UNIT V SENSOR NETWORK PLATFORMS AND TOOLS				9	
Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level softwork platforms, Node-level Simulators, State-centric programming.				are		
TOTAL : 45 PERIODS						
OUTCO	ME	S:				
•	Une	derstand the concepts of wireless sensor networks				
•	Ana	alyze the architecture of sensor networks				

•	Understand the protocols for wireless sensor networks with respect to some protocol design issues
•	Analyse the infrastructure establishment in Sensor networks.
•	Analyze the sensor network platforms and tools.
TEXT B	OOKS:
1.	Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2.	Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
REFER	ENCES:
1.	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.
2.	Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003

17LOE003

INDUSTRIAL AUTOMATION AND ROBOTICS

OBJECTIVES:

	INTRODUCTION TO ROBOTICS AND	9
•	To understand the automation	
•	To learn the various sensors	
•	To learn the various actuators	
•	To study the dynamics and kinematics	
•	To know the evolution of robotics	

UNIT I

INTRODUCTION TO ROBOTICS AND AUTOMATION

-

Robotics: History of Robotics, Applications of Robotics, Current Research in Robotics, General Structure of Robotic Mechanical Systems, Classification of Robots based on coordinate system, Classification of Robotics, Overview of robot subsystems, Components of Robot system-Manipulator, Controller, Power conversion unit etc, Specifications of robot. Commercially available Software Packages for Robot Simulation

UNIT II KINEMATICS AND DYNAMICS

12

Kinematics: Homogeneous co-ordinate vector operations, Workspace, Forward Kinematics forward solutions- Link coordinate frames, D-H matrix, Inverse Kinematics - Existence and Uniqueness of Solutions, Analytical Approaches - Reduction of Inverse Kinematics to Subproblems, **Dynamics**: Newton's equation, Euler equations, Dynamic Modeling of Robotic Manipulators - Two DOF Planar Robot with Two Revolute Joints, Generalized Coordinates and Speeds, Velocities, Partial Velocities, Accelerations, Generalized Inertia Forces, Generalized Active Forces, Equations of Motion, Special Issues in Kane's Method

UNIT III MECHANISMS ACTUATORS AND SENSORS

9

Some Popular **Mechanisms** - Four-bar Mechanism, Slider-crank Mechanism, Rack and Pinion, Cams and Cranks, Gear and Gear Trains, System Features, Kinematics and Kinetics, Serial Robots, Parallel Robots, Mechanical Structure, Joint Mechanisms.

Actuators: Electromagnetic Actuators, Fluid Power Actuators. Different types of grippers -Compressed Air, Vacuum, Hydraulic Fluid Power, Electrical Power & other methods of gripping. DC Motors, Stepper Motors, Servo Motor, Controlling of these motors.

UNIT IV SENSORS

7

Sensors: Encoders - Rotary and Linear Incremental Encoders, Tachometer, Quadrature Encoders, Absolute Encoders. Analog Displacement Sensors, Force and Tactile Sensors, Ultrasonic Transponder, Accelerometers, Gyroscopes, proximity sensors, Infrared Sensors,

touch slip sensor, laser range finder, Vision-based Sensors, Color-tracking Sensors, Sensor Mounting Arrangement, Reading the Pulses in a Computer, Design of the Circuitry

UNIT V AUTOMATION

Structure of Automatic Industrial Systems, Relationship between the Robot Intelligence and the Product, Productivity of a Manufacturing Process, Kinematics and Control of Automatic Machines, Feedback Sensors, Transporting Devices, Feeding and Orientation Devices, Automatic Assembling, Inspection Systems, Welding _ Automation.

TOTAL : 45 PERIODS

8

OUTCOMES:

•	Understand the basic concepts of working of robot
•	Analyze the function of sensors in the robot
•	Apply program to use a robot for a typical application
•	Analyze Robots in different applications
•	Study the basic needs of automation of robots
TEXT H	BOOKS:
1.	Bruno Siciliano, Oussama Khatib (Eds.), _"Springer Handbook of Robotics"_, 2008,.
2.	Jorge Angeles, _"Fundamentals of Robotic Mechanical Systems Theory, Methods, and Algorithms"_ Second Edition, 2003, Springer-Verlag New York, Inc.,
3.	Edwin Wise, _"Robotics Demystified_", 2005, The McGraw-Hill Companies,
REFER	ENCES:
1.	Thomas R. Kurfess, _"Robotics And Automation Handbook"_, CRC Press, 2004,
2.	_Robotics: "Appin Knowledge Solutions (Firm)"_, Infinity Science Press, 2007,
3.	J. Norberto Pires, Altino Loureiro and Gunnar Bölmsjo, _"Welding Robots - Technology, System Issues and Applications"_, Springer-Verlag 2006,
4.	J.G Proakis, "Digital Communication", 4th Edition, Tata Mc Graw Hill Company, 2001.

17LOE004		PRINCIPLES OF VLSI DESIGN	L	Т	Р	С
			3	0	0	3
OBJECTI	V	ES:			I	
• 1	Un	derstand the fabrication process of CMOS				
• 7	Го	understand the electrical properties of circuits				
•	Го	Study the design of combinational and sequential circuit				
•	Го	learn the testing of CMOS				
• 1	An	alyse the verilog HDL				
UNIT I		CMOS TECHNOLOGY				9
A brief Histo effects, DC process enha	ory tr .nc	y-MOS transistor, Ideal I-V characteristics, C-V characteristic ansfer characteristics - CMOS technologies, Layout design ements, Technology related CAD issues, Manufacturing issues	cs, N 1 Ri	lon iles,	ideal CM	IV IOS
UNIT II	Γ II CIRCUIT CHARACTERIZATION AND SIMULATION			9	9	
Delay estimation, Logical effort and Transistor sizing, Power dissipation, Interconn Design margin, Reliability, Scaling- SPICE tutorial, Device models, Device characterizat Circuit characterization, Interconnect simulation			conn rizati	ect, ion,		
UNIT III		COMBINATIONAL AND SEQUENTIAL CIRCU DESIGN	J IT			9
Circuit families –Low power logic design – comparison of circuit families – Sequencing stati circuits, circuit design of latches and flip flops, Static sequencing element methodology sequencing dynamic circuits – synchronizers			atic gy-			
UNIT IV	T IV CMOS TESTING					9
Need for tes principles- M	Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – Design for testability – Boundary scan				bug	
UNIT V SPECIFICATION USING VERILOG HDL				9		
Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedur assignments conditional statements, Data flow and RTL, structural gate level switch lev modeling, Behavioral and RTL modeling, Structural gate level description of decod- equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, latch and D flip flop.			ural evel der, :, D			
	TOTAL : 45 PERIODS					

OUTCOMES:				
•	Understand the basics of CMOS circuits.			
•	To understand the CMOS process technology.			
•	To understand the concepts of designing VLSI subsystems.			
•	Analyze the techniques of chip design using programmable devices.			
•	Remember digital system using hardware description language.			
ТЕХТ	BOOKS:			
1.	Weste and Harris: "CMOS VLSI DESIGN", (Third edition) Pearson Education, 2005			
2.	J.Bhasker: "Verilog HDL primer", BS publication,2001			
REFE	CRENCES:			
1.	Uyemura J.P: "Introduction to VLSI circuits and systems", Wiley 2002.			
2.	D.A Pucknell & K.Eshraghian , "Basic VLSI Design", Third edition, PHI, 2003			
3.	M.J.S.Smith: "Application specific integrated circuits", Pearson Education, 1997			
4.	<i>Ciletti "Advanced Digital Design with the Verilog HDL", Prentice Hall of India, 2003</i>			

17LOE005

APPLIED ELECTRONICS

L T P C 3 0 0 3

OBJECTIVES:

•	Describe the basic principles of electronics
•	Identify the electronic components and their various applications on board
•	Trace and analyze the electronic circuits
•	Analyse the telecommunication systems
•	To study the concepts of PIC microcontroller

UNIT I ANALOG CIRCUITS

Overview on semiconductors, diodes, transistor switches, capacitors, fields and inductors – BJT amplifiers, JFET amplifiers, MOSFET amplifiers.

UNIT II APPLICATION OF ANALOG CIRCUITS

Operational amplifiers, application of op-amps, active filters, 555 timer and oscillators – power amplifiers – power supplies.

UNIT III DIGITAL CIRCUITS

Overview on logical circuits, logical operations, combinational and sequential circuits – display devices – converter circuits.

UNIT IV ELECTRONIC COMMUNICATION SYSTEMS

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Audio and video systems – noise – telecommunications – cable transmission, optical transmission – electronic control systems – process control systems.

UNIT V MICROPROCESSORS AND MICROCONTROLLER 9

Input and output - microprocessors and programming - sensors and interfacing - The PIC microcontroller - circuit simulation – circuit construction.

TOTAL : 45 PERIODS

OUTCOMES:

•	Acquires knowledge for building, testing and modifying simple circuits to complex circuits.
•	Acquires the basic knowledge of electronics.
•	Gains knowledge about the microprocessor and microcontroller.
•	Understand the communication systems
٠	Study the applications of electronic circuits

TEXT BOOKS:			
1.	Owen Bishop, "Electronics – Circuits and Systems", 3 rd Edition, Newnes, 2010.		
2.	Michael Tooley B A, "Electronic Circuits: Fundamentals and Applications", 3 rd Edition, Newnes, 2006.		
REFERENCES:			
1.	John B.Peatman," Design with PIC Microcontrollers", Prentice Hall, 1998.		

17LOE006

WIRELESS NETWORKS

L	Т	Р	С
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OBJECTIVES:

•	Learn the design of the wireless networks	
•	Understand the concepts of wireless networks layer	
•	To study the wireless protocols with TCP enhancement	
•	Analyse the wireless wide area network	
•	Understand the concepts of wireless networks and next generation networks	

UNIT I WIRELESS LAN

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

UNIT II MOBILE NETWORK LAYER

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.

UNIT III MOBILE TRANSPORT LAYER

TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission.

UNIT IV WIRELESS WIDE AREA NETWORK

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT V 4G NETWORKS

oduction – 4G vision – 4G features and challenges -

Introduction -4G vision -4G features and challenges - Applications of 4G - 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems.

TOTAL : 45 PERIODS

OUTCOMES:

• Acquires knowledge about the latest 3G/4G and WiMAX networks and its architecture.

•	Understand the wireless network environment for any application using latest wireless protocols and standards.
•	Apply different types of applications for smart phones and mobile devices with latest network strategies.
•	Remember the concepts of networks layers and its applications.
•	Study the concepts and applications of WAN
ТЕХТ	BOOKS:
1.	Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.(Unit I,II,III)
2.	Vijay Garg, "Wireless Communications and networking", First Edition, Elsevier 2007.(Unit IV,V)
REFE	CRENCES:
1.	Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.
2.	Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.
3.	Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013

LIST OF OPEN ELECTIVES OFFERED BY CSE DEPARTMENT

17SC	DE001		PROGRAMMINO	G IN C++	L	Т	P	С
					3	0	0	3
OBJ	OBJECTIVES:							
	• To get introduced to bacis of C++ programming							
	•	To be	miliar with OOPS concep	ots				
• To understand the concept of Inheritance and its types								
	•	To uno	stand the concept of Poly	ymorphism				
	•	To be	miliar with templates and	file handling concepts				
UNI	ГΙ	BASI	C++ PROGRAMM	ING				9
C++]	Programmi	ng feat	es –Data types, Variabl	les and Arrays – Ope	rato	rs -	Poin	ters –
Refere	ences – Fun	ctions -	ring Handling.					
UNI	ГП	OOP	CONCEPTS					9
Data A	Abstraction	- Encap	lation - Class - Object –	Constructors - Destructor	ors -	Stat	ic Me	mbers
-Con	istant Mem	bers – I	ember Functions - Frience	d Functions- Role of th	is po	ointe	r – S	torage
	es – Copy C F 111		ITANCE					0
Inheri	tance _Tvi	ves of	heritancepublicprot	ected and private inh	erita	nce	_ N	9 Tethod
Overri	iding – Ał	ostract a	l Concrete Class – Virt	tual Class - Virtual Fu	incti	ons	- Dv	mamic
Memo	ory Allocati	on - Nes	d Classes.			0110	29	
UNI	ΓΙ	POL	MORPHISM					9
Polym	orphism –	Compi	Time and Run Time I	Polymorphisms – Func	tion	Ov	erload	ling –
Opera	tors Overlo	ading –	ynamic Binding – Except	ion Handling.				
UNI	ΓV	ADV	NCED OOPS FEAT	URES				9
Standa	ard Librarie	s - Gen	c Programming - Templa	ites – Class Template - I	Func	tion	Temp	plate –
Iterato	ors – Functi	on Adar	rs – Allocators - File Har	Idling concepts.		DO		
0.110				IOTAL: 45 PER		DS		
OUT	COMES		on completion of this cour	rse, students will be able	e to			
1.	Have the	knowle	ge about the concepts of c	object oriented program	ning	; lang	guage	•
2.	2. Know the various concepts related to inheritance and polymorphism.							
5. TEV	TEVT DOOKS.							
1 Biarne Stroustrup "The C++ Programming Language" 2rd edition Degreen Education								
1.	2007.							
2.	2. K R Venugopal, Rajkumar Buyya, "Mastering C++", 2nd Edition, McGraw Hi				w Hill			
DEE	Education, 2013.							
	EKENCE	Dhicat 1	iontal Duaguanning	no C + + " Jud adition	Dag	1001	<i>E.J.</i>	ation
	<i>I. Ira Pohl, "Object Oriented Programming using C++", 2nd edition, Pearson Education, 1997.</i>							
2. 1	Herbert Sch	ildt, "C	+: The Complete Referen	nce", 4th Edition, McG	raw	Hill	Educ	cation,
	2003.							

17SOE002	JAVA PROGRAMMING	L	Т	Р	С				
		3	0	0	3				
OBJECTIV	OBJECTIVES								
• To get introduced to fundamentals of java programming									
• To be familiar with concepts of classes and objects in java									
•	• To understand how information hiding and reusability is implemented in java								
	To understand the concept of exception, concurrency and s	trea	ms		5				
•	To be familiar with graphical programming using applets								
UNITI	FUNDAMENTALS OF JAVA				7				
rules Automati & Associativit for Java Progra	c Type Conversion- Type Casting and Arrays- Operators - Op y – Expression- Control Statements- Comparison of C++ and ms.	bera d Ja	tors va-	Prec Entr	edence y point				
UNIT II	CLASSES AND OBJECTS				11				
Constructors- I finalize() methologiect in methologiect	Default Constructor Parameterized constructor- this keyword- od- Overloading methods and constructors- Using object as pa ods – recursion- Access control- static and final keyword- and Line argument- String and String Buffer class.	Gai Gai ran No	th page rbage neter estec	aram e Col s- ret l anc	llector- turning I Inner				
	INFORMATION HIDING AND REUSABILIT	'V			9				
dispatch Abstra Path Environm Inheritance in J	act class- Using final with inheritance - Packages - Default Pac ent Variables- Package level access- Importing Packages – I ava- Extending interface- Wrapper class.	kag	ge- P rface	ath &	z Class Iultiple				
UNIT IV	EACEPTION, CONCURRENCY NAD STREA		3	7.44.1	9				
input- Reading Thread class of Deadlock.	console input & Writing console output- Reading and Writing & Runnable Interface- Inter Thread Communication- Syncl	g fil	es- [nized	Thread I he	ig user ading – yword-				
UNIT V	GRAPHICAL PROGRAMMING				9				
Applet Basics – methods – creation - designing and examples - Event handling- event classes - Event listener interfaces - AWT classes - working with frames - AWT controls-layout manager - user interface components –Swings – JDBC Connectivity – Introduction to JavaFX.									
IUIAL: 45 PEKIUDS									
1 Diffor	on completion of this course, students will be able	ιο							
1.Diffe2Devel	on programs using classes and objects								
3. Imple	3. Implement multi threading.								
4. Design	4. Design a page using applet.								
TEXT BOO	TEXT BOOKS:								
1. Patric Hill, N	1. Patric Naughton & Herbert Schildt, "The Complete Reference Java 2", Tata Mcgraw Hill, New Delhi, 2001, 4th Edition. 2. Bruce Eckel "Thinking in Java" Pearson Eduction Asia 2000, 2nd Edition								

RE	FERENCES:
1.	Deitel & Deitel, "Java How to Program", Prentice Hall, 2002, 5th Edition.
2.	Ken Arnold & James Gosling, "The Java Programming Language", 2000, AWL.
3.	Peter Haggar, "Practical Java: Programming Language Guide", Addison Wesley Pub Co.
	2000, 1st Edition.

17SOE003			PYTHON PROGRAMMING	L	Т	Р	С		
				3	0	0	3		
OBJE	OBJECTIVES:								
	•	To Un	derstand the basic of Python Programming						
	• To Learn about string in Python								
	• To be introduced to Classes in python								
	•	To Un	derstand basic concepts on files.						
	•	To get	hands on XML and serialization						
UNIT	Ι	INTE	RODUCTION TO PYTHON				9		
Functio	n Declara	tion - I	mport - Objects - Indenting as Requirement - Ex	cept	ions	- Un	bound		
Variabl	les - Case S	Sensitiv	e - Scripts - Native Data Types - Booleans - Numb	ers -	List	ts - Ti	uples -		
Sets - I	Dictionarie	s - Com	prehensions - List Comprehensions - Dictionary Co	omp	rehe	nsion	s - Set		
Compre	ehensions.	1							
UNIT	II	STRI	ING				9		
Strings	- Unicode	e - Forr	natting - String Methods - Bytes - Encoding - Re	gula	ır Ey	press	sions -		
Verbos	e - Case St	tudies.							
UNIT	III	CLA	SSES				9		
Closure	es - List of	Function	ons - List of Patterns - File of Patterns - Generators	- De	efinii	ng Cla	asses -		
Instanti	ating Clas	ses - Ins	stance Variables - Iterators – Itertools - Assert - Ger	erat	or E	xpres	sions.		
UNIT	IV	FILE	2S				9		
Reading	g and Wri	ting Te	xt Files - Binary Files - Stream Objects - Standard	d In	put,	Outp	ut and		
UNIT	V	XMI	AND SERIALIZATION				9		
XML -	Atom Fe	ed - Pa	rsing HTML - Searching for Nodes - html - Gene	erati	on -	Seria	alizing		
Objects	s - Pickle F	Files - V	ersions - Debugging - Serializing to JSON.				U		
_			TOTAL: 45 PER	RIO	DS				
OUT	COMES:		On completion of this course, students will be able	to					
1.	Understa	and the d	concepts of object oriented programming.						
2.	Use gene	erators a	ind iterators.						
3.	3. Develop test cases and handle refactoring.								
4.	4. Use objects to program over the web.								
TEXT BOOKS:									
1. Mark Pilgrim, "Div			Dive into Python 3", Apress, 2009.						
2.	2. John V. Guttag, "Introduction to Computation and Programming using				using				
Python",Prentice			e Hall of India, 2014.						
KEFE	KENCE			,,	D: 01	<u> </u>			
$\begin{bmatrix} I. & M \\ O \end{bmatrix}$	lark Lutz, P'Reilly. Sh	"Learni roff Pul	ng Python: Powerful Object-Oriented Programming blishers and Distributors. 2013.	g", 1	Fifth	Editi	on,		
2. A	llen Down	ev, Jeff	rev Elkner, Chris Mevers. "How to Think Like a C	Com	pute	r Scie	entist -		
	Learning with Python", Green Tea Press, 2002.					· - T			

1/20100-	WEB DESIGNING L	Ĩ	P	U				
	3	0	0	3				
OBJECTIVES:								
• To Learn about basics of websites and get introduced to HTML 5, CSS 3, WEB 2.0								
•	To understand client side programming using java script							
•	To Learn about java servlets and DB connectivity							
•	To Learn web development using PHP and XML							
•	To Get Introduced to AJAX and web services							
UNIT I	WEBSITES BASICS, HTML 5, CSS 3, WEB 2.0	2.0 9						
Web 2.0: F	asics-RIA Rich Internet Applications – Collaborations tools -	– U	nderst	anding				
websites and	web servers: Understanding Internet – Difference between w	ebsi	tes an	d web				
server- Inter	net technologies Overview –Understanding the difference betwee	een	intern	et and				
intranet.								
HTML and (CSS: HTML 5.0 , XHTML, CSS 3.							
UNIT II	CLIENT SIDE PROGRAMMING			9				
Java Script:	An introduction to JavaScript–JavaScript DOM Model-Date and	Obj	ects,-F	Regular				
Expressions	Exception Handling-Validation-Built-in objects-Event Handling	g- Ď	HTM	L with				
IavaScript								
JavaSchpl. VR Script: VR Script programming Forma Scripting Object								
VB Script: V	B Script programming – Forms – Scripting Object.							
VB Script: V	B Script programming – Forms – Scripting Object. SERVLETS AND JSP			9				
VB Script: V UNIT III Servlets: Jay	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST	acti	ons- S	9 Session				
VB Script: V UNIT III Servlets: Jav Handling-	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST Understanding Cookies-Installing and Configuring Apache	acti To	ons- S	9 Session Web				
VB Script: V UNIT III Servlets: Jav Handling- Server.Datab	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST Understanding Cookies-Installing and Configuring Apache ase Connectivity: JDBC perspectives, JDBC program example.	acti To	ons- S omcat	9 Session Web				
VB Script: V UNIT III Servlets: Jaw Handling- Server.Datab JSP: Unders	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST Understanding Cookies-Installing and Configuring Apache ase Connectivity: JDBC perspectives, JDBC program example. anding Java Server Pages-JSP Standard Tag Library(JSTL)-Creati	acti To	ons- S omcat HTML	9 Session Web				
VB Script: V UNIT III Servlets: Jav Handling- Server.Datab JSP: Unders by embeddir	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST Understanding Cookies-Installing and Configuring Apache ase Connectivity: JDBC perspectives, JDBC program example. anding Java Server Pages-JSP Standard Tag Library(JSTL)-Creati g JSP code.	acti To ing I	ons- S omcat HTML	9 Session Web 2 forms				
VB Script: V UNIT III Servlets: Jaw Handling- Server.Datab JSP: Unders by embeddir UNIT IV	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST Understanding Cookies-Installing and Configuring Apache ase Connectivity: JDBC perspectives, JDBC program example. anding Java Server Pages-JSP Standard Tag Library(JSTL)-Creati g JSP code. PHP AND XML	acti To ing I	ons- S omcat ITML	9 Session Web 2 forms 9				
VB Script: V UNIT III Servlets: Jav Handling- Server.Datab JSP: Unders by embeddir UNIT IV An introduc	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST Understanding Cookies-Installing and Configuring Apache ase Connectivity: JDBC perspectives, JDBC program example. anding Java Server Pages-JSP Standard Tag Library(JSTL)-Creati g JSP code. PHP AND XML ion to PHP: PHP- Using PHP- Variables- Program control- Brown control- B	acti To ing I uilt-	ons- Somcat ITML	9 Session Web L forms 9 actions-				
VB Script: V UNIT III Servlets: Jaw Handling- Server.Datab JSP: Unders by embeddir UNIT IV An introduc Connecting	B Script programming – Forms – Scripting Object. SERVLETS AND JSP a Servlet Architecture- Servlet Life Cycle- Form GET and POST Understanding Cookies-Installing and Configuring Apache ase Connectivity: JDBC perspectives, JDBC program example. anding Java Server Pages-JSP Standard Tag Library(JSTL)-Creati g JSP code. PHP AND XML ion to PHP: PHP- Using PHP- Variables- Program control- Brop Database – Using Cookies-Regular Expressions.	acti To ing H uilt-	ons- Somcat HTML	9 Session Web 2 forms 9 actions-				
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5	5.	Design and imple	ement server side programs using Servlets and JSP.	
TE	ХT	BOOKS:		
	1.	Deitel and Deite	l, Nieto, "Internet and World Wide Web – How to Program", Prentice	
		Hall, 5 th Edition,	2011.	
	2.	Herbert Schildt,	"Java-The Complete Reference", Eighth Edition, Mc Graw Hill	
		Professional, 201	11.	
RE	FE	RENCES:		
1.	Ste	ephen Wynkoop,Jo	ohn Burke "Running a Perfect Website", QUE, 2 nd Edition,1999.	
2.	Ch	ris Bates, "Web	Programming – Building Intranet Applications", 3 rd Edition, Wiley	
	Ри	ublications, 2009.		
З.	Jeffrey C, Jackson, "Web Technologies- A Computer Science Perspective", Pearson			
	Education, 2011.			
4.	Paul Dietel, Harvey Deitel, "Java How to Program", 8 th Edition Prentice Hall of India.			
5.	Gopalan N.P., Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.			
6.	Ma	ahesh P. Matha, ''	<i>Core Java A Comprehensive Study", Prentice Hall of India, 2011.</i>	
7.	Ut	tam K.Roy, "Web	Technologies", Oxford University Press, 2011.	

DEVELOPMENT 3 0 0 3 OBJECTIVES: • Understand how to work with various mobile application development frameworks. • Understand how UI for mobile application development is done for Android • Learn how UI for mobile application development is done for Android • Know the tools used in android application development • Learn the basic and important design concepts and issues of development of					
3 0 0 3 OBJECTIVES: • Understand how to work with various mobile application development frameworks. • Learn how UI for mobile application development is done for Android • Know the tools used in android application development • Learn the basic and important design concepts and issues of development of					
OBJECTIVES: • Understand how to work with various mobile application development frameworks. • Learn how UI for mobile application development is done for Android • Know the tools used in android application development • Learn the basic and important design concepts and issues of development of					
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Know the tools used in android application development Learn the basic and important design concepts and issues of development of					
• Learn the basic and important design concepts and issues of development of					
mobile applications.					
Understand the process of android application development					
UNIT I INTRODUCTION 9					
Mobile Applications – Characteristics and Benefits – Frameworks and Tools – Introduction to Java – Classes and Objects – Inheritance – Packages and Interfaces – Strings – I/O – Event handling.					
UNIT II USER INTERFACE 9					
Generic UI Development – Multimodal and Multichannel UI – Designing the right UI– Introduction to XML –XML basics – Attributes – DTD - XML schema – Screen Elements and Layouts.					
UNIT III TOOLS 9					
Google Android Platform – Android Application Architecture – Android Studio – Android Widgets and Menus – Event handling – Packaging and Deployment - Apple iPhone Platform.					
UNIT IV APPLICATION DESIGN 9					
Memory Management - Design patterns for limited memory - Work flow for Application					
Development – Techniques for composing Applications – Intents and Services – Fragments –					
Graphics – Animation.					
Storing and Retrieving data - Communication via the Web - Notification and Alarms -					
Telephony – Location based services – Apps with Firebase Real Time Database – Project on respective Discipline.					
TOTAL: 45 PERIODS					
OUTCOMES: On completion of this course, students will be able to					
1. Design and implement the user interfaces for mobile applications.					
Design the mobile applications that are aware of the resource constraints of mobile devices.					
3. Develop advanced mobile applications that access the databases and the web.					
Develop useful mobile applications in the current scenario using Google Android Studio.					
TEXT BOOKS:					
1. Jeff Friesen, "Learn Java for Android Development: Java 8 and Android", 5th Edition					
Paperback – 2014.					
2. Share Conder, Lauren Darcey, "Android Wireless Application Development" Pearson 3 rd Edition.					
REFERENCES:					

1.	Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, "Programming
	Android", O"Reilly, 2011.
2.	Jeff Mcherter, Scott Gowell, "Professional mobile Application Development",
	paperback,2012, Wiley India Private Limited.
3.	Reto Meier, Wrox Wiley, "Professional Android 2 Application Development", 2010.
4.	Alasdair Allan, "iPhone Programming", O"Reilly, 2010.
5.	Wei-Meng Lee, "Beginning iPhone SDK Programming with Objective-C", Wrox Wiley,
	2010.
6.	Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and interactions",
	Wiley, 2009.
7.	Bear Cachil, "iOS in Practise", Paperback, 2012.
8.	Markus Jakobsson, "Mobile Authentication: Problems and Solutions", (SpringerBriefs in
	Computer Science), Paperback, 2012.
9.	Paula Beer, Carl Simmons, "Android App Development for Young Adults & The Rest of
	US", Paperback, 2015.
10.	Luc Bros., "Oracle Mobile Application Framework Developer Guide: Build Multiplatform
	Enterprise Mobile Apps", Paperback, 2014.
11.	Herbert Schildt, "Java: The Complete Reference", Ninth Edition –The McGraw-Hill,
	2014.
12.	Heather Williamson, "XML: The Complete Reference", The McGraw-Hill, 2001.
<i>13</i> .	Tim Duckett, Apress, "Pro iOS Table VIews: for iPhone, iPad and IPod Touch",
	Paperback,2012.
14.	Joe COnway, Aaron Hilegass, Christian Keur, "iOS Programming: The Big Nerd Ranch
	Guide", Paperback, 2014.

LIST OF OPEN ELECTIVES OFFERED BY EEE DEPARTMENT

17EOE001		MATLAB PROGRAMMING	L	Τ	P	C
			3	0	0	3
OBJECTIVES:						
•	To study	basics of MATLAB programming				
•	To introd	luce MATLAB Functions and File processing				
•	To impar	t knowledge on MATLAB programming techniques				
•	To enable	e the students to plot the functions using MATLAB				
•	To devel	op skill in simple engineering applications development	with	MA	TLA	В
UNIT I		INTRODUCTION				9
Basics of M Multidimen Scalar and	IATLAB nsional Ar Array Ope	programming–Variables and Arrays – initializing variabl rays – Sub arrays – Special Values–Displaying Output D erations – Hierarchy of Operations	les ir Pata -	n MA - Da	ATLA ta Fi	AB – les –
UNIT II		FUNCTIONS & FILES				9
Built-in M. Binary I/C Processing	ATLAB F) Function –, File Op	Functions – Elementary Mathematical Functions – User as – Advanced Function Programming – Introduction beinng and Closing, Working with Data Files.	Defi to	ned MA	Func TLA	tions – B File
UNIT III	[PROGRAMMING TECHNIQUES9				
Program Operators a LAB Progr	Design a and Functi am.	nd Development–Relational Operators and Logical ons–Conditional Statements–Loops–The Switch Structu	Va re–Ľ	ariab Debu	oles—] gging	Logical g MAT
UNIT IV	r	PLOTTING OF FUNCTIONS				9
XY plottin Polar Plot- Regression Problems-C	XY plotting functions– Subplots and Overlay plots–Plots With Error Bars– Special Plot types– Polar Plot– Interactive plotting– Putting Multiple Plots on the Same Page– Function Discovery– Regression– 3-D plots–Mesh and Surface Plots – Examples of MATLAB Applications– Problems-GUI.					
UNIT V		ENGINEERING APPLICATIONS				9
Numerical Differentiation in single variable,: Higher derivatives, multiple variables, New Cotes integration formulae, MATLAB functions for integration, Linear algebra in MATI Gauss Elimination, LU decomposition and partial pivoting, Iterative methods: Gauss Si Special Matrices: Tri- diagonal matrix algorithm- Engineering Applications-Optimization.			ewton- TLAB, Siedel,			
	TOTAL :45 PERIODS					
OUTCO	MES:	After successful completion of the course students able to	C			
• Articul		te importance of MATLAB software's in research by sin	nula	tion	work	

•	Understand the Basics of MATLAB programming tools, functions and files that are essential in solving engineering problems					
•	In-depth knowledge of providing programming techniques and plotting of functions.					
•	Understand the loops and Debugging of MAT LAB Programs					
•	Understand the writing of programs & simulation in MATLAB for engineering problems.					
TEXT BO	TEXT BOOKS:					
1.	Amos Gilat , MATLAB An Introduction With Applications By, Wiley Publication.6 th edition, 2016					
2.	Rudra Pratap, "MATLAB 7", Oxford University Press,2006					
3	R.K. Bansal, A.K. Goel, "MATLAB and Its Applications In Engineering" Dorling kindeslay pvt. Lt, india, 2009.					
REFERE	NCES:					
1.	Stephen j. Chapman.,"MATLAB programming for engineers ", FifthEducation,United States of America, 2015.					
2.	Otto S.R, Denier J.P., "An introduction to programming and numerical methods in MATLAB", Springer –verlag London limited. 2005.					

RENEWABLE ENERGY SOURCES

L T P C

			0 3			
OBJECTIV	ES:					
•	To ir	ntroduce Different types of Renewable Energy Sources				
•	To educate the students on principle of solar energy					
•	To educate the students on wind energy conversion systems					
•	To educate the students on biomass energy and cogeneration systems					
•	• To impart knowledge on tidal energy and geothermal energy					
UNIT I	INT	RODUCTION	9			

Energy Conservation and Energy Efficiency – Needs and Advantages, Different types of Renewable Energy Sources - Energy Resources Availability in World –Environmental aspects of energy utilization – Energy Conservation Act 2003 - Statistical Report on Renewable energy scenario in India - Applications.

UNIT II SOLAR ENERGY

Solar Flat plate and concentrating collectors – Solar heating and cooling techniques –Solar desalination – Solar Pond – Solar cooker – Solar Drying – Solar pumping – Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

UNIT III WIND ENERGY

Wind energy estimation in World and in India – Types of wind energy systems –Performance of Wind energy System– Details of wind turbine generator – Safety and Environmental Aspects.

UNIT IV

17EOE002

BIOMASS ENERGY

Biomass direct combustion – Biomass gasifier – Biomass: Types – Advantages &Drawbacks -Biogas plant – Ethanol production – Bio diesel – Cogeneration: steam turbine cogeneration systems, gas turbine cogeneration systems, reciprocating IC engine cogeneration systems, combined cycle cogeneration systems – Applications of Cogeneration in utility sector – Biomass applications.

UNIT V

OTHER RENEWABLE ENERGY SOURCES

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Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro –Geothermal energy – Fuel cell systems - Stirling Engines.

			TOTAL :45 PERIODS	
OUTCOMES:		After successful completion of the course students able to		
To know importance of renewable energy source			ce	
•	Une	derstand about Solar Energy.		

•	Understand about Wind Energy.
•	Understand about BioMass Energy.
•	Understand about all renewable Energy Sources.
REFERENC	CES:
1.	G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.
2.	S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
3.	G.N. Tiwari, Solar Energy – Fundamentals Design, Modelling and applications, Narosa Publishing House, New Delhi, 2002.

17EOE003 ENERGY MANAGEMENT AND AUDITING

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OBJEC																			
•	To introduce the forms of energy, energy auditing types and roles of energy managers																		
•	To impart knowledge on energy costing and importance of power factor in energy cost																		
•	to study metering for energy management & power quality analyses																		
•	To educate the students on different lighting systems																		
•	To study energy economics techniques																		
UNIT I]	INTR	RC	οι	DU	CTI	ON	N										9	

Types & Forms of Energy - Primary / Secondary Energy Sources –EC Act 2003 – Energy Auditing: Types, Classifications, Deliverables, Barriers – Benchmarking - Roles & Responsibility of Energy Managers.

UNIT II ENERGY COSTING, MONITORING &TARGETING

Data & Information Analysis – Cost / Energy Share Diagram – Data Graphing – Electricity Billing : Components & Costs – kVA – Need & Control – Determination of kVA demand & Consumption –Time of Day Tariff – Power Factor Basics – Penalty Concept for PF – PF Correction – Wheeling and Banking - Demand Side Management – comparison on unit cost of power cost from various sources – steam cost from different sources.

UNIT III METERING FOR ENERGY MANAGEMENT & POWER QUALITY ANALYSES

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Instruments Used in Energy systems: Load and power factor measuring equipment, Wattmeter, Flue gas analysis, Temperature and thermal loss measurements, Air quality analysis-Relationships between parameters-Units of measure-Typical cost factors- Utility meters – Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements – Net metering - Metering techniques and practical examples.

UNIT IV LIGHTING SYSTEMS & COGENERATION

Concept of lighting systems - The task and the working space - Light sources - Ballasts -Luminaries - Lighting controls - Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques - Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

UNIT V ECONOMICS

Energy Economics – Depreciation - Financial Analysis Techniques – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept –

CUSUM	Technique -	– ESCO Concept – ESCO Contracts.							
		TOTAL : 45 PERIODS							
OUTC	OMES:	After successful completion of the course students able to							
Analyse the energy data of industries.									
• Can carry out energy accounting and balancing.									
•	Can sugge	st methodologies for energy saving.							
•	Design Lig	ghting systems							
•	Explain the	e concepts of Energy Economics							
TEXT	BOOKS:								
1.	Energy Manager Training Manual (4Volumes) available at www.Energymanag training.com, a website administered by Bureau of Energy Efficiency (BEE), statutory body under Ministry of Power, Government of India. 2004.								
2.	Amit K. T	yagi, Handbook on Energy Audits and Management, TERI, 2003.							
3.	Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006.								
REFE	RENCES:								
1.	L.C. Witte Utilisation	e, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and "Hemisphere Publ, Washington, 1988.							
2.	Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981								
3.	Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists, Logman Scientific & Technical, ISBN-0-582-03184, 1990.								
4.	<i>WC Turne</i> 2007)	er: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc.,							

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OBJEC	TIV	ES:																						
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•	To e	ducate t	the	stude	nts o	on le	load	d flo	low	' ana	alys	is ir	ı sm	art	gri	d								
• To impart knowledge on voltage stability in smart grid																								
•	To ir	ntroduce	ce g	rid int	egrat	tior	on fo	for re	rene	ewa	able	ene	rgy	sou	ices	5								
UNIT I SMART GRID ARCHITECTURE														9										
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UNIT V GRID INTEGRATION WITH RENEWABLE 9 ENERGY																								
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	TOTAL :45 PERIODS									
OUTCOME	After successful completion of the course students able to									
•	Explain the concepts and design of Smart grid									
•	Explain the various communication and measurement technologies in smart grid									
•	Perform load flow in smart grid.									
•	Analyze the stability of smart grid.									
•	Integrate the renewable energy resources and storages with smart grid									
TEXT BOO	KS:									
1.	Stuart Borlase "Smart Grid: Infrastructure, Technology and Solutions", CRC Press 2012.									
2.	Janaka E kanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technologyand Applications", Wiley2012.									
REFERENC	CES:									
1.	VehbiC.Güngör,DilanSahin,TaskinKocak,SalihErgüt,ConcettinaBuccella,Carl oCecati, and Gerhard P. Hancke, "Smart Grid Technologies: CommunicationTechnologiesandStandards"IEEETransactionsOn Industrial Informatics, Vol.7,No.4, November2011.									
2.	Xi Fang,SatyajayantMisra, Guoliang Xue,andDejunYang"Smart Grid – TheNewand ImprovedPowerGrid: ASurvey",IEEETransactiononSmart Grids,vol.14,2012.									
LIST OF OPEN ELECTIVES OFFERED BY MECHANICAL DEPARTMENT

17MOE001 DISASTER MANAGEMENT AND MITIGATION L T P C

OBJECTIVES:

•	To make the students understand basic concepts of disaster and hazards if India
•	To study the various natural disasters
•	To study the various manmade disasters
•	To understand the disaster management principles.
•	To study the modern techniques used in disaster mitigation and management.

UNIT I INTRODUCTION TO DISASTER

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Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster-Dimensions & Scope of Disaster Management - India's Key Hazards –Vulnerabilities - National disaster management framework - Disaster Management Cycle.

UNIT II NATURAL DISASTER

Natural Disasters- Meaning and nature of natural disaster; their types and effects.Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions,Heat and cold waves, Climatic change: global warming, Sea level rise, ozonedepletion.

UNIT III

ANTHROPOGENIC DISASTER

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

UNIT IV

APPROACHES IN DISASTER MANAGEMENT

Pre-disaster stage (preparedness) - Preparing hazard zonation maps,Predictability/ forecasting & warning - Preparing disaster preparedness plan -Land use zoning - Preparedness through Information, education. EmergencyStage - Rescue training for search & operation - Immediate relief – Assessmentsurveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspectand Environmental Aspect.

UNIT V

DISASTER MITIGATION

Meteorological observatory - Seismological observatory - Hydrology Laboratoryand Industrial Safety inspectorate. Technology in Disaster Management -Emergency Management Systems (EMS) in the Disaster Management Cycle -Remote Sensing and Geographic Information Systems (GIS) in Disaster Management.

TOTAL: 45 PERIODS

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

• Explain the basic concepts of disaster and hazards.

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•	Understand the various natural disasters.							
•	Analyzethe various manmade disasters.							
•	Explore the disaster management principles.							
•	Compare the modern techniques used in disaster mitigation and management.							
TEXT	BOOKS:							
1.	Sharma.S.R, "Disaster management", A P H Publishers, 2011.							
2.	Gupta.H.K, "Disaster Management", University Press, India, 2003.							
3.	D. B. N. Moorthy, "Disaster Management: Text and Case studies" , Deep and Deep Publications, 2007.							
REFE	RENCES:							
1.	VenuGopalRao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors, 2010.							
2.	Singh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat Publications, 2006.							
3.	Gupta.M.C, "Manuals on Natural Disaster management in India", NationalCentre for Disaster Management,IIPA, New Delhi, 2001.							
4.	Rajan Kumar Sahoo, TilotamaSenapati, "Management and Mitigation of Natural Disasters", Regal Publication, 2013.							
5.	Palanivel K., Saravanavel J., Gunasekaran S., "Disaster Management", Allied Publishers Pvt. Ltd., 2015							

17MOE002		ENVIRONMENTAL MANAGEMENT							L	Т	Р	C										
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•	To under	stand th	ne imp	ortance	e of	na	atur	e an	ıd st	ud	ly a	bou	lt tl	he	wa	ter	. bo	llut	ion a	and c	ontr	ol.
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UNIT IV SOLID WASTE MANAGEMENT AND SOII POLLUTION					IL	1					9											
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UNIT V ENVIRONMENTAL MANAGEMENT SYSTEM

Terminology – installation and common motives of EMS – Environmental standards – ISO 14000 (Series) – basicprinciples – Environmental Audit – Environmental Impact assessment - Trade rules and environmental protection– Practices For Waste Minimisation And Cleaner Production.

TOTAL : 45 PERIODS

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OUTCOMES:		On completion of this course, students will be able to							
•	Explainthe	e concept of sustainable development, climate change and roles of NGO's.							
•	Understand	d the sources and management of Water pollution.							
•	Discuss the	e causes of Air and Noise pollution and various management techniques.							
•	Analyse so	olid waste and environmental protection legislations.							
•	Explore th	e various Environmental Standards.							

TEXT BOOKS: 1. N.K.Uberoi, "Environmental Management", Excel Books, New Delhi(2006). 2. Mallick A., "Environmental Science and Management", 1st Edition, Viva Books, 2014. 3. PrakashTalwar, "Environmental Management", Isha Books, 2006. REFERENCES:

1. S. Vigneahwaran,M.Sundaravadivel and D.S.Chaudhary, "EnvironmentalManagement", SCITECH Publications(India) Pvt.Ltd, Chennai & Hyderabad (2004). 2. <u>Mackenzie Davis, David Cornwell.,</u> "Introduction to Environmental Engineering", 4th Edition, McGraw-Hill Companies Incorporated, 2008. 3. Mary K. Theodore, Louis Theodore, "Introduction to Environmental Management", 1st Edition, CRC Press, 2009. 4. P.S. BhushanaRao., "Environment Management", Deep & Deep Publishers, 2007. 5. T.V. Ramachandra,Vijay Kulkarni, "Environmental Management", TERI Press New Delhi, 2009.

I/MOE	003	COMPOSITE MATERIALS	L	Τ	Р	C				
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OBJECT	FIVE S	S:								
•	To en	hable the students understand the properties and design of comp	posite	mate	erial	S				
•	• To familiarize the manufacturing methods for polymer matrix composites									
•	To familiarize the students with the manufacturing methods for metal matrix composites									
•	To fai comp	To familiarize the students with the manufacturing methods for ceramic matrix composites								
•	To un	nderstand practical requirements associated with joining and m	anufa	cturi	ng					
UNIT I	I I	NTRODUCTION TO REINFORCEMENT AND INTERFACE	MAT	RI	X Í	12				
Reinforcer Properties Matrix ma	nent – – Apj	Fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fil plications – Comparison of fibres – Particulate and whish – Properties Wettability – Effect of surface roughness – In	bre – ker re	Fabre Fabre	ricati rcenti ondi	ion nent				
Methods for	or meas	suring bond strength.	licitae	iai u		0				
Methods for UNIT II	or meas	suring bond strength. POLYMER MATRIX COMPOSITES				8				
Methods fo UNIT II Types – P winding, composites Glass fibre	Processi Pultrut s – Inje	 POLYMER MATRIX COMPOSITES ing – Thermal matrix composites – Hand layup and spray tion, resin transfer moulding, autoclave moulding – The ection moulding, film stacking – Diaphragm forming – Thermaner interface. Mechanical properties – Fracture. Applications. 	techni ermop oplast	ique, blasti ic taj	fila c m pe la	8 Imer natri				
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Methods for UNIT II Types – P winding, composites Glass fibre UNIT II Types. In fibre / Tita UNIT IV Ceramic r process, ir Mechanica	Processi Pultrut s – Inje e/polym I N nportan inium in 7 C natrix nsitu ch al prope	 Polymer Matrix Composites – Hand layup and spray tion, resin transfer moulding, autoclave moulding – The ection moulding, film stacking – Diaphragm forming – Thermoner interface. Mechanical properties – Fracture. Applications. METAL MATRIX COMPOSITES At metallic matrices. Processing – Solid state, liquid state, de nterface. Mechanical properties. Applications. CERAMIC MATRIX COMPOSITES materials – Processing – Hot pressing, liquid infiltration hemical reaction techniques – CVD, CVI, sol-gel process. erties – Thermal shock resistance – Applications. GEOMETRICAL ASPECTS, FATIGUE AND CRICOMPOSITE MATERIALS 	techni ermop oplast epositi techni Interfa	ique, plasti ic taj on, i ace i IN	fila c m pe la nsitu Lan n Cl	8 mentratr autr autr autr autr autr autr autr				
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OUTO	COMES:	On completion of this course, students will be able to							
•	Analyse the fiber reinforced Laminate for optimum design.								
•	Explore the concepts of Polymer Matrix Composites.								
•	Discuss different Metal Matrix Composites properties and manufacturing process.								
•	Understand the different Ceramic Matrix Compositesproperties.								
•	• Apply Fatigue and creep theory to study and analyse the Mechanical behaviour of Composites.								
ТЕХТ	BOOKS	:							
1.	Krishnan I	Chawla, "Composite Materials Science and Engineering", Springer, 2001.							
2.	Mathews 1 CRC Press	F L and Rawlings R D, "Composite Materials: Engineering and Science" and Woodhead Publishing Limited, 2002.							
3.	Derek Hul	l, "An introduction to Composite Materials", Cambridge Univ. Press, 1988.							
REFE	RENCES	5:							
1.	"Handboo	k of Composites" – American Society of Metals, 1990							
2.	<i>Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-</i> <i>Hill, CRC press in progress, 1994.</i>								
3.	Autar K. Kaw, "Mechanics of Composite Materials", Second Edition, CRC Press,2006								
4.	Halpin, J. 1984.	C., "Primer on Composite Materials, Analysis", Technomic Publishing Co.,							
5.	Mallick, H Properties	P.K. and Newman, S., "Composite Materials Technology: Processes and ", Hansen Publisher, Munish, 1990.							

17MOE004
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RENEWABLE ENERGY SOURCES ANDTECHNOLOGY

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OBJECTIVES:

•	To educate the students scientifically the new developments in renewable energy studies.

- To educate the concepts of various aspects of Solar energy and utilization
- To enable the students understand wind energy
- To understand the various aspects of Biomass energy and utilization
- To emphasize the significance of Green Energy Technologies.

UNIT I INTRODUCTION

World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment - Economy - Energy and Sustainable Development, Energy planning. Reserves of Energy resources, Renewable energy resources - potentials -achievements – applications. Technical and social implications, issuesin grid integration of power from renewable energy sources, Comparison between different Renewable energy sources.

UNIT II SOLAR ENERGY

Basic concepts, Solar radiation, Measurement, Solar thermal systems, Flat plate and concentrating collectors, Solar passive space, Solar heating andcooling techniques, Solar desalination, Solar dryers, Solar furnaces, Solar pumping, Solar greenhouse, Solar thermal electricpower plant, Photo-voltaics, p-n junctions. Solar cells, PV systems, Standalone, Grid connected solar power satellite, Calculation of energy through photovoltaic power generation, Hybrid systems, Solar Engines: Stirling, Brayton engines.

UNIT III WIND ENERGY

Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Windmill rotors, Horizontal axis and Vertical axis rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant and Site selection.

UNIT V BIOMASS ENERGY

Biomass – usable forms- composition- fuel properties – applications, Biomassresources, Biomass conversion technologies - direction combustion - pyrolysis –gasification -anaerobic digestion, Bioethanol and Biodiesel Production -Economics - Recent developments.Energy farming, Biogas technology – Domestic biogas plants, Community and institutional biogas plants – design consideration –applications.

UNIT V	OTHER RENEWABLE ENERGY SOURCES	9
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Tidal energy – Wave energy – Open and closed OTEC Cycles – small hydro –Geothermal energy – Social and environmental aspects.Fuel cell technology -types, principle of operation – applications.Hydrogen energy production – Storage– transportation – utilization.

TOTAL : 45 PERIODS

OUTCOMES: O		On	completion of this course, students will be able to						
•	Emphasis	the c	current energy status and role of renewable energy sources.						
•	Explain the	e coi	ncepts of various aspects of Solar energy and utilization.						
•	Explore the various aspects of Wind energy and utilization.								
•	Familiarize with various aspects of Biomass energy and utilization.								
•	Understan	d vai	rious other renewable energy sources.						
ТЕХТ	BOOKS	:							
1.	Ashok Des	sai V	7, "Non-Conventional Energy", Wiley Eastern Ltd, 1990						
2.	Mittal K.M	1, "N	Non-Conventional Energy Systems", Wheeler Publishing Co. Ltd, 1997.						
3.	Ramesh R New Delhi	, Ku i, 19	rrnar K.U, "Renewable Energy Technologies" , Narosa Publishing House, 97.						
REFE	RENCES	5:							
1.	Freris, L.I	Ľ, " W	Vind Energy Conversion systems", Prentice Hall, UK, 1990						
2.	Veziroglu.T.N, "Alternative Energy Sources", Vol 5 and 6, McGraw-Hill, 1978.								
3.	S.P. Sukha	S.P. Sukhatme, "Solar Energy" , Tata McGraw Hill, New Delhi, 1997.							
4.	Kothari P, Technolog	, K (gies"	C Singal and RakeshRanjan, " Renewable Energy Sources and Emerging , PHI Pvt. Ltd.,New Delhi, 2008.						
5.	G.D. Rai,	"Noi	n-Conventional Energy Sources",Khanna Publishers, New Delhi, 1999.						

17M	IOE005	I	NTELLECTUAL PROPERTY RIGHTS	L	Т	Р	С		
				3	0	0	3		
OBJE	CTIVES	:							
•	To enab	le the	students have an overall law of Property						
٠	To unde	erstand	d details about of the impacts of IP on industry						
٠	To unde	erstand	d the protecting cumulative innovations						
•	To unde	erstanc	d Litigation and Enforcement						
•	To teach	n stude	ents about details current government policy about IPR						
UNI	ΓΙ	INT	RODUCTION			9	9		
Backg Failure Patent	round an es in Kno s - Copyr	d Cor wledg ights -	ncepts - Brief History of - Institutions - Investing in ge - IP, Public Sponsorship & Prize - IP Law Basics Mea - Trade Secrets - Others - IP andAntitrusProperty.	Know nsof I	vledg P Pro	ge-M otect	arket tion -		
UNI	Г II	THE	E IMPACTS OF IP ON THE PLANT/SEED IN	DUS	TR	Y	9		
The lo Plants Design Entry	ogic of IF : A Puzzl n - Bread Cost Regi	P - Pa e - Oj th - L ime H	tenting vs. Company Secrets - Plant Patent Timeline En ptimal Design of IP - Scarce Ideas vs.Non-scarce ideas - Length - Required InventiveSteps - Optimal Size of Rew forizontalCompetitionRegime- Economic Effects of Exem	npiric Policy ard an ptions	alEv / Lev nd S	iden vers truct	ce in in IP ture -		
UNI	T III	PRO	DTECTING CUMULATIVE INNOVATIONS				9		
Three Policy	Types of Levers a	Cum Cum	nulativeness - Basic v. Applied Research - Research Topospecting - Open Source.	ol Qua	alityl	Ladd	lers -		
UNI	ΓIV	LIT]	TIGATION AND ENFORCEMENT						
Litigat Techn Adopt Effects	ion and I ical Mean ion - Ne s - Physic	Enforc ns - L twork al Net	cement - Remedies for Infringement - How they matter E Limited Sharing of Copyrighted Works TechnologyTrans as and Network Effects Conceptsand Issues - Direct ver- tworks BusinessStrategies- System Competition vs. Stand	Enforce sfer, I s. Indi ard Co	emen Diffu rect ompe	tof sion Net titio	IP by , and work n		
UNI	ΓV	INN	OVATION TODAY				9		
A Priv Public Treatic Efficie	vate-Publi Incentive es - Paris ent Protec	c Part es - In Conv tion -]	tnership - University Innovation - Government Grant Pro- novation in the Global Economy – WhoPatents and Wher- rention, BerneConvention, TRIPS - PCT and WIPO - National Harmonization - Externalities and International Cooperation	ocess l e - Tra ional T on	Mixe Ide P Freat	edPri Policy men	vate- y and t and		
			TOTAL	: 45	PE	RIC	DDS		
OUT	COME	S: C	On completion of this course, students will be able to						
•	Explain	n the b	pasics of intellectual property.						
•	Discuss the impacts of IP on Plants/Seed industry								
			225						

•	Explore protecting methods of innovations.		
•	Understand the concept of litigation and enforcement.		
•	Learn Various treaties and acts on Innovation.		
TEXT	BOOKS:		
1.	Christopher M Publishers. 200	May, Susan K. Sell, "Intellectual Property Rights", LynneRienner	
2.	N. K. Acharya,	"Text Book on Intellectual Property Rights" Asia Law House, 2010.	
3.	R Radhakrishnan and S. Balasubramanian, "Intellectual Property Rights: Text and Cases" , First Edition, Excel books New Delhi, 2008		
REFE	REFERENCES:		
1.	Subbaram, N. Printers And P	R. "Handbook Of Indian Patent Law And Practice", S. Viswanathan ublishers Pvt. Ltd., 1998.	
2.	<i>N.S. Gopalakrishnan</i> & T.G. Agitha, "Principles Of Intellectual Property". 2 nd Edition, Eastern Book Company, 2014.		
3.	Tanya Frances Aplin, Jennifer Davis, "Intellectual Property Law: Text, Cases and Materials", 3 rd Edition, Oxford University Press, 2017.		
4.	NeerajPandey, 2014.	KhushdeepDharni, "Intellectual Property Rights", PHI Learning,	
5.	Rachna Singh Property Righ t	Puri, ArvindViswanathan , "Practical Approach to Intellectual t s", I. K. International Publishing House Pvt. Ltd. Delhi 2009.	

17MOE006

ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING

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OBJECTIVES:

- To make the students understand the basics of demand, supply and related concepts.
- To make the students understand various production and cost concepts
- To make the students understand and apply the basic concepts of pricing.
- To make the students understand and apply the basic concepts of capital budgeting.

UNIT I INTRODUCTION

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis.

UNIT II DEMAND & SUPPLY ANALYSIS

Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity –Demand forecasting - Supply – Determinants of supply - Supply function -Supply elasticity.

UNIT III PRODUCTION AND COST ANALYSIS

Production function - Returns to scale - Production optimization - Least cost input - Isoquants – Managerial uses of production function.

Cost Concepts- Cost function - Determinants of cost - Short run and Long run cost Cost Output Decision - Estimation of Cost.

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UNIT IV PRICING

Determinants of Price - Pricing under different objectives and different market structures

- Price discrimination - Pricing methods in practice.

UNIT V CAPITAL BUDGETING

Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL : 45 PERIODS OUTCOMES: On completion of this course, students will be able to • Explain the basics of managerial economics and decisions. • Analyse the concepts of demand and supply. • Discuss various functions of production and cost analysis concepts.

•	Understand various pricing techniques.			
•	Explore the concept of capital budgeting.			
ТЕХТ	BOOKS:			
1.	R. Kesavan, C. Accounting", lax	Elanchezhian, T. Sunder selvin, "Engineering Economics And Financial mi publications (p) Ltd. First edition, 2005.		
2.	M. Kasi Reddy, Prentice Hall o	, S. Saraswathy, "Managerial Economics and Financial Accounting" , f India Private Limited ,2007.		
3.	McGuigan, Moy Tactics', Thomso	yer and Harris, 'Managerial Economics; Applications, Strategy and on South Western, 10th Edition, 2005.		
REFE	CRENCES:			
1.	Salvatore Domin Western, 4th Edi	nick, 'Managerial Economics in a global economy'. Thomson South ition, 2001.		
2.	Prasanna Chan Publishing Ltd.,	dra. 'Fundamentals of Financial Management' , Tata Mcgraw Hill 4th edition, 2005.		
3.	N. Samuelson. P Publishing Com	Paul A and Nordhaus W.D ., 'Economics' , Tata Mcgraw Hill pany Limited, New Delhi, 2004.		
4.	Paresh Shah, 'Ba ew Delhi, 2007.	usic Financial Accounting for Management', Oxford University Press, N		
5.	R. Panneerselva	m, "Engineering Economics", PHI Learning PVT. Ltd. Delhi. 2013.		

17MOE007

INDUSTRIAL SAFETY ACTS AND STANDARDS

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OBJECTIVES:

- Tomake the students to understand basic concepts of factories act.
- To understand basic concepts of Environment act.
- To study the various hazardous chemical rules
- To study the various Indian Boiler ,industry and Electricity act
- To study the various international acts and standards

UNIT I FACTORIES ACT – 1948

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948

UNIT II ENVIRONMENT ACT – 1986

General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board. Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.

UNIT III MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989

Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets

UNIT IV OTHER ACTS AND RULES

Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules – electricity act and rules – hazardous wastes (management and handling) rules, 1989, with amendments in 2000- the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules-Explosives Act 1983-Pesticides Act

UNIT V INTERNATIONAL ACTS AND STANDARDS

Occupational Safety and Health act of USA (The Williames - Steiger Act of 1970) – Health and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI)

TOTAL : 45 PERIODS

OUTO	COMES:	On completion of this course, students will be able to
•	• List out important legislations related to health, Safety and Environment.	
•	Creating re	equirements mentioned in factories act for the prevention of accidents.

•	Analyze the health and welfare provisions given in factories act.			
•	Evaluate the statutory requirements for an Industry on registration and license			
•	Learn the various international acts and standards.			
ТЕХТ	BOOKS:			
1.	The Factories	Act 1948, Madras Book Agency, Chennai, 2000		
2.	The Environment Act (Protection) 1986, Commercial Law Publishers, Delhi, 1986.			
3.	L. M.Deshmuk	ch, Industrial Safety Management, Tata McGraw Hill, NewDelhi, 2005.		
REFE	REFERENCES:			
1.	The manufact Agency,	ture, storage and import of hazardous chemical rules 1989, Madras Book		
2.	The Indian bo	ilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad		
3.	S. N. Dhyani, International LabourOrganisation and India: In Pursuit of Social Justice, National, 1977.			
4.	The Mines Act	t 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.		
5.	Water (Preven pollution) act	ntion and control of pollution) act 1974, Air (Prevention and control of 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.		

17MOE008		GLOBAL WARMING AND CLIMATE CHANGE	L 2	T	P	C
OB.II	ECTIV	ES:	3	U	U	3
	To mak	e the students to understand basic concepts of disaster and hazar	ds if I	ndia		
•	To stud	v the various natural disasters.	u o 11 1			
•	To stud	y the various manmade disasters.				
•	To und	erstand the disaster management principles.				
•	To stud	y the modern techniques used in disaster mitigation and manager	ment.			
UNIJ	ΓΙ	EARTH'S CLIMATE SYSTEM				9
Role o Effects – Carb	of ozone s of Gree oon Cycle	in environment-ozone layer-ozone depleting gases - Green Hou nhouse Gases - The Hydrological Cycle - Green House Gases an e.	se Eff nd Glo	ect, j obal	Radi War	ative ming
UNIT	NIT II ATMOSPHERE AND ITS COMPONENTS					9
Import of the Lapse	tance of atmosph rates –Te	Atmosphere-Physical Chemical Characteristics of Atmosphere ere-Composition - Atmospheric stability-Temperature profile of emperature inversion-effects of inversion on pollution dispersion	- Ver of the	tical atm	stru osph	cture ere -
UNIT	ГШ	IMPACTS OF CLIMATE CHANGE				
Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors –Agriculture, Forestry and Ecosystem – Water Resources – Human Health –Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes						
UNIT	ΓIV	IV OBSERVED CHANGES AND ITS CAUSES				
Climate change and Carbon credits- Initiatives in India - Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks –The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India .						
UNIT V		NIT V CLIMATE CHANGE AND MITIGATION MEASURES				9
Clean Biodie Solar I Key M Forestr Biome	Develop esel – Na Energy – Iitigation ry - Cart edical, Ind	oment Mechanism –Carbon Trading - examples of future tural Compost – Eco - Friendly Plastic – Alternate Energy – Hyd Wind – Hydroelectric Power – Mitigation Efforts in India - A Technologies – Energy Supply – Transport – Buildings – Indu- tion sequestration – Carbon capture and storage (CCS)- Waste I dustrial waste – International and Regional cooperation.	Clean Irogen Adapta stry – MSW	Te – B ation Agr & B	chno io-fu fun icult io w	ology iels – ding- ure – zaste,

OUTCOMES: On		On completion of this course, students will be able to			
•	• Analysethe earth's climate system.				
•	Explain the various layers and composition of earth atmosphere.				
•	Discuss the	e impacts of Climate Change on various sectors.			
•	Explore various observed climate changes and its causes.				
•	Understand the concept of mitigation measures against global warming.				
ТЕХТ	TEXT BOOKS:				
1.	Dash Sushil Kumar, " <i>Climate Change – An Indian Perspective</i> ", Cambridge University Press (India Pvt. Ltd), 2007.				
2.	J. Houghton, "Global Warming The Complete Briefing", Cambridge Univ. press, 2015.				
3.	Jerry Silver, "Global Warming and Climate Change Demystified", McGraw- Hill,2008.				
REFE	RENCES	5:			
1.	Watson, Ra and mitiga	obert T., Marufu C. Zinyowera, and Richard H. Moss. "Impacts, adaptations ation of climate change: scientific-technical analyses. 1996.			
2.	J.M. Walla	ace and P.V. Hobbs, "Atmospheric Science", Elsevier / Academic Press 2006.			
3.	Jan C. van	Dam, Impacts of "Climate Change and Climate Variability on			
	Hydrologi	cal Regimes", Cambridge University Press, 2003.			
4.	T. M. Letc	her, "Climate Change: Observed impacts on planet Earth", Elsevier, 2015			
5.	Farmer, G. Thomas, Cook,John, "Climate Change Science: A Modern Synthesis", Springer Netherlands, 2013.				