DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

PERAMBALUR - 621212

REGULATIONS – 2020

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(Applicable to the students admitted from the Academic year 2020 – 2021)

Discussed in BOS meeting Dated: 29.04.21 / ECE Ratified & Approved in Academic Council on 11.05.21

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE (AUTONOMOUS)
PERAMBALUR – 621 212

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS – 2020
CHOICE BASED CREDIT SYSTEM
I – VIII SEMESTER CURRICULA AND SYLLABI
SEMESTER I

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20HS101	Communicative English	HS	3	3	0	0	3
2	U20MA101	Engineering Mathematics	BS	4	3	1	0	4
3	U20PH101	Engineering Physics - I	BS	3	3	0	0	3
4	U20CY101	Engineering Chemistry	BS	3	3	0	0	3
5	U20GE101	C - Programming	ES	3	3	0	0	3
6	U20GE102	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
7	U20BS101	Physics and Chemistry Laboratory	BS	4	0	0	4	2
8	U20GE103	C - Programming Laboratory	ES	4	0	0	4	2
			TOTAL	**30**	**17**	**1**	**12**	**24**

SEMESTER II

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20HS201	Functional English	HS	3	3	0	0	3
2	U20MA201	Advanced Calculus and Ordinary Differential Equations	BS	4	3	1	0	4
3	U20PH201	Engineering Physics - II	BS	3	3	0	0	3
4	U20GE201	Python Programming	ES	3	3	0	0	3
5	U20EE201	Circuit Theory	PC	3	3	0	0	3
6	U20EC201	Semiconductor Devices	PC	3	3	0	0	3
PRACTICALS								
7	U20GE203	Engineering Practices Laboratory	ES	4	0	0	4	2
8	U20GE204	Python Programming Laboratory	ES	4	0	0	4	2
9	U20EC202	Semiconductor Circuits and Simulation Laboratory	PC	4	0	0	4	2
			TOTAL	**31**	**18**	**1**	**12**	**25**

SEMESTER III

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20MA301	Transforms and Partial Differential Equations	BS	4	3	1	0	4
2	U20EC301	Signals and Systems	PC	4	3	1	0	4
3	U20EC302	Electronic Circuits	PC	3	3	0	0	3
4	U20EC303	Digital Integrated Circuits	PC	3	3	0	0	3
5	U20EC304	Electrical Engineering and Control Systems	PC	3	3	0	0	3
6	U20CS301	Data Structures and OOPS	ES	3	3	0	0	3
PRACTICALS								
7	U20EC305	Analog and Digital Circuits Laboratory	PC	4	0	0	4	2
8	U20CS302	Data Structures Laboratory	ES	4	0	0	4	2
9	U20HS301	Interpersonal Skills/Listening and Speaking	EEC	4	0	0	4	1
TOTAL				**32**	**18**	**2**	**12**	**25**

SEMESTER IV

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20MA401	Probability and Random Process	BS	4	3	1	0	4
2	U20EC401	Analog Integrated Circuits	PC	3	3	0	0	3
3	U20EC402	Analog and Digital Communication	PC	3	3	0	0	3
4	U20EC403	Electromagnetic Fields	PC	4	3	1	0	4
5	U20HS202	Environmental Science and Engineering	HS	3	3	0	0	3
6		**Professional Elective I**	PE	3	3	0	0	3
PRACTICALS								
7	U20EC404	Integrated Circuits and Simulation Laboratory	PC	4	0	0	4	2
8	U20EC405	Analog and Digital Communication Laboratory	PC	4	0	0	4	2
TOTAL				**28**	**18**	**2**	**8**	**24**

SEMESTER V

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20EC501	Transmission Lines and Waveguides	PC	4	3	1	0	4
2	U20EC502	Digital Signal Processing	PC	4	3	1	0	4
3	U20EC503	Processors and Controllers	PC	3	3	0	0	3
4	U20EC504	Adhoc and Sensor Networks	PC	3	3	0	0	3
5	U20EC505	Communication Networks and Architecture	PC	3	3	0	0	3
6		**Open Elective I**	OE	3	3	0	0	3
PRACTICALS								
7	U20EC506	Processor and Controllers Laboratory	PC	4	0	0	4	2
8	U20EC507	Signal Processing and Networking Laboratory	PC	4	0	0	4	2
			TOTAL	**28**	**18**	**2**	**8**	**24**

SEMESTER VI

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20EC601	Antenna and Wave Propagation	PC	4	3	1	0	4
2	U20EC602	VLSI Circuits and CAD Design	PC	3	3	0	0	3
3	U20EC603	Image and Video Processing	PC	3	3	0	0	3
4	U20EC604	Satellite Communication and Remote Sensing	PC	3	3	0	0	3
5		**Professional Elective II**	PE	3	3	0	0	3
PRACTICALS								
6	U20EC605	Electronic System Design Laboratory	PC	4	0	0	4	2
7	U20EC606	VLSI and Image Processing Laboratory	PC	4	0	0	4	2
8	U20EC607	Mini Project	EEC	4	0	0	4	0
			TOTAL	**28**	**15**	**1**	**12**	**20**

SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20EC701	Broadband Wireless Communications	PC	4	3	1	0	4
2	U20EC702	Microwave Theory and Circuits	PC	4	3	1	0	4
3	U20EC703	Fiber Optic Communication and Networks	PC	3	3	0	0	3
4	U20EC704	Real Time System Design	PC	3	3	0	0	3
5		**Open Elective II**	OE	3	3	0	0	3
PRACTICALS								
6	U20EC705	Microwave and Optical Laboratory	PC	4	0	0	4	2
7	U20EC706	Project Work - Phase I	EEC	4	0	0	4	1
TOTAL				**25**	**15**	**2**	**8**	**20**

SEMESTER VIII

S. No.	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		**Professional Elective III**	PE	3	3	0	0	3
2		**Professional Elective IV**	PE	3	3	0	0	3
PRACTICALS								
3	U20EC801	Project Work - Phase II	EEC	12	0	0	12	6
			TOTAL	**18**	**6**	**0**	**12**	**12**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR THE AWARD OF DEGREE: 174

PROFESSIONAL ELECTIVE I
SEMESTER IV

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20EC411	Measurement and Instrumentation	PE	3	3	0	0	3
2	U20EC412	Sensors and Transducers	PE	3	3	0	0	3
3	U20EC413	Information Theory and Coding	PE	3	3	0	0	3
4	U20EC414	High Speed Networks	PE	3	3	0	0	3
5	U20HS401	Principles of Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE II
SEMESTER VI

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20EC621	Electromagnetic Interference and Compatibility	PE	3	3	0	0	3
2	U20EC622	Multimedia Compression techniques	PE	3	3	0	0	3
3	U20EC623	MEMS and NEMS	PE	3	3	0	0	3
4	U20EC624	Electronic Design and Automation tools	PE	3	3	0	0	3
5	U20HS601	Professional Ethics	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE III
SEMESTER VIII

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20EC831	RADAR systems	PE	3	3	0	0	3
2	U20EC832	Soft computing	PE	3	3	0	0	3
3	U20EC833	DSP Architecture and programming	PE	3	3	0	0	3
4	U20EC834	Intellectual Property Rights	PE	3	3	0	0	3
5	U20EC835	Telecommunication System Modeling and Simulation	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE IV
SEMESTER VIII

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U20EC841	Photonic Networks	PE	3	3	0	0	3
2	U20EC842	Thin Film Technology	PE	3	3	0	0	3
3	U20EC843	Digital Audio Engineering	PE	3	3	0	0	3
4	U20EC844	Electronics Packaging and Testing	PE	3	3	0	0	3
5	U20HS701	Total Quality management	PE	3	3	0	0	3

CATEGORY WISE SUBJECT DETAILS

HUMANITIES & SOCIAL SCIENCES (HS)

S. No.	COURSE CODE	SEMESTER	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	U20HS101	I	Communicative English	3	3	0	0	3
2	U20HS201	II	Functional English	3	3	0	0	3
3	U20HS401	IV	Environmental Science and Engineering	3	3	0	0	3

BASIC SCIENCES (BS)

S.No.	COURSE CODE	SEMESTER	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	U20MA101	I	Engineering Mathematics	4	3	1	0	4
2	U20PH101	I	Engineering Physics – I	3	3	0	0	3
3	U20CY101	I	Engineering Chemistry	3	3	0	0	3
4	U20BS102	I	Physics and Chemistry Laboratory	4	0	0	4	2
5	U20MA201	II	Advanced Calculus and Ordinary Differential Equations	4	3	1	0	4
6	U20PH201	II	Engineering Physics – II	3	3	0	0	3
7	U20MA301	III	Transforms and Partial Differential Equations	4	3	1	0	4
8	U20MA401	IV	Probability and Random Process	4	3	1	0	4

ENGINEERING SCIENCES (ES)

S. No.	COURSE CODE	SEMESTER	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	U20GE101	I	C - Programming	3	3	0	0	3
2	U20GE101	I	Engineering Graphics	6	2	0	4	4
3	U20BE102	I	C - Programming Laboratory	4	0	0	4	2
4	U20GE201	II	Python Programming	3	3	0	0	3
5	U20GE203	II	Engineering Practices Laboratory	4	0	0	4	2
6	U20GE204	II	Python Programming Laboratory	4	0	0	4	2
7	U20DS301	III	Data Structures and OOPS	3	3	0	0	3
8	U20DS302	III	Data Structures Laboratory	4	0	0	4	2

PROFESSIONAL CORE (PC)

S. No.	COURSE CODE	SEMESTER	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	U20EE201	II	Circuit Theory	3	3	0	0	3
2	U20EC201	II	Semiconductor Devices	3	3	0	0	3
3	U20EC202	II	Semiconductor Circuit and Simulation Laboratory	4	0	0	4	2
4	U20EC301	III	Signals and Systems	4	3	1	0	4
5	U20EC302	III	Electronic Circuits	3	3	0	0	3
6	U20EC303	III	Digital Integrated Circuits	3	3	0	0	3
7	U20EC304	III	Electrical Engineering and Control Systems	3	3	0	0	3
8	U20EC305	III	Analog and Digital Circuits Laboratory	4	0	0	4	2
9	U20EC401	IV	Analog Integrated Circuits	3	3	0	0	3
10	U20EC402	IV	Analog and Digital Communication	3	3	0	0	3
11	U20EC403	IV	Electromagnetic Fields	4	3	1	0	4
12	U20EC404	IV	Integrated Circuits and Simulation Laboratory	4	0	0	4	2
13	U20EC405	IV	Analog and Digital Communication Laboratory	4	0	0	4	2
14	U20EC501	V	Transmission Lines and Waveguides	4	3	1	0	4
15	U20EC502	V	Digital Signal Processing	4	3	1	0	4
16	U20EC503	V	Processor and Controllers	3	3	0	0	3
17	U20EC504	V	Adhoc and Sensor Networks	3	3	0	0	3

18	U20EC505	V	Communication Networks and Architecture	3	3	0	0	3
19	U20EC506	V	Processor and Controllers Laboratory	4	0	0	4	2
20	U20EC507	V	Signal Processing and Networking Laboratory	4	0	0	4	2
21	U20EC601	VI	Antenna and Wave propagation	4	3	1	0	4
22	U20EC602	VI	VLSI Circuits and CAD Design	3	3	0	0	3
23	U20EC603	VI	Image and Video Processing	3	3	0	0	3
24	U20EC604	VI	Satellite Communication and Remote Sensing	3	3	0	0	3
25	U20EC605	VI	Electronic System Design Laboratory	4	0	0	4	2
26	U20EC606	VI	VLSI and Image Processing Laboratory	4	0	0	4	2
27	U20EC701	VII	Broadband Wireless Communications	4	3	1	0	4
28	U20EC702	VII	Microwave Theory and Circuits	4	3	1	0	4
29	U20EC703	VII	Fiber Optic Communication and Networks	3	3	0	0	3
30	U20EC704	VII	Real Time System Design	3	3	0	0	3
31	U20EC705	VII	Microwave and Optical Laboratory	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	COURSE CODE	SEMESTER	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	U20HS301	III	Interpersonal Skills / Listening and Speaking	4	0	0	4	1
2	U20EC607	VI	Mini Project	4	0	0	4	0
3	U20EC706	VII	Project Work - Phase I	4	0	0	4	1
4	U20EC801	VIII	Project Work - Phase II	12	0	0	12	6

SUMMARY

B. E., Electronics and Communication Engineering											
S. No.	**Subject Area**	**Credits per Semester**								**Credits Total**	**Percentage %**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
1	Humanities & Social Sciences	3	3	-	3	-	-	-	-	9	5.17
2	Basic Sciences	12	7	4	4	-	-	-	-	27	15.51
3	Engineering Sciences	9	7	5	-	-	-	-	-	21	12.07
4	Professional Cores	-	8	15	14	21	17	16	-	91	52.30
5	Professional Electives	-	-	-	3	-	3	-	6	12	6.90
6	Open Electives	-	-	-	-	3	-	3	-	6	3.45
7	Employability Enhancement Courses	-	-	1	-	-	0	1	6	8	4.60
Total		**24**	**25**	**25**	**24**	**24**	**20**	**20**	**12**	**174**	**100**

SEMESTER I

U20HS101	**COMMUNICATIVE ENGLISH**	**L**	**T**	**P**	**C**
	(COMMON TO ALL BRANCHES)	**3**	**0**	**0**	**3**

Pre-requisite: Acquiring Basic grammar knowledge

COURSE OBJECTIVES

- To enable the engineering students to develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To integrate English Language learning with employability skills and training.
- To enhance the students' proficiency in reading skills enabling them meet the academic demands of their course.

UNIT I GENERAL INTRODUCTION **9**

Listening - Listening to conversations, Welcome Speeches, Lectures and description of equipment. Speaking - introducing one self - family and friends. Reading - Practice in skimming - scanning and predicting - Writing - completing sentences. Grammar - WH - Questions - asking and answering - Yes or No questions and Question Tag - Parts of Speech. Prefixes - Suffixes - Tense- Present, Past and Future Tense. Word formation.

UNIT II TECHNIQUES OF READING AND WRITING **9**

Reading - Purpose of reading-comprehension - re - reading- post reading - comprehension questions (multiple choice questions or short questions/open-ended questions). Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Autobiographical writing (writing about one's leisure time activities, hometown, etc.) - Listening - Situational Conversation, Telephonic Conversation. Speaking - Sharing information of a personal kind - greeting - Taking leave - Grammar - Adjectives, Prepositions, Conjunctions, Articles, Punctuations - Error correction, editing mistakes in grammar, vocabulary, spelling.

UNIT III GRAMMAR AND SKILL DEVELOPMENT **9**

Reading - Reading general contexts and interpreting graphical representations. Writing - understanding text structure - Use of reference words and discourse markers - Coherence - Jumbled Sentences Listening - listening to longer texts and filling up the table - Product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Grammar-Past Tense - Kinds of noun, verb and adverb, Impersonal Passive voice.

UNIT IV READING AND LANGUAGE DEVELOPMENT **9**

Reading - Short reading passages for sentence matching exercises, Picking out specific information in a short text. Writing - Letter writing, informal or personal letters - e-mails - conventions of personal e-mail - Listening-listening to dialogues or conversations and completing exercises based on them. Speaking - Group Discussion - Grammar - Future tense, Synonyms - Antonyms - Phrasal verbs.

UNIT V WRITING SKILLS **9**

Reading - Intensive reading - Writing - Writing short essays - Dialogue Writing - Listening - listening to talks - conversations - Speaking - Presenting welcome speech and vote of thank - Grammar - Modal verbs - Collocations - Single word substitutes.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Learners are able to

1. Speak clearly, effortlessly, confidently and appropriately.
2. Write coherently with acceptable accuracy, organizing ideas logically.
3. Listen and comprehend different discourses and genres of texts.
4. Read and comprehend different discourses and genres of texts.
5. Read and infer, analyze, predict, interpret and draw conclusions any printed text.

TEXT BOOKS

1. Board of Editors Using English "A Course book for Undergraduate Engineers and Technologists". Orient Black Swan Limited, Hyderabad, 2015.
2. Richards, C. Jack. "Interchange Students'Book-2", New Delhi: CUP, 2015.

REFERENCES

1. Bailey, Stephen. "Academic Writing: A practical guide for students". New York: Rutledge, 2011.
2. Raymond Murphy, Murphy's "English Grammar", Cambridge University Press 2004.
3. Meenakshi Raman, Sangeeta Sharma, "Technical Communication: English Skills for Engineers", Oxford University Press, 2009.
4. Dr.S.Sumant, "Technical English-I" Tata McGraw-Hill, New Delhi, 2001.
5. Essential English - E.Suresh Kumar, P. Sreehari, J. Savithri - Orient Blackswan 2011.

U20MA101	ENGINEERING MATHEMATICS (COMMON TO ALL BRANCHES)	L	T	P	C
		3	1	0	4

Prerequisite: Basic ideas of Matrices, Differentiation and Integration

COURSE OBJECTIVES

- To handle practical problems arising in the field of engineering.
- To achieve conceptual understanding and to retain the best traditions of traditional calculus.
- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To deal with topics such as single variable and multivariable Calculus.
- To play an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I EVALUATION AND APPLICATION OF MATRICES **12**

Definition - Basic concepts of Matrices - Eigen values and Eigen vectors of a real matrix -Characteristic equation -Properties of Eigen values and Eigen vectors - Cayley - Hamilton theorem - Diagonalization of matrices - Reduction of a quadratic form to canonical form by Orthogonal transformation - Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit of a function - Continuity - Derivatives - Differentiation Rules - Mean Value Theorem - Interval of increasing and decreasing functions - Maxima and Minima - Interval of concavity and convexity.

UNIT III MULTIVARIABLE CALCULUS 12

Limits and Continuity - Partial derivatives - Total derivative - Differentiation of implicit functions - Jacobian and properties -Taylor's series for functions of two variables -Maxima, Minima and saddle points - Method of Lagrange multipliers.

UNIT IV INTEGRAL CALCULUS 12

Definite Integrals and its properties - Fundamental theorem of Calculus - Techniques of integration for Indefinite Integrals using basic integration formulas -Integration by parts -Trigonometric Substitutions - Integration of Rational functions by Partial Fractions.

UNIT V MULTIPLE INTEGRAL AND THEIR APPLICATIONS 12

Double integrals - Change the order of integration - Polar Coordinates - Area - Change of variables - Triple integrals - Volume - Applications - Areas and Volumes.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Express large amounts of data and functions in an organized and concise form apart from diagonalizing matrices.
2. Solve maxima and minima problems using differentiation.
3. Apply functions of several variables to solve problems in engineering and technology.
4. Evaluate integrals by using Fundamental Theorem of Calculus.
5. Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change the order and change of variables.

TEXT BOOKS

1. Grewal B.S.,"Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Ed., 2014.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2011.

REFERENCES

1. Bali N. P. and Manish Goyal, "Engineering Mathematics" (For Semester I) Third Edition, University Science Press, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons,2014
3. Fritz John and Richard Courant, "Introduction to Calculus and Analysis" Springer, 1999.
4. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015.
5. Venkatraman M K, "Engineering Mathematics, Volume-I", Second edition, National Publishing Co, Chennai, 2003.

U20PH101	ENGINEERING PHYSICS - I	L	T	P	C
	(COMMON TO ALL BRANCHES)	3	0	0	3

Pre-requisite: Adequate knowledge in basic and modern physics

COURSE OBJECTIVES

- To import knowledge in basic concepts of physics relevant to engineering applications.
- Capability to understand advanced topics in engineering.
- To acquire the knowledge of recent trends in LASER, Optical Fiber, and Ultrasonic.

UNIT I SOLID STATE PHYSICS 9

Lattice -unit cell -seven crystal systems -Bravai's lattices -lattice planes -Miller indices –derivation for inter-planar spacing in terms of Miller indices-calculation of number of atoms per unit cell , atomic radius coordination number and packing factor for SC, BCC, FCC and HCP structures. X-ray diffraction: Bragg's law -diffraction methods: powder and Laue methods. Crystal Growth Techniques: melt growth technique (Bridgman and Czochralski techniques).

UNIT II ELASTICITY OF MATTER 9

Introduction- Elasticity - Plasticity–Hooke's law - relationship between three modulii of elasticity (qualitative) -stress –strain diagram -Poisson's ratio - factors affecting elasticity. Beam: Internal Bending moment -Cantilever: theory and experiment-Young's modulus: theory and experiment (uniform and non-uniform bending) -I-shaped girders-advantages and applications -twisting couple of a wire or cylinder -torsion pendulum - determination of moment of inertia of disc and rigidity modulus of cylindrical wire.

UNIT III ULTRASONICS AND ITS APPLICATIONS 9

Introduction-classification of sound- properties of infrasonic, audible and ultrasonics -production: magnetostriction and piezoelectric methods–detection of ultrasonic waves–determination of velocity of sound in liquid (Acoustic grating method). Applications: Engineering and medical field- Non-destructive testing: pulse echo system through transmission and reflection modes. Ultrasonic scanning methods-Sonogram.

UNIT IV MODERN PHYSICS 9

Black body radiation- Basic Laws -Planck's hypothesis and its radiation law: derivation -deduction of Wien's displacement law and Rayleigh Jean's law from Planck's law -Photons and its properties-Compton Effect –derivation –experimental verification. Photo Electric effect and its Laws -Einstein's Equation - Matter waves–de-Broglie hypothesis - de-Broglie wavelength-Schrodinger's time independent and time dependent wave equations -physical significance of the wave function. Application: particle in one dimensional box-normalization - degenerate and non-degenerate states.

UNIT V LASER AND OPTICAL FIBER 9

Laser: properties–population inversion-pumping methods –Einstein's coefficients-derivation. Types: He-Ne and semiconductor lasers (Homo and Hetero junction) –uses of LASER- Hologram -Construction and Reconstruction Process. Optical fiber: Structure-advantages of optical fibre-Principle and propagation of light through optical fiber–expressions for numerical aperture and acceptance angle–fabrication of optical fiber- types of optical fibers-fiber optical communication system -endoscope -Fiber optic sensors (Qualitative Study only).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Assess the elastic behavior of the materials and bending behavior of beam.
2. Acquire knowledge of NDT and applications of ultrasonics.
3. Know the development of modern physics and its applications.
4. Recognize the uses of laser and fiber optics.
5. Distinguish the different crystal systems, structural determination and synthesis of crystals.

TEXT BOOKS

1. Marikani, “Engineering Physics”, PHI, New Delhi, 2013.
2. S. Vadivel & A. Pannerselvam, “Engineering Physics”, Jaitech Publications, 2015.

REFERENCES

1. Selladurai, “Engineering Physics Part-I”, PHI learning private limited, New Delhi, 2010.
2. V.Rajendran, “Engineering Physics”, Tata McGraw-Hill. New Delhi.2011
3. P. K. Palanisamy “Engineering Physics”. Scitech Publications, 2011
4. Raymond A. Serway and John Jewett, Jr. , “Physics for Scientist and Engineer with modern Physics”, Mary Finch Publication, 9th edition,2014.
5. William T. Silfvast ,“Laser Fundamentals”, Second Edition, Cambridge University Press, 2008.

U20CY101	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

Pre-requisite: Basics of Ionisation, adsorption phenomenon kinetics, Light emission components

COURSE OBJECTIVES

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photo physical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two Component systems and appreciate the purpose and significance of alloys.

UNIT I BASICS OF POLYMER 9

Introduction: Classification of Polymers -Natural and Synthetic: Thermoplastic and Thermosetting Functionality -Degree of Polymerization. Types and mechanism of Polymerization: Addition, Condensation and Co polymerization. Properties of Polymer - Techniques of Polymerization: Bulk, Emulsion, Solution and Suspension. Preparation, Properties and uses of Nylon6.6, and Epoxy resin.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of Adsorption -Adsorption of gases on solids -Adsorption of solute from solutions - Adsorption isotherms -Freundlich’s Adsorption Isotherm -Langmuir’s Adsorption Isotherm -Applications of Adsorption on pollution abatement. Catalysis: Catalyst -Types of Catalysis -Criteria -Auto Catalysis - Catalytic Poisoning and Catalytic Promoters - Acid Base Catalysis -Enzyme Catalysis - Michaelis - Menten equation.

UNIT III CHEMICAL THERMODYNAMICS 9

Terminology of Thermodynamics - Second Law: Entropy - Entropy change for an ideal gas, Reversible and Irreversible Processes; Entropy of Phase Transitions; Clausius inequality. Free Energy and Work function: Helmholtz and Gibbs free energy functions - Criteria of Spontaneity: Gibbs - Helmholtz equation -Clausius - Clapeyron equation: Maxwell Relations - Van't Hoff Isotherm and Isochore.

UNIT IV PHOTO CHEMISTRY AND SPECTROSCOPY 9

Photo Chemistry: Laws of Photo Chemistry - Grotthuss-Draper law, Stark - Einstein Law and Lambert - Beer Law. Quantum Efficiency - Determination - Photo Processes - Internal Conversion, Inter - system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic Spectrum- Absorption of Radiation - Electronic, Vibrational and Rotational transitions. UV - visible and IR Spectroscopy.

UNIT V PHASE RULE AND ALLOYS 9

Phase Rule: Introduction, Definition of terms with examples, One Component System - Water System - Reduced Phase Rule - Two Component Systems - Classification - Lead - Silver system, Zinc - Magnesium system. Alloys: Introduction - Definition- Properties of Alloys - Significance of Alloying, Functions and Effect of Alloying elements- Ferrous Alloys- Nichrome and Stainless Steel - Heat Treatment of Steel.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners able to

1. Describe the General Structure of Polymers. Identify and Explain differences between Addition and Stepwise Polymerization.
2. Explain how selected Isomers could be used for measurement of Surface Area of Materials or in Rationalization of Catalysis.
3. Derive and discuss the First and Second Laws of Thermodynamics.
4. Making possible to apply this knowledge in different areas, other than Photo Chemistry and Spectroscopy.
5. Illustrate the Phase Transition of One Component and Two Component system and Types of Alloys and their applications in industries.

TEXT BOOKS

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010.
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi- tech Publishing Company Pvt. Ltd. Chennai, 2009.

REFERENCES

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V. R. , Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2006.
4. Shashi Chawla, "A Text Book of Engineering Chemistry", Dhanapat Rai & Co. (P) Ltd, Delhi, 2013.
5. Satya Prakash and Manish Agarwal, "Engineering Chemistry", Khanna Book Publishing Co.(P) Ltd, Delhi,2018.

U20GE101	C - PROGRAMMING	L	T	P	C
	(COMMON TO ALL BRANCHES)	3	0	0	3

Pre-requisite: Basic Computer knowledge to access a computer

COURSE OBJECTIVES

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

UNIT I BASICS OF C PROGRAMMING 9

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

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization - One dimensional array - Example Program: Computing Mean, Median and Mode - Two dimensional arrays.- String operations: length, compare, concatenate, copy - Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) - Recursion - Example Program: Scientific calculator using built-in functions, Binary Search using recursive functions - Pointers - Pointer operators - Pointer arithmetic - Arrays and pointers - Array of pointers.

UNIT IV STRUCTURES 9

Structure - Nested structures - Pointer and Structures - Array of structures - Example Program using structures and pointers - Union- Example Program using unions and pointers.

UNIT V FILE PROCESSING 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Develop simple applications in C using basic constructs
2. Design and implement applications using arrays and strings
3. Develop and implement applications in C using functions and pointers.
4. Develop applications in C using structures.
5. Design applications using sequential and random access file processing

TEXT BOOKS

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

REFERENCES

1. Paul Deitel and Harvey Deitel, —”C How to Program”, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, “Programming in C”, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

U20GE102	ENGINEERING GRAPHICS	L	T	P	C
	(COMMON TO ALL BRANCHES)	2	0	4	4

Pre-requisite: Basic knowledge in practical geometry construction, imagination and mathematics

COURSE OBJECTIVES

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

UNIT I PLANE CURVES AND ORTHOGRAPHIC PROJECTION 6+12

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimension. Basic Geometrical constructions, Curves used in engineering practices: Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves. Visualization 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 SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method (polygonal and circular surfaces) inclined to both the planes.

UNIT III PROJECTION OF SOLIDS 6+12

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

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12

Sectioning of above solids 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 solids - Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC PROJECTION 6+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.

TOTAL: 30+60 = 90 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Familiarize with the fundamentals and standards of Engineering graphics.
2. Perform freehand sketching of basic geometrical constructions and multiple views of objects.
3. Project orthographic projections of lines and plane surfaces.
4. Draw projections and solids and development of surfaces.
5. Visualize and to project isometric and perspective sections of simple solids.

TEXT BOOKS

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

REFERENCES

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. N S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 - 2001: Technical products Documentation - Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) - 2001: Technical products Documentation - Lettering.
3. IS 10714 (Part 20) - 2001 & SP 46 - 2003: Lines for technical drawings.
4. IS 11669 - 1986 & SP 46 - 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) - 2001: Technical drawings - Projection Methods.

Special points applicable to Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

U20BS101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

Pre-requisite: Basic knowledge of Physics and chemistry laboratory apparatus.

PHYSICS LABORATORY

COURSE OBJECTIVE

- To handle different experiments to test the physics concepts applied in optics, thermal physics, electronics, sound, elasticity and etc..

LIST OF EXPERIMENTS

1. Find the Young's modulus by non-uniform bending method
2. Verify of band gap energy of a PN junction semiconductor using PN junction kit
3. Determination of wavelength of Laser and particle size using Laser grating method
4. Determination of rigidity modulus of given wire using Torsion pendulum method
5. Determination of thickness of a thin specimen using Air wedge method

LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:

Young's Modulus: Non-Uniform bending

a. Travelling Microscope - 6 Nos.
b. Pin -Scale Knife edge - 6 Nos.

Band gap

a. PN Junction diode setup - 6 Nos.
b. Eliminator - 6 Nos.

Particle Size

a. Laser grating - 6 Nos.
b. Circular disc with particle coated - 6 Nos.
c. Laser Source - 6 Nos.

Torsional Pendulum

a. Torsional Pendulum - 6 Nos.
b. Thin wire - 6 Nos.
c. Cloch - 6 Nos.
d. Screw gauge - 6 Nos.

Air wedge

a. Air wedge - 6 Nos.
b. Travelling Microscope - 6 Nos.
c. Mercury vapour lamp - 6 Nos.

TOTAL :30 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Apply the basic theory for the corresponding experiment
2. Know the procedure to use physics equipment

CHEMISTRY LABORATORY

COURSE OBJECTIVES

- To make the student to acquire practical skills in the determination of water quality
- Parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by Viscometery.

LIST OF EXPERIMENTS

1. Determination of DO content of water sample by Winkler's method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of strength of given hydrochloric acid using pH meter.
4. Determination of strength of HCL using conductivity meter
5. Determination of molecular weight of polyvinyl alcohol using Ostwald visco meter.

LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:

a.	Iodine flask	- 30 Nos.
b.	PH meter	- 5 Nos.
c.	Conductivity meter	- 5Nos.
d.	Spectrophotometer	- 5 Nos.
e.	Ostwald Viscometer	- 10 Nos.
f.	Common Apparatus:	Pipette, Burette, Conical Flask, Porcelain tile, Dropper

TOTAL :30 PERIODS

COURSE OUTCOMES :

Learners are able to

1. The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.
2. Utilize the fundamental laboratory techniques for analyses such as titrations, separation, purification and spectroscopy.
3.

		L	T	P	C
U20GE103	**C - PROGRAMMING LABORATORY (COMMON TO ALL BRANCHES)**	**0**	**0**	**4**	**2**

Pre-requisite: Basic computer knowledge to install software

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Populate an array with height of persons and find how many persons are above the average height.
7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
8. Given a string “a$bcd./fg “find its reverse without changing the position of special characters.(Example input:a@gh%;j and output:j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
10. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.
11. Solve towers of Hanoi using recursion.
12. Sort the list of numbers using pass by reference.
13. Generate salary slip of employees using structures and pointers.
14. Compute internal marks of students for five different subjects using structures and functions.
15. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:

HARDWARE:

1. Standalone desktops 30 Nos.

SOFTWARE:

1. C / Equivalent Compiler 30 Nos.

COURSE OUTCOMES

1. Develop C programs for simple applications making use of basic constructs, arrays and strings.
2. Develop C programs involving functions, recursion, pointers, and structures.
3. Design applications using sequential and random access file processing.

SEMESTER II

		L	T	P	C
U20HS201	**FUNCTIONAL ENGLISH (COMMON TO ALL BRANCHES)**	**3**	**0**	**0**	**3**

Pre-requisite: Basics skills development of Reading and Writing

COURSE OBJECTIVES

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I VOCABULARY AND GRAMMAR 9

Listening - Listening to talks mostly of a scientific/technical .Speaking - Asking for and giving directions- Reading - reading short technical texts from journals-newspapers- Writing- purpose statements– extended definitions- issue-writing instructions - recommendations- Language Development–subject verb agreement -compound words. Technical vocabulary.

UNIT II TECHNIQUES OF READING AND WRITING 9

Listening: Listening Process; Types of Listening; Intensive vs. Extensive Listening; Barriers to Listening. Speaking - describing a process-Reading - reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs- Language Development - vocabulary used informal letters/emails and reports .Homonyms and Homophones-Common Errors. Numerical adjectives.

UNIT III GRAMMAR AND SKILL DEVELOPMENT 9

Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking –introduction to technical presentations- Reading–longer texts both general and technical, practice in speed reading; Writing- checklists- Describing a process, use of sequence words-Language Development -sequence words- Misspelled words.-use of clauses. Verb forms. Direct/Indirect Speech.

UNIT IV INTERVIEW SKILL AND LANGUAGE DEVELOPMENT 9

Listening- Listening to documentaries and making notes. Speaking - mechanics of presentations- Reading- Reading for detailed comprehension-Writing-email etiquette -job application–cover letter- Résumé preparation (via email and hard copy)- analytical essays and issue based essays-- Language Development -finding suitable synonyms-paraphrasing-. -if conditionals.

UNIT V TECHNICAL WRITING 9

Listening- TED/Ink talks; Speaking–participating in a group discussion - Reading- reading and understanding technical articles Writing- Writing reports- minutes of a meeting- accident and survey- Language Development- Comparative Adjectives

TOTAL: 45 PERIODS

COURSE OUTCOMES

Learners are able to:

1. Use academic and technical vocabulary in relevant contexts. Construct meaningful and grammatically correct sentence.
2. Effectively listen and acquire language and content, read fast and understand texts.
3. Use oral presentation skills in all professional contexts.
4. Demonstrate the understanding of the nature and importance of technical communication Draft various types of technical and business documents like, reports, proposals and business letters.
5. Compose documents like job application, book review etc.

TEXT BOOKS

1. Board of editors. Fluency Using English" A Course book for Undergraduate Engineering Technologists". Orient Blackswan, Hyderabad, 2015.
2. Sudharshana. N.P and Saveetha.C. "English for Technical Communication". Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Barrass, Robert. "Scientists Must Write". London: Routledge.2003.
2. Faculty of English. "Technical Communication". SASTRA Publication. 2017.
3. Raman, Meenakshi & Sangeeta Sharma. "Technical Communication: Wren & Martin. High School English Grammar and Composition". (Revised edn.) New Delhi: Chand & Co. 1995.
4. Dr.S.Sumant, "Technical English-I" Tata McGraw-Hill, New Delhi, 2001.
5. Essential English - E.Suresh Kumar, P. Sreehari, J. Savithri - Orient Blackswan 2011

U20MA201	ADVANCED CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS (COMMON TO ALL BRANCHES)	L	T	P	C
		3	1	0	4

Prerequisite: Basic concepts of vectors and complex numbers

COURSE OBJECTIVES

- To familiarize the prospective engineers with techniques in ordinary differential equations, complex variables and complex integration.
- The Study of Laplace transforms help to solve the differential equations that occur in various branches of engineering disciplines.
- Vector calculus can be widely used for modeling the various laws of physics.
- The various methods of complex analysis can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS 12

Basic concepts - Separable differential equations - Exact differential equations - Integrating factors - Linear differential equations - Second order linear differential equations with constant coefficients - Particular Integral using operator method and Method of variation of parameters - Homogenous equation of Euler's and Legendre's type-Physical Applications-Oscillations of a Spring.

UNIT II LAPLACE TRANSFORMS 12

Existence conditions - Transforms of elementary functions –Transform of unit step function and unit impulse function - Basic properties - Shifting theorems -Transforms of derivatives and integrals - Transform of periodic functions - Inverse transforms: Convolution theorem (Statement only) and Partial Fractions - Application to solution of linear second order ordinary differential equations with constant coefficients-Unit Step Function-Unit impulse function.

UNIT III VECTOR CALCULUS AND APPLICATIONS 12

Gradient and directional derivative - Divergence and curl - Irrotational and Solenoidal vector fields - Line integral - Surface integral - Area of a curved surface - Green's, Gauss divergence and Stokes' theorems in evaluating line, surface and volume integrals (Planar, Cylindrical and Spherical Surfaces).

UNIT IV ANALYTIC FUNCTIONS 12

Analytic functions - Necessary and sufficient conditions for analyticity in Cartesian form - Properties - Harmonic conjugates - Construction of analytic function - Conformal mapping - Mapping by function-Bilinear Transformation.

UNIT V CALCULUS OF COMPLEX FUNCTIONS 12

Complex integral - Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series - Singularities - Residues - Residue theorem - Application of residue theorem for evaluation of real integrals - Use of circular contour and semicircular contour (No poles on the real axis).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Evaluate the effective mathematical tools to obtain the solutions of first and second order differential equations that model physical processes.
2. Express Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
3. Apply the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. Express Analytic functions, conformal mapping and complex integration.
5. Solve Laplace transform and inverse transform of simple functions, properties, various related theorems and application to solve the differential equations with constant coefficients.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi.

REFERENCES

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2014.
2. N. P. Bali and Manish Goyal "Engineering Mathematics" (For Semester II) Third Edition, University Science Press.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

4. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
5. Venkatraman M K, “Engineering Mathematics”, Volume 1,Second edition, National Publishing Co,Chennai,2003.

U20PH201	ENGINEERING PHYSICS - II	L	T	P	C
	(COMMON TO ALL BRANCHES)	3	0	0	3

Prerequisite: Basic knowledge in material property and its uses

COURSE OBJECTIVES

- To understand the basics of electric, thermal, magnetic, super conducting and di electric properties of materials
- To aware about recent trends in physics

UNIT I ELECTRON THEORY OF SOLIDS 9

Introduction: types of materials- classical free electron theory: postulates- derivation of electrical conductivity and thermal conductivity- derivation. Wiedemann-Franz law and its verification-merits and demerits of classical free electron theory. Quantum free electron theory: Fermi energy level and its importance -Fermi-Dirac distribution function and its variation with temperature - density of energy states –carrier concentration in metals -average energy of electrons at 0 K.

UNIT II FUNDAMENTALS OF SEMICONDUCTORS 9

Introduction: properties- Types semiconductors- concept of effective mass of an electron and hole. Intrinsic semiconductor: carrier concentration in an intrinsic semiconductor-derivation –variation of Fermi energy level with temperature - Extrinsic semiconductor: carrier concentration derivation (P and N type semiconductor) - Hall effect–theory and experimental determination of Hall coefficient - Applications.

UNIT III DIELECTRICS AND FERRO ELECTRICS 9

Introduction: fundamental definitions in dielectrics–expressions for electronic and ionic polarization mechanisms- orientation polarization - space charge polarization - Langevin - Debye equation - frequency and temperature effects on polarization. Capacitor-energy stored in capacitor- Internal field - Clausius Mossotti relation-dielectric loss –dielectric breakdown - various breakdown mechanisms with characteristics - applications of dielectric materials - Ferro electrics -properties and applications.

UNIT IV MAGNETISM AND SUPER CONDUCTORS 9

Magnetic Materials: Introduction-basic definitions - origin of magnetic moment –Bohr magneton - magnetic materials: classification of dia, para, ferro magnetic materials. Ferro magnetic domains-energies involved in the growth of magnetic domains-hysteresis-explanation of hysteresis curve based on domain theory-soft and hard magnetic materials. Superconducting Materials: properties - types - BCS theory of super conductivity-Applications: cryotron and Mag-lev.

UNIT V NANOMATERIALS 9

Definition of nano system- Quantum confinement - 0D to 3D Quantum confined nanostructures - density of energy states from 3D to 0D- Preparation: top down and bottom up approaches- PLD - PVD - CVD - Electro deposition- Carbon nanotubes-types - SWCNT and MWCNT, Armchair, Zig-zag and Chiral structures-properties-applications

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Learners are able to

1. Select the metals required for specific applications in the area of engineering and technology.
2. Distinguish between different types of semiconductor and determination of Hall co-efficient.
3. Understand the property of dielectric and ferro electric property of materials.
4. Identify different magnetic materials and super conducting materials.
5. Understand the idea used in new technologies

TEXT BOOKS

1. V.Rajendran, “Materials Science”, Tata McGraw- Hill, New Delhi, 2011.
2. S. Vadivel, A. Pannerselvam, “Solid State Physics”, Jaitech Publications, 2015 (Revised edition).

REFERENCES

1. Charles Kittel, “Introduction to Solid State Physics”, John Wiley & sons, 7th edition, Singapore (2007).
2. M. Arumugam, “Materials Science”. Anuradha publishers, 2010.
3. Dr. W. R. Fahrner, "Nanotechnology and Nanoelectronics Materials”, Devices, Measurement Techniques", Springer, 2005
4. J M D. Coey, “Magnetism and Magnetic Materials”, Combridge University Press, 1st edition, 2009.
5. V. Pokropivny, R. Lohmus, I. Hussainova, A. Pokropivny, S. Vlassov. Introduction in nanomaterials and nanotechnology. - University of Tartu. - 2007.

U20EE201	CIRCUIT THEORY	L	T	P	C
		3	0	0	3

Prerequisite: Basic knowledge of AC and DC circuits

COURSE OBJECTIVES

- To introduce Electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To analyze the three phase circuits and basic concepts two port networks.

UNIT I BASIC CIRCUITS ANALYSIS 9

Ohm’s Law - Kirchoff’s laws - - Mesh current and node voltage method of analysis for DC and AC circuits - Network reduction: voltage and current division, source transformation - star delta conversion.

UNIT II NETWORK THEOREMS 9

Network Theorems - Thevenin’s and Norton Theorems - Superposition Theorem - Maximum power transfer Theorem - Reciprocity Theorem- Millman’s Theorem - Power Division Theorem - Applications of network theorems.

UNIT III RESONANCE AND COUPLED CIRCUITS 9

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

UNIT IV TRANSIENT RESPONSE OF DC AND AC CIRCUITS 9

Natural response - Forced response - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input - Time constant.

UNIT V THREE PHASE CIRCUITS AND TWO PORT NETWORKS 9

Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced –power and power factor measurement in three phase circuits - Two port networks - π and T networks

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Analyse electrical circuits
2. Apply circuit theorems
3. Analyse transients
4. Analyse two port networks

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, McGraw Hill publishers, edition, New Delhi, 2013.
2. Chakrabarti A, “Circuit Theory (Analysis and synthesis), Dhanpat Rai & Sons, New Delhi, 1999.

REFERENCES

1. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.
2. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum’s series,
3. McGrawHill, New Delhi, 2010.
4. Mahadevan, K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd.,
5. New Delhi, 2015.
6. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”,
7. McGraw Hill, 2015.
8. Dr.P.S.Kannan, “Establishment of Power Division Theorem”, International Journal of Engineering Science and Computing, Volume - 8, Issue - 10.

		L	T	P	C
U20EC201	**SEMICONDUCTOR DEVICES**	**3**	**0**	**0**	**3**

Pre-requisite: Basic knowledge of Engineering Physics

COURSE OBJECTIVES

- Accustom with the basics of semiconductor physics
- Understand the operation, characteristics, parameters and specifications of semiconductor diodes and special diodes
- Discuss the operation and performance of important applications of diodes

- Explain the bipolar, field-effect and metal oxide semiconductor transistor construction, operation, characteristics and parameters
- Acquaint with the construction, theory and operation of Special semiconductor and display devices

UNIT I SEMICONDUCTORS 9

History of semiconductor device development - Intrinsic semiconductor - Energy band diagram - Direct and indirect semiconductors - Carrier concentration in intrinsic semiconductor - Extrinsic semiconductors - Carrier concentration in N-type and P-type semiconductors - Semiconductor device materials - Semiconductor devices - Advantages, disadvantages and applications.

UNIT II SEMICONDUCTOR DIODE 9

Equilibrium PN junction - Forward biased PN junction - Reverse biased PN junction - Current-voltage relationship - Calculation of depletion width - Potential barrier - Diode current - Capacitive effects in PN junction - Energy band structure - Ideal diode and its current-voltage characteristics - Terminal characteristics and parameters.

UNIT III DIODE CIRCUITS 9

Diode Characteristics and Parameters - Diode Equivalent Circuit - Half Wave Rectifier - Precision Half Wave Rectifier - Full Wave Rectifier - Bridge Rectifier - Rectifiers with filter capacitors - Diode Switching Time and Frequency Response - Clippers and Clampers - Voltage multipliers Circuits.

UNIT IV JUNCTION TRANSISTORS 9

BJT: NPN and PNP - Operations - Early effect - Current equations - Input and Output characteristics of CE, CB, CC. **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 V SPECIAL SEMICONDUCTOR, POWER DEVICES AND DISPLAY DEVICES 9

Schottky barrier diode - Zener diode - Varactor diode - Tunnel diode - LASER diode - LDR - UJT - SCR - DIAC - TRIAC - LED - LCD - Photo transistor - Solar cell.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Confidence in handling and usage of electronic devices, tools and instruments in engineering applications.
2. Know broadly the concepts and functionalities of the electronic devices, tools and instruments.
3. Understand use, general specifications and deployabilities of the electronic devices and assemblies.
4. Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors,
5. Understand the concepts on Power control devices, LED, LCD and other Opto-electronic devices.

TEXT BOOKS:

1. David A. Bell, “Electronic Devices & Circuits”, Oxford University Press, 4th edition, 2006.
2. Donald A Neaman, “Semiconductor Physics and Devices”, 2nd Edition, Mc GrawHill Inc, 2002.

REFERENCES:

1. Adel S. Sedra, Kenneth C. Smith, “Microelectronic Circuits: Theory and Applications”, Oxford University Press, 7th Edition, 2017.
2. Jacob Millman, Christos C Halkias, Satyabrata Jit, Millman's, “Electronic Devices and Circuits”, McGraw Hill Education, 4th Edition, 2015.
3. Salivahanan.S, Suresh Kumar.N, Vallavaraj.A, “Electronic Devices and circuits”, Tata McGraw-Hill, 3rd Edition, 2012.
4. Thomas L. Floyd, “Electronic Devices”, Pearson Education, 7th edition, 2008.
5. Sanjeev Gupta,Santosh Gupta, “Electron Devices and Circuits” Rai Publication, 4 edition 2007

U20GE203	ENGINEERING PRACTICES LABORATORY	L	T	P	C
	(COMMON TO ALL BRANCHES)	0	0	4	2

Prerequisite: Basic knowledge of Civil, Mechanical, Electrical and Electronics Engineering Equipments

COURSE OBJECTIVE

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

CIVIL ENGINEERING PRACTICES

Buildings:

a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
b) Study of pipe connections requirements for pumps and turbines.
c) Preparation of plumbing line sketches for water supply and sewage works.
d) Hands-on-exercise:

   Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components.
e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

a) Study of the joints in roofs, doors, windows and furniture.
b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting

MECHANICAL ENGINEERING PRACTICES

Welding:

a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
b) Gas welding practice

Basic Machining:

a) Simple Turning and Taper turning
b) Drilling Practice

Sheet Metal Work:

a) Forming & Bending:
b) Model making - Trays and funnels.
c) Different type of joints.

Machine assembly practice:

a) Study of centrifugal pump

b) Study of air conditioner

Demonstration on:

a) Smithy operations, upsetting, swaging, setting down and bending.
Example –Exercise - Production of hexagonal headed bolt.

b) Foundry operations like mould preparation for gear and step cone pulley.

c) Fitting - Exercises - Preparation of square fitting and V - fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICES

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.

ELECTRONICS ENGINEERING PRACTICES

1. Study of Electronic components and equipments - Resistor, colour coding measurement 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 PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.

1. Carpentry vice (fitted to work bench	15 sets
2. Standard woodworking tools	15 Nos.
3. Models of industrial trusses, door joints, furniture joints	15 sets
Power Tools:	5 each
(a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

MECHANICAL

	Arc welding transformer with cables and holders	5 Nos.
1.	Welding booth with exhaust facility	5 Nos.
2.	Welding accessories like welding shield, chipping hammer, wire brush, etc..	5 Sets
3.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
4.	Centre lathe	2 Nos.
5.	Hearth furnace, anvil and smithy tools	2 Sets
6.	Moldings table, foundry tools	2 Sets.
7.	Power Tool: Angle Grinder	2 Nos.
8.	Study-purpose items: centrifugal pump, air-conditioner	One each

ELECTRICAL

1.	Assorted electrical components for house wiring	15 Sets
2.	Electrical measuring instruments	10 Sets
3.	Study purpose items: Iron box, fan and regulator, emergency lamp	1 each 1 No.
4.	Megger (250V/500V)	2 Nos.
5.	Power Tools:	2 Nos.
	a) Range Finder	2 Nos.
	b) Digital Live-wire detector	2 Nos.

ELECTRONICS

1.	Soldering guns	10 Nos.
2.	Assorted electronic components for making circuits Small PCBs	 50 Nos.
3.	Multimeters	10 Nos.
4.	Study purpose items:	10 Nos. (Telephone, FM radio, low-voltage power supply)

COURSE OUTCOMES:

Learners are able to

1. Fabricate carpentry components and pipe connections including plumbing works.
2. Use welding equipments to join the structures.
3. Carry out the basic machining operations
4. Make the models using sheet metal works
5. Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
6. Carry out basic home electrical works and appliances
7. Measure the electrical quantities
8. Elaborate on the components, gates, soldering practices.

U20GE204	PYTHON PROGRAMMING LABORATORY (COMMON TO ALL BRANCHES)	L	T	P	C
		0	0	4	2

Pre-requisite: Basic knowledge of install programming soft ware

COURSE OBJECTIVES

- To read, write and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- To implement functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- To get input data from/to files in Python.

LIST OF PROGRAMS

1. Write python program to Compute the GCD of two numbers.
2. Write python program to Find the square root of a number (Newton‘s method).
3. Write python program to Exponentiation (power of a number).
4. Write python program to Find the maximum of a list of numbers.
5. Write python program to Linear search and Binary search.
6. Write python program to Selection sort, Insertion sort.
7. Write python program to Merge sort
8. Write python program to First n prime numbers.
9. Write python program to Multiply matrices.
10. Implement python programs that take command line arguments (word count).
11. Implement python program to Find the most frequent words in a text read from a file.
12. Write python program to Simulate elliptical orbits in Pygame.
13. Write python program to Simulate bouncing ball using Pygame.

TOTAL :60 PERIODS

LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:

HARDWARE:

1. Standalone desktops 30 Nos

SOFTWARE:

Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:

Learners are able to

1. Compile and execute simple Python programs.
2. Implement mathematical calculation in programs
3. Develop Python programs step-wise by defining functions and calling them.
4. Use Python lists, tuples, dictionaries for representing compound data.
5. Execute simulation of pygame programs

U20EC202	SEMICONDUCTOR CIRCUITS AND SIMULATION LABORATORY	L	T	P	C
		0	0	4	2

Pre-requisite: Basic Knowledge of Engineering Physics

COURSE OBJECTIVES:

- The laboratory emphasizes the practical, hands-on component of this course.

- It complements the theoretical material presented in lecture, and as such, is integral and indispensible to the mastery of the subject.
- Several items of importance here including proper safety procedures, required tools, and laboratory reports.
- To gain hand on experience in Thevinin & Norton theorem, KVL & KCL, and Super Position Theorems
- Exercise with a section on component identification.

LIST OF EXPERIMENTS (HARDWARE)

1. V-I characteristics of PN junction diode.
2. Diode characteristics and regulator using ZENER diode.
3. V-I characteristics of LDR, SCR and UJT.
4. V-I characteristics of DIAC and TRIAC.
5. Verifications of KVL & KCL
6. Verifications of Thevinin & Norton theorem
7. Verifications of Super Position, Maximum Power Transfer & Reciprocity Theorem

LIST OF EXPERIMENTS (Software using PSPICE / Any Public Domain or Commercial Software)

8. Drain and transfer characteristics of FET.
9. Input - Output characteristics and frequency response of CE, CB and CC configurations.
10. Frequency response of CS and CD amplifiers.
11. Observe the resultant waveform for Half-wave rectifier with and without filter.
12. Observe the resultant waveform for Full-wave and bridge rectifier with and without filter.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS, 2 STUDENTS / EXPERIMENT:

BC 107, BC 148,2N2646,BFW10, LDR, NTE6408, BT136	- 25 each
1N4007, Zener diodes	- 25 each
Resistors, Capacitors, Inductors	- sufficient quantities
Bread Boards	- 15 Nos
CRO (30MHz)	- 10 Nos.
Function Generators (3MHz)	- 10 Nos.
Dual Regulated Power Supplies (0 - 30V)	- 15 Nos.
Voltmeter (0-1), (0-15)	- 25 each
Ammeter (0-50mA) (0-100mA) (0-500µA)	- 25 each
Standalone desktop PCs with PSPICE software	- 15 Nos
Multimeter	- 15 Nos

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Identify various semiconductor devices.
2. Interpret the characteristics of semiconductor devices.
3. Apply the basic knowledge on semiconductor devices for basic switching applications.
4. Select a right semiconductor device for a given application.
5. Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

SEMESTER III

U20MA301 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C

4 0 0 4

Pre Requisites: Integral Calculus, Ordinary differential equations, Complex variables

COURSE OBJECTIVES:

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

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Origin of partial differential equations, its order and degree, concept of solution in PDE - Solutions of standard types of first order partial differential equation - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

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

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

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

UNIT IV FOURIER TRANSFORMS 12

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

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to:

1. Understand how to solve the given standard partial differential equations.

2. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
3. Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
5. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS :

1. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3. Veerarajan, T., 'Engineering mathematics’, Tata McGraw-Hill(Education) India Pvt.Ltd, 2006.
4. Kandasamy P., Thilagavathy K., and Gunavathy K., “ Engineering Mathematics” Volume III, S. Chand & Company Ltd., 2011.

REFERENCES :

1. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Venkatraman, M.K., ‘ Engineering Mathematics Vol.4’, National publishing company, 2004.
3. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
4. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
5. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
6. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.

U20EC301 **SIGNALS AND SYSTEMS**

L	T	P	C
3	1	0	4

Pre-requisite: Integration, Differentiation & Complex Numbers.

COURSE OBJECTIVES:

1. Understand about various types of signals and systems, classify them, analyze them and perform various operations on them.
2. Realize use of transforms in analysis of signals and system.
3. Characterize LTI systems in the Time domain and various Transform domains.

UNIT I: CLASSIFICATION OF SIGNALS AND SYSTEMS (12)

Basic definitions - Classification of signals and systems - Signal operations and properties - Basic continuous time signals - signal sampling and quantization - discretization of continuous time signals - discrete time signals - Basic system properties - Representation of digital signals - Case study of different signals form communication and biomedical field.

UNIT II: ANALYSIS OF CONTINOUS TIME SIGNALS (12)

Representation of periodic functions - Fourier series - Fourier Transform - Laplace Transform - Relation between Laplace Transform and Fourier Transform – Transform properties.

UNIT III: ANALYSIS OF DISCRETE TIME SIGNALS (12)

DTFT- Properties of DTFT- Z Transform - Convergence of Z-Transform - Properties of Z-Transform - Inverse Z-Transform and solving difference equation using Z-Transform.

UNIT IV: LINEAR TIME INVARIANT - CT SYSTEMS (12)

Impulse response characterization and convolution integral for CT-LTI system - Properties of convolution - Fourier and Laplace transforms in analysis of CT systems - Block diagram representation.

UNIT V: LINEAR TIME INVARIANT - DT SYSTEMS (12)

Impulse response characterization and convolution sum – DTFT and Z transform analysis of recursive and non-recursive systems - Block diagram representation.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to:

1. Analyze the properties of signals & systems.
2. Analyze CT and DT signal.
3. Apply Fourier transform, Laplace transform and Z transform in signal analysis.
4. Analyze continuous time LTI systems using Fourier and Laplace Transforms.
5. Analyze discrete time LTI systems using Z transform.

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson limited,2013
2. Tarun Kumar Rawat Signals and Systems Oxford University press, 2010

REFERENCE BOOKS:

1. John Alan Stuller, An Introduction to Signals and Systems, Nelson, 2007
2. M.J.Roberts, Signals & Systems Analysis using Transform Methods & MATLAB, Tata McGraw Hill.2011
3. B.P Lathi Roger Green Signal processing and Linear Systems- Oxford University, press 2021.

U20EC302	ELECTRONIC CIRCUITS	L	T	P	C
		3	0	0	3

Pre-requisites: Semiconductor materials

COURSE OBJECTIVES:

- To study the working methods of biasing in transistors.
- To understand mid band analysis of amplifier circuits using small - signal equivalent circuit to determine gain input impedance and output impedance.
- To design and analyze Oscillator circuits
- To understand the concept of feedback amplifiers and study about the tuned amplifier circuits
- To understand the analysis of multi vibrator circuits and concepts of blocking Oscillators and time base circuits

UNIT I: TRANSISTORS AND BIAS STABILITY (9)

Principle of operation of PNP and NPN transistors - Transistor configurations and their characteristics - Principle of operation of JFET - JFET characteristics - Principle of operation of MOSFET - MOSFET characteristics - Bias stability Concepts - Fixed bias & collector to base bias of BJT - Voltage Divider bias of BJT - Source or self bias of FET amplifier - Bias Compensation, Diode compensation - Thermistor & Sensistor compensation.

UNIT II: SMALL SIGNAL ANALYSIS OF AMPLIFIERS (9)

Analysis of a Transistor amplifier using h-parameter model - Comparison of Transistor Amplifier Configurations - Simplified Calculation of CE model - Simplified Calculation of CB model - Small signal model of FET Amplifier - Comparison of BJT and FET model - High input resistance Transistor Circuits - Bootstrapping circuit - Darlington Circuit - Step response of Multistage amplifiers - Emitter coupled differential amplifier circuit - Use of constant current circuit to improve CMRR.

UNIT III: OSCILLATORS (9)

Classification of Oscillator, Condition for Oscillation- General form of LC Oscillator circuit- Analysis of LC oscillators: Hartley, Colpitt's and Clapp oscillators- RC oscillators: Phase shift oscillator, Wein bridge oscillator- Crystals Oscillator, Miller and Pierce Crystal oscillators, Frequency stability of oscillators.

UNIT IV: FEEDBACK AND TUNED AMPLIFIER (9)

Classification of basic amplifiers- Block diagram and transfer gain with and without feedback- General Characteristics of Negative feedback amplifiers-Effects of negative feedback on Input and output Resistance - Method of identifying four feedback topologies and feedback factors.

Single tuned amplifier- Double tuned amplifier- Effect of cascading single tuned and double tuned amplifiers on bandwidth - Stagger tuned amplifiers - Class C tuned amplifier.

UNIT V: MULTIVIBRATOR CIRCUITS AND TIMEBASE GENERATORS (9)

Collector coupled and Emitter coupled Astable multivibrator - Monostable multivibrator - Bistable

multivibrator, Triggering methods for Bistable multivibrator -Schmitt trigger circuit.- UJT Sawtooth waveform generator.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Discuss the stability factors of various biasing techniques used in BJT and FET.
2. Compute the hybrid model for different amplifiers.
3. Manipulate the high frequency analysis of single and multi stage amplifiers.
4. Illustrate the concept of Feedback amplifiers in Electronic Circuits
5. Demonstrate the working of blocking oscillators and time base circuits.

TEXT BOOKS:

1. Millman J and Halkias.C. Integrated Electronics, TMH, 2007.
2. Albert Malvino and David Bates,Electronic Principles,7th edition, McGrawHill, 2015,
3. David A. Bell, Electronic Devices & Circuits, 4th Edition, PHI, 2007.

REFERENCE BOOKS:

1. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd, 2012.
2. Sedra / Smith, “Micro Electronic Circuits” Oxford University Press, 2004.
3. Floyd, Electronic Devices, Sixth Edition, Pearson Education, 2002.

		L	T	P	C
U20EC303	**DIGITAL INTEGRATED CIRCUITS**	3	0	0	3

Pre-requisites: Logic gates and logic families

COURSE OBJECTIVES:

- To introduce the basics of logic gates, SOP, POS and their simplification techniques.
- To design and analyze various combinational and sequential class of simple and complex logic circuits and in-turn to provide a strong foundation to learn courses like Microprocessors, Microcontrollers and VLSI Design.
- To understand the concept of memories and programmable logic devices.

UNIT I: BOOLEAN SIMPLIFICATION & LOGIC FAMILY (9)

Review of Number Systems and Codes -Boolean Functions: Boolean Laws- Simplification using the Laws- Minterms- Maxterms- Sum of Product and Product of Sum forms – Simplification of Boolean expressions using Karnaugh Map – Quine McClusky Method -NAND, NOR Implementation-Digital Logic families: RTL - DTL – ECL – TTL – CMOS Logic Families- Characteristics -Comparison of IC Families.

UNIT II: COMBINATIONAL CIRCUITS (9)

Combinational Circuits: Half and full adder- Ripple carry adder- Carry look ahead adder-BCD adder-Half and full subtractor- Parallel adder/subtractor- BCD subtractor-Magnitude comparators-

Multiplexer-Demultiplexer- Encoder :Decimal to BCD-Octal to Binary- Priority encoder- Decoder :2-4 line,3-8 line,4-16 line-BCD to Decimal-BCD to seven segment-Code converters :Gray to Binary-Binary to Gray- Gray to BCD-Parity generator/checker-Implementation of Boolean functions using Multiplexer and demultiplexer.

UNIT III: SYNCHRONOUS SEQUENTIAL CIRCUIT (9)

Flip flops -Characteristics equation and excitation table-Master Slave Flip flops Realization of one flip flop using other flip flops-Shift registers:, Bi-directional Shift register and Universal Shift register using Multiplexer-**Counters:** Design of Synchronous counters and Asynchronous counters, Ring counter, Johnson counter, Sequence generator using counters and shift register-Finite State Machine (FSM): Basic Design Procedure-Mealy and Moore Machine.

UNIT IV: ASYNCHRONOUS SEQUENTIAL CIRCUIT (9)

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V: PLDs & MEMORIES (9)

Memories: Memory basics – Types of Memories: RAM, ROM, PROM, EPROM and Flash Memory – Memory expansion-Programmable Devices: SPLD: PAL, PLA, GAL and CPLD-FPGA-Implementation of combinational circuits using PLA and PAL - Design of 4 bit microprocessor.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Get a basic knowledge on the laws of binary logic and will also have an understanding of the various digital logic families.
2. Design various combinational logic circuits.
3. Analyze, design and implement the synchronous and asynchronous sequential circuits
4. Develop finite state machines.
5. Program programmable logic devices and design a processor.

TEXT BOOKS:

1. Albert Malvino Leach, Digital principles and Applications, 7th Edition, Tata Mc-Graw Hill, 2011.
2. Floyd.T.L, Digital Fundamentals, 10th Edition, Pearson Education, 2011.
3. Morris Mano.M, Digital Design, 4th Edition, Pearson Education, 2011.

REFERENCE BOOKS:

1. Thomas Floyd, Digital Fundamentals,11th edition, Pearson Education, 2014,
2. Salivahanan.S and Arivazhagan.S, Digital Electronics, 1st Edition, Vikas Publishing House Private Limited, 2012.
3. John M. Yarbrough,Digital Logic: Applications and Design,Cengage Learning, 2015.
4. Soumitra Kumar Mandal, Digital Electronics, McGraw Hill Education Private Limited, 2016.

U20EC304	ELECTRICAL ENGINEERING AND CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

Pre-requisites: Mathematics, Physics & Electric Circuit

COURSE OBJECTIVES:

- To impart knowledge on Constructional details, principle of operation, performance, starters and testing of D.C. machines.
- To impart knowledge on Constructional details, principle of operation and performance of transformers.
- To introduce the components and their representation of control systems.
- To learn various methods for analyzing the time domain response, frequency domain response and stability of the systems.

UNIT I: D.C. MACHINES (9)

Constructional details – emf equation –Methods of excitation – Self and separately excited generators –Characteristics of series, shunt and compound generators – Principle of operation of D.C. motor – Back emf and torque equation – Characteristics of series, shunt and compound motors – Starting of D.C. motors – Types of starters - Testing, brake test and Swinburne's test – Speed control of D.C. shunt motors.

UNIT II: TRANSFORMERS (9)

Constructional details –Principle of operation – emf equation – Transformation ratio –Transformer on no load – Parameters referred to HV/LV windings – Equivalent circuit – Transformer on load – Regulation – Testing – Load test, open circuit and short circuit tests.

UNIT III: COMPONENTS OF CONTROL SYSTEM (9)

Basic elements in control system, Mathematical modeling of electrical and mechanical systems (Translational and Rotational) – Analogous system – Block diagram representation of systems – Block diagram reduction techniques – Signal flow graph.

UNIT IV: TIME DOMAIN RESPONSE AND STABILITY ANALYSIS (9)

Standard test signals – First order system – Step, ramp and impulse response analysis – Second order system – Step response analysis – Steady state error – Generalized error coefficients – Controllers – Stability analysis – Routh Hurwitz criterion – Root locus method.

UNIT V: FREQUENCY DOMAIN ANALYSIS (9)

Frequency response analysis- Polar plots, Bode plot, Stability in frequency domain, Nyquist plots, Nyquist stability criterion.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand the principles and characteristics of motors.
2. Know the concepts of transformers.
3. Identify the various control system components and their representations

4. Analyze the various time domain parameters
5. Analysis the various frequency response plots and its system.

TEXT BOOKS:

1. S.K.Bhattacharya, Electrical Machines, Tata McGraw Hill Publishing company Ltd, 3rd edition, 2008.
2. Nagrath I.J.and M.Gopal Control Systems Engineering, 6th Edition, New Age Publications, 2018
3. Richard C. Dorf Robert H Bishop, Modern Control Systems, Pearson 13th Edition 2018

REFERENCE BOOKS:

1. Ogata Katsuhiko, Modern Control Engineering,5th Edition,Pearson 2015.
2. B. C. Kuo, Farid Golnarghi, "Automatic Control Systems", MCH, 10th edition, 2017.
3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. S.Salivahanan, Control System Engineering,Pearson, 2019.

		L	T	P	C
U20CS301	**DATA STRUCTURES AND OOPS**	3	0	0	3

Pre-requisites: C Language

COURSE OBJECTIVES:

- Design oops concepts and to create object and classes
- Solve exception handling techniques
- Apply various linear and non linear data structures in real time applications and projects
- Design algorithms to solve common tree and graph problems
- Identify algorithms for searching and sorting techniques.

UNIT I: DATA ABSTRACTION & OVERLOADING (9)

Overview of C++ – Structures – Class Scope and Accessing Class Members – Reference Variables – Initialization – Constructors – Destructors – Member Functions and Classes – Friend Function – Dynamic Memory Allocation – Static Class Members – Container Classes and Integrators – Proxy Classes – Overloading: Function overloading and Operator Overloading.

UNIT II: INHERITANCE & POLYMORPHISM (9)

Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Implicit Derived – Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding.

UNIT III: LINEAR DATA STRUCTURES (9)

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – – singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions

UNIT IV: NON-LINEAR DATA STRUCTURES (9)

Trees – Binary Trees – Binary tree representation and traversals – Application of trees: Set representation and Union-Find operations – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search - Connected components.

UNIT V: SORTING AND SEARCHING (9)

Sorting algorithms: Insertion sort - Quick sort - Merge sort - Searching: Linear search –Binary Search

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
2. Classify different types of inheritance and exception handling techniques
3. Understand basis data structures such as arrange, linked list, stack and queues
4. Solve problems using graphs trees and heaps
5. Understand the various sorting and searching techniques

TEXT BOOKS:

1. Deitel and Deitel, C++, How to Program, 5th Edition, Pearson Education, 2005.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 3rd Edition, Addison-Wesley, 2007.

REFERENCE BOOKS:

1. Bhushan Trivedi, Programming with ANSI C++, A Step-By-Step approach, Oxford University Press, 2010.
2. Goodrich, Michael T., Roberto Tamassia, David Mount, Data Structures and Algorithms in C++, 7th Edition, Wiley. 2004.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, 2nd Edition, Mc Graw Hill, 2002.
4. Bjarne Stroustrup, The C++ Programming Language, 3rd Edition, Pearson Education, 2007.
5. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, Fundamentals of Data Structures in C++, Galgotia Publications, 2007.

U20EC305 ANALOG AND DIGITAL CIRCUITS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisites: Semiconductor materials, Logic gates

COURSE OBJECTIVES:

- Study the Frequency response of CE, CB Amplifier.
- Study the Transfer characteristics of differential amplifier.
- Perform SPICE simulation of Electronic Circuits.

- Design oscillators and multivibrators.
- Design and implement the Combinational and sequential logic circuits.

LIST OF EXPERIMENTS (ANALOG)

1. Frequency Response of CE, CB amplifiers.
2. Differential Amplifiers - Transfer characteristics, CMRR Measurement.
3. Analysis of BJT with Fixed bias and Voltage divider bias using simulation software.
4. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software.
5. Sinusoidal waveform generators RC Phase shift oscillator and Wien Bridge Oscillator
6. Non-sinusoidal Waveform generators and converters (Astable, Monostable, Integrator & Differentiator).
7. Schmitt Trigger circuit.
8. Clippers and Clampers.

LIST OF EXPERIMENTS (DIGITAL)

9. Design and implementation of code converters using logic gates (i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa.
10. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483.
11. Design and implementation of Multiplexer and De-multiplexer using logic gates.
12. Design and implementation of encoder and decoder using logic gates.
13. Design and implementation of counters.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Design and Test BJT/JFET amplifiers.
2. Measure CMRR in differential amplifier.
3. Simulate and analyze amplifier circuits using PSpice.
4. Design and Test the digital logic circuits.
5. Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the equipment	Quantity
1.	CRO / DSO – 30 MHz	15 Nos.
2.	Signal Generator / Function Generator – 3 MHz	15 Nos.
3.	Dual Regulated Power Supplies – 0 to 30 V / Single mode power supply	15 Nos.
4.	Standalone Desktop PC's with SPICE software	15 Nos.
5.	Transistor / FET (BJT / NPN / PNP and NMOS / PMOS)	50 Nos.

6.	Components and accessories: Resistors, Capacitors, Inductors, Diodes, Zener diodes, Bread board	As required
7.	SPICE circuit simulation software – Any public domain or commercial software	-
8.	IC trainer kit	15 Nos.
9.	7 segment display	15 Nos.
10.	Multimeter	15 Nos.
11.	IC's: 7400, 7402, 7404, 7486, 7408, 7432, 7483, 74150, 74151, 74147, 7445, 7476, 7491, 555, 7494, 7447, 74180, 7485, 7473, 74138, 7411, 7474	Each 50 Nos.

U20CS302 **DATA STRUCTURES LABORATORY**

L	T	P	C
0	0	4	2

Pre-requisites: NIL

COURSE OBJECTIVES:

- To understand and implement basic data structures using C++.
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures.
- To implement searching and sorting algorithms.

LIST OF EXPERIMENTS

1. Basic Programs for C++ Concepts
2. Linked implementation of list ADT
3. Cursor implementation of list ADT
4. Array implementation of stacks ADT
5. Linked list implementation of stacks
6. Application of Stacks and Queues
7. Implementation of Tree Traversal
8. Implementation of Binary Search trees
9. Implementation of Linear search
10. Implementation of binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort.
12. Implementation Hash functions, collision resolution technique

TOTAL: 60 PERIODS

U20HS301 INTERPERSONAL SKILLS/LISTENING &SPEAKING

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

The Course will enable learners to:

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

UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

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

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

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

TOTAL :30 PERIODS

COURSE OUTCOMES:

Learners are able to:

1. Listen and respond appropriately.
2. Participate in group discussions

3. Make effective presentations
4. Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES:

1. Pease, Allan. 1998. Body Language: How to Read Others Thoughts by their Gestures. Suda Publications. New Delhi.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Robert M Sherfield and et al. “Developing Soft Skills” 4th edition, New Delhi: Pearson Education, 2009.
4. Robbins, S. P. and Hunsaker, Phillip, L. (2009). Training in Interpersonal skills. Tips for managing people at work. 5th ed. New Delhi: PHI Learning.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

SEMESTER IV

U20MA401	PROBABILITY AND RANDOM PROCESS	L	T	P	C
		4	0	0	4

Pre requisite: Basic probability, Multivariable Calculus

COURSE OBJECTIVES:

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

UNIT I PROBABILITY AND RANDOM VARIABLES 12

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

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

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

UNIT III RANDOM PROCESSES 12

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

UNIT IV CORRELATION AND SPECTRAL DENSITIES 12

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

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12

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

TOTAL : 60 PERIODS

COURSE OUTCOMES:

Learners are able to:

1. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
3. Apply the concept random processes in engineering disciplines.
4. Understand and apply the concept of correlation and spectral densities.
5. 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.

TEXT BOOKS:

1.Veerarajan, T., 'Probability, Statistics and Random Processes', Tata McGraw-Hill(Education) India Pvt.Ltd, 2006.

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

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

REFERENCES:

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

2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.

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

4. Stark. H. and Woods. J.W., —Probability and Random Processes with Applications to Signal Processing ", Pearson Education, Asia, 3rd Edition, 2002.

5. Kandasamy P., Thilagavathy K., and Gunavathy K., " Engineering Mathematics" Volume III, S. Chand & Company Ltd., 2011.

U20EC401	ANALOG INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

Pre-requisite: Electronic Circuits

COURSE OBJECTIVES:

- To study the basic principles, configurations and practical limitations of op-amp.
- To understand the various linear and non-linear applications of op-amp
- To analyze, the characteristics and applications of active filters, including the switched capacitor filter
- To understand the operation of the most commonly used D/A and A/D converter types and its applications.
- To understand the special functions if IC's using wave form generator.

UNIT I: IC FABRICATION AND CIRCUIT COFIGURATION FOR LINEAR ICS (9)

Advantages of ICs over Discrete Components - Manufacturing process of Monolithic ICs – Basic Operational Amplifier-IC741- Characteristics of Op-Amp-Functional Block Diagram- DC characteristics and AC characteristics- Current Mirror – Widlar Current Source – Wilson Current Source.

UNIT II: APPLICATIONS OF OPERATIONAL AMPLIFIERS (9)

Inverting amplifier, Non- Inverting amplifier - V-to-I and I-to-V Converters – Instrumentation amplifier - Log and Antilog amplifiers - Differentiator, Integrator - Comparators -Schmitt Trigger – Precision Rectifier – Low pass, High pass and Band pass Butterworth filters.

UNIT III: TIMER CIRCUITS ,VCO AND PLL (9)

IC 555 Timer– Astable and Monostable Multivibrators using IC555-Monolithic PLL IC565 – Voltage Controlled Oscillator(LM566) – Application of PLL: Frequency multiplication/division, Frequency Translation, AM detection, FM detection, FSK modulation/demodulation.

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

Introduction- Specifications of DAC / ADC, Sample and Hold circuit, D/A converter: Weighted Resistor type - R-2R Ladder type – Inverted R - 2R Ladder type. A/D Converters: Flash type - Successive Approximation type – Counter type - Dual Slope type.

UNIT V: WAVEFORM GENERATOR & SPECIAL FUNCTION ICs (9)

Square Wave Generator- Triangular Wave Generator- IC Voltage Regulators: Fixed (78XX,79XX) and Adjustable (LM317, LM337) Voltage Regulators – Switching Regulator (LM 2575 and LM 2577)- IC 723 general purpose regulator – LM392 (POWER AMPLIFIER), LM309 (VOLTAGE REGULATOR), LM723 (VOLTAGE REGULATOR), Power amplifier(LM3886) and Isolation Amplifier (IC7840)- Opto-couplers(4N25).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Discuss the op-amp's basic construction, characteristics, parameter limitations, various configurations and countless applications of op-amp.
2. Analyze the basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters.
3. Analyze the t timer circuits and PLL.
4. Discuss Analog to digital and Digital to Analog Convertors.
5. Analyze the special functions of IC's using wave form generator.

TEXT BOOKS:

1. D.Roy Choudhry, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd. 4th edition, 2014.
2. D. Roy Choudhary and Shail B. Jain, Linear Integrated Circuits, 4th edition, New Age International. 2015,
3. 3. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th edition, Pearson.2015,

REFERENCE BOOKS:

1. Sergio Franco, Design with operational amplifiers and analog integrated circuits, 3rd Edition, Tata McGraw-Hill, 2007.
2. David A.Bell,Operational Amplifiers and Linear IC's, 3rdEdition, Oxford University Press.2011,
3. Kenneth Martain, Analog Integrated Circuits Design, 2nd Edition Wiley, 2013
4. Gray and Meyer, Analysis and Design of Analog Integrated Circuits, Wiley International, 2005.

U20EC402	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

Pre-requisite: Circuits & Systems, Fourier Series & Transforms

COURSE OBJECTIVES:

- The fundamentals of basic communication system, types of noise affecting communication system and noise parameters.
- Need of modulation, sampling
- Generation and detection of pulse modulation techniques and multiplexing.
- Identification of the functions of different components.
- About representation of a digital signal using several modulation methods..

UNIT I: ANALOG COMMUNICATION (9)

Modulation –Types of modulation–Modulation index-Power and current relations-Generation of AM waves –DSB-SC, SSB-SC generation and detection– VSB and its applications to TV transmission-Demodulation of AM waves –FM and PM – Carson's rule – Spectrum of Narrow Band and Wide Band FM-Direct and Indirect method – Relationship between FM and PM –Demodulation of FM waves –Comparison of FM and PM.

UNIT II: TRANSMITTERS AND RECEIVERS (9)

AM transmitters-AM receivers-Receiver parameters-Super heterodyne receivers- SSB transmitter-SSB Receiver-Communication receiver - AGC - Squelch circuit-FM transmitters–Armstrong FM transmitter-FM stereo broadcasting-FM in TV broadcasting-FM receivers –Amplitude Limiter- FM stereo receiver-Noise in AM systems- DSB,SSB systems-Effect of noise on Angle modulation systems-Capture effect-Threshold effect - pre-emphasis & de-emphasis circuits.

UNIT III: FUNDAMENTALS OF DIGITAL COMMUNICATION (9)

Introduction to Digital Communication: sources and signals –Noise in communication systems–Distortion less transmission –Ideal filter– Sampling theorem - Sampling and Quantization—Types of sampling– Reconstruction.

Source and Error Control Coding: Entropy-Source encoding theorem-Shannon fano coding-Huffman coding-mutual information-channel capacity-Error Control Coding-linear block codes- cyclic codes.

UNIT IV: MODULATION AND DEMODULATION (9)

PAM–Differential Pulse Code Modulation (DPCM) – Delta modulation – Adaptive delta modulation-Inter Symbol Interference– Pulse shaping –Duo binary signalling – Eye patterns-Digital modulation formats – Coherent binary modulation/demodulation techniques – Coherent Quadrature modulation techniques – Non-coherent binary FSK – Differential PSK – M-ary modulation techniques – M-ary QAM.

UNIT V: MULTIPLEXING AND MULTIPLE ACCESS TECHNIQUES (9)

Allocation of the communication resources – FDM and TDM - FDMA TDMA and CDMA– Introduction to spread spectrum modulation –Pseudo noise sequence –Direct Sequence Spread Spectrum (DSSS)–Frequency Hopped Spread Spectrum (FHSS).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand different blocks in communication system and how noise affects communication using different parameters.
2. Sample analog signal and recover original signal without any distortion.
3. Differentiate between different pulse modulation and demodulation techniques and signal multiplexing for various applications.
4. Understand the basics of information theory, source coding techniques and calculate Entropy of source.
5. Understand the generation, detection signal space diagram, spectrum, bandwidth efficiency, and probability of error analysis of different band pass modulation techniques.

TEXT BOOKS:

1. Simon Haykin, Communication Systems, Michael Moher, 5th Edition, Wiley, 2019,
2. Sam K. Shanmugam, Digital and analog communication systems,Wiley,2017.
3. Taub, Haub Schilling .D.L, Goutamsaha, Principles of Communication Systems, 4th Edition, Tata McGraw Hill, 2013.

REFERENCE BOOKS:

1. Chandra Sekar.V, Analog Communication, Oxford University Press, 3rd impression, 2012.
2. B. P. Lathi, Modern digital and analog Communication systems, 3rd edition, Oxford University Press, 2015,.
3. Kennedy and George Davis, Electronic Communication Systems, 5th Edition, 2011.
4. Lathi.B.P and Zhiding, Modern digital and analog communication systems, 4th Edition, Oxford University Press, 2011.

		L	T	P	C
U20EC403	**ELECTROMAGNETIC FIELDS**	3	1	0	4

Pre-requisite: Electrical Sciences & Physics

COURSE OBJECTIVES:

- To Gain basic knowledge of static electric and magnetic field principles and related laws governing them.
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To derive wave equations for Electromagnetic wave propagation in free space and media.

UNIT I: STEADY ELECTRIC FIELDS (12)

Vector analysis- Co-ordinate systems-Coulomb's Law-Electric field intensity-Field due to continuous Volume charge distribution-Field due to line charge-Field due to sheet of charge-Electric flux-Gauss law-Application of Gauss law- Divergence theorem-Electric scalar potential-Equi-potential surface-Boundary conditions- Null Identities - Helmholtz theorem.'

UNIT II: STEADY MAGNETIC FIELDS (12)

Biot-Savart's Law - Ampere's circuital law-Stokes Theorem - Magnetic flux and flux density - Scalar and Vector potential – Magnetic Materials - Lorentz Force Equations - Force on a moving charge and differential current element – Magnetic Forces and Toques - Magnetic Boundary conditions-Magnetic circuits.

UNIT III: ELECTRIC AND MAGNETIC FIELDS IN MATERIALS (12)

Poisson's and Laplace equations - Capacitance of parallel plate-Capacitance of Coaxial cable-Parallel wire capacitance - Energy stored in electric field-Energy density - Boundary conditions - Inductance of transmission line- Faraday's law of electromagnetic inductance-Inductance and Mutual inductance – Energy stored in magnetic field-Energy density.

UNIT IV: TIME VARYING ELECTRIC AND MAGNETIC FIELDS (12)

Displacement current - Equation of continuity - Maxwell's equations – point form and Integral form - Poynting Theorem- power loss in a plane conductor – Instantaneous Average and complex Poynting Vector – Electromagnetic boundary conditions – Time harmonic fields.

UNIT V: ELECTROMAGNETIC WAVES (12)

Derivation of Wave equations – Uniform plane waves – wave equation in a phasor form – Plane waves in a lossless medium – Plane waves in a lossy medium (low loss dielectric and good conductors) – Group velocity – skin effect – Reflection of plane waves by a perfect dielectric – normal and oblique incidence – Brewster angle.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Basic knowledge of static electric and magnetic field principles and related laws governing them.
2. Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning.
3. Ability to derive wave equations for electromagnetic wave propagation in free space and media.
4. Ability to analyze the characteristics of wave propagation in parallel plate, rectangular and circular waveguides.
5. Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws.

TEXT BOOKS:

1. William H.Hayt, Engineering Electromagnetics, Tata McGraw-Hill, 2011.
2. Fawwaz T.Ulaby & Umberto Ravaioli, 7th Edition Pearson 2014
3. Edward.C.Jordan & Keith.G.Balmai, Electromagnetic Waves and Radiating Systems, Pearson, 2015.

REFERENCE BOOKS:

1. David K.Cheng, Field and Wave Electromagnetics, Pearson Edition, 2014.

2. M.N.O. Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th Edition., Oxford (Asian Edition), 2015.
3. Gottapu Sasibhushana Rao, Electromagnetic Field Theory and Transmission Lines, , Wiley,2012
4. Ghosh, Electromagnetic Field Theory, Tata McGraw-Hill, 2012.

U20HS202	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

Pre-requisite: Environmental Pollutions and awareness

COURSE OBJECTIVES:

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

UNIT I: ECO SYSTEMS AND BIODIVERSITY (9)

Definition – concept of an ecosystem– structure and function of an ecosystem - Oxygen cycle and Nitrogen cycle –energy flow in the ecosystem – ecological succession- structure and function of the (a) forest ecosystem (b) grassland ecosystem(c) desert ecosystem (d) aquatic ecosystems. Introduction- definition, classification of India–value of biodiversity-India as a mega-diversity nation – hot-spots of biodiversity– threats to biodiversity endangered and endemic species of India– conservation of biodiversity.

UNIT II: ENVIRONMENTAL POLLUTION (9)

Definition–causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management- disaster management: floods, earthquake, cyclone and landslides

UNIT III: NATURAL RESOURCES (9)

Forest resources-deforestation-Water resources-dams-benefits and problems–Mineral resources - mineral resources–Food resources–Energy resources, Land resources–Role of an individual in conservation of natural resources.

UNIT IV: GREEN CHEMISTRY (9)

Introduction, Principles, Toxicity-Green chemistry in Plastics, Energy, sustainable development – Controlled environmental agriculture Avoidance of toxic fictional group- reduce the toxic chemicals-

Advantage and disadvantages of protected cultivation- Green chemistry using the bio catalytic reactions- Fermentation and Bio transformations. Eco mark, Eco symbol, Green lable.

UNIT V: SOCIAL ISSUES AND ENVIRONMENT (9)

Human health Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment From unsustainable to sustainable development–water conservation, rain water harvesting, water shed management – resettlement and rehabilitation - Population growth, variation among nations– population explosion –family welfare programme human rights, consumerism-value education –HIV /AIDS –women and child welfare.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Explain why an ecosystem is an open system.
2. Public participation is an important aspect which serves the environmental Protection.
3. Public awareness of environmental is at infant stage.
4. Ignorance and incomplete knowledge has lead to misconceptions
5. Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCE BOOKS:

1. R.K.Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

		L	T	P	C
U20EC404	**INTEGRATED CIRCUITS AND SIMULATION LABORATORY**	0	0	4	2

Pre-requisite: Electronic Circuits

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS (DESIGN AND ANALYSIS)

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

LIST OF EXPERIMENTS (SIMULATION USING SPICE or MULTISIM)

8. Study of diode and transistor characteristics.
9. Design of Amplifiers.
10. Design of Oscillators.
11. Design of First order Active Filters.
12. Tuned Collector Oscillator.
13. Twin -T Oscillator / Wein Bridge Oscillator.
14. Double and Stagger tuned Amplifiers.
15. Analysis of power amplifier.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Analyze various types of feedback amplifiers.
2. Design tuned amplifiers, wave-shaping circuits.
3. Design multivibrator circuits
4. Design and simulate feedback amplifiers using SPICE Tool.
5. Design and simulate oscillators using SPICE Tool.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the equipment	Quantity
1.	CRO / DSO – 30 MHz	15 Nos.
2.	Signal Generator / Function Generator – 2 MHz	15 Nos.
3.	Dual Regulated Power Supplies – 0 to 30 V	15 Nos.
4.	Standalone Desktop PC's with SPICE software	15 Nos.
5.	Transistor / FET (BJT / NPN / PNP and NMOS / PMOS)	50 Nos.
6.	Components and accessories: Resistors, Capacitors, Inductors, Diodes, Zener diodes, Bread board	As required
7.	SPICE circuit simulation software – Any public domain or commercial software	-
8.	Digital Multimeter	15 Nos.
9.	Digital LCR meter	2 Nos.

U20EC405	ANALOG AND DIGITAL COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

Pre-requisite: NIL

COURSE OBJECTIVES:

- Design various elements of analog and digital communication systems.
- Simulate Error control coding schemes.
- Visualize the effects of sampling and TDM.

LIST OF EXPERIMENTS (DESIGN AND ANALYSIS)

1. Signal Sampling and reconstruction.
2. Amplitude modulation and demodulation.
3. Frequency modulation and demodulation.
4. Pulse code modulation and demodulation.
5. Delta modulation and Adaptive delta Modulation.
6. TDM and FDM.
7. Line Coding Schemes.
8. Simulation of BFSK modulation and Demodulation.
9. Simulation of BPSK modulation and Demodulation.
10. Simulation of FSK, QPSK and DPSK schemes.
11. Simulation of Error control coding schemes.
12. Communication link Simulation.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Design, construct and Test the circuit of Analog modulation and demodulation.
2. Design, construct and Test the circuit for Digital modulation and demodulation.
3. Design, construct and Test the circuit for Pulse modulation and demodulation.
4. Design and analyze the reconstruction of the signal from its samples.
5. Demonstrate their knowledge in base band signalling schemes through implementation of digital modulation schemes.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the equipment	Quantity
1.	Kits for signal sampling, TDM, AM, FM, PCM, DM and line coding schemes	As required
2.	CRO's / DSO's	15 Nos.
3.	Function generators	15 Nos.
4.	MATLAB or equivalent software package for simulation experiments	-
5.	PC's	15 Nos.

SEMESTER V

		L	T	P	C
U20EC501	**TRANSMISSION LINES AND WAVEGUIDES**	3	1	0	4

Pre-requisite: Electro Magnetic Fields

COURSE OBJECTIVES:

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To get acquaintance with RF system transceiver design

UNIT I: TRANSMISSION LINE THEORY (12)

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 Z_0 - 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 (12)

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 (12)

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: WAVEGUIDES (12)

General Wave behaviour along uniform guiding structures – Transverse Electromagnetic Waves, Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides.

UNIT V: FILTERS (12)

The neper - the decibel - Characteristic impedance of Symmetrical Networks – Current and voltage ratios - Propagation constant, - Properties of Symmetrical Networks – Filter fundamentals – Pass and Stop bands. Behaviour of the Characteristic impedance. Constant K Filters - Low pass, High pass band, pass band elimination filters - m -derived sections – Filter circuit design – Filter performance – Crystal Filters.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Explain the propagation characteristics of electromagnetic waves in transmission lines
2. Analyze signal propagation at Radio Frequencies
3. Solve the transmission line parameters using Smith chart
4. Describe the characteristics of guided waves between parallel planes, rectangular waveguide and circular waveguide. Calculate the resonance frequency of cavity resonators and the associated modal field.
5. Explain the various types of filters

TEXT BOOKS:

1. John D Ryder, "Networks lines and fields", Pearson, 2015
2. William H Hayt and Jr John A Buck, "Engineering Electromagnetics" Tata Mc Graw-Hill Publishing Company Ltd, New Delhi, 2008

REFERENCE BOOKS:

1. E.C.Jordan and K.G. Balmain, —Electromagnetic Waves and Radiating Systems 2nd Edition Pearson, 2015..
2. GSN Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, 2005.
3. Joseph Edminister, Schaum's Series, Electromegnetics, TMH, 2007.
4. N. Narayana Rao, "Elements of Engineering Electromagnetics"6thEdition Pearson,2006.

U20EC502 DIGITAL SIGNAL PROCESSING

L	T	P	C
3	1	0	4

Pre-requisite: Llinear algebra, Signals and systems

COURSE OBJECTIVES:

- To understand the concept of DFT and FFT algorithms.
- To study the design methods of digital filters.
- To know the finite word length effects in digital filters.
- To study the fundamentals of Multirate Digital Signal Processing.
- To study the Architecture and programming concepts of digital signal processors.

UNIT I: FAST FOURIER TRANSFORM (12)

Introduction to DFT – Efficient computation of DFT - Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Overlap add and save methods- Application of FFT Algorithms in Filtering.

UNIT II: DIGITAL FILTER DESIGN (12)

FIR filters: Linear phase filters, Gibbs phenomenon, Design of FIR filters using windowing techniques – Rectangular,-Hamming - Hanning and Blackman Window, Design of FIR filters using Frequency sampling technique, FIR filter structure-Direct form realizations.

IIR Filters: Design of analog Low Pass Butterworth and Chebyshev Filters – Impulse invariance technique – pre warping - bilinear transformation.

UNIT III: FINITE WORD LENGTH EFFECTS (12)

Fixed point and floating point number representations – Comparison – Quantization noise – derivation for quantization noise power –Direct & Cascade Form- truncation and rounding error –input quantization error- product quantization error- coefficient quantization error – limit cycle oscillations-dead band- signal scaling.

UNIT IV: MULTIRATE DIGITAL SIGNAL PROCESSING (12)

Introduction to Multirate signal processing- Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor - Sampling rate conversion by a rational factor - Multistage implementation of sampling rate conversion - Applications of Multirate signal processing.

UNIT V: DIGITAL SIGNAL PROCESSORS (12)

Architectural Features – Harvard, Von-Neumann, VLIW architecture – MAC Unit - ALU – Pipelining- Architecture of TMS320C5x- instruction set - Addressing Modes – Architecture of TMS320C8x Processor- Application of DSP – Model of Speech Wave Form, Vocoders.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Compute DFT and FFT algorithms.
2. Design the FIR and IIR filters.
3. Analyze the quantization errors in filters and avoiding.
4. Understand the Multirate Digital Signal Processing.
5. Understand and write program using DSP Processors.

TEXT BOOKS:

1. Proakis & Monalakis, Digital signal processing Principles, Algorithms & Applications, , 4 th Edition,Pearson education. 2014
2. S.Salivahanan, Digital Signal Processing, 4th Edition, TMH/McGraw Hill International, 2019.
3. B.Venkataramani & M-Bhaskar- Digital Signal Processor Architecture Programming and Application- 2nd Edition, TMH 2017.

REFERENCE BOOKS:

1. S.K.Mitra, Digital Signal Processing 4th Edition, Tata McGraw-Hill- 2014
2. P.Ramesh Babu, Digital Signal Processing, 6th Edition, SEITECH, 2014
3. Allan V.Openheim, Ronald W.Sehafer, Discrete Time Signal Processing, 3rd edition-Pearson/Prentice Hall, 2014
4. A.Nagookani, Digital Signal Processing, 2nd Edition, McGraw Hill, 2017

U20EC503 PROCESSORS AND CONTROLLERS

L	T	P	C
3	0	0	3

Pre-requisite: Digital electronics

COURSE OBJECTIVES:

- To study the architecture and addressing modes of 8085 and to write assembly language programs of 8085.

- To study the architecture and addressing modes of 8086 and to write assembly language programs of 8086.
- To know the importance of different peripheral devices and their interfacing to 8085/8086.
- To study the architecture and addressing modes of 8051 and to write assembly language programs of 8051.
- To study multiprocessor and high end processor configurations.

UNIT I: THE 8085 MICROPROCESSOR (9)

Evolution of Microprocessors – Introduction to 8085 – Architecture – Pins and Signals –Addressing modes – Interfacing: Memory – I/O devices– Instruction Formats – Instruction Set – Timing Diagrams – Assembly Language Programming – Applications.

UNIT II: THE 8086 MICROPROCESSOR (9)

Introduction to 8086 Microprocessors – Architecture – Pin Configuration – Minimum and Maximum mode – Addressing modes – Memory organization – Timing diagram – Instruction set – Assembler directives & Operations – Assembly language programming – Procedures – Macros – Interrupts & Interrupt Service Routines – BIOS function calls – Concept and structure of Stack – Applications of 8086.

UNIT III: INTERFACING OF PERIPHERAL DEVICES (9)

8085 Interrupt – Interfacing of Data Converters – Programmable devices – Parallel & Serial I/O and Data Communication – Timer - Keyboard /Display controller – Interrupt controller – DMA controller – 8086 Interfacing of RAM and EPROM - I/O addressing - I/O mapped I/O - and memory mapped I/O schemes.

UNIT IV: THE 8051 MICROCONTROLLER (9)

Introduction to 8051 Microcontroller – Architecture - Pin diagram - Special Function Registers - Power Control Register - Program Protection Modes - Mode of Operations of I/O ports - External Memory Interface with 8051 – Counter and Timers in 8051 - Interrupts - Addressing modes - Instruction set - Assembly language programming of 8051 – Applications of 8051.

UNIT V: MULTIPROCESSOR & HIGH END PROCESSORS (9)

Coprocessor configuration – Closely coupled configuration – Loosely coupled configuration – 8087 Numeric data processor – Data types – Architecture – 8089 I/O Processor – Architecture – Communication between CPU and IOP. 32/64 Bit Processors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Write assembly language program in 8085 and 8086 for various applications.
2. Impart knowledge on the architecture and software aspects of microprocessor 8086.
3. Design the memory and IO interfacing with 8085, 8086 and 8051.
4. Give an overview on the architecture and basic concepts of microcontroller.
5. Write assembly language program in microcontroller 8051 for various application.

TEXT BOOKS:

1. Ramesh S. Gaonkar, Microprocessor – Architecture, Programming and Applications with the 8085, Penram International Publisher, 6th Edition, 2013
2. Ray.A.K. & Bhurchandi.K.M, Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing, Tata Mc Graw Hill,3rd Edition, 2017
3. Mohamed Ali Mazidi, Janice Gillispie Mazidi, The 8051 microcontroller and embedded systems using Assembly and C, 2ndedition, Pearson education /Prentice hall of India, 2007.
4. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design 2nd Edition, Pearson 2011

REFERENCE BOOKS:

1. Douglas V.Hall, Microprocessors and Interfacing: Programming and Hardware, 3rd edition, Tata Mc Graw Hill, 2017.
2. Mazidi M. A.,McKinley R. D., Causey D. Smith PIC Microcontroller And Embedded Systems, , Pearson Education International, 2008.
3. Martin Bates, PIC Microcontrollers, 3rd Edition,Elsvier 2012
4. Yn-cheng Liu,Glenn A.Gibson, Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design, 2ndedition, Pearson , 2015.

		L	T	P	C
U20EC504	**ADHOC AND SENSOR NETWORKS**	3	0	0	3

Pre-requisite: Nil

COURSE OBJECTIVES:

- Study the functions of different wireless architectures.
- Learn the various aspects of MAC protocols.
- Know the concept of Infrastructure Establishment.
- Gain various tools and platform in the networks.

UNIT I: AD-HOC AND SENSOR NETWORKS (9)

Introduction to Wireless communication Technology, characteristics features, applications, constraints and challenges, required mechanisms, difference between ad-hoc and sensor networks, enabling technologies, Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group Models

UNIT II: ARCHITECTURES (9)

Single Node Architecture -Hardware Components -Energy Consumption of Sensor -Nodes -Operating Systems and Execution Environments -Network Architecture-Sensor Network Scenarios -Optimization Goals and Figures of Merit -Gateway Concepts.

UNIT III: NETWORKING SENSORS (9)

Physical Layer and Transceiver Design Considerations -MAC Protocols for Wireless Sensor Networks -Low Duty Cycle Protocols and Wakeup Concepts -S-MAC -The Mediation Device Protocol -Wakeup Radio Concepts -Address and Name Management –Assignment of MAC Addresses -Routing Protocols of sensor networks

UNIT IV: SENSOR NETWORK MANAGEMENT **(9)**

Sensor Management - Topology Control Protocols and Sensing Mode Selection Protocols - Time synchronization - Localization and positioning – Operating systems and Sensor Network programming – Sensor Network Simulators.

UNIT V: SENSOR NETWORK PLATFORMS AND TOOLS **(9)**

Operating Systems for Wireless Sensor Networks-Sensor Node Hardware -Berkeley Motes Programming Challenges -Node level software platforms -Node level Simulators – NS2 and its extension to sensor networks - State centric programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Examine the various wireless sensor networking strategies.
2. Evaluate the different types of architecture used in sensor networks.
3. Analyze the technical issues related to networking of sensors.
4. Synthesize knowledge to control the sensor network.
5. Design and build a wireless sensor network using simulators.

TEXT BOOKS:

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.

REFERENCE BOOKS:

1. Kazem Sohraby-Daniel Minoli and Taieb Znati, Wireless Sensor Networks-Technology Protocols and Applications, John Wiley-2007.
2. Anna Hac, Wireless Sensor Network Designs, John Wiley-2003.
3. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.

U20EC505 COMMUNICATION NETWORKS AND ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite: Analog and Digital Communication

COURSE OBJECTIVES:

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

UNIT I: FUNDAMENTALS & LINK LAYER **(9)**

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

UNIT II: MEDIA ACCESS & INTERNETWORKING (9)

Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee - Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP).

UNIT III: ROUTING (9)

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

UNIT IV: COMPUTER ORGANIZATION & INSTRUCTIONS (9)

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uni-processors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

UNIT V: ARITHMETIC AND PROCESSOR OPERATION (9)

Fixed point Addition, Subtraction, Multiplication and Division. An Overview of Pipelining - Pipelined Data path and Control. Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to o

1. Identify the components required to build different types of networks.
2. Understand the protocols for user applications.
3. Describe data representation, instruction formats and the operation of a digital computer.
4. Discuss about implementation schemes of control unit and pipeline performance.
5. Explain the concept of various memories, interfacing and organization of multiple processors.

TEXT BOOKS:

1. Behrouz A. Forouzan, Data communication and Networking, 5th Edition, Tata McGraw Hill, 2013.
2. David A. Patterson and John L. Hennessey, Computer Organization and Design, 5th edition, Morgan Kauffman / Elsevier, 2014.
3. William Stallings, Computer Organization and Architecture, Designing for Performance, 10th Edition, Pearson Education, 2017.

REFERENCE BOOKS:

1. Govindarajalu, Computer Architecture and Organization - Design Principles and Applications, 2nd edition, McGraw-Hill Education India Pvt Ltd, 2014.
2. James F. Kurose, Keith W. Ross, Computer Networking - A Top-Down Approach Featuring the Internet, 7th Edition, Pearson Education, 2016.
3. Miles J. Murdocca and Vincent P. Heuring, Computer Architecture and Organization: An Integrated approach, 2nd edition, Wiley India Pvt Ltd, 2015.
4. Nader. F. Mir, Computer and Communication Networks, Pearson Prentice Hall Publishers, 2nd Edition, 2014.

U20EC506	PROCESSOR AND CONTROLLERS LABORATORY	L	T	P	C
		0	0	4	2

Pre-requisite: Electronic Devices and Circuits Lab

COURSE OBJECTIVES:

- Introduce Assembly Language Programming concepts and features.
- Write ALP for arithmetic and logical operations in 8085, 8086 and 8051.
- Understand Serial and Parallel Interface.
- Interface different I/Os with Microprocessors.

LIST OF EXPERIMENTS (PROCESSOR)

1. Programs for 16 bit Arithmetic operations (Using 8085, 8086 and MASM).
2. Programs for Sorting and Searching (Using 8085, 8086 and MASM).
3. Programs for String manipulation operations (Using 8085, 8086 and MASM).
4. Programs for Digital clock and Stop watch (Using 8085, 8086).
5. Interfacing ADC and DAC. (Using 8086 and MASM).
6. Interfacing and Programming 8279, 8259, and 8253.
7. Serial Communication between two MP Kits using 8251.
8. Parallel Communication between two MP Kits using Mode 1 and Mode 2 of 8255.
9. Interfacing and Programming of Stepper Motor and DC Motor Speed control.
10. Interfacing and Programming of Traffic light control

LIST OF EXPERIMENTS (SIMULATION USING MASM)

1. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 Micro controller.
2. Programming and verifying Timer operation in 8051 Micro controller.
3. Programming and verifying Interrupts operations in 8051Micro controller.
4. Programming and verifying UART operation in 8051Micro controller.
5. Communication between 8051 Microcontroller kit and PC.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Execute new assembly language programs using instruction sets of 8085, 8086 and 8051
2. Interface different I/Os with processor.
3. Generate waveforms using Microprocessors.
4. Execute Programs in 8051.
5. Recreate programs using the knowledge of instruction set of 8085, 8086 and 8051 with the help of trainer kit and MASM software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the equipment	Quantity
1.	8085, 8086, 8051 development kits	Each 30 Nos.
2.	Interfacing units: ADC, DAC, 8279, 8259, 8253, 8251, 8255, stepper motor, DC motor, traffic light control kit	Each 10 Nos.
3.	Intel desktop systems with MASM	30 Nos.
4.	8085, 8086 Assembler	-
5.	8051 cross Assembler	-

U20EC507	SIGNAL PROCESSING AND NETWORKING LABORATORY	L	T	P	C
		0	0	4	2

Pre-requisite: Signals and systems

COURSE OBJECTIVES:

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB.
- To implement FIR and IIR filters in MATLAB and DSP Processor.
- To study the architecture of DSP processor.
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts.
- Learn to communicate between two desktop computers.
- Learn to implement the different protocols.
- Be familiar with IP Configuration, the various routing algorithms and with simulation tools.

LIST OF EXPERIMENTS (SIGNAL PROCESSING USING MATLAB)

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

LIST OF EXPERIMENTS (NETWORKING)

7. Implementation of Error Detection/ Error Correction Techniques.
8. Implementation of Stop and Wait Protocol and sliding window.
9. Implementation of IP address configuration.
10. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.

11. Network Topology - Star, Bus, Ring.
12. Implementation of Link state routing algorithm.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Carryout basic signal processing operations.
2. Demonstrate their abilities towards MATLAB based implementation of various DSP systems.
3. Simulate& validate the various functional modules of a communication system.
4. Demonstrate their knowledge in baseband signalling schemes through implementation of digital modulation schemes.
5. Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system.
6. Simulate end-to-end communication Link.

SEMESTER VI

		L	T	P	C
U20EC601	**ANTENNA AND WAVE PROPAGATION**	3	1	0	4

Pre-requisite: Electromagnetic fields

COURSE OBJECTIVES:

- To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas.
- To analyze the characteristics of UHF, VHF and Microwave Antennas, their requirements, specifications, characteristics and design relations.
- To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
- To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), and estimate their characteristics, identifying their profiles and parameters involved.

UNIT I: BASICS OF ANTENNAS & WIRE ANTENNAS (12)

Basics of Antennas: Introduction, Basic Antenna Parameters – Radiation Patterns, Beam Area, Beam Efficiency, Radiation Intensity, Directivity-Gain-Resolution, Effective Apertures, Effective Height. Field Zones, Front-to-back Ratio.

Basics of Antennas & Wire Antennas: Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole, Loop Antennas – Introduction, Far Fields components and Radiation Resistances of Small Loop and Short Dipole. Method of Pattern Multiplication.

UNIT II: HIGH FREQUENCIES (VHF,UHF) AND MICROWAVE ANTENNAS – I (12)

Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas –Axial and Normal Modes of operation, Slot antenna & its pattern, Babinet's principle and complementary antennas, impedance of slot antennas. Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems. Lens Antennas - Introduction, Geometry of Non-metallic Dielectric Lenses, Zoning, Tolerances, Applications.

UNIT III: HIGH FREQUENCIES (VHF,UHF) AND MICROWAVE ANTENNAS – II (12)

Broadband antenna, Frequency independent antenna-log periodic antennas. Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features, Illustrative Problems.

UNIT IV: RADIO WAVE PROPAGATION (12)

Modes of propagation, Ground Wave Propagation, Structure of troposphere and ionosphere, Characteristic of Ionospheric layers, Sky wave propagation, Definitions for Virtual height, MUF and Skip distance, OWF, Fading, ionospheric absorptions, Multi-hop propagation, Space wave propagation and Super refraction.

UNIT V: ANTENNA MEASUREMENTS &ANTENNAS FOR SPECIAL APPLICATIONS (12)

Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate

System, Sources of Errors. Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements.

Antennas for special applications: Antennas design consideration for satellite communication, antenna for terrestrial mobile communication systems, GPR, Embedded antennas, UWB, Plasma antenna, Military application

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Identify and measure the basic antenna parameters.
2. Explain the radiation through antenna and identify different types of antennas based on frequency.
3. Design and analyze wire and aperture antennas.
4. Design and analyze matching and feeding networks for antennas.
5. Identify the characteristics of radio-wave propagation.

TEXT BOOKS:

1. C.A. Balanis, Antenna Theory, Wiley 4th Edition 2015.
2. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, PHI, 2nd ed. 2000.

REFERENCE BOOKS:

1. K.D. Prasad, Satya Prakashan, Antennas and Wave Propagation, Tech India Publications, New Delhi, 2008.
2. J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, Antennas and Wave Propagation, Mc Graw Hill Education, New Delhi, 4thed., (Special Indian Edition), 2010.
3. Sisir K Das, Antenna and Wave Propagation, MCH,2012.

U20EC602 VLSI CIRCUITS AND CAD DESIGN

L	T	P	C
3	0	0	3

Pre-requisite: Analog and digital electronic IC's

COURSE OBJECTIVES:

- To understand the concepts of MOS transistors operations and their characteristics and fabrication process of CMOS technology.
- To study the concepts of CMOS invertors and their sizing methods.
- To learn VLSI Design methodologies.
- To understand VLSI design automation tools.

UNIT I: MOS TRANSISTOR AND CMOS TECHNOLOGY (9)

MOS transistor theory – Introduction, Enhancement mode transistor action, Ideal I-V characteristics, DC transfer characteristics, Threshold voltage- Body effect- Design equations- Second order effects, CMOS technologies – P -Well process, N -Well process, twin - tub process, Technology – related CAD issues.

UNIT II: MICROWAVE SEMICONDUCTOR DEVICES (9)

CMOS logic structures, Switching characteristics transistor sizing, Power dissipation and design margining, Charge sharing, Scaling, Transmission gates, Static CMOS design, Dynamic CMOS design.

UNIT III: VLSI SYSTEM COMPONENTS CIRCUITS USIGN HDL (9)

Multiplexers, Decoders, comparators, priority encoders, Shift registers. Arithmetic circuits – Ripple carry adders, Carry look ahead adders, High-speed adders, Multipliers

UNIT IV: VLSI DESIGN METHODOLOGIES AND DESIGN RULES (9)

Introduction to VLSI Design methodologies, Basics of VLSI design automation tools, Layout Compaction, Design rules, Problem formulation, Algorithms for constraint graph compaction, Placement and partitioning, Circuit representation, Placement algorithms, Partitioning.

UNIT V: FLOOR PLANNING AND ROUTING (9)

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Explain the concepts of MOS transistors operations and their characteristics.
2. Explain the fabrication process of CMOS technology.
3. Outline floor planning and routing.
4. Explain Simulation and Logic Synthesis.
5. Discuss the hardware models for high level synthesis.

TEXT BOOKS:

1. Steven M.Rubin, Computer Aids for VLSI Design, Addison Wesley Publishing 1987.
2. "CMOS VLSI Design – A Circuits and Systems Perspective", Neil H. E. Weste, David Money Harris, 4th Edition, Pearson Education, 2015
3. Jan Rabaey, Anantha Chandrakasan, B Nikolic, Digital Integrated Circuits: A Design Perspective, 2nd Edition, Feb 2003, Prentice Hall of India.

REFERENCE BOOKS:

1. N.A. Sherwani, Algorithms for VLSI Physical Design Automation, Kluwer Academic Publishers, 2002.
2. S.H. Gerez, Algorithms for VLSI Design Automation, John Wiley & Sons, 2002.
3. Debaprasad Das, VLSI Design, 2nd edition,Oxford University Press, 2016

U20EC603 IMAGE AND VIDEO PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite: Linear algebra, differential equations, signals and systems, digital electronics, basic programming skills (C++, MATLAB)

COURSE OBJECTIVES:

- Learn digital image and video fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features and to estimate the video.

UNIT I: FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS (9)

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.

UNIT II: IMAGE PROCESSING TECHNIQUES (9)

Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation.

UNIT III: IMAGE COMPRESSION (9)

Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.

UNIT IV: BASIC STEPS OF VIDEO PROCESSING (9)

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.

UNIT V: 2-D MOTION ESTIMATION (9)

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Discuss digital image and video fundamentals.
2. Apply image enhancement and restoration techniques.
3. Use image compression and segmentation Techniques.
4. Represent features of images and video.
5. Explain the 2-D motion estimation process.

TEXT BOOKS:

1. Gonzaleze and Woods , Digital Image Processing, 4th edition , Pearson.2017
2. Ling Guan's, Multimedia and Video Processing, 2nd Edition, CRC Press, 2017.
3. A.L.Bovik, Hand Book of Image and Video Processing, 2nd Edition, Elsvier, 2005

REFERENCE BOOKS:

1. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002.
2. Chris Solomon, Toby Breckon,Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab, John Wiley & Sons, 2012.
3. Ranjan Parekh, Fundamentals of Image, Audio and Video Processing, CRC Press, 2021
4. William K. Pratt, Digital Image Processing, John Wiley, New York, 2002

U20EC604 SATELLITE COMMUNICATION AND REMOTE SENSING

L	T	P	C
3	0	0	3

Pre-requisite: Analog and Digital communication, Wireless Communication, RF and Microwave

COURSE OBJECTIVES:

- Understand the satellite segment and earth segment.
- Analyze the various methods of satellite access.
- Understand the applications of satellites.
- To learn Digital audio/video broadcasting using satellites.
- To Analysis the satellite images.

UNIT I: INTRODUCTION TO SATELLITE COMMUNICATION (9)

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits, Radio Wave Propagation: Introduction, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Other Propagation Impairments

UNIT II: SPACE SEGMENT (9)

Introduction, The Power Supply, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier, The Antenna Subsystem.

UNIT III: LINKS AND ACCESS (9)

The Space Link: Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio, The Uplink, Saturation flux density, Input backoff, Downlink, Output back-off, Combined Uplink and Downlink C/N Ratio

Satellite Access: Introduction, Single Access, Pre assigned FDMA, Demand-Assigned FDMA, Spade System, TDMA, Pre assigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code-Division Multiple Access

UNIT IV: DATA ACQUISITIONS (9)

Various types of platforms, different types of aircraft, manned and unmanned space crafts used for data acquisition - characteristics of different types of platforms - LANDSAT, SPOT, IRS, ERS, INSAT and other platforms. Data Acquisition Sensors (Visible & Infrared): Photographic products, Resolving power of lenses and films, Opto-mechanical / Electro optical sensors - spatial, spectral and radiometric resolution, Thermal sensors, Geometric Characteristics of thermal imagery, calibration of thermal scanner, signal to noise ratio.

UNIT V: DATA ANALYSIS (9)

Data Products and Their Characteristics, Data Pre-processing – Atmospheric, Radiometric, Geometric Corrections - Basic Principles of Visual Interpretation, Equipment for Visual Interpretation, Ground Truth, Ground Truth Equipment.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand the working and operation of various sub systems of satellite and the earth station.
2. Apply various communication techniques for satellite applications
3. Analyze and design satellite communication link
4. Identify the earth surface features from satellite images
5. Analyze the energy interactions in the atmosphere and earth surface features

TEXT BOOKS:

1. Jeremy E.Allnutt, Satellite Communication, 3rd Edition, Wiley, 2019.
2. Basudeb Bhatta, Remote Sensing and GIS, 3rd Edition, OUP India, 2021
3. Dennis Roddy, Satellite Communication, 4th Edition, McGraw Hill , 2017.
4. George Joseph and C jeganathan, Fundamentals of Remote Sensing, 3rd Edition, The Orient Blackswan, 2018.

.**REFERENCE BOOKS:**

1. B C Panda, Remote Sensing: Principles and Applications, Viva books, 2008
2. Thomas Lillesand & Kiefer R.W., Remote Sensing and Image Interpretation, 7th Edition, Wiely, 2015.
3. R N Muttagi, Satellite Communication Principles and Applications, 1st Edition OUP, 2016.
4. Dharma Raj Cheruku, Satellite Communication, 2nd Edition, Dreamtech Press, 2021.

		L	T	P	C
U20EC605	**ELECTRONIC SYSTEM DESIGN LABORATORY**	0	0	4	2

Pre-requisite: Analog circuit, digital communication, VLSI, Processor and controllers

COURSE OBJECTIVES:

- To understand the design procedure of different power supplies.
- To know to design transreceiver and voltage regulator
- To understand the working of Microprocessor and DSP based system design

LIST OF EXPERIMENTS

1. Design of a 4-20 mA transmitter for a bridge type transducer.
2. Design of AC/DC voltage regulator using SCR
3. Design of process control timer
4. Design of AM / FM modulator / demodulator
5. Programmable Logic Controller with Ladder Diagram.
6. PCB layout design using CAD
7. Microcontroller based systems design
8. DSP based system design
9. Psuedo-random Sequence Generator
10. Arithmetic Logic Unit Design

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Design different forms of power supply.
2. Design Voltage regulators
3. AM/FM transreceiver.
4. Know the design procedure of Instrumentation amplifier and Digital Indicator.
5. Learn CAD based PCB layout design.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the equipment	Quantity
1.	Digital Multimeter	15 Nos.
2.	CRO's / DSO's	15 Nos.
3.	Function generators	15 Nos.
4.	MATLAB or equivalent software package for simulation experiment	-
5.	PC's with Windows OS	15 Nos.
6.	PCB Layout software such as ORCAD	As required
7.	8051 Microcontroller kit	15 Nos.
8.	Stepper motor	15 Nos.
9.	Interface card	15 Nos.
10.	Transistor CL100	2 Nos.
11.	Relay	1 No.
12.	Diode IN4001	1 No.
13.	LED	1 No.
14.	Capacitor 100μF	1 No.
15.	Resistor: 4.7KOhm, 2.2 KOhm	Each 1 No.
16.	ADSP2181 Unit, ADSP2181 universal, IBM PC Keyboard	15 Nos.
17.	Single phase SCR Bridge converter trainer kit	15 Nos.
18.	Patch Cords	15 Nos.

U20EC606 VLSI AND IMAGE PROCESSING LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite: VLSI, digital signal processing

COURSE OBJECTIVES:

- To practice the basic image processing techniques.
- To understand the concepts of image restoration and segmentation.
- To explore the applications of image processing techniques.

- To learn Hardware Descriptive Language (Verilog/VHDL).
- To learn the fundamental principles of VLSI circuit design in digital and analog domain.
- To familiarize fusing of logical modules on FPGAs.
- To provide hands on design experience with professional design (EDA) platforms.

LIST OF EXPERIMENTS (IMAGE PROCESSING USING MATLAB)

1. Image sampling and quantization.
2. Histogram Processing.
3. Image Enhancement-Spatial filtering.
4. Image segmentation – Edge detection, line detection and point detection.
5. Basic Morphological operations.
6. Analysis of Images with colour Model.

LIST OF EXPERIMENTS (DIGITAL SYSTEM DESIGN USING HDL & FPGA)

7. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
8. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
9. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA Compare pre synthesis and post synthesis simulation.

LIST OF EXPERIMENTS (DIGITAL CIRCUIT DESIGN)

10. Design and simulate a CMOS Basic Gates & Flip-Flops.
11. Design and simulate a 4-bit synchronous counter using Flip-Flops.

LIST OF EXPERIMENTS (ANALOG CIRCUIT DESIGN)

12. Bandwidth and CMRR by performing Schematic Simulations.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Perform enhancing and segmentation operations on the image using spatial filters.
2. Write HDL code for basic as well as advanced digital integrated circuit.
3. Import the logic modules into FPGA Boards.
4. Synthesize Place and Route the digital IPs.
5. Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the equipment	Quantity
1.	Xilinx ISE /Altera Quartus / Equivalent EDA tools	10 user license
2.	Xilinx ISE /Altera Quartus / Equivalent FPGA	10 Nos.
3.	Personal computer	30 Nos.
4.	MATLAB	10 user license

SEMESTER VII

U20EC701	BROADBAND WIRELESS COMMUNICATIONS	L	T	P	C
		3	1	0	4

Pre-requisite: Antennas, modulation techniques and basics of digital communication techniques

COURSE OBJECTIVES:

- Know the characteristic of Multiple access Techniques
- Learn the Propagation principles
- Understand the concepts behind various digital signalling schemes for fading channels
- Be familiar the various Equalisation & Diversity techniques
- Understand the various multiple antenna systems
- Impart the new concepts in Advanced Wireless Communications

UNIT I: INTRODUCTION (12)

Introduction about wireless communication - technical challenges of wireless communication- applications, Cellular architecture - frequency reuse - channel assignment - handoff - coverage and capacity improvement, Multiple access Techniques- FDMA/CDMA/TDMA/SDMA.

UNIT II: PROPAGATION PRINCIPLES (12)

Propagation mechanisms - channel modelling methods - radio channels- indoor channels - outdoor channels - fading channels. Large scale path loss – path loss and propagation models -Free Space and Two-Ray models - small scale fading - types of small scale fading- parameters of mobile multipath channels - statistical models for multipath fading channels.

UNIT III: MODULATION AND DETECTION TECHNIQUES (12)

Structure of a wireless communication link - linear and constant envelope modulation techniques for wireless communication - Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, error performance in fading channel, Transmission System, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT IV: EQUALISATION & DIVERSITY TECHNIQUES (12)

Equalisation – 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: MIMO SYSTEMS (12)

Types of MIMO Systems: Beam forming - spatial multiplexing - basic space time code design principles- orthogonal and quasi orthogonal space time block codes- space time trellis codes - representation of space - performance analysis and comparison.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Characterize Multiple access Techniques
2. Design and implement various signaling schemes for fading channels

3. Compare Modulation and Detection techniques
4. Compare Equalisation & Diversity Techniques and analyze their performance
5. Design and implement systems with transmit/receive diversity and MIMO systems and analyze their performance

TEXT BOOKS:

1. Jiangzhou Wang, Broadband Wireless Communications, 1st Edition, Springer, 2013.
2. Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson, 2010.
3. Douglas H. Morais, Fixed Broadband Wireless Communications, 1st Edition, Prentice Hall, 2011

REFERENCE BOOKS:

1. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005.
2. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2009.
3. Andreas F. Molisch, Wireless Communications, 2nd Edition, Wiley, 2012.

		L	T	P	C
U20EC702	**MICROWAVE THEORY AND CIRCUITS**	3	1	0	4

Prerequisite: Electromagnetic fields, Antenna and wave propagation

COURSE OBJECTIVES:

- To acquire knowledge on passive microwave components and their S- Parameters.
- To be aware of working of Microwave semiconductor devices.
- To understand the various components of RF system for Wireless Communications.
- To know the basic techniques needed for analysis of RF systems.

UNIT I: MICROWAVE PASSIVE COMPONENTS (12)

Microwave frequency range - significance of microwave frequency range - important properties & applications of microwaves. Microwave junctions -Tee junctions -Magic Tee - Rat race - Corners - bends and twists - Directional couplers - two hole directional couplers- Ferrites - Termination - Gyrator- Isolator - Circulator - Attenuator - Phase changer – S Matrix for microwave components – Cylindrical cavity resonators. Filter design by insertion loss method-Butterworth and Chebyshev Filters.

UNIT II: MICROWAVE SEMICONDUCTOR DEVICES (12)

Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs - Principles of tunnel diodes - Varactor and Step recovery diodes – Transferred Electron Devices -Gunn diode, Avalanche Transit time devices- Reed diode, IMPATT and TRAPATT devices. Parametric devices -Principles of operation - applications of parametric Amplifier– Microwave monolithic integrated circuit (MMIC) - Materials and fabrication Techniques.

UNIT III: MICROWAVE TUBES AND MEASUREMENTS (12)

Microwave tubes- High frequency limitations - Principle of operation of Multicavity Klystron, Reflex Klystron, Traveling Wave Tube and Magnetron. Microwave measurements– power, wavelength, impedance, SWR, attenuation, Q and Phase shift.

UNIT IV: IMPEDANCE MATCHING AND AMPLIFIERS (12)

Review of S-parameters and Smith chart, Passive IC components, Impedance matching networks, Amplifiers**:** Common Gate, Common Source Amplifiers, OC Time constants in bandwidth estimation and enhancement, High frequency amplifier design, Low Noise Amplifiers: Power match and Noise match , Single ended and Differential schemes.

UNIT V: MIC COMPONENTS (12)

Introduction to MICs, Fabrication Technology, Advantages and applications, MIC components- Micro strip components, Coplanar circuits: Transistors, switches, active filters. Coplanar microwave amplifiers: LNA design and Medium power amplifiers.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Design active and passive microwave components.
2. Capability to design RF circuits.
3. Able to design impedance matching networks for any transmission line or system
4. Analyze RF circuits
5. Summarize the process, advantages and applications of microwave integrated components

TEXT BOOKS:

1. Samuel Y Liao, Microwave Devices & Circuits, Prentice Hall of India, 2006.
2. D.M.Pozar, Microwave Engineering, Wiley, Indian edition 2020.
3. Kyung-Whan Yeom, Microwave Circuit Design, 1st Edition, Pearson, 2015

REFERENCE BOOKS:

1. Annapurna Das and Sisir K Das, Microwave Engineering, 3rd Edition, Tata Mc Graw Hill, 2017.
2. R.S.Rao, Microwave Engineering, 1st Edition, Prentice,2012
3. Robert E.Colin, Foundations for Microwave Engineering, Wiley, 2nd Edition, 2007.

		L	T	P	C
U20EC703	**FIBER OPTIC COMMUNICATION AND NETWORKS**	3	0	0	3

Prerequisite: Digital communication and basics of networks

COURSE OBJECTIVES:

- Gain the knowledge about optical fiber sources and transmission techniques.
- Learn the principle of light propagation through optical fibers.
- Understand signal distortion mechanisms in the fiber.
- Study optical transmitters and receivers for fiber /free space links.
- Acquire optical network concepts and components involved.

UNIT I: OVERVIEW OF OPTICAL FIBER COMMUNICATION (9)

Introduction Historical development general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.

UNIT II: OPTICAL SOURCES AND COUPLING (9)

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-Lensing Schemes- Fiber-to-Fiber Joints-Fiber splicing-Signal to Noise ratio-Detector response time.

UNIT III: TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS (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 IV: FIBER OPTIC RECEIVER AND MEASUREMENTS (9)

Fundamental receiver operation- 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)

SONET / SDH- WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, Isolators and circulators, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, -Optical CDMA-Ultra High Capacity Networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Examine the various optical fiber modes, configurations.
2. Evaluate the various signal degradation factors associated with Optical fiber.
3. Apply the various optical sources and optical detectors and their use in the optical communication system.
4. Compare the fiber optic receiver and measurements.
5. Analyze the digital transmission and its associated parameters on system performance.

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communication, 5th Edition, McGraw -Hill International 2017.
2. John M.Senior, Optical Fiber Communication, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS:

1. Ramaswami, Sivarajan and Sasaki, Optical Networks, Morgan Kaufmann, 2009.
2. Govind P. Agrawal, Fiber Optic Communication Systems, 4th Edition, Wiley, 2012.
3. Gupta S.C., Optical Fiber Communication and Its Applications, 2nd Edition, PHI, 2012

U20EC704	REAL TIME SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Prerequisite: Microprocessors ,operating systems and C programming

COURSE OBJECTIVES:

- To study the basic concepts of ARM processors.
- To understand the computing platform and design analysis of ARM processors.
- To study the concepts of Operating systems in ARM.
- To study the concept of embedded networks.
- To understand case studies related to embedded systems.

UNIT I: INTRODUCTION TO ARM PROCEESORS (9)

Fundamentals of ARM, ARM Instruction set, Thumb Instruction set, ARM assembly language programming, Digital Signal Processing in ARM, Exceptions & Interrupt Handling.

UNIT II: COMPUTING PLATFORM AND DESIGN ANALYSIS (9)

CPU buses – Memory devices – I/O devices – Memory Protection Units – Memory Management Units – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT III: PROCESS AND OPERATING SYSTEMS (9)

Multiple tasks and multi processes – Processes – Context Switching – Scheduling policies - Multiprocessor – Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes – Firmware and Operating Systems for ARM processor.

UNIT IV: HARDWARE ACCELERATES & NETWORKS (9)

Accelerators – Accelerated system design – Distributed Embedded Architecture – Networks for Embedded Systems – Network based design – Internet enabled systems.

UNIT V: CASE STUDY (9)

Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set–Top–Box. – System-on-Silicon – FOSS Tools for embedded system development.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Analyze the embedded systems specifications and develop software programs
2. Revise computing platform and design analysis
3. Demonstrate multiple tasks and multi processes
4. Discuss hardware and software co-design
5. Evaluate the requirements of programming embedded systems

TEXT BOOKS:

1. Wayne Wolf, Computers as Components - Principles of Embedded Computer System Design, Morgan Kaufmann Publisher, 2006.
2. Philip A. Laplante, Real Time System Design and Analysis, 4th Edition, Wiley, 2013

REFERENCE BOOKS:

1. David E-Simon, An Embedded Software Primer, Pearson Education, 2007.
2. K.V.K.K.Prasad, Embedded Real-Time Systems: Concepts, Design & Programming, dream tech press, 2005.
3. Barry Crowley, Modern Embedded Computing, Morgan Kaufmann Publishers, 2012.

		L	T	P	C
U20EC705	**MICROWAVE AND OPTICAL LABORATORY**	0	0	4	2

Prerequisite: Ni**l**

COURSE OBJECTIVES:

- Understand measurement of antenna parameters and application of basic theorems in analyzing radiation characteristics of antenna.
- Design and implement antennas using EM simulation tools.
- Know about the behaviour of microwave components.
- Practice microwave measurement procedures

LIST OF EXPERIMENTS (SIGNAL PROCESSING USING MATLAB)

1. Study and plot the radiation pattern of Half Wave dipole antenna
2. Study and plot the radiation pattern of folded dipole antenna
3. Study and plot the radiation pattern of 5 Element Yagi Uda antenna
4. Study and plot the radiation pattern of Log Periodic antenna
5. Study and plot the radiation pattern of helical antenna
6. Study and Plat the Radiation Pattern of Horn Antenna
7. S - Parameters Measurement of Directional Coupler
8. S - Parameters Measurement of Isolator and Circulator
9. S - Parameters Measurement of Magic Tee
10. S – Parameters Measurement of Micro Strip Devices

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Demonstrate the structure and operation of various antennas and to describe their parameters.
2. Apply basic theorems to analyze the variation of field strength of radiated waves.
3. Measure the radiation pattern of wired, aperture, planar and array antennas.
4. Familiar with EM simulation tools to implement antenna prototypes.
5. Measure the frequency and wavelength of an antenna

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the equipment	Quantity
1.	Microwave test bench at X band to determine directional coupler characteristics	2 Nos.
2.	Microwave test bench at X band and Antenna turn table to measure radiation pattern of Horn antenna, Log periodic antennas, Helical antennas, Half wave dipole antennas, Folded dipole antennas, Yagi Uda antennas	Each 2 Nos.
3.	Microwave test bench at X band to determine VSWR for Isolator and Circulator, VSWR meter, Isolator, Circulator, Magic Tee	2 Nos.

PROFESSIONAL ELECTIVE – I

SEMESTER IV

		L	T	P	C
U20EC411	**MEASUREMENT AND INSTRUMENTATION**	3	0	0	3

Prerequisite : Basic principles of Electrical Engineering, Analog & Digital Electronics

COURSE OBJECTIVES:

- To learn basic measurement concepts.
- To make the students to have a clear knowledge about the instruments and their working.
- To provide ample knowledge in electrical instruments and measurements techniques.
- Emphasis is laid on analog and digital techniques used to measure voltage, current and power.

UNIT I: BASICS OF MEASUREMENT (9)

Measurement System -Instrumentation - Characteristics of measurement systems -Static and Dynamic - Errors in Measurements - Calibration and Standards.

UNIT II: INDICATING INSTRUMENTS (9)

D'ARSONAL Galvanometer- PMMC Mechanism- DC Ammeters and voltmeters- AC current and voltage measurements-RLC measurements-using ac and dc bridges-measurement of incremental inductance and low capacitances-AC voltmeters using rectifiers- digital voltmeters- Q meters-RF power and voltage measurement-high frequency measurement of inductances and capacitances.

UNIT III: INSTRUMENTS FOR SIGNAL GENERATION AND ANALYSIS (9)

Introduction- Sine wave generator- frequency synthesized signal generator-pulse and square wave generator-Wave analyzers-harmonic distortion analyzer-spectrum analyzer- heterodyne wave analyzer-frequency counter and time interval measurement- Block diagram of General Purpose Oscilloscope Measurement of voltage, current , phase and frequency using CRO.

UNIT IV: ANALOG AND DIGITAL DATA ACQUISITION SYSTEMS (9)

Components of analog and digital data acquisition systems Instrumentation Systems-Interfacing transducers to Electronic control and measuring instruments-Multiplexing-Types of multiplexing systems-Uses of data acquisition systems-Use of recorders in digital systems-Digital recording systems-Input conditioning systems-- digital data acquisition systems digital display units-segmental display-liquid crystal displays.

UNIT V: VIRTUAL INSTRUMENTATION (9)

Introduction to Virtual Instrumentation – Basics of LABVIEW – FOR and WHILE loops – Structures – Arrays and Clusters – Graphs and Charts – Introduction to DAQ – Data Acquisition with LABVIEW.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Knowledge on the basics of measurement and digital Instruments.
2. An in-depth knowledge on ac and dc bridges for measurement.
3. Basic knowledge on the working principles of signal analyzers and oscilloscopes.
4. Explain the digital instruments, data display and recording Systems.
5. Summarize the concepts of LABVIEW

TEXT BOOKS:

1. Albert D Helfrich, Cooper. W.D Electronic Instrumentation and Measurement Techniques Prentice Hall of India, New Delhi, 2009.
2. Sawhney A K, A course in Electrical and Electronic Measurement and instrumentation, Dhanpat Rai and Sons, New Delhi, 2000.

REFERENCE BOOKS:

1. Garry M Johnson, Lab View Graphical Programming, Tata McGraw Hill, New Delhi, 2010.
2. Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Eduation, New Delhi, 2008.
3. Jovitha Jerome, Virtual Instrumentation Using Lab View, Prentice Hall of India, New Delhi, 2010.

		L	T	P	C
U20EC412	**SENSORS AND TRANSDUCERS**	3	0	0	3

Prerequisite : Knowledge in Basic electrical and electronics engineering

COURSE OBJECTIVES:

- To understand basic principles of transducers and sensing various parameters.
- To develop mathematical background of sensor design.
- To Learn selection of sensors for typical applications

UNIT I: INTRODUCTION (9)

Measurement and measurement system, industrial measuring parameters and their units, definitions of sensors and transducers, classification of transducers, static and dynamic characteristics, selection criteria, importance.

UNIT II: DISPLACEMENT MEASUREMENT (9)

Resistive: Potentiometer, Strain gauges, Inductive: LVDT and Eddy current type , Capacitive: Capacitance pickups, Differential capacitive type, Piezoelectric, Ultrasonic transducers and Hall effect transducers, Optical transducer

UNIT III: FORCE, MAGNETIC AND HEADING SENSORS (9)

Strain Gauge, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV: OPTICAL, PRESSURE AND TEMPERATURE SENSORS (9)

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure –Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD,Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V: SIGNAL CONDITIONING AND DAQ SYSTEMS (9)

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Knowledge on basic principles of transducers and sensing various parameters.
2. Expertise in various calibration techniques and signal types for sensors
3. Apply the various sensors in the Automotive and Mechatronics applications
4. Study the basic principles of various smart sensors.
5. Implement the DAQ systems with different sensors for real time applications

TEXT BOOKS:

1. Ernest O Doebelin, Measurement Systems – Applications and Design, Tata McGraw-Hill, 2009.
2. Sawney A K and Puneet Sawney, A Course in Mechanical Measurements and Instrumentation and Control, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCE BOOKS:

1. Patranabis D, Sensors and Transducers, 2nd Edition, PHI, New Delhi, 2010.
2. Richard Zurawski, Industrial Communication Technology Handbook, 2nd edition, CRC Press, 2015.
3. I R Sinclair, Sensors and Transducers, 3rd Edition, Newnes Oxford, 2001

U20EC413 INFORMATION THEORY AND CODING

L	T	P	C
3	0	0	3

Prerequisite: Probability and Random Processes, Digital Communications

COURSE OBJECTIVES:

- To understand error–control coding.
- Be familiar with the methods for the generation of the codes and their decoding techniques.
- Be aware of compression and decompression techniques.
- Learn the concepts of multimedia communication.

UNIT I: INFORMATION ENTROPY FUNDAMENTALS (9)

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II: DATA AND VOICE CODING (9)

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III: ERROR CONTROL CODING (9)

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

UNIT IV: COMPRESSION TECHNIQUES (9)

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V: AUDIO AND VIDEO CODING (9)

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Learn the fundamentals of information
2. Summarize various modulation techniques used in information coding
3. Design an application with error–control.
4. Use compression and decompression techniques.
5. Apply the concepts of multimedia communication

TEXT BOOKS:

1. Simon Haykin, Communication Systems, 4th Edition, John Wiley and Sons, 2001.
2. Fred Halsall, Multimedia Communications, Applications Networks Protocols and Standards, Pearson Education, Asia 2002.

REFERENCE BOOKS:

1. Information Theory, Coding and Cryptography, Ranjan Bose, Tata McGraw Hill, 2012.
2. Information Theory and Cryptography, Arijit Saha, Nilotpal Manna, Surajit Mandal Pearson ,2013.
3. Watkinson J, Compression in Video and Audio, Focal Press, London, 1995.

U20EC414 HIGH SPEED NETWORKS

L	T	P	C
3	0	0	3

Prerequisite: Computer networks

COURSE OBJECTIVES:

- An overview of High speed computer networks and TCP/IP protocols.
- It also discusses the security and network management aspects.

UNIT I: HIGH SPEED NETWORKS – INTRODUCTION (9)

Frame relay networks – Asynchronous transfer mode – ATM protocol architecture – ATM logical connection– ATM cell – ATM service categories – AAL – High speed LANs – Fast ethernet, gigabit ethernet – Fiber channel – Wireless LANs– Applications – Requirements – Architecture of 802.11.

UNIT II: CONGESTION AND TRAFFIC MANAGEMENT (9)

Queuing analysis – Queuing models – Single server queues – Effects of congestion – Congestion control – Traffic management – Congestion control in packet switching networks – Frame relay congestion control.

UNIT III: TCP AND ATM CONGESTION CONTROL (9)

TCP flow control – TCP congestion control – Retransmission – Timer management – Exponential RTO backoff – KARN's algorithm – Window management – Performance of TCP over ATM – Traffic and congestion control in ATM – Requirements – Attributes – Traffic management frame work – traffic control – ABR traffic management – ABR rate control – RM cell formats – ABR capacity allocation – GFR traffic management.

UNIT IV: INTEGRATED AND DIFFERENTIATED SERVICES (9)

Integrated services architecture – Approach, components, services – Queuing discipline, FQ – PS – BRFQ – GPS – WFQ – Random early detection, differentiated services.

UNIT V: PROTOCOLS FOR QOS SUPPORT (9)

RSVP – Goals and characteristics – data flow – RSVP operations – Protocol mechanisms – Multi protocol label switching – Operations – Label stacking – Protocol details – RTP – Protocol architecture – Data transfer protocol – RTCP.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Learn High speed networks, Traffic and congestion management
2. Understand resource allocation and service management approaches
3. Study wireless network operations and functions
4. Explain various services that support high speed networks
5. Learn network management and its protocols

TEXT BOOKS:

1. Jean warland and Pravin Wadaja, High Performance Communication Networks, 2nd Edition, Jean Harcourt Asia Pvt. Ltd., 2001.
2. Williams Stallings, High Speed networks And Internet Performance and Quality of Service, Pearson 2nd Edition, 2002.

REFERENCE BOOKS:

1. Irvan Pepelnjk, Jim Guichard and Jeff Apcar, Mpls and Vpn Architecture, Volume 1 and 2, Cisco Press, 2003.
2. Adrian Farrel, The Internet And Its Protocols, Elsevier Publications, 2011.
3. Larry L. Peterson and Bruce S.Davie, Computer Networks, 3rd edition, Elsevier Publications, 2003.

U20HS401 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Prerequisite: Management concepts

COURSE OBJECTIVES:

- To enable the students to study the evolution of Management.
- To study the functions and principles of management.
- To learn the application of the principles in an organization.

UNIT I: INTRODUCTION (9)

Definition of Management –types of managers – managerial roles and skills – Evolution of Management – 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 – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III: ORGANISING (9)

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

UNIT IV: DIRECTING (9)

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

UNIT V: CONTROLLING (9)

Concept of control – Application of the process of control at different levels of management (top, middle and first line). Performance standards – Measurements of performance – Remedial action. An integrated control system in an organization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand of managerial functions like planning, organizing, staffing, leading & controlling.
2. Know the basics on international aspect of management.
3. Understand the concept of organization
4. Demonstrate the ability to directing, leadership and communicate effectively.
5. Analyze issues and formulate best control methods

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, Fundamentals of Management, 7th Edition, Pearson Education, 2011.
2. Robert Kreitner & Mamata Mohapatra, Management, Biztantra, 2008.
3. Chandrabose. D., Principles of Management and Administration, PHI 2002.

PROFESSIONAL ELECTIVE – II

SEMESTER VI

		L	T	P	C
U20EC621	**ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY**	3	0	0	3

Prerequisite: EM Waves & Transmission Lines, Antenna Wave Propagation

COURSE OBJECTIVES:

- To introduce the basic concepts of Electromagnetic Interference.
- To teach the importance of Electromagnetic Compatible designs.
- To explain the existing standards for Electromagnetic Compatibility.

UNIT I: BASIC CONCEPTS (9)

EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission and Susceptibility; Case Histories; Radiation Hazards to humans.

UNIT II: EMI COUPLING PRINCIPLES (9)

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling; Field to cable coupling; Power mains and Power supply coupling; Transient EMI, ESD

UNIT III: EMI CONTROL (9)

Shielding; EMI Filters; Grounding; Bonding; Isolation transformer; Transient suppressors; EMI Suppression Cables.

UNIT IV: EMC DESIGN FOR CIRCUITS AND PCBS (9)

Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and cross talk control; Component selection and mounting; PCB trace impedance; Routing; Power distribution decoupling; Zoning; Grounding; VIAs; Terminations.

UNIT V: EMI MEASUREMENTS AND STANDARDS (9)

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Line impedance stabilization networks; EMI Rx and spectrum analyzer; Civilian standards - CISPR, FCC, IEC, EN; Military standards-MIL461E/462.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Identify the various types and mechanisms of Electromagnetic Interference.
2. Propose a suitable EMI mitigation technique.
3. Summarize various interference controlling measures
4. Explain the EMC design process for circuits and PCB’s
5. Describe the various EMC Standards and methods to measure them.

TEXT BOOKS:

1. Clayton R. Paul, Introduction to Electromagnetic Compatibility, Wiley and Sons, 1992.
2. Prasad Kodali V., Engineering Electromagnetic Compatibility, S. Chand and Co, 2000.

REFERENCE BOOKS:

1. Donwhite Consultant Incorporate , Handbook of EMI / EMC, Vol I , 1985
2. Bemhard Keiser, Principles of Electromagnetic Compatibility, 3rd Edition, Artech House, 1994
3. Henry W.Ott., Noise Reduction Techniques in Electronic Systems, A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.

U20EC622	MULTIMEDIA COMPRESSION TECHNIQUES	L	T	P	C
		3	0	0	3

Prerequisite: Digital Communication & Digital Image Processing

COURSE OBJECTIVES:

- To gain knowledge about Multimedia components and characteristics.
- To understand various text and image compression algorithms.
- To know about audio and video compression techniques and standards.

UNIT I: MULTIMEDIA COMPONENTS (9)

Introduction- Multimedia skills-Multimedia components and their characteristics-Text, Sound, images, Graphics, Animation, Video, Hardware.

UNIT II: TEXT 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-LZW Compression- Entropy and Quality measures.

UNIT III: IMAGE COMPRESSION (9)

Approaches to image compression- Predictive Techniques- PCM, DPCM, DM- Progressive based compression- Vector quantization-Binary Tree Predictive-Quad trees-DCT coding-Wavelet methods-Filter banks-EZW, SPIHT- Compression standards.

UNIT IV: AUDIO COMPRESSION (9)

Audio compression-Companding laws-frequency domain filtering-Basic subband coding-application to speech coding- G.722-Application to Audio coding-MPEG Audio-Progressive encoding for Audio-Silence compression-Speech compression techniques-CELP Vocoders-LPC.

UNIT V: VIDEO COMPRESSION (9)

Video compression techniques-Standards-MPEG1, 2, 4, 7 Video coding-Motion estimation and compensation techniques-H.261-H.263.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Knowledge about Multimedia components and characteristics.
2. Exposure to various text and image compression algorithms.
3. Exposure to audio and video compression techniques and standards.

TEXT BOOKS:

1. Fred Halshall, Multimedia Communication- Applications, Networks, Protocols and Standards, Pearson education, 2007.

2. Khalid Sayood, Introduction to Data Compression, 3rd Edition, Morgan Kaufmann Series in Multimedia Information and Systems, 2006.

REFERENCE BOOKS:

1. K.R.Rao, Z.S.Bojkovic, D.A.Milovanovic, Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education 2007.
2. Ranjan Parekh, Principles of Multimedia, TMH, 2006.
3. Tay Vaughan, Multideai- making it work, 7/e, TMH, 2007.

U20EC623	MEMS AND NEMS	L	T	P	C
		3	0	0	3

Prerequisite: Basic mechanics, System modelling and Analysis

COURSE OBJECTIVES:

- Have a concept on the scope and recent development of the science and technology of micro- and nano-systems.
- Gain the physical knowledge underlying the operation principles and design of micro and nano-systems.
- Learn some typical or potentially applicable micro- and nano-systems at the frontier of the development of the field

UNIT I: OVERVIEW AND INTRODUCTION (9)

New trends in Engineering and Science: Micro and Nano scale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Micro electromechanical Systems, Applications of Micro and Nano electro mechanical systems, Micro electromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals.

UNIT II: MEMS FABRICATION TECHNOLOGIES (9)

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT III: MICRO SENSORS (9)

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor.

UNIT IV: MICRO ACTUATORS (9)

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators.

UNIT V: NANOSYSTEMS AND QUANTUM MECHANICS (9)

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Ability to understand the operation of micro devices, micro systems and their applications.
2. Ability to design the micro devices, micro systems using the MEMS fabrication process.
3. Gain knowledge of basic approaches for various sensor and actuator design.
4. Gain the technical knowledge required for computer-aided design, fabrication, analysis and characterization of nano-structured materials, micro- and nano-scale devices.
5. Comprehend the theoretical foundations of quantum mechanics and nano systems.

TEXT BOOKS:

1. Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley.
2. Stephen D. Senturia, Micro system Design, Kluwer Academic Publishers, 2001.

REFERENCE BOOKS:

1. Tai Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata Mcraw Hill, 2002.
2. Hans H. Gatzen, Volker Saile, JurgLeuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.
3. Chang Liu, Foundations of MEMS, Pearson education India limited, 2006.
4. www.tutorials point.com.

		L	T	P	C
U20EC624	**ELECTRONIC DESIGN AND AUTOMATION TOOLS**	3	0	0	3

Prerequisite: PSPICE, VERILOG, VHDL

COURSE OBJECTIVES:

- To study the features of various VLSI EDA Tools.
- To study the concepts of simulation and synthesis of HDLs.
- To understand the concepts of SPICE and circuit simulation using Spice.

UNIT I: BASICS OF EDA TOOLS (9)

VLSI Design Automation tools-An overview of the features of practical CAD tools – FPGA Technology & Tools – Model sim - Leonardo spectrum -Xilinx ISE - Quartus II – ASIC Technology & Tools – Pyxis, Cadence, Synopsys and Microwind.

UNIT II: BASICS OF VERILOG HDL AND MODELING (9)

Importance of HDL, Design Methodologies, Basic Concepts- Lexical Conventions- Data Types Verilog Operators- Modules and Ports - Types of Modeling- Gate-Level Modeling, Dataflow Modeling, Behavioural Modeling, Switch Level Modeling- Design Examples using Combinational & Sequential Logic.

UNIT III: ADVANCED VERILOG HDL AND VERILOG TEST BENCHES (9)

Finite State Machines (FSM) Synthesis in Verilog, Memory Design – Single Port and Dual Port SRAM, Tasks, Functions, User Defined Primitives (UDP)- Timing and Delays, Compiler Directives- Verilog Test Benches for Combinational Logic Modules and Sequential Digital Circuits, Applications oriented system design.

UNIT IV: ANALYSIS OF SPICE& LAYOUT DESIGN (9)

Introduction - Types of SPICE – Types of Analysis - Circuit description - DC circuit analysis Transient analysis - AC circuit analysis - Advanced spice commands and analysis – VLSI Layout – Design Rules – Stick Diagram – Example Layout of digital logic circuits using EDA Tools.

UNIT V: DESIGN FLOW IN AUTOMATION TOOLS (9)

Design flow in EDA tools for FPGA based design and ASIC based Design. Comparisons between PLDs CPLD and FPGAs - Interfacing Matlab Simulink with Xilinx ISE - DSP Application using Xilinx System Generator.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Explain various features of EDA tools.
2. Model the various Digital Circuits using HDL.
3. Select appropriate analysis for circuit design.
4. Sketch the Layout of simple logic circuits.
5. Comprehend the design of circuits using XILINX ISE

TEXT BOOKS:

1. Ming-Bo Lin, Digital System Designs and Practices using Verilog HDL and FPGAs, Wiley, 2012.
2. Samir Palnitkar, Verilog HDL, Pearson Education, 2nd Edition, 2004.

REFERENCE BOOKS:

1. M.H.Rashid, Spice for Circuits and Electronics using Pspice, PHI 1995.
2. M.J.S.Smith, Application Specific Integrated Circuits, Pearson Education, 2008.
3. J.Bhaskar, A VHDL Primer, Prentice Hall, 1998.
4. J.Bhaskar, A Verilog Primer, Prentice Hall, 2005.

		L	T	P	C
U20HS601	**PROFESSIONAL ETHICS**	3	0	0	3

Prerequisite: Ethics

COURSE OBJECTIVES:

- To gain knowledge of Engineering Ethics and their responsibility in society.
- To know about safety and risk assessment and benefit analysis.
- To know the employee responsibilities and rights.
- To follow the ethics of Engineers in global issues.

UNIT I: ENGINEERING ETHICS (9)

Senses of Engineering Ethics'-variety of moral issued-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 II: ENGINEERING AS SOCIAL EXPERIMENTATION (9)

Engineering as experimentation-engineers as responsible experimenters-codes of ethics- a balanced outlook on law-the challenger case study.

UNIT III: SAFETY (9)

Safety and risk-assessment of safety and risk-risk benefit analysis and reducing risk-the three mile island and Chernobyl case studies.

UNIT IV: RESPONSIBILITIES AND RIGHTS (9)

Collegiality and loyalty-respect for authority-collective bargaining-confidentiality-conflicts of interest occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V: GLOBAL ISSUES (9)

Multinational corporations-Environmental ethics-computer ethics-weapons development-engineers as managers- consulting engineers-engineers as expert witnesses and advisors-moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Apply ethics in society
2. Discuss the ethical issues related to engineering.
3. Knowledge on safety & risk assessment and benefit analysis.
4. Realize the employee responsibilities and rights.
5. Ability to follow the ethics of Engineers in global issues.

TEXT BOOKS:

1. Charles D.Fleddermann, Engineering Ethics, Pearson Education/Prentice Hall, New Jersey, 2004 (Indian Reprint)
2. Govindarajan M, Natarajan S, Senthil Kumar V.S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS:

1. Charles E Harris, Michael S.Protchard and Michael J Rabins, Engineering Ethics–Concepts and Cases, Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
2. John R Boatright, Ethics and the Conduct of Business, Pearson Education, New Delhi, 2003.
3. Edmund G Seebauer and Robert L Barry, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.

PROFESSIONAL ELECTIVE – III

SEMESTER VIII

		L	T	P	C
U20EC831	**RADAR SYSTEMS**	3	0	0	3

Prerequisite: Analog Communication & Antenna Theory

COURSE OBJECTIVES:

- To understand the basic concepts of radar signals and systems.
- To gain knowledge about radar transmitter and receiver.
- To understand the concepts of radar detection, tracking and measurement.

UNIT I: INTRODUCTION TO RADAR (9)

Fundamentals of Radar-Elements-Functions-System considerations- Radar Targets-Basic Principle. Radar equation. Radar cross section. Cross section of small targets. Target scattering matrices. Area and volume targets.

UNIT II: RADAR SIGNALS (9)

Real, Complex, Analytic Radar signals-Duration, Frequency, Bandwidth of radar signals. Ambiguity function and its properties. Uncertainty principle. Pulse compression-linear FM pulse-Pulse compression by Costas FM and binary phase coding.

UNIT III: RADAR TRANSMITTER AND RECEIVER (9)

Radar Transmitters- Introduction-Linear Beam Power Tubes-Solid State RF Power Sources-Magnetron Crossed Field Amplifiers-Other RF Power Sources-Other aspects of Radar Transmitter. Radar Receivers-The Radar Receiver-Receiver noise Figure-Super heterodyne Receiver-Duplexers and Receiver Protectors-Radar Displays.

UNIT IV: RADAR DETECTION (9)

Radar detection. Optimum Bayesian decision rules. Detection criteria for different target models.

UNIT V: MEASUREMENT AND TRACKING (9)

Range and Doppler measurements and tracking. Range and Doppler frequency resolutions. Optimum receivers. Optimum filters for Doppler measurements. Coherent and non coherent implementations. Angle measurement and tracking. Angle measurement and tracking by conical scan and mono pulse. Optimum mono pulse systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand the fundamentals of radar and their working
2. Know the concepts on radar signals and systems.
3. Expose towards radar transmitter and receiver.
4. Understand the concepts of radar detection
5. Summarize the tracking and measurement process

TEXT BOOKS:

1. Peyton Z.Peebles, Radar Principles, John wiley, 2004.
2. Merrill I. Skolnik, Introduction to Radar Systems, Tata McGraw-Hill, 3rd Edition, 2017.

REFERENCE BOOKS:

1. G S N Raju, Radar Enginnering, Wiley, 2020.
2. K K Sharma, Fundamentals of Microwave and Radar Engineering, S.Chand & Company, 2011.
3. J.CToomay, Principles of Radar, 2nd Edition, PHI, 2004.

U20EC832	SOFT COMPUTING	L	T	P	C
		3	0	0	3

Prerequisite: C Language, C++ and JAVA

COURSE OBJECTIVES:

- To learn the basic concepts of Soft Computing.
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

UNIT I: FUZZY SET THEORY (9)

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT II: OPTIMIZATION (9)

Importance of HDL, Design Methodologies, Basic Concepts- Lexical Conventions- Data Types Verilog Operators- Modules and Ports - Types of Modeling- Gate-Level Modeling, Dataflow Modeling, Behavioural Modeling, Switch Level Modeling- Design Examples using Combinational & Sequential Logic.

UNIT III: ARTIFICIAL INTELLIGENCE (9)

Introduction, Knowledge Representation – Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainity Basic knowledge Representation Issues Knowledge acquisition – Heuristic Search: Techniques for Heuristic search Heuristic Classification - State Space Search: Strategies Implementation of Graph Search Search based on Recursion Patent-directed Search Production System and Learning.

UNIT IV: NEURO FUZZY MODELING (9)

Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT V: APPLICATIONS OF COMPUTATIONAL INTELLIGENCE (9)

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Apply suitable soft computing techniques for various applications
2. Use fuzzy rules and reasoning to develop decision making and expert systems
3. Get an idea on artificial intelligence, various types of production systems, characteristics of production systems
4. Integrate various soft computing techniques for complex problems
5. Acquire knowledge on computational intelligence

TEXT BOOKS:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004, Pearson Education 2004
2. N.P.Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2006.

REFERENCE BOOKS:

1. Elaine Rich & Kevin Knight, Artificial Intelligence, 2nd Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
2. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2003.
3. Amit Konar, Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain, CRC Press, 2008.

U20EC833 DSP ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

Prerequisite: Digital Signal processing

COURSE OBJECTIVES:

- Basics on Digital Signal Processors
- Programmable DSP's Architecture, On-chip Peripherals and Instruction set
- Programming for signal processing applications
- Advanced Programmable DSP Processors

UNIT I: FUNDAMENTALS OF PROGRAMMABLE DSPs (9)

Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals, Applications of Programmable DSPs.

UNIT II: TMS320C5X PROCESSOR (9)

Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals, Application Programs for processing real time signals.

UNIT III: TMS320C6X PROCESSOR (9)

Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, On-chip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples for Signals and Noise generation, Frequency analysis, Filter design.

UNIT IV: ADSP PROCESSORS (9)

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V: ADVANCED PROCESSORS (9)

Study of TI‘s advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP‘s Blackfin and Sigma DSP Processors, NXP‘s DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Analyze the concepts of Digital Signal Processors.
2. Demonstrate their ability to program the DSP processor for signal processing applications.
3. Elucidate TMS320C5X processor architecture, addressing modes and tools
4. Explain TMS320C6X processor kit and on-board peripherals
5. Discuss, compare and select the suitable Advanced DSP Processors for real-time signal processing applications.

TEXT BOOKS:

1. J. B. Venkataramani and M. Bhaskar, Digital Signal Processors Architecture, Programming and Applications, Tata McGraw Hill Publishing Company Limited. New Delhi, 2003.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012.

REFERENCE BOOKS:

1. Rulph Chassaing and Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley & Sons, Inc., Publication, 2012 (Reprint).
2. User guides Texas Instruments, Analog Devices and NXP.

U20EC834	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

Prerequisite: Ethics

COURSE OBJECTIVES:

- Know the basic concepts of Intellectual Property.
- Know the various types of property.
- Understand and to be well versed with the conceptual, legal framework and procedural requirements relating to the facets of Intellectual Property Rights.
- Understand the various International Treaties on Intellectual Property Rights.
- Acquire knowledge of law and practice relating to Intellectual Property Rights in India.
- Apply the theoretical knowledge to solve the conflicts that arises in relation to Intellectual Property Rights.

UNIT I: INTRODUCTION (9)

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i) Movable Property (ii) Immovable Property and (iii) Intellectual Property.

UNIT II: PATENTS, COPYRIGHTS AND TRADEMARKS (9)

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

UNIT III: INTERNATIONAL STANDARDISATION (9)

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV: INDIAN STRATEGIES (9)

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V: CASE STUDIES (9)

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Define the basic concepts of Intellectual Property and various types of property.
2. Outline the registration process and enforcing Intellectual Property Rights.

3. Explain the treaties governing Intellectual Property Rights.
4. Identify the strategies adopted in India in relation to Intellectual Property.
5. Apply the knowledge of Intellectual Property Rights in solving the issues that rise in relation to Intellectual Property Rights.

TEXT BOOKS:

1. David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012.
2. Subbaram N.R. Handbook of Indian Patent Law and Practice, S. Viswanathan, Printers and Publishers Pvt. Ltd., 1998.

REFERENCE BOOKS:

1. Derwent IP Matters, Using the Internet for non-patent prior art searches, July 2000.
2. Dr. R, Radhakrishnan and Dr. S. Balasubramanian Intellectual Property Rights- Text and Cases, Excel Books,2008
3. Peter Groves, Sourcebook on Intellectual Property Law, Routledge-Cavendish, 1997.

U20EC835	TELECOMMUNICATION SYSTEM MODELING AND SIMULATION	L	T	P	C
		3	0	0	3

Prerequisite: LTI system, Probability Random Processes &Wireless communication

COURSE OBJECTIVES:

- To learn simulation of random variables and random process
- To learn modeling of radio communication channels.
- To understand various simulation techniques.
- To understand simulation methodologies and performance evaluation.
- To analyse some digital communication optical communication and satellite communication techniques as case studies through simulation.

UNIT I: SIMULATION OF RANDOM VARIABLES RANDOM PROCESS (9)

Generation of random numbers and sequence, Guassian and uniform random numbers Correlated random sequences, Testing of random numbers generators, Stationary and uncorrelated noise, Goodness of fit test.

UNIT II: MODELING OF COMMUNICATION SYSTEMS (9)

Radio frequency and optical sources, Analog and Digital signals, Communication channel and models, Free space channels, Multipath channel and discrete channel noise and interference.

UNIT III: ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION (9)

Quality of estimator, Estimation of SNR, Probability density function and bit error rate, Monte Carlo method, Importance sampling method, Extreme value theory.

UNIT IV: SIMULATION AND MODELING METHODOLOGY (9)

Simulation environment, Modeling considerations, Performance evaluation techniques, error source simulation, Validation.

UNIT V: CASE STUDIES (9)

Simulations of QAM digital radio link in environment, Light wave communication link and satellite system.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Apply the constituents of a telecommunication system.
2. Analyze various modeling methodologies and simulation techniques.
3. Estimate the performance measures of telecommunication systems.
4. Apply system modeling in telecommunication.
5. Demonstrate light wave communication and satellite communication systems.

TEXT BOOKS:

1. MC.Jeruchim, P.Balaban and Sam K Shanmugam, "Simulation of communication Systems: Modeling, Methodology and Techniques ", Plenum press , New York, 2001.
2. Jerry banks and John S.Carson, "Discrete Event System Simulation", Prentice Hall of India, 1984.

REFERENCE BOOKS:

1. Averill.M.Law and W.David Kelton,"Simulation Modeling and Analysis", McGraw-Hill Inc., 2000.
2. Geoffrey Gorden, "System Simulation", Prentice Hall of India, 2nd Edition, 1992.
3. W.Turin, "Performance Analysis of Digital Communication Systems", Computer Science Press, New York, 1990.

PROFESSIONAL ELECTIVE – IV

SEMESTER VIII

		L	T	P	C
U20EC841	**PHOTONIC NETWORKS**	3	0	0	3

Prerequisite: Physics, Fibre Optic Communication & Nanotechnology

COURSE OBJECTIVES:

- To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use.
- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue.
- To expose the student to the advances in networking and switching domains and the future trends.

UNIT I: OPTICAL SYSTEM COMPONENTS (9)

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT II: OPTICAL NETWORK ARCHITECTURES (9)

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture.

UNIT III: WAVELENGTH ROUTING NETWORKS (9)

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations- Linear Light wave networks, Logically Routed Networks.

UNIT IV: PACKET SWITCHING AND ACCESS NETWORKS (9)

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks, Contention Resolution Access Networks – Network Architecture overview, Optical Access Network Architectures and OTDM networks.

UNIT V: NETWORK DESIGN AND MANAGEMENT (9)

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface..

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Know the fundamental principles & techniques of optical fiber systems.
2. Understand the Photonic components in optical communication systems.
3. Use the backbone infrastructure for our present and future communication needs.
4. Analyze the architectures and the protocol stack.
5. Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods and network management and protection methods in vogue.

TEXT BOOKS:

1. Rajiv Ramaswami and Kumar N. Sivarajan, Optical Networks: A Practical Perspective, Harcourt Asia Pvt Ltd., 2nd Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, WDM Optical Networks: Concept, Design and Algorithms, Prentice Hall of India, 1st Edition, 2002.

REFERENCE BOOKS:

1. Biswanath Mukherjee, Optical WDM Networks, Springer Series, 2006.
2. P.E. Green, Jr., Fiber Optic Networks, Prentice Hall, NJ, 1993.

U20EC842 **THIN FILM TECHNOLOGY**

L	T	P	C
3	0	0	3

Prerequisite: Optical Analysis & Solar cell devices

COURSE OBJECTIVES:

- The course covers the importance of thin film technology and nanofabrication, vacuum technology, various physical and chemical methods of thin film a fabrication and various applications of thin films including sensors.

UNIT I: VACUUM TECHNOLOGY (9)

Principles of vacuum pumps in range of 10 -2 torr to 10-11 torr, principle of different vacuum pumps: roots pump, rotary, diffusion, turbo molecular pump, cryogenic-pump, ion pump, Ti-sublimation pump, importance of measurement of Pressure, Concept of different gauges: Bayet-Albert gauge, Pirani, Penning and pressure control.

UNIT II: PHYSICAL VAPOR DEPOSITION (PVD) (9)

Introduction, vacuum pumps and systems, Physics and chemistry behind evaporation, film thickness, uniformity and purity, evaporation hardware and techniques; thermal, ebeam etc. sputtering; RF, DC, DC magnetron sputtering, hybrid and modified PVD processes, advantages of PVD, disadvantages of PVD.

UNIT III: CHEMICAL VAPOR DEPOSITION (CVD) (9)

Introduction, reaction types, thermodynamics of CVD, gas transport and growth kinetics, CVD process and basic systems; Low-Pressure CVD (LPCVD), Plasma-Enhanced CVD (PECVD), Atmosphere-Pressure CVD (APCVD), Metal-Organic CVD (MOCVD), advantages of CVD, disadvantages of CVD.

UNIT IV: SPRAY DEPOSITION TECHNIQUES (9)

Introduction, basic instrumentation, different type of spray techniques; spray pyrolysis technique, electrospray deposition technique, electro-spin deposition technique, spray printing, advantages and disadvantages of spry deposition techniques.

UNIT V: OTHER TECHNIQUES (9)

Electroplating, Spin coating, Sol gel, Langmuir Blodgett (LB) Techniques, Epitaxial Film Growth, SILAR technique, Doctor blade technique etc. their introduction, basic instrumentation, varying parameters, their advantages and disadvantages.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Discuss the differences and similarities between different vacuum based deposition techniques.
2. Evaluate and use models for nucleating and growth of thin films.
3. Assess the relation between deposition technique, film structure, and film properties.
4. Discuss typical thin film applications.
5. Motivate selection of deposition techniques for various applications.

TEXT BOOKS:

1. Frey, Hartmut, Khan and Hamid R, Handbook of thin film Technology.
2. K. L. Chopra & L. K. Malhotra, Thin film Technology and Application.
3. Rointan F. Bunshah, Deposition Technology for films and coatings.
4. A.Roth, Vacuum technology, North-Holland Publishing Company, Amsterdam, 1982.

REFERENCE BOOKS:

1. Milton Ohring, The Material Science of thin films.
2. H. K. Pulker, Coatings on Glass (volume 6).
3. C. W. Pitt, G. G. Roberts, Langmuir Blodgett films (volume 3).
4. J.Yarwood, High vacuum techniques, Chapman & Hall, 1967.

U20EC843 DIGITAL AUDIO ENGINEERING

L	T	P	C
3	0	0	3

Prerequisite: Digital signal processing

COURSE OBJECTIVES:

- To understand the concept of fundamentals of digital audio.
- To understand the concept of audio in digital TV broadcasting.
- To understand the various codes of digital coding.
- To understand the concept of digital audio tape recorder.
- To analyze the concept internet audio in digital audio engineering.

UNIT I: FUNDAMENTALS OF DIGITAL AUDIO (9)

Discrete time sampling - sampling theorem - Nyquist frequency – aliasing – prevention – quantization – signal to error ratio – distortion – other architectures – dithers – types of dither.

UNIT II: RECORDING AND TRANSMISSION PRINCIPLES (9)

PCM – record processing – recording oriented codes – transmission oriented codes – audio in digital TV broadcasting – DAB.

UNIT III: DIGITAL CODING & COMPRESSION (9)

Block & convolutional codes – cyclic codes – Reed Solomon codes – interleaving – compression principles – lossless & perceptive coding – subband codes – transform coding – compression formats – MPEG audio – Dolby AC 3 – ATRAC.

UNIT IV: DIGITAL AUDIO TECHNIQUES (9)

Digital audio tape recorder – cassettes – modes – track format – digital audio editing – editing with random access media & recording media – editor structure – digital audio in optical disks – CD, MD, DVD, playing optical disk – Minidisk.

UNIT V: APPLICATIONS OF DIGITAL AUDIO (9)

Internet audio – MP3 – SDMI – audio MPEG 4 – PC – MIDI – sound cards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Analyze the type of dither.
2. Analyze the recording and transmission principles in digital audio.
3. Analyze the various compression techniques.
4. Design and analyze the digital audio editing.
5. Analyze the various application of digital audio.

TEXT BOOKS:

1. John Watkinson, An Introduction to Digital Audio, Focal Press, 2nd edition. 2013.
2. Ken C Pohlmann, Principles of Digital Audio, McGraw Hill, 6th edition, 2010.

REFERENCE BOOKS:

1. Then Ballin, Handbook for sound Engineers Taylor & Francis, 5th edition, 2015.
2. John Watkinson, The art of Digital Audio, Focal Press, 3rd edition, 2013.

U20EC844	ELECTRONIC PACKAGING AND TESTING	L	T	P	C
		3	0	0	3

Prerequisite: Circuits and Electronics

COURSE OBJECTIVES:

- To introduce and discuss various issues related to the system packaging.

UNIT I: OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING (9)

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates.

UNIT II: ELECTRICAL ISSUES IN PACKAGING (9)

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitic.

UNIT III: CHIP PACKAGES (9)

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated, and embedded.

UNIT IV: PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS (9)

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements

UNIT V: TESTING (9)

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced –electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Give a comprehensive introduction to the various packaging types used along with the associated thermal, speed.
2. Understand the concepts on issues arise on signal and integrity power issues.
3. Design the packages which can withstand higher temperature, vibrations and shock.

4. Design PCBs which minimize the EMI and operate at higher frequency.
5. Analyze the concepts of Testing and testing methods.

TEXT BOOKS:

1. Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.
2. Tummala, Rao R, Fundamentals of Microsystems Packaging, McGraw Hill, 2001.

REFERENCE BOOKS:

1. M. Abramovici, M. A. Breuer, and A.D. Friedman, Digital System Testing and Testable Design, Computer Science Press, 1990.
2. Bosshart, Printed Circuit Boards Design and Technology, Tata McGraw Hill, 1988
3. R.G. Kaduskar and V.B.Baru, Electronic Product Design, Wiley India, 2011.
4. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005.
5. Michael L. Bushnell & Vishwani D. Agrawal, Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits, Kluwer Academic Publishers.2000.
6. Recent literature in Electronic Packaging.
7. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.

U20HS701 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: Management concepts

COURSE OBJECTIVES:

- To understand the Total Quality Management concept and principles and the various tools available to attain Total Quality Management.
- To understand the various models of TQM.
- To understand the concept of six sigma, process management, total employees involvement.
- To understand the concept of benchmarking, quality systems.
- To understand the ISO importance.

UNIT I: INTRODUCTION (9)

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II: TQM PRINCIPLES (9)

Leadership – Employee involvement – Motivation, Empowerment, Team and Teamwork, Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention –Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III: TQM TOOLS AND TECHNIQUES I (9)

The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology– Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV: TQM TOOLS AND TECHNIQUES II (9)

Control Charts – Process Capability– Quality Function Development (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures. Costs of quality

UNIT V: QUALITY SYSTEMS (9)

Need for ISO 9000 – ISO 9001-2008 Quality System – Elements, Documentation, Quality Auditing – QS 9000 – ISO 14000 – Concepts, Requirements and Benefits. 5S, Kaizen.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Realize the importance of quality
2. Manage quality improvement teams
3. Identify requirements of quality improvement programs
4. Summarize various tools and techniques of total quality management
5. Explain various standardized organizations and process for quality systems

TEXT BOOKS:

1. Dale H. Besterfiled, Total Quality Management, 3rd Edition, Pearson Education Asia, Indian Reprint, 2006.
2. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, 1st Edition 2002.

REFERENCE BOOKS:

1. James R.Evans and William M. Lindsay, The Management and Control of Quality, 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.l and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt Ltd., 2006
3. Janakiraman.B and Gopal.R.K., Total Quality Management-Text and Cases, Prentice Hall (India) Pvt Ltd., 2006.
4. Indian standard quality management systems Guidelines for performance improvement (Fifth Revision), Bureau of Indian standards, New Delhi