SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti – 626 115

(AN AUTONOMOUS INSTITUTION)

B.E. Degree Programme

CURRICULUM

Regulations 2019

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

CHOICE BASED CREDIT SYSTEM

CURRICULUM AND SYLLABUS

Chairperson

Board Of Studies

Chairman

Academic Council

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Bachelor of Engineering in Electronics and Communication Engineering

OVERALL COURSE STRUCTURE

Code	Category	Total No. of Courses	Credits	Percentage
HSS	Humanities & Social Sciences	5	9.5	5.4
BS	Basic Sciences	10	28.5	16.2
ES	Engineering Sciences	4	10	5.7
PC	Professional Core (including Lab courses)	27	82	46.8
PE	Professional Electives	6	18	10.3
OE	Open Electives	4	12	6.8
PW	Project Work, Seminar & Internship	5	15	8.5
MC	Mandatory Courses	5	-	-
	TOTAL	66	175	100

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
ECE	23	20.5	23	23.5	24.5	25	21.5	14	175

Semester I

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UEN101	English for Technical Communication (Common to all Branches)	2	0	0	2	Humanities and Social Science
19UMA102	Engineering Mathematics – I (Common to all Branches)	3	1	0	4	Basic Science
19UPH103	Engineering Physics (Common to all Branches)	3	0	0	3	Basic Science
19UCY105	Applied Chemistry (Common to CSE,ECE,BME,IT,EEE)	3	0	0	3	Basic Science
19UCS108	Problem solving and Python Programming (Common to all Branches)	3	0	0	3	Engineering Science
19UME109	Engineering Graphics (Common to all Branches)	3	1	0	4	Engineering Science
MANDATORY						
19UGM131	Induction program	-	-	-	-	Mandatory Course
PRACTICAL						
19UCS110	Problem solving and Python Programming Lab (Common to all Branches)	0	0	3	1.5	Engineering Science
19UCS112	Engineering Fundamentals Lab (Common to CSE,ECE,IT, BME)	0	0	3	1.5	Engineering Science
19UGS113	Basic Sciences Lab (Common to all Branches)	0	0	2	1	Basic Science
	TOTAL	**17**	**2**	**8**	**23**	

Semester II

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UEN201	Communication skills for professionals (Common to all Branches)	1	0	1	1 .5	Humanities and Social Science
19UMA204	Calculus, complex analysis and numerical methods for Electronics and Communication Engineering	3	1	0	4	Basic Science
19UPH205	Electromagnetic theory	3	0	0	3	Basic Science
19UCY204	Environmental Science (Common to all Branches)	3	0	0	3	Humanities and Social Science
19UEC205	Introduction to Electronics and Communication Engineering	3	0	0	3	Professional Core
19UEC206	Electronic Devices	3	0	0	3	Professional Core
PRACTICAL						
19UGS210	Energy and Environmental Science Laboratory (Common to all Branches)	0	0	3	1 .5	Basic Science
19UEC211	Electronic Devices Laboratory	0	0	3	1.5	Professional Core
	TOTAL	**16**	**1**	**6**	**20.5**	

Semester III

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UMA323	Numerical Analysis and Linear Algebra	3	1	0	4	Basic Science
19UEC302	Digital Electronics and Design	3	0	3	4.5	Professional Core
19UEC303	Circuit Theory	3	0	0	3	Professional Core
19UEC304	Basic Electrical and Instrumentation Engineering	3	0	0	3	Professional Core
19UEC305	Analog circuits	3	0	3	4.5	Professional Core
19UIT326	Fundamentals of C Programming	2	0	2	3	Professional Core
PRACTICAL						
19UEC307	Seminar	0	0	2	1	Project work
MANDATORY						
19UGM332	Biology for Engineering Applications	2	-	-	P/F	Mandatory Course
	TOTAL	**19**	**1**	**10**	**23**	

Semester IV

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UMA422	Probability and Statistics	3	1	0	4	Basic Science
19UEC402	Electromagnetic Fields and Transmission Lines	3	0	0	3	Professional Core
19UEC403	Signals and Systems	3	1	0	4	Professional Core
19UEC404	Linear Integrated circuits	2	0	3	3.5	Professional Core
19UEC405	Analog and Digital Communication	3	0	3	4.5	Professional Core
19UIT429	Introduction to data structures and algorithms (Integrated course)	2	0	2	3	Professional Core
PRACTICAL						
19UGS433	Interpersonal Skills laboratory	0	0	3	1.5	Humanities and Social Science
MANDATORY						
19UGM431	Gender Equality	1	-	-	P/F	Mandatory Course
	TOTAL	**17**	**2**	**11**	**23.5**	

Semester V

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
19UEC501	Digital Signal Processing	3	1	0	4	Professional Core
19UEC502	Microprocessors, Microcontrollers and Applications	3	0	0	3	Professional Core
19UEC503	Data Communication and Networks	3	0	0	3	Professional Core
19UEC504	Antenna and Wave Propagation	3	0	0	3	Professional Core
	Professional Elective I	3	0	0	3	Professional Elective
	Open Elective I	3	0	0	3	Open Elective
19UGS531	Reasoning and Aptitude	1	0	0	1	Basic Engineering
PRACTICALS						
19UEC505	Microprocessors, Microcontrollers and Applications lab	0	0	2	1	Professional Core
19UEC506	Digital Signal Processing lab	0	0	2	1	Professional Core
19UEC507	Creative Thinking and Innovation	0	0	2	1	Project Work
19UGS532	Soft Skills Laboratory	0	0	3	1.5	Humanities and Social Science
	TOTAL	**19**	**1**	**9**	**24.5**	

Semester VI

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UEC601	Wireless Communication	3	0	0	3	Professional Core
19UEC602	VLSI Design	3	0	0	3	Professional Core
19UEC603	Internet of Things	3	0	0	3	Professional Core
	Professional Elective II	3	0	0	3	Professional Elective
	Professional Elective III	3	0	0	3	Professional Elective
	Open Elective II	3	0	0	3	Open Elective
PRACTICAL						
19UEC607	Product development Project	0	0	8	4	Project work
19UEC608	VLSI Design Laboratory	0	0	2	1.5	Professional Core
19UEC609	Networks Laboratory	0	0	3	1.5	Professional Core
MANDATORY						
19UGM632	Indian Constitution	1	-	-	P/F	Mandatory Course
	TOTAL	**19**	**0**	**10**	**25**	
Total Credits : 25						

Semester VII

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UME701	Project Management and Finance	3	0	0	3	Professional Core
19UEC702	Optical and Microwave communication	3	0	0	3	Professional Core
19UEC703	Image processing and Machine learning	3	0	0	3	Professional Core
	Professional Elective IV	3	0	0	3	Professional Elective
	Professional Elective V	3	0	0	3	Professional Elective
	Open Elective III	3	0	0	3	Open Elective
PRACTICAL						
19UEC707	Summer Internship	-	-	-	1	Project work
19UEC708	Optical and Microwave communication laboratory	0	0	2	1	Professional Core
19UEC709	Image processing laboratory	0	0	3	1.5	Professional Core
MANDATORY						
19UGM731	Professional Ethics and Human Values (common to all Branches)	2	-	-	P/F	Mandatory Course
	TOTAL	**20**	**0**	**5**	**21.5**	

Semester VIII

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
	Professional Elective VI	3	0	0	3	Professional Elective
	Open Elective IV	3	0	0	3	Open Elective
PRACTICAL						
19UEC801	Project Work	0	0	16	8	Project work
	TOTAL	**6**	**0**	**16**	**14**	

LIST OF PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Name	L	T	P	C
1.	19UEC901	Principles of Artificial Intelligence	3	0	0	3
2.	19UEC902	Principles of Robotics	3	0	0	3
3.	19UEC903	Biomedical Signal and Image Processing	3	0	0	3
4.	19UEC904	Control Engineering	3	0	0	3
5.	19UEC905	5G Technology	3	0	0	3
6.	19UEC906	ARM System Development	3	0	0	3
7.	19UEC907	Real Time System Design	3	0	0	3
8.	19UEC908	Soft Computing Techniques	3	0	0	3
9.	19UEC909	Image Analysis and Video Processing	2	0	2	3
10.	19UEC910	Multimedia Compression and communication	3	0	0	3
11.	19UEC911	IOT Architecture and protocols	3	0	0	3
12.	19UEC912	RF Circuit Design	3	0	0	3
13.	19UEC913	Introduction to MEMS and NEMS	3	0	0	3
14.	19UEC914	AI in VLSI Design Automation	3	0	0	3
15.	19UEC915	Embedded Systems in Medical Devices	3	0	0	3
16.	19UEC916	Satellite Communication Principles and Applications	3	0	0	3
17.	19UEC917	Speech and Audio Signal Processing	3	0	0	3
18.	19UEC918	Remote Sensing and Information system	3	0	0	3
19.	19UEC919	Nano Electronics	3	0	0	3
20.	19UEC920	Adaptive and Smart Antennas	3	0	0	3
21.	19UEC921	Software Defined and Cognitive Radio Networks	3	0	0	3
22.	19UEC922	Biomedical Instrumentation	3	0	0	3
23.	19UEC923	ASIC and FPGA Based Design	3	0	0	3
24.	19UEC924	Cyber Physical System (Industry Designed)	3	0	0	3
25.	19UEC925	Block Chain (Industry Designed)	3	0	0	3
26.	19UEC926	Sensors for IOT	3	0	0	3
27.	19UEC927	Smart sensor networks	3	0	0	3
28.	19UEC928	Tele Medicine	3	0	0	3

LIST OF OPEN ELECTIVES

Sl. No.	Course Code	Course Name	L	T	P	C
1.	19UEC951	Consumer Electronics	3	0	0	3
2.	19UEC952	Remote Sensing and its Applications	3	0	0	3
3.	19UEC953	Embedded Systems and Programming	3	0	0	3
4.	19UEC954	Fundamentals of Digital Image Processing	3	0	0	3
5.	19UEC955	Introduction to R programming	3	0	0	3
6.	19UEC956	Anatomy of Smart Phones and Laptops	3	0	0	3
7.	19UEC957	IOT based Automation and Monitoring System	3	0	0	3
8.	19UEC958	Design thinking for innovations	3	0	0	3

LIST OF ONE CREDIT COURSES

Sl. No.	Course Code	Course Name
1.	19UEC861	PIC Embedded Programming
2.	19UEC862	PCB Design
3.	19UEC863	Python Programming
4.	19UEC864	Android Programming
5.	19UEC865	Programming In R
6.	19UEC928	Tele Medicine (Industry Designed)
7.	19UEC956	Anatomy of Smart Phones and Laptops

ECE DESIGNED COURSES FOR OTHER DEPARTMENTS

Sl. No.	Course Code	Course Name	Dept	L	T	P	C
1.	19UEC425	Microprocessor And Microcontrollers	CSE	3	0	0	3
2.	19UEC426	Microprocessors And Microcontrollers Laboratory	CSE	0	0	3	1.5
3.	19UEC621	Digital Signal Processing For Electrical Engineers	EEE	3	0	0	3
4.	19UEC959	Principles Of Communication	EEE	3	0	0	3
5.	19UEC960	Fiber Optic Communication	EEE	3	0	0	3

SEMESTER I

SEMESTER I

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UEN101	English for Technical Communication (Common to all Branches)	2	0	0	2	Humanities and Social Science
19UMA102	Engineering Mathematics – I (Common to all Branches)	3	1	0	4	Basic Science
19UPH103	Engineering Physics (Common to all Branches)	3	0	0	3	Basic Science
19UCY105	Applied Chemistry (Common to CSE,ECE,BME,IT,EEE)	3	0	0	3	Basic Science
19UCS108	Problem solving and Python Programming (Common to all Branches)	3	0	0	3	Engineering Science
19UME109	Engineering Graphics (Common to all Branches)	3	1	0	4	Engineering Science
MANDATORY						
19UGM131	Induction program	-	-	-	-	Mandatory Course
PRACTICAL						
19UCS110	Problem solving and Python Programming Lab (Common to all Branches)	0	0	3	1.5	Engineering Science
19UCS112	Engineering Fundamentals Lab (Common to CSE,ECE,IT, BME)	0	0	3	1.5	Engineering Science
19UGS113	Basic Sciences Lab (Common to all Branches)	0	0	2	1	Basic Science
	TOTAL	**17**	**2**	**8**	**23**	

19UEN101	ENGLISH FOR TECHNICAL COMMUNICATION (Common to All Branches except CSBS)	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To enhance the vocabulary of students
- To strengthen the application of functional grammar and basic skills
- To improve the language proficiency of students

Unit – 1		8

Listening –Formal and informal conversations and comprehension. Speaking- introducing oneself – exchanging personal and social information-Reading – Skimming and Scanning. Writing–Sentence Formation, Formal Letters (Permission/Requisition) - Grammar - Parts of Speech - Tense - Vocabulary Development – Technical Word Formation- Prefix- suffix - Synonyms and Antonyms-Phrases and Clauses.

Unit – 2		8

Listening– Telephonic Conversations. Speaking– Pronunciation rules with Stress pattern. Reading – comprehension-pre-reading, post-reading- comprehension questions Writing – Punctuation rules, paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions, Precise writing, Developing Hints - Report Writing (Industrial, Accident)- Grammar – Voice Vocabulary Development- Words from other languages in English.

Unit – 3		7

Listening – Motivational speech by Great Speakers Speaking–Narrating daily events - retelling short stories. Reading – Newspaper reading. Writing – Job application letter - Transformation of Information (Transcoding)–Grammar Subject-Verb Agreement (Concord),— Vocabulary Development –Same word in different parts of speech

Unit – 4		7

Listening – Understating the instruction. Speaking-Intonation and preparing dialogue on various formal and informal situation Reading –Note Making from given text - Writing– Creating coherence, Essay writing with proper introduction and conclusion, Giving Instruction (Guidance/Procedure) -Grammar–Spot the Errors in English, Vocabulary Development– One word substitution.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply grammar effectively in writing meaningful sentences and paragraphs.	Apply
CO2	Exhibit reading skills and comprehension to express the ideas in the given text.	Understand
CO3	Develop writing skills to present the ideas in various formal situations.	Create
CO4	Develop oral fluency to express the ideas in various formal situations.	Create

CO5	Exhibit writing skills to prepare reports for various purposes.	Create

TEXT BOOKS:

1. KN Shoba, Lourdes Joavani Rayen,Communicative English, New Delhi, Cambridge University Press, 2017

REFERENCES:

1. Raman, Meenakshi, Sangeetha Sharma, Business Communication, New Delhi, Oxford University Press, 2014.
2. Lakshminarayanan. K.R,English for Technical Communication, Chennai, Scitech Publications (India) Pvt. Ltd, 2004.
3. Rizvi. Asraf M, Effective Technical Communication, New Delhi, Tata McGraw-Hill Publishing Company Limited, 2007.

19UMA102	ENGINEERING MATHEMATICS – I	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To make the students capable of identifying linear equations based problems (Eigen Value) from practical areas and obtain the Eigen value oriented solutions in certain cases.
- To widen the students' knowledge base on linear algebra, growth rate computation and application of integrals.
- Able to integrating various types of functions using various integration methods.
- To familiarize the students with the basic rules of differentiation and use them to find derivatives of products and quotients of functions
- To apply these mathematical concepts (matrix theory, differentiation and integration) in engineering field.

UNIT 1	MATRICES	8+3

Eigen value and eigenvector of a real matrix – Characteristic equation – Properties – Cayley- Hamilton theorem (excluding Proof) – Orthogonal reduction – (transformation of a symmetric matrix to diagonal form) – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation

UNIT 2	DIFFERENTIAL CALCULUS	8+3

Introduction – Definition of derivatives – Limits and Continuity – Differentiation techniques (Product rule, Quotient rule, Chain rule) – Successive differentiation (nth derivatives) – Leibnitz theorem (without proof) – Maclaurin's series – Physical Applications (Newton's law of cooling– Heat flow problems, Rate of decay of radioactive materials - Chemical reactions and solutions, Ohm's law, Kirchoff's law – Simple electric circuit problems)

UNIT 3	FUNCTIONS OF SEVERAL VARIABLES	8+3

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobian – Taylor's expansion – Maxima and Minima – Method of Lagrangian Multipliers

UNIT 4	INTEGRAL CALCULUS	8+3

Definitions and concepts of integrals – Methods of integration (Decomposition method, Substitution method, Integration by parts) – Definite integrals – Properties and problems – Reduction formulae – Beta and Gamma functions.

UNIT 5	MULTIPLE INTEGRALS	8+3

Doubleintegration–CartesianandPolarcoordinates–Changeoforderofintegration–Areaas a double integral - Change of variables between Cartesian and Polar coordinates – Triple integrationinCartesiancoordinates–Volumeastripleintegral.

SUPPLEMENT TOPIC (for internal evaluation only) 3

Evocation /Application of Mathematics, Quick Mathematics – Speed Multiplication and Division Applications of Matrices.

TOTAL : 45 (L) + 15 (T) = 60

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the Characteristic Equation, Characteristic roots and	Apply

	use the applicability of Cayley – Hamilton theorem to find the Inverse of matrix. (CO1) AP – K3.	
CO2	Analyze functions using limits, continuity, derivatives and to solve Physical application problems.(CO2) A – K4	Analyze
CO3	Apply differentiation techniques and Lagrange multiplier method to predict the extreme values of the functions with constrain.(CO3) AP – K3	Apply
CO4	Apply the concept of some special function like Gamma, Beta function and their relation to evaluate some definite integral.(CO4) AP – K3	Apply
CO5	Apply integration to compute Multiple integrals, Area and Volume in addition to change of order and change of variables Apply integration to compute Multiple integrals, Area and Volume in addition to change of order and change of variables.(CO5) AP – K3	Apply
CO6	Understand the basic concept in Matrix, Differentiation and Integration. (CO6) U – K2	Understand

TEXT BOOKS:

1. Bali n. P and manish goyal, “a text book of engineering mathematics”, laxmi publications (p) ltd, new delhi, 8th edition, (2011).
2. Veerarajan.t “engineering mathematics” tata mcgraw hill publishing company, new delhi, 2008.
3. Grewal. B.s, “higher engineering mathematics”, khanna publications, new delhi, 42nd edition, (2012).

REFERENCES:

1. Ramana b.v, “higher engineering mathematics”, tata mcgraw hill publishing company, new delhi, 11th reprint, (2010).
2. Glyn james, “advanced engineering mathematics”, pearson education, new delhi, 7th edition, (2007).
3. Jain r.k and iyengar s.r.k,” advanced engineering mathematics”, narosa publishing house, new delhi, 3rd edition, (2007).
4. Bharati krishna tirthaji, “vedic mathematics - mental calculation”, motilal banarsi dass publications, new delhi, 1st edition, (1965).
5. Kreyszig. E, “advanced engineering mathematics”, john wiley & sons, new york, 10th edition, (2011).
6. P.sivaramakrishna das, e.rukmangadachari “engineering mathematics”, volume 1, pearson edison new delhi, 2nd edition, (2013).

19UPH103	ENGINEERING PHYSICS (Common toAll Branches-Except CSBS)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop the research interest in crystal physics
- To use the principles of Lasers and its types
- To apply principles of Quantum physics in engineering field
- To develop knowledge on properties of materials

UNIT 1	CRYSTAL STRUCTURE	12

Introduction – Classification of solids –Space lattice –Basis-Lattice parameter – Unit cell – Crystal system –Miller indices –d-spacing in cubic lattice - Calculation of number of atoms per unit cell – Atomic radius-Coordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal imperfection –Point defects-Line defects-Surface defects-Volume defects Burger vector.

UNIT 2	PHOTONICS	10

Introduction- Principles of Laser- Characteristics of laser -Spontaneous and stimulated emission –Population inversion – Einstein's A and B coefficients - Pumping methods – Basic components of Laser - Types of lasers – Nd -YAG laser - CO2 laser –Holography – Construction and Reconstruction of hologram – Industrial and Medical Applications.

UNIT 3	QUANTUM MECHANICS	13

Introduction - Black body radiation – Planck's law of radiation - Wien's displacement law- Rayleigh Jeans law- – Compton Effect – Theory and experimental verification – Matter waves- Schrodinger's wave equation – Time dependent – Time independent equation – Particle in 1-D dimensional box

UNIT 4	PROPERTIES OF SOLIDS	10

Introduction - Elasticity- Stress and Strain - Hooke's law – Three moduli of elasticity –stress-strain curve – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending –I- shaped girders.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Classify the types of crystals, lasers and elastic behavior of solids	Understand
CO2	Apply the basic knowledge of crystal, quantum mechanics and mechanical behavior of solids to solve engineering problems	Apply
CO3	Apply the principle of laser to estimate the wavelength of emitted photons.	Apply
CO4	Analyze the dual nature of matter using the concepts of quantum mechanics	Analyze
CO5	Analyze the structural and optical properties of crystals in industrial and medical applications	Analyze
CO6	Analyze the structural and optical properties of materials for specific Engineering Applications.	Analyze

TEXT BOOKS:

1. Dr.Mani.P,“EngineeringPhysics”,DhanamPublications,Edition, 2018,Chennai.
2. Rajendran.V,“Engineering,Physics”,TataMc-GrawHillPublishingCompanylimited, New Delhi, Revised Edition2018.
3. PalanisamiP.K.,“PhysicsForEngineers”,ScitechPublications(India),PvtLtd., Chennai,2018.

REFERENCES:

1. Raghuvenshi G.S., “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition 2018.
2. Arul doss .G., “Engineering Physics”, PHI Learning Limited, New Delhi, Revised Edition 2018.
3. Marikani .A., “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition 2017.
4. Sankar B.N., and Pillai .S.O., “A Text book of Engineering Physics”, New Age International Publishers Private Limited, New Delhi, Revised Edition 2017.
5. Avadhanulu M.N. and Kshirsagar P.G., “A Textbook: of Engineering Physics”, S.Chand & Company Ltd., New Delhi, 2018.

19UCY105	APPLIED CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain the knowledge on Chemical bonding and types.
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To know the importance of smart material and green chemistry.
- To acquire knowledge on energy storage devices..

UNIT 1	CHEMICAL BONDING	11

Chemical Bonding: Electronic Configuration– Ionic Bond - Covalent Bond – Metallic bond –Aufbau principle, Pauli Exclusion principle, Valence bond theory application and its limitations, Various types of hybridization (sp, sp2,sp3) (C H , C H , CH) -bond strength and bond energy - Hydrogen bonding, Vander Waals forces

UNIT 2	WATER AND ITS TREATMENT TECHNOLOGIES	11

Hardness of water – types – expression of hardness (Problems) – units – estimation of hardness of water by EDTA – boiler troubles (scale and sludge) – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) – External treatment - Ion exchange process- zeolite process – desalination of brackish water – Reverse Osmosis

UNIT 3	SMART MATERIALS AND GREEN CHEMISTRY	11

Introduction to smart materials and their structure - Organic Light Emitting Diodes – Principles and applications, Liquid crystals – definition and applications. Green chemistry – Concept, importance, principles – e- waste disposal

UNIT 4	ENERGY STORAGE DEVICES	12

Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) Secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H2- O2 fuel cell and application.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the basic concept of chemistry involved in chemical bonding, water treatment methods, smart materials, e-waste management and energy storage devices.	Understand
CO2	Apply the knowledge of chemical bonding to identify the types of bonds in molecules.	Apply
CO3	Analyze the impurities of water to find its hardness and remove the hardness causing substances.	Analyze
CO4	Explain the principles and application of organic light emitting diodes, liquid crystals and green chemistry	Understand
CO5	Apply the knowledge of the basic electrochemical cell terminology to differentiate various types of energy storage devices.	Apply

TEXT BOOKS:

1. JainP.C.andMonicaJain,“EngineeringChemistry”,DhanpatRaiPublishingCompany (P) Ltd, New Delhi, 2002.
2. Dr.SunitaRattan,“ATextbookofEngineeringChemistry”S.K.Kataria&Sons.,New Delhi,2013.

REFERENCES:

1. DerekPletcherandFrankC.Walsh,“IndustrialElectrochemistry”,ChapmanandHall, New York,1993.
2. PeterGrundler,“ChemicalSensors–AnintroductionforScientistsandEngineers”, Springer, New York,2007

19UCS108	PROBLEM SOLVING AND PYTHON PROGRAMMING (Common to ALL Branches-Except CSBS)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the concepts in problem solving for computing
- To familiarize the logical constructs of programming
- To illustrate programming in Python

UNIT 1	INTRODUCTION	9

Definitionandbasicorganizationofcomputers–classificationofcomputers–Software–Types ofsoftware–typesofprogrammingparadigms-Translators:compilerandinterpreter–Problem solvingtools:Algorithms–Flowchart–Pseudocode

UNIT 2	INTRODUCTION TO PYTHON	9

Introduction to python – features of python – modes of working with python. Values and data types: numbers, Boolean, strings; variables, expressions, statements, tuple assignment, precedence of operators, comments – print function- conversion of algorithm in to program – Solving simple problems involving arithmetic computations and sequential logic to solve

UNIT 3	CONTROL CONSTRUCTS	9

Flow of execution – control structures: conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass – Solving problems involving decision making and iterations

UNIT 4	FUNCTIONS AND PACKAGES	9

Functions - function definition and use, flow of execution, parameters and arguments; parameters, local and global scope, function composition-Anonymous or Lambda Function, recursion -packages.

UNIT 5	LISTS, TUPLES, DICTIONARIES AND STRINGS	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension - Strings: string slices; immutability, string functions and methods, string module

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Utilize problem solving tools in solving computing problems	Apply
CO2	Solvemathematicalexpressionsinvolvingsequentiallogicinpython	Apply
CO3	Solve problems using python using decision structure and looping constructs	Apply

CO4	Write modular programs using functions and packages	Apply
CO5	Manipulate data using List, Tuples, Dictionaries and strings	Apply

TEXT BOOKS:

1. Ashok NamdevKamthane& Amit Ashok Kamthane, “Problem solving and python programming”, McGraw Hill Education, 2018 (copyright)
2. Anurag Gupta & G P Biswas, “Python Programming – Problem solving, packages and libraries”, McGraw Hill Education, 2020 (copyright).

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REFERENCES:

1. John V Guttag, “Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-Disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, “Exploring Python||, Mc-Graw Hill Education (India) Private Ltd., 2015. 4.Kenneth A. Lambert, “Fundamentals of Python: First Programs||, CENGAGE Learning, 2012. 5.Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.
4. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3||, Second edition, Pragmatic Programmers, LLC, 2013.

19UME109	ENGINEERING GRAPHICS (Common to ALL Branches)	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To develop student's graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.
- To impart knowledge in development of surfaces, isometric and perspective projections.

	CONCEPTS AND CONVENTIONS (NOTFOR EXAMINATION)	4

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning-Introduction to Plane Curves, Projection of Points, Lines and Plane Surfaces

UNIT 1	PROJECTION OF SOLIDS	12

Projection of simple solids like prisms, pyramids, cylinder and cone with axis is parallel, perpendicular and inclined to one of the plane.

UNIT 2	SECTION OF SOLIDS	10

Section of solids - simple position with cutting plane parallel, perpendicular and inclined to one of the plane

UNIT 3	DEVELOPMENT OF SURFACES	10

Development of lateral surfaces of simple and truncated solids - Prisms, pyramids and cylinders and cones - Development of lateral surfaces of sectioned solids.

UNIT 4	ISOMETRIC PROJECTIONS	12

Principles of isometric projection – isometric scale – isometric view - isometric projections of simple solids and cut solids

UNIT 5	ORTHOGRAPHIC PROJECTION	12

Representation of Three Dimensional objects – General principles of orthographic projection- Need for importance of multiple views and their placement – First angle projection – layout views – layout views – Developing visualization skills of multiple views (Front, top and side views) from pictorial views of objects

TOTAL : 45 (L) + 15 (T) = 60 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	ApplytheknowledgeofFirstangleprojectiontodrawtheprojectionofpoints,straight lines and planes	Apply
CO2	Draw the Projection of different simple solids	Apply
CO3	Draw the section of solids and development of lateral surfaces of solids	Apply
CO4	Apply the knowledge of Isometric projection to draw the objects like truncated solids and frustum	Apply
CO5	Sketch the orthographic views from the given pictorial (isometric) view	Apply

TEXT BOOKS:

1. NatarajanK.V.,"ATextbookofEngineeringGraphics",DhanalakshmiPublishers,(2006).
2. BhattN.D.,"EngineeringDrawing",46thEdition,CharotarPublishingHouse, (2003).

REFERENCES:

1. VenugopalK.,andPrabhuRajaV.,"EngineeringGraphics",NewAgeInternational(P) Limited, (2008).
2. GopalakrishnanK.R.,"EngineeringDrawing"(Vol.I&II),SubhasPublications. (1998).
3. DhananjayA.Jolhe,"EngineeringDrawingwithanintroductiontoAutoCAD",Tata McGraw Hill Publishing CompanyLimited, (2008).

19UGM131	INDUCTION PROGRAMME	L	T	P	C
		0	0	0	3

OBJECTIVES:

- To rejuvenate the Body and Mind
- To strengthen Attitude and soft skills
- To practice Moral values of life.

UNIT 1	**PHYSICAL ACTIVITY**	**10**
Zumba-Bokwa Fitness – Yoga – Mediation – Fine Arts		
UNIT 2	**CREATIVE ARTS**	**5**
Painting – Class Painting – Wall Painting – Art from waste		
UNIT 3	**UNIVERSAL HUMAN VALUES & EMINENT SPEAKERS**	**5**
Ethical values – Ambition and Family Expectation, Gratitude, Competition and Excellence– Belief – Morality of life – Guest Lecture by Eminent personality		
UNIT 4	**LITERARY**	
Elocution - Essay writing Competition - Impromptu Session - Dance and singing competition		
UNIT 5	**PROFICIENCY MODULES**	**15**
Elocution - Essay writing Competition - Impromptu Session - Dance and singing competition		
UNIT 6	**INDUSTRIAL & LOCAL VISIT**	**8**
VaigaiDam–Theni-VOC-Port-Tuticorin-MaduraiRadioCity-Madurai-AavinMilk –Madurai-NSS Activities		
UNIT 7	**FAMILIARIZATION OF THE DEPARTMENT AND INNOVATION**	**2**
DepartmentIntroductionandPurposeofCourse-Eminentspeakers– ScopeandFeatureofthe Course - Latest Innovation		
	TOTAL : 45 PERIODS	

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Practice physical activities regularly.
CO2	Implement creativity in drawing and waste material
CO3	Communicate their ideas effectively.
CO4	Identify inputs and outputs of different industry process
CO5	Describe the scope and features of their programme of study

TEXT BOOKS:

Student Induction Programme: A Detailed Guide by AICTE, NewDelhi.

		L	T	P	C
19UCS110	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY** (Common to ALL Branches)	**0**	**0**	**3**	**1.5**

OBJECTIVES:

- To familiarize with programming environment
- To familiarize the implementation of programs in Python.

LIST OF EXPERIMENTS:

Problems involve Sequential logic and Decision Making

1. WriteaPythonprogramtoprocessthemarkprocessingsystem(Recordhasthefollowing Fields:Name,Reg_no,Mark1,Mark2,Mark3,Mark4,Total,average).Printthestudentdetails andfindthetotalandaveragemark.

2. WriteaPythonprogramtocomputethe+2Cutoffmark,giventheMathematics,physicsand Chemistrymarks.Acollegehasdecidedtoadmitthestudentswithacutoffmarksof180.Decide whetherthestudentiseligibletogetanadmissioninthatcollegeornot.

3. Apizzainacircularshapewith8inchesandwhichisplacedinasquareboxwhosesidelength is10inches.Findhowmuchoftheboxis“empty”?

4. A person owns an air conditioned sleeper bus with 35 seating capacity that routes between Chennai to Bangalore. He wishes to calculate whether the bus is running in profit or loss state basedonthefollowingscenario:
   - Amount he spent for a day for diesel filling is: Rs. 15,000
   - Amount he spent for a day for Driver and cleaner beta is: Rs. 3,000
   - TicketamountforaSinglepersonisRs:950
   - Ifalltheseatsarefilled,whatwouldbetheresult?
   - Ifonly15seatsarefilled,whatwouldbetheresult?

5. Considertheperson'X'hassomeamountinhishandandtheperson'Y'hassomeamountinhis hand.Iftheywishtoexchangetheamountamongthem,howtheycanexchangetheamountby usingthethirdparty'Z'.

Problems involve iterations

6. A man is blessed with a duck that can lay golden eggs. First day it lays one egg, in second day it lays two eggs, in third day it lays three eggs, and it continues to lay eggs in an incremental manner day by day. Now calculate how many golden eggs that duck lays till 'n'th day.
7. Four People A,B,C,D are sitting in a Circular arrangement. In how many ways their seating can be arranged.
8. The Greek theater shown at the right has 30 seats in the first row of the center section. Each row behind the first row gains two additional seats. How many seats are in the 5th row in the center section?

Problem involve functions and recursive functions

6. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle. (Recall from the Pythagoras theorem that in a right triangle, the square of one side equals the sum of the squares of other two sides)

7. A game has to be made from marbles of five colors, yellow, blue, green, red and Violet where

five marbles has to be kept one upon another. Write a python program using recursion, to find how many ways these marbles can be arranged.

8. Tower of Hanoi is a mathematical puzzle where we have three rods and n disks. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules: Here is a high-level outline of how to move a tower from the starting pole, to the goal pole, using an intermediate pole:
    1. Move a tower of height-1 to an intermediate pole, using the final pole.
    2. Move the remaining disk to the final pole.
    3. Move the tower of height-1 from the intermediate pole to the final pole using original pole

Problems involve List and Nested List

9. In a class of 50 numbers of students, 6 students are selected for state cricket academy. Sports faculty of this school has to report to the state cricket academy about the selected students' physical fitness. Here is one of the physical measures of the selected students'; Height in cm is given for those 6 selected students [153,162,148,167,175,151]. By implementing functions, do the following operations.
    (i) State academy selector has to check whether the given height is present in the

Selected students list or not.

    (ii) State academy selector has to order the height of students in an incremental manner.
    (iii) State academy selector has to identify the maximum height from the list.

Problems involve Dictionary and Tuples Dictionary

10. A university wishes to create and maintain the details of the students such as Rollno, Regno, Name, Dept, Batch, Contact_no, Nativity(Indian/NRI) as key value pairs. Do the following operations:
    (i) Display the complete student details on giving Rollno as input.
    (ii) Display the complete student details whose nativity belongs to NRI.
    (iii) Display the complete student details whose department is CSE.

Tuples

11. A librarian wishes to maintain books details such as ISBN, Book Name, Author Name, Year published, Publisher Name. He wishes to retrieve the book details in the following scenario:
    (i) Retrieve the complete details of the book on giving ISBN.
    (ii) Retrieve the details of the book which published after the year 2015.
    (iii) Retrieve the details of the book whose author name is 'Andrew'.
    (iv) Retrieve the details of the book that name of the book is 'Python'

Problems involve Strings

12. A musical album company has 'n' number of musical albums. The PRO of this company wishes to do following operations based on some scenarios:
    (i) Name of the album starts with 's' or 'S'.
    (ii) Name of the album which contains 'jay' as substring.
    (iii) Check whether the album name presents in the repository or not.

Count number of vowels and consonants in the given album name

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Formulate algorithms for simple problems and translate the algorithms to a working program.	**Apply**
CO2	Formulate algorithms and programs for arithmetic computations and sequential logic	**Apply**
CO3	Write iterative programs using control constructs	**Apply**
CO4	Develop programs using functions, packages and use recursion to reduce redundancy	**Apply**
CO5	Represent data using lists, tuples, dictionaries and manipulate them through a program	**Apply**

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS HARDWARE LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS

SOFTWARE OS – UNIX CLONE (License free Linux) EDITOR – IDLE

19UCS112	ENGINEERING FUNDAMENTALS LABORATORY (Common to CSE, ECE, IT & BME Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To familiarize the Hardware components of Computer
- To practice the installation of operating systems and other software.

LIST OF EXPERIMENTS:

GROUP A (COMPUTER) 24 Periods

- Demonstrating basic components of a personal computer
- Assembling hardware components of a computer
- Installation of windows and linux operating systems
- Installation of software's both in windows and linux operating system
- Configuring the computer to connect with internet
- PC trouble shooting and maintenance

GROUP B (ELECTRICAL & ELECTRONICS)

21 Periods

- Study of electronic components and equipments-
  a. Resistor color coding
  b. Measurement of AC signal parameter (peak to peak, rms, period, frequency) using CRO
- Study of logic gates
- Soldering practice – components devices and circuits - using general purpose PCB
- Characteristics of LED
- Interfacing of PIR sensor with micro controller
- Switch control with micro controller
- Temperature measurement with micro controller

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Identify the components of the computer and assemble the hardware components of a computer	**Apply**
CO2	Install and uninstall the Operating systems and other software's both in in windows and Linux environment	**Apply**
CO3	Demonstrate the basic network settings and make trouble shoot and Maintain the compute	**Apply**
CO4	Demonstrate the function of electronics components	**Apply**
CO5	Develop code for interfacing sensors with microcontroller	**Apply**

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS.

SOFTWARE

OS – UNIX CLONE (License free Linux)

EQUIPMENT

Sl No.	Name of the Equipment / Software	Quantity
1.	Logic Trainer Kit	2
2.	CRO And AFO	2
3.	Small Multipurpose PCBS	5
4.	Soldering Guns	5
5.	Multimeters	5
6.	DC Ammeter	10
7.	DC Voltmeter	10
8.	Variable DC Power Supply	5
9.	Node MCU Development Board	10
10.	PIR Sensor (HC-SR501)	5
11.	Temperature Sensor (IM35 or DHT11)	5
12.	PC With Windows 7	3

19UGS113	BASIC SCIENCES LABORATORY	L	T	P	C
		0	0	2	1
	PHYSICS LABORATORY (Common to AllBranches)				

OBJECTIVES:

- To create scientific Temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments

LIST OF EXPERIMENTS:

1. Laser–Determination of particle size and wavelength of Laser source. Using Diode Laser.
2. UltrasonicInterferometer-Determinationofvelocityofsoundandcompressibility of liquid.
3. Poiseuille's method-Determination of Coefficient of viscosity of liquid.
4. Spectrometer–Determination of dispersive power of a prism.
5. Air Wedge method-Determination of thickness of a thin wire.
6. Uniform bending method–Determination of Young's modulus of the given rectangular beam.

- **A minimum of FIVE experiments shall be offered**

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the principles of Optics, Laser physics and Mechanics to determine the Engineering properties of materials	**Apply**
CO2	Analyze the given liquid sample to determine the viscosity and compressibility of the liquid	**Analyze**
CO3	Apply the principles of spectroscopy to determine the properties using prism	**Apply**
	CHEMISTRY LABORATORY (Common to All Branches-Except CSBS)	

OBJECTIVES:

- To impart knowledge on basic concepts in applications of chemicalanalysis
- Train the students to handle variousinstruments.
- To acquire knowledge on the chemical analysis of various metalions

LIST OF EXPERIMENTS:

1. Preparationofmolarandnormalsolutionsofthefollowingsubstances–Oxalicacid,Sodium Carbonate,Sodium Hydroxide and Hydrochloric acid
2. ConductometricTitrationofstrongacidwithstrongbase
3. Conductometric Titration of Mixture of Acids
4. Estimation of Iron by potentiometry
5. Determination of Strength of given acid using pHmetry
6. Determination of molecular weigh to fpolymer by viscometry
7. Comparison of the electrical conductivity of two samples-conductometric method
8. Estimation of copper in brass by EDTA method

- **A minimum of FIVE experiments shall be offered for every course**

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of Molarity and Normality to prepare standard solution for chemical analysis.	**Apply**
CO2	Analyze the concentration of a given analyte by analytical methods.	**Analyze**
CO3	Apply the knowledge of electrochemical techniques to study various ions present in the industrial effluents.	**Apply**

Semester II

Semester II

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UEN201	Communication skills for professionals (Common to all Branches)	1	0	1	1 .5	Humanities and Social Science
19UMA204	Calculus, complex analysis and numerical methods for Electronics and Communication Engineering	3	1	0	4	Basic Science
19UPH205	Electromagnetic theory	3	0	0	3	Basic Science
19UCY204	Environmental Science (Common to all Branches)	3	0	0	3	Humanities and Social Science
19UEC205	Introduction to Electronics and Communication Engineering	3	0	0	3	Professional Core
19UEC206	Electronic Devices	3	0	0	3	Professional Core
PRACTICAL						
19UGS210	Energy and Environmental Science Laboratory (Common to all Branches)	0	0	3	1 .5	Basic Science
19UEC211	Electronic Devices Laboratory	0	0	3	1.5	Professional Core
	TOTAL	**16**	**1**	**6**	**20.5**	

19UEN201	COMMUNICATION SKILLS FOR PROFESSIONALS	L	T	P	C
		1	1	0	1.5

OBJECTIVES:

- Improve their oral expression and thought.
- Develop their confidence and ability to speak in Public.
- Develop their capacity for leadership.

Project 1	SELF INTRODUCTION & DELIVER A SPEECH BEFORE AUDIENCE	Time: 5 to 7 minutes

- To Speak in front of an audience with courage.
- Make your message clear, with supporting material.
- Create a strong opening and conclusion

Project 2	SPEAK ON THE CHOSEN CONTENT	Time: 5 to 7 minutes

- Select a general topic and bring out specific purposes.
- Avoid using notes.
- Use symbolic ideas to develop your ideas.

Project 3	USE EFFECTIVE BODY LANGUAGE & INTONATION	Time: 5 to 7 minutes

- Use appropriate posture, gestures, facial expressions and eye contact to express your ideas**.**
- Use proper intonation and adequate speech module.

Project 4	PRESENT YOUR TOPIC WITH VISUAL AIDS	Time: 5 to 7 minutes

- Persuade your points with suitable illustration, specific facts, examples
- Use suitable visual aids to present your topic with confidence.

Project 5	GRASP THE ATTENTION OF THE AUDIENCE	Time: 5 to 7 minutes

- Influence your listeners by adopting holistic viewpoint. Use emotions, stories, and positive quotes in your speech.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply Language skills to write and speak effectively	Create
CO2	Select the right words and sentence to communicate ideas clearly and accurately	Create
CO3	Exhibit good postures and proper attire to present the ideas effectively	Create
CO4	Present the ideas effectively using visual aids.	Create
CO5	Communicate with clarity and present the ideas effectively to the audience	Create

REFERENCES:

1. Competent Communication- A Practical Guide to becoming a better speaker, Toastmasters International, USA.
2. Norman Lewis – Word Power Made Easy, Pocket Book Publication, 2019.

19UMA204	CALCULUS, COMPLEX ANALYSIS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To develop an understanding of the basics of vector calculus comprising of gradient,
  divergence and curl, and line, surface and volume integrals and the classical theorems
  involving them.
- To acquaint the student with the concepts of analytic functions and their interesting properties which could be exploited in a few engineering areas, and be introduced to the host of conformal mappings with a few standard examples that have direct application

UNIT 1	SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS	8+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Applications of ODE (Bacterial growth, Population growth, Decayed problems).

UNIT 2	VECTOR CALCULUS	8+3

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

UNIT 3	COMPLEX ANALYSIS	8+3

Functions of a complex variable – Analytic function – Necessary and Sufficient Conditions (excluding Proofs) – Harmonic function - Properties of an analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping-Simple Transformation: w = z+c, cz, 1/z, and Bilinear transformation.

UNIT 4	COMPLEX INTEGRATION	8+3

Statement and applications of Cauchy's integral theorem, Cauchy's integral formula and Cauchy Residue Theorem – Taylor's and Laurent's expansions – Applications of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding Poles on the real axis).

UNIT 5	SOLUTION OF ALGEBRAIC, TRANSCENDENTAL EQUATIONS AND EIGENVALUE PROBLEMS	8+3

Iteration method – Newton-Raphson method – Gauss Elimination method – Pivoting – Gauss Jordan methods –iterative methods: Gauss Jacobi method, Gauss Seidel method - Eigen values of a matrix by Power method – Jacobi's method for a real symmetric matrix

SUPPLEMENT TOPIC (for internal evaluation only)

Evocation / Applicationof Mathematics,Applications of Matrices.

TOTAL : 45 (L) + 15 (T) = 60

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the Characteristic Equation, Characteristic roots and use the applicability of Cayley – Hamilton theorem to find the Inverse of matrix	Apply
CO2	Apply the Characteristic Equation, Characteristic roots and use the applicability of Cayley – Hamilton theorem to find the Inverse of matrix	Analyze
CO3	Apply differentiation techniques and Lagrange multiplier method to predict the extreme values of the functions with constrain	Apply
CO4	Apply the concept of some special function like Gamma, Beta function and their relation to evaluate some definite integral	Apply
CO5	Apply integration to compute Multiple integrals, Area and Volume in addition to change of order and change of variables	Apply
CO6	Understand the basic concept in Matrix, Differentiation and Integration	Understand

TEXT BOOKS:

1. VEERARAJAN.T “Engineering Mathematics for First year” Tata McGraw Hill Publishing Company, New Delhi, 2008.
2. IYENGAR S.R.K , JAIN R.K. , MAHIDEN KUMAR JAIN “ Numerical Methods for Scientific and Engineering Computations” New Age International Publishers 7th Edition 2019.
3. GREWAL. B.S, “Higher Engineering Mathematics”, Khanna Publications, New Delhi, 43rd Edition, (2014).

REFERENCES:

1. RAMANA B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. BROWN J.W. and CHURCHIL R.V.” Complex Variable and Applications” 7th Edition McGraw Hill Publishing Company 2004.
3. JAIN R.K and IYENGAR S.R.K, “Advanced Engineering Mathematics”, Narosa Publishing House Pvt. Ltd., New Delhi, 3rd Edition, (2007).
4. INCE E.L “Ordinary Differential Equations “ Dover Publications 1958.

19UPH205	ELECTRO MAGNETIC THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To demonstrate the concepts of different coordinate systems, Maxwell`s equations, static electric and magnetic fields.
- To apply fundamental knowledge in the area of Electromagnetism.
- To enable the students to understand the Nano electronic devices.

UNIT 1	ELECTRON THEORY OF SOLIDS	12

Introduction-Conduction in metals-mobility and conductivity – classical free electron theory of metals –merits and demerits- Electrical and thermal conductivity (derivation)– Wiedemann – Franz law – Lorentz number–Quantum Free electron theory--Density of energy states – carrier concentration in

UNIT 2	ELECTROSTATICS	10

Introduction-Electric dipole- Field lines- Flux- Gauss's law- Electric potential due to continuous charge distribution, equipotential line/ surface- Poisson's equation and its solution- Electric displacement vector- Conductors and Capacitors-dielectric permittivity and susceptibility-Force and torque on a dipole due to external static electric field

UNIT 3	MAGNETOSTATICS	13

Introduction– Bio-Savart law – Properties of magnetic field-Magnetic flux density-Magnetic vector and scalar potential-Amperes law- magnetic dipole moment- force and torque on a magnetic dipole due to external static magnetic field-Magnetization -Magnetic susceptibility and permeability- Dia, Para and ferromagnetism - Boundary conditions - Force on a charged particle under electric and magnetic fields

UNIT 4	NANO MATERIALS	10

Introduction to Nano materials-Various forms of Nano materials-Nano Electronic devices-Nanowires-Nano sensor-Quantum confinement-quantum structures-Quantum dot laser-Quantum resistance -Optical properties of Nano materials-Applications

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Explain the basic concepts of Conducting, Magnetic, Dielectric and Nanomaterial's	Understand
CO2	Apply the principles of electrostatics and magnetostatics to solve engineering problems in communication field.	Apply
CO3	Apply the concepts of spin and orbital motion of electrons in determining the magnetic properties of materials having specific engineering applications.	Apply
CO4	Analyze the conductivity of conductors, dielectrics, magnetic and nanomaterials to select suitable material for industrial	Understand

	application.	
CO5	Describe the behavior of elastic and magnetic dipoles to study the energy storage properties of engineering materials.	Apply
CO6	Apply free electron theory, to calculate energy density and carrier concentration in metals.	Apply

TEXT BOOKS:

1. NanoElectronicsandInformationTechnology:RainerWaser,Wiley-VCH,2018
2. Dr.Mani.P,"EngineeringPhysicsII",DhanamPublications,Edition,2018,Chennai
   Electromagnetic Theory and Applications: A. K. Saxena:
   secondEdition, Alphascience

REFERENCES:

1. Nano-electronics & Nano-systems: From Transistor to Molecular & Quantum Devices: Karl Goser, JanDienstuhl ,Springer 2004 or new Edition

19UCY204	ENVIRONMENTAL SCIENCE (Common to all branches)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of environment and ecosystem.
- To acquire knowledge about the impact of environmental pollution.
- To understand the importance of environmental issues in the society.
- To Gain Knowledge about the impact of environment related to human health.
- To gain knowledge in alternative energies.

UNIT 1	ENVIRONMENT AND ECOSYSTEMS	9

Definition, scope and importance of environment – Need for public awareness – Concept of ecosystem – Structure and function of ecosystem – Producers, consumers and Decomposers-Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Aquatic ecosystems (c) Grassland ecosystem

UNIT 2	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 - pollution case studies - Role of an individual in prevention of pollution Disaster management: floods, earthquake, cyclone and landslides

UNIT 3	SOCIAL ISSUES AND THE ENVIRONMENT	9

Water conservation, rain water harvesting, watershed management – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Environmental laws/Acts, (EPA).

UNIT 4	HUMAN POPULATION AND THE ENVIRONMENT	9

Population growth, variation among nations – Population explosion – Human rights – Family welfare programme – Environment and Human Health – Human Rights - Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health.

UNIT 5	FUTURE POLICY AND ALTERNATIVES	9

Introduction to future policy and alternatives - fossil fuels - nuclear energy - solar energy -windenergy-hydroelectricenergy-geothermalenergy-tidalenergy–sustainability-greenpower-nanotechnology.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the basic concept of structure and function of ecosystem	Understand

CO2	Apply the knowledge of various pollution types to prevent the ecosystem and Environment	Apply
CO3	Analyze the environmental problem to report the social issues and the environment.	Analyze
CO4	Compare the suitable methods for conservation and sustainable development of natural resources	Analyze
CO5	Apply the principles of value education with respect to human population to preserve environment	Apply
CO6	Analyze the current energy crisis and suggest a suitable sustainable alternatives that promotes social health and environmental prospects.	Analyze

TEXT BOOKS:

1. Anubha Kaushik, kaushik C.P., “Environmental Science and Engineering”, Third Edition, New Age International, New Delhi, 2009
2. Benny Joseph “Environmental Science and Engineering”, Tata Mc-Graw Hill, New Delhi, 2006

REFERENCES:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', Pearson Education,Upper saddle River, New Jersey, 2008.
2. Miller T.G. Jr., Environmental Science”, Wadsworth Publishing Company, Belmont, California, 2005.
3. De A.K., “Environmental Chemistry”, Wiley Eastern Ltd., New Delhi, 2001.
4. Trivedi R.K., Goel P.K., “Introduction to Air Pollution”, Techno-Science Publication,Jaipur, 2005

19UEC205	INTRODUCTION TO ELECTRONIC ANDCOMMUNICATION ENGINEERING (Qualitative treatment)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart basic knowledge about electronics and communication
- To explain recent trends and opportunities in electronics and communication

UNIT 1	ANALOG ELECTRONICS	9

Negative and positive feedback merits and demerits, Principle of amplifiers and oscillators, Electronic measurements- Integrated circuit fabrication process- oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

UNIT 2	DIGITAL ELECTRONICS	9

Number systems and logic gates, Boolean algebra, Combinational Logic circuits, Flip-Flops, counters and shift registers, data converters, Analog to Digital and Digital to Analog converters (ADC/DAC's).

UNIT 3	MICROPROCESSOR AND MICROCONTROLLER	9

Architecture and Addressing modes of 8-bit microprocessor, Architecture and Addressing modes of 8 bit Microcontroller.

UNIT 4	PRINCIPLES OF COMMUNICATION	9

Need for Modulation, Analog and Digital - Modulation and Demodulation techniques - Communication systems- wired and Wireless communication- Antennas and its types and applications -Evolution of wireless communication

UNIT 5	RECENT TRENDS & CAREER OPPORTUNITIES	9

4G, 5G wireless technology, IoT, wearable antennas for medical applications, Machine learning. Defense and Space applications, Automation and Robotics, Telecommunications, Electronics system design, R & D Labs, MNCs, Avenues for higher studies in India and abroad, distinguished alumni in India and Abroad.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of electronic fundamentals to compare the operation of amplifiers and oscillators	Apply
CO2	Outline the processes involved in ICs fabrication	Understand
CO3	Apply the knowledge of logic gates and flip flops to construct	Apply

	different digital circuits	
CO4	Apply the basic engineering knowledge to compare Microprocessor and Microcontrollers.	Apply
CO5	Apply the knowledge of communication fundamentals to identify a suitable communication system for a given application	Apply
CO6	Elaborate the recent trends in Electronics and Communication	Understand

REFERENCES:

1. Salivahanan S., Suresh kumar N. and Vallavanraj A., “Electronic Devices and Circuits”, Tata McGraw Hill., 4th Edition, 2017.
2. Morris Mano.M, “Digital Design”, Prentice Hall of India Pvt. Ltd., 2008 Pearson Education Singapore) Pvt. Ltd., New Delhi, 4th Edition, 2003.
3. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and Application with 8085”, Penram International Publishing, 4th Edition, New Delhi, 2000
4. Simon Haykin, “Digital Communications”, John Wiley , 2010.

19UEC206	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basic physical structure, principles of operation & electrical characteristics of diode
- To make the students understand the construction, operation and characteristics of BJT, FET and MOSFET
- To give an idea about the characteristics and behavior of special semiconductor devices

UNIT 1	INTRODUCTION TO SEMICONDUCTORS	9

Classification of solids based on energy band theory - classification of semiconductors- carrier concentration in intrinsic semiconductor- Generation and recombination of carriers -mass action law - variation in semiconductor parameters with temperature - Continuity and Poisson equation - Carrier transport: diffusion current, drift current, mobility and resistivity

UNIT 2	SEMICONDUCTOR DIODES	9

Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism- Zener diode and its characteristics.
Applications: Rectifiers - Half-wave, full-wave and bridge rectifiers with resistive load, Analysis for dc voltage (Vdc) and ripple factor with filters, types of voltage regulator, Zener diode regulator, Clipper, Clamper.

UNIT 3	TRANSISTORS	9

Bipolar Junction Transistor (BJT) : Introduction, transistor operation, study of CE, CB and CC configurations, BJT characteristics, load line, operating point, Necessity of biasing- Transistor biasing methods, Thermal stabilization, Stability factor, Thermal runaway and Compensation circuits, transistor as a switch, as an amplifier - Hybrid π model - h-parameter model for BJT, Switched mode power supply(SMPS)

UNIT 4	FIELD EFFECT TRANSISTORS	9

JFET – Construction and Operation of N-Channel, P-channel – Characteristic parameters – Drain characteristics –transfer characteristics– Comparison of JFET and BJT – Applications of JFET, MOSFET : Enhancement MOSFET – Depletion MOSFET– Comparison of N and P-Channel MOSFETs

UNIT 5	SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment Only)	9

Tunnel diodes – PIN diode, varactor diode – SCR characteristics, Power control using SCR and two transistor equivalent model – UJT – Laser, CCD, Photodiode, Phototransistor, Photovoltaic cells, LED, LCD

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of quantitative theory to compute current flow in semiconductor	Apply
CO2	Apply the knowledge of electronic fundamentals to compare the functions of PN and Zener diode	Understand
CO3	Apply the knowledge of semiconductor diode to design rectifiers and regulators	Apply
CO4	Analyze the characteristics of BJT for suitable application	Analyze
CO5	Apply the knowledge of FET characteristics to identify the different modes of operation	Apply
CO6	Identify the operation of different special semiconductor devices for various applications	Understand

TEXT BOOKS:

1. Salivahanan S., Suresh kumar N. and Vallavanraj A., "Electronic Devices and Circuits", Tata McGraw Hill., 4th Edition, 2017.
2. David A. Bell, "Electronic Circuits and Electron Devices", Oxford University Press, Anna Edition, 2010.

REFERENCES:

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, Seventh Edition, 2010.
2. Millman J. &Halkins and Satyebranta Jit, "Electronic Devices &Circuits", Tata Mc- Graw Hill, Second Edition, 2008.

19UGS210	ENERGY AND ENVIRONMENTAL SCIENCE LABORATORY	L	T	P	C
		0	0	3	1.5
	PHYSICS LABORATORY (Common to AllBranches)				

OBJECTIVES:

- To analyze the Band gap, moment of inertia, thermal conductivity and rigidity modulus of the materials.
- To gain knowledge in Photonics

LIST OF EXPERIMENTS:

1. Determination of Energy band gap of a semiconductor.
2. Torsion pendulum – Determination of Moment of inertia of a metallic disc and rigidity modulus of a given metallic wire.
3. Spectrometer - Determination of wavelength of mercury spectrum using grating.
4. Laser – Determination of numerical aperture and acceptance angle of an optical fiber
5. Newton's rings – Determination of radius of curvature of a convex lens
6. Lee's Disc - Determination of thermal conductivity of a bad conductor.
7. Determination of Solar cell Characteristics using optical transducers kit.

A minimum of FIVE experiments shall be offered

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the principles of Light and Elasticity to determine the Engineering properties of materials	Apply
CO2	Analyze the thermal conductivities of different bad conductors	Analyze
CO3	Analyze the Characteristics of a semiconductor	Analyze
	CHEMISTRY LABORATORY (Common to AllBranches)	

OBJECTIVES:

- Apply the theoretical concepts to perform lab experiments.
- To assess the water quality parameters.
- To acquire knowledge on water quality parameters for the analysis of industrial effluents.

LIST OF EXPERIMENTS:

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of Chloride in water sample (Argentometric method)
4. Determination of DO in water
5. Estimation of chromium in tannery wastes
6. Estimation of available chlorine in bleaching powder
7. Estimation of iron by Spectrophotometry.
8. Determination of acidity of industrial effluents.

- **AminimumofFIVEexperimentsshallbeofferedforeverycourse**

Laboratory classes on alternate weeks for Physics and Chemistry.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the basic knowledge of water quality testing for environmental sustainability.	Apply
CO2	Analyze the water quality parameters for industrial effluents to prevent water pollution.	Analyze
CO3	Estimate the quality of water that suits for domestic and industrial applications	Apply

19UEC211	ELECTRONIC DEVICES LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To familiarize with different active and passive electronic devices components.

LIST OF EXPERIMENTS:

1.Charcteristics of PN diode
2.Characteristics of Zener diode and voltage regulator using Zener diode.
3.Half wave rectifier and full wave rectifier with capacitor filter
4.Bridge rectifier with capacitor filter
5. Characteristics of CE configuration
6. Characteristics of CB configuration
7. Characteristics of UJT and SCR
8. Characteristics of JFET and MOSFET
9. Characteristics of phototransistor
10.Clippers and clampers using diode

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of diodes and transistors to identify device for various applications	**Apply**
CO2	Apply the knowledge of semiconductor diodes to construct rectifiers and regulators	**Apply**
CO3	Analyze the characteristics of power electronic devices for switching applications	**Analyze**

SEMESTER III

SEMESTER III

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UMA323	Numerical Analysis and Linear Algebra	3	1	0	4	Basic Science
19UEC302	Digital Electronics and Design	3	0	3	4.5	Professional Core
19UEC303	Circuit Theory	3	0	0	3	Professional Core
19UEC304	Basic Electrical and Instrumentation Engineering	3	0	0	3	Professional Core
19UEC305	Analog circuits	3	0	3	4.5	Professional Core
19UIT326	Fundamentals of C Programming	2	0	2	3	Professional Core
PRACTICAL						
19UEC307	Seminar	0	0	2	1	Project work
MANDATORY						
19UGM332	Biology for Engineering Applications	2	-	-	P/F	Mandatory Course
	TOTAL	**19**	**1**	**10**	**23**	

19UMA323	NUMERICAL ANALYSIS AND LINEAR ALGEBRA	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To make the student acquire sound knowledge in applications of numerical methods in various fields, solving practical technical problems using scientific and mathematical tools when available in Engineering.
- To apply the concept of Inner product space in orthogonalization.

UNIT I	NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	9 + 3

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two point and Three point Gaussian quadrature formulae

UNIT II	NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS	9 + 3

Single step methods: Taylor series method – Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT III	NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9 + 3

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

UNIT IV	VECTOR SPACES	9 + 3

Linear dependence of vectors, basis, dimension, linear transformations(maps), range and kernel of a linear map, rank and nullity inverse of a linear transformation rank nullity theorem
, composition of linear maps, matrix associated with a linear map

UNIT V	INNER PRODUCT SPACE	9 + 3

Inner product space, Norm of a vector matrix vector, Cauchy Schwarz inequality Triangle inequality, orthogonal space

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the Numerical techniques of Differentiation and Integration for Engineering Problems.	Apply
CO2	Apply the knowledge of numerical techniques and methods for solving first and second order Ordinary Differential Equation.	Apply

CO3	Apply Partial Differential Equation with initial and boundary conditions by using certain techniques with engineering applications	Apply
CO4	Apply the knowledge in structure and principles of vector space through linear independence namely basis	Apply
CO5	Apply inner product and determine orthogonally on vector spaces including Cauchy Schwarz inequality, Triangle inequality	Apply
CO6	Understand the knowledge of basis and norm of a vector and nature of partial differential equation	Understand

TEXT BOOKS:

1. GREWAL B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 42nd Edition, (2012).
2. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Numerical Methods, S.Chand& Company Ltd., New Delhi, 2rd Edition, (2012).
3. DAVID, C., LAY, "Linear Algebra and its applications" 4th Edition Published by Addison Wesley / Pearson, 2011.

REFERENCES:

1. BALI N.P., MANISH GOYAL and WATAINS, "Advanced Engineering Mathematics", Firewall Media (An imprint of Laxmi Publication Private limited) New Delhi, 7th Edition, (2009).
2. David C. Lay, "Linear Algebra and its applications" 3rd Edition updated Pearson Education, (2005).
3. RAMANA.B.V, "Higher Engineering Mathematics" Tata McGraw Hill, New Delhi, 11th Reprint (2010).
4. Peter, D. Lax, "Linear Algebra and its applications" 2nd Edition Wiley-Interscience Publication, (2007).

19UEC302	DIGITAL ELECTRONICS AND DESIGN	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

- To Introduce basic postulates of Boolean algebra
- To outline the formal procedures for the analysis and design of combinational and sequential circuits
- To introduce the concept of memories, programmable logic devices, synchronous and asynchronous circuits
-

UNIT 1	NUMBER SYSTEM, LOGIC GATES AND MINIMIZATION TECHNIQUES	9

Number Systems- Binary Arithmetic - Addition, Subtraction, Complementary numbering systems: 1s and 2s Complements, Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR- NAND–NOR implementations Minimization -Boolean postulates and laws – De-Morgan's Theorem -Principle of Duality - Boolean expression - Minimization of Boolean expressions- Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions - Quine-McCluskey method of minimization

UNIT II	COMBINATIONAL CIRCUITS	9

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

UNIT III	SEQUENTIAL CIRCUITS	9

Latches, Flip-flops -Characteristic table and equation–Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops –Asynchronous counter - Synchronous counters –Design of Synchronous counters: - Modulo–n counter, Registers – shift registers - Universal shift registers– Shift register counters -Sequence generators

UNIT IV	DESIGN OF SEQUENTIAL CIRCUITS	9

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

UNIT V	MEMORY DEVICES	9

Classification of memories – ROM organization -Types of ROM - RAM organization -Types of RAM –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply appropriate simplification methods to simplify Boolean expressions	Apply
CO2	Design combinational circuits using appropriate gates	Apply
CO3	Apply the Knowledge of sequential circuits to analyze the propagation delay of synchronous and asynchronous circuits	Analyze

CO4	Design synchronous and asynchronous circuits for real time applications	Create
CO5	Apply the Knowledge of programmable logic devices to design combinational circuits	Apply
CO6	Create a gate-level implementation of a combinational logic function described by a truth table using AND/OR/NOT gates.	Create
CO7	Create a state transition diagram from a description of a sequential logic function and then convert the diagram into an implementation of sequential circuits.	Create
CO8	Properly incorporate synchronous and asynchronous memories into a circuit design	Apply

TEXT BOOKS:

1. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education,2013.
2. S.Salivahanan, S. arivazhagan'Digital Circuits and Design' Oxford university press,2018

REFERENCES:

1. Comer "Digital Logic & State Machine Design, Oxford, 2012.
2. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
3. D.P.Kothari,J.S.Dhillon, 'Digital circuits and Design',Pearson Education, 2016.

LIST OF EXPERIMENTS

1. Design and implementation of Adder and Subtractor using logic gates.
2. 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
3. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
4. Design and implementation of 2 bit Magnitude Comparator using logic gates, 8 Bit Magnitude Comparator using IC 7485
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De-multiplexer using logic gates and study of IC74150 and IC 74154
7. Design and implementation of encoder and decoder using logic gates and study of IC7445and IC74017
8. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
9. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters.
10. Design and implementation of 3-bit synchronous up/down counter.

19UEC303	CIRCUIT THEORY	L	T	P	C
		3	0	0	3

Prerequisites: Basic Mathematics

OBJECTIVES:

- To learn an engineering circuit analysis technique such as nodal analysis, and mesh analysis.
- To explain Network theorems and their applications to electric circuits.
- To familiarize resonant, coupled, transient circuits, and two port networks.

UNIT I	CIRCUIT ANALYSIS (BOTH DC & AC CIRCUIT ANALYSIS)	9

Circuit Elements-Network graphs- Concept of branch, link, tree and co-tree- dual networks-Ohm's Law-Kirchoff's voltage law – Kirchoff's current law – Mesh analysis – Super mesh analysis – Nodal analysis – Supernode analysis – Source transformation technique – Voltage and current source transformations- Star delta transformation.

UNIT II	NETWORK THEOREMS (ONLY DC CIRCUITS)	9

Superposition theorem – Thevenin's theorem – Norton's theorem – Reciprocity theorem – Compensation theorem – Maximum power transfer theorem – Tellegen's theorem – Millman theorem

UNIT III	RESONANT CIRCUITS AND COUPLED CIRCUITS	9

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

UNIT IV	TRANSIENT CIRCUITS	9

Transient response of RL, RC and RLC series and parallel circuits – frequency response – step and sinusoidal responses – natural frequency, damped frequency, damping factor and logarithmic decrement.

UNIT V	TWO PORT NETWORKS	9

Driving point and transfer impedances/admittances – voltage and current ratios of two port networks – admittance, impedance, hybrid, transmission and image parameters for two-port networks - Interconnection of two port networks.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the basic properties of circuit elements.	Understand
CO2	Apply the knowledge of Kirchhoff's laws to compute voltage and current in AC and DC circuits	Apply
CO3	Apply the knowledge of network theorems to compute power in DC circuits.	Apply
CO4	Analyze the characteristics of resonant and coupled circuits.	Analyze
CO5	Analyze the frequency response of transient circuits.	Analyze
CO6	Analyze the performance of two port networks.	Analyze

TEXT BOOKS:

1. A.Sudhakar, Shyam Mohan S P “Circuits and Networks: Analysis & Synthesis”, Tata McGraw - Hill, 5th edition, 2015.
2. William H.Hyte, J.E.Kemmerly, Steven M.Durban “Engineering Circuit Analysis”, Tata McGraw – Hill, 8th edition.
3.

REFERENCES:

1. Joseph Edminister, “Electric circuits”, Schaums Outline Series, McGraw-Hill, 6th edition, 2013.
2. M.Arumugam, N.Premkumar “Electric circuit Theory”, Khanna Publishers, New Delhi 2006.
3. M.L.Soni, J.C Gupta “Electrical Circuit Analysis”, DhanpatRai and Sons, New Delhi 2006.
4. Charles K. Alexander, Mathew N.O.Sadiku, “Fundamentals of Electric Circuit”, McGraw-Hill’s New York,2003

19UEC304	BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the methods of biasing of transistors.
- To familiarize the students about the mid band analysis of amplifier circuits using small - signal equivalent circuits.
- To summarize the method of analyzing large signal and feedback amplifiers.

UNIT 1	A.C CIRCUITS AND TRANSFORMERS	9

Introduction to AC circuits – waveforms and RMS value – power and power factor – Pure R,L and C alone-series RL, RC and RLC circuits. Transformers-Introduction –principle of working-Types of transformers-emf equation of a Transformer-Losses in a Transformer- Auto transformer

UNIT 2	AC AND DC MACHINES	9

Single phase Induction motors -Construction– Types–starting and speed control methods, Synchronous motors- working principle-starting methods -– Torque equation – Stepper Motors.

Introduction – Constructional Features– Motoring and generation principle - Emf and Torque equation – Circuit Model –– Starting and Speed Control – Universal Motor

UNIT 3	ELECTROMECHANCIAL INDICATING INSTRUMENTS	9

Suspension Galvanometer, Torque and deflection of the galvanometer, Permanent magnet moving coil mechanism, DC Ammeter, DC Voltmeter, Voltmeter Sensitivity, Series type Ohm meter, Shunt type Ohmmeter, Multimeter or VOM

UNIT 4	SIGNAL GENERATORS AND ANALYZERS	9

Signal generators - sine wave generators, Frequency synthesized signal generator, Frequency divider generator, Signal generator modulation, Sweep Frequency generators, pulse and square wave generators, Function generator, Audio frequency signal generator, spectrum analyzer.

UNIT 5	OSCILLOSCOPES	9

Cathode ray oscilloscopes - block diagram, Cathode ray tube, CRT circuits, Vertical Deflection system, Delay line, Multiple trace, Horizontal Deflection system, Oscilloscope probe and transducers, Oscilloscope technique, Special oscilloscopes- Analog and Digital Storage oscilloscope.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Analyze the concept of AC circuits and principles in Transformers. (K2)	Understand
CO2	Comprehend the working principles in electrical generators and motors. (K2)	Understand
CO3	Apply the knowledge of various electronics instruments to measure the physical quantities in the field of science,	Apply

	engineering and technology.(K3)	
CO4	Compare the different types of measuring instruments, their construction, operation and characteristics. (K2)	Understand
CO5	Identify appropriate measuring instruments for given application. (K4)	Analyze

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, —Basic Electrical and Electronics Engineering‖, McGraw Hill
   Education(India) Private Limited, Third Reprint ,2016.
2. Swahney, A.K.," A Course in Electronic Measurements and Instrumentation " DhanpatRai& Co ,2015.

REFERENCES:

1. B.L.Theraja and A.K. Theraja, "A text book of electrical technology-Volume 1 "S.Chand& company limited,2005.
2. Helfric AD and Cooper WD, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 1992.

19UEC305	ANALOG CIRCUITS	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

- To familiarize the students about the mid band analysis of amplifier circuits using small - signal equivalent circuits.
- To summarize the method of analyzing large signal and feedback amplifiers.
- To impart knowledge on design of sinusoidal and non-sinusoidal oscillators.

UNIT I	**MIDBAND ANALYSIS OF SMALL SIGNAL AMPLIFIERS**	**9**
	Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis	
UNIT II	**FREQUENCY RESPONSE OF SINGLE STAGE AND MULTISTAGE AMPLIFIERS**	**9**
	General shape of frequency response of amplifiers - Definition of cut off frequencies and bandwidth - Low frequency analysis of amplifiers to obtain lower cut off frequency, High frequency analysis of amplifiers to obtain upper cut off frequency, High frequency transistor models for BJT and FET amplifiers, Unity Gain-Bandwidth product, General expression for frequency response of multistage amplifiers – Amplifier rise time , sag time and their relation to cut off frequencies, design procedure for given parameters.	
UNIT III	**POWER AMPLIFIERS**	**9**
	Classification of amplifiers, Class A large signal amplifiers and Direct-coupled Class A audio power amplifier - transformer-coupled Class A audio power amplifier – efficiency and linearity issues, Class B amplifier –push-pull amplifier - distortion in amplifiers - complementary-symmetry (Class B) push-pull amplifier -efficiency, class AB-Class C,MOSFET power amplifier, Thermal stability and heat sink.	
UNIT IV	**FEEDBACK AMPLIFIERS**	**9**
	Block Diagram of Feedback amplifiers, Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., concept of stability, gain margin and phase margin , design of feedback amplifiers	
UNIT V	**OSCILLATORS**	**9**
	Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge), LC oscillators (Hartley, Colpitt, Clapp), non-sinusoidal oscillators, Frequency range of RC and LC Oscillators, crystal oscillator , non-sinusoidal oscillators-UJT relaxation oscillator, negative resistance oscillator	
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of stabilization technique for analyzing the operation of amplifier in mid band region. (K3)	Apply
CO2	Analyze the frequency response of BJT and FET amplifiers. (K3)	Apply
CO3	Design and experiment with various voltage amplifier circuits using BJTs. (K3)	Apply
CO4	Design and experiment with various power amplifier circuit using power transistor for AF and RF application. (K4)	Analyze
CO5	Design and experiment with various electronic sub systems such as feedback amplifiers to meet the required specifications. (K4)	Analyze
CO6	Design and experiment with various the different sinusoidal and non-sinusoidal oscillator circuits for various frequencies. (K4)	Analyze
CO7	Design and simulate the amplifier and oscillator circuit by using SPICE tool / open source. (K4)	Analyze

TEXT BOOKS:

1. Salivahanan.S, Suresh Kumar. N, Vallavaraj. A "Electronic Devices and Circuits", TMH,
   4th Edition, 2017.
2. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education/ PHI, 11th Edition,2013.
3. R.S.Sedha" A textbook of Electronic Circuits",S.Chand,4th edition,2014.

REFERENCES:

4. Millman.J, Halkias.C, "Integrated Electronics", TMH, 2nd edition, 2010.
5. David A. Bell, "Electronic Devices & Circuits", PHI, 4th Edition, 2007.
6. Floyd, "Electronic Devices", Pearson Education, 6th Edition, 2002.
7. Nagrath.I.J, "Electronic Devices and Circuits", PHI, 2007.

LIST OF EXPERIMENTS

1. Design of DC biasing circuit using potential divider arrangement.
2. Bipolar Transistors- Design of single stage RC coupled amplifier – Plot of frequency versus gain in dB., Measurement of bandwidth and input impedance of an amplifier.
3. Field Effect Transistors - Single stage Common source FET amplifier –plot of gain in dB Vs frequency, Measurement of bandwidth and input impedance of an amplifier.
4. Two stage Amplifier. Plot of frequency Vs gain. Estimation of gain and bandwidth of an amplifier.
5. Power Amplifiers – Class A Amplifier – measurement of gain.
6. Power Amplifiers – Complementary Symmetry class B Amplifier –measurement of gain.
7. Power Amplifiers - Class C amplifier –measurement of gain.

8. Design of voltage shunt feedback (collector to base bias) amplifier - Plot the frequency response - Input and output impedance calculation, measurement of bandwidth with & without feedback.
9. Design of voltage series feedback (Emitter follower) amplifier - Plot the frequency response - Input and output impedance calculation, measurement of bandwidth with & without feedback.
10. Design of current series feedback (CE amplifier with emitter resistor RE) amplifier - Plot the frequency response - Input and output impedance calculation, measurement of bandwidth with & without feedback.
11. Design of RC phase shift oscillator - Estimation of frequency of oscillation – compare with theoretical value.
12. Design of Hartley oscillator - Estimation of frequency of oscillation – compare with theoretical value.
13. Design of Colpitts oscillator - Estimation of frequency of oscillation – compare with theoretical value.
14. Design of Non- Sinusoidal Oscillators- Estimation of frequency of oscillation – compare with theoretical value.
15. Simulation of Amplifier and Oscillator circuits studied in the lab using any available simulation software and measurement of bandwidth and other parameters with the help of simulation software.

19UIT326	FUNDAMENTALS OF C PROGRAMMING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To develop C Programs using basic programming constructs
- To develop C programs using functions, array and string
- To develop applications in C using pointers and structures

UNIT I	**MODULE 1 BASICS OF C, DECISION CONTROL AND LOOPING STATEMENTS**	**10+10**
	Introduction to C - Introduction, Structure of C program, Writing simple C Program, Input and Output statements, Conditional Branching Statements - Iterative Statements, Nested Loops, Break and Continue Statements, goto Statement. **List of Experiments:** 1. Implement Simple C Programs 2. Implement C programs using Operators 3. Implement C Programs using Decision Control statements 4. Implement C Programs using Looping statements	
UNIT II	**MODULE 2 ARRAYS, STRINGS AND FUNCTIONS**	**10+10**
	Arrays – Introduction, Declaration of Arrays, Accessing the Elements of an Array, Operations on Arrays, Passing Arrays to functions, Two dimensional Arrays, Multidimensional Arrays, Strings – Introduction, Operations on Strings, Arrays of Strings. Function: Introduction, function declaration and definition, function call, return statement, passing parameter to function, Storage classes, Recursive function. **List of Experiments:** 1. Implement C Programs using Arrays 2. Implement C Programs using Strings 3. Implement C Programs using Function	
UNIT III	**MODULE 3 – POINTERS AND STRUCTURES**	**10+10**
	Pointers - Introduction to Pointers - Declaring Pointer Variables, Pointers and Arrays, Pointers to Pointers, Dynamic memory allocation, Structure - Introduction, Nested Structures, Arrays of Structures, Structures and Functions. **List of Experiments:** 1. Implement C Programs using Pointers 2. Implement C Programs using array of Pointer 3. Implement C Programs using Structures	

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Infer the Knowledge of fundamental C programming concepts	Understand
CO2	Apply various concepts of C program for solving problems	Apply
CO3	Analyze different features of C program for a given scenario	Understand
CO4	Design a solution without anomalies using C programming concept for the given applications	Design
CO5	Select and apply appropriate tools to implement any few concepts of C programming	Modern Tool Usage
CO6	Identify the requirement and take further preparation in order to adopt Technological change	Lifelong learning / Communication

TEXT BOOKS:

1. ReemaThareja,"Programming in C", 2nd Edition, Oxford university press, 2015.
2. Yashavant P. Kanetkar,"Let us C", 5th Edition, BPB Publications, 2004.

REFERENCES:

1. Brian.K.Kernighan,Dennis.M.Ritchie,"The C Programming Language", 2nd Edition, Pearson,
2. PradipDey,ManasGhosh, "Computer fundamentals and programming in C", 2nd Edition, Oxford university press,2013.
3. Noel Kalicharan,"Learn to program with C", Apress, 2015.

19UEC307	SEMINAR	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To engage the student in integrated activities of reading, research, discussion and presentation around a designated subject.

This course is introduced to enrich the communication skills of the student and to create awareness on recent development in Electronics and communication through Technical presentation.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Identify promising new directions of various cutting edge technologies.	Apply
CO2	Communicate the technical information effectively by making an oral presentation before an evaluation committee	Lifelong learning / Communication

19UGM332	BIOLOGY FOR ENGINEERING APPLICATIONS (Common to Agri, Civil, Chem, ECE, EEE & IT)	L	T	P	C
		2	0	0	P/F

OBJECTIVES:

- To provide a basic understanding of biological mechanisms of living organisms and the human biology from the perspective ofengineers.
- To encourage engineering students to think about solving biological problems with engineering principles andtools.

UNIT I	**INTRODUCTION AND CLASSIFICATION**	**5**
	Introduction to Biology – Comparison of Biology and Engineering – Eye and Camera – Bird flying and Aircraft – Brownian motion and Thermodynamics – Classification – Unicellular or multicellular – Unicellular: Bacteria, Protozoa, Yeast – Multi Cellular: Animals, Humans, Plants, fungi etc. – Ultra structure: prokaryotes or eukaryotes – Habitat: aquatic or terrestrial.	
UNIT II	**DIGESTIVE & RESPIRATORY SYSTEMS – ENZYME**	**6**
	Study of digestive – Respiratory systems and their functions – .Enzyme – Classification of Enzyme – Mechanism of Enzyme activity – Enzymes for Industrial Applications: Waste management – Food processing industry – Beverages – Pharmaceutical – Paper Industry etc.	
UNIT III	**GENETICS AND BIO MOLECULES (Basics only)**	**7**
	Basics of Genes – DNA structure – Genes and hereditary – Genetic Code – Coding and decoding Genetic information – Gene Mapping – Gene Interactions – Mutations – Genetic disorders – Gene therapy – Biomolecules: Carbohydrates, lipids, nucleic acids, proteins. Biological Applications in Engineering: Genetic Algorithm – Computer Application in Genetic Engineering – Genetic Programming–Genetic Computers.	
UNIT IV	**NERVOUS SYSTEM AND CELL SIGNALING**	**7**
	Central Nervous System: Brain and Spinal Cord – Peripheral Nervous System – Sensory Division – Motor Division – Neurons – sensory, motor, and interneurons – Signals –Transfer of Information – Bio Signals – Electrocardiography (ECG) – Electroencephalography (EEG) – Electromyography (EMG) – Electrooculography (EOG) – X-ray – CT Scan – MRI scan – Biological Applications in Engineering – Neurons and Neural Network.	
UNIT V	**BIOLOGY AND ITS INDUSTRIAL APPLICATION**	**5**
	Bioreactors – Biopharming – Recombinant vaccines – Cloning – Drug discovery –Bioremediation – Biofertilizer – Biocontrol – Biofilters – Biosensors – Biopolymers – Bioenergy – Biomaterials – Biochips	
		TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Explain the fundamentals of living things, their classification, cell structure and biochemical constituents.	Understand
CO2	Apply the concept of plant, animal and microbial systems and growth in real life situations	Apply
CO3	Analyze biological engineering principles and procedures needed to solve societal issues.	Analyze

TEXT BOOKS

1. R.C.Dubey, “A Text book of Biotechnology”, S. Chand Higher Academic Publications,2013.
2. R. Khandpur, “Biomedical instrumentation - Technology and applications”, McGraw Hill Professional,2004.

REFERENCES:

1. Arthur T. Johnson, “Biology for Engineers”, CRC Press, Taylor and Francis, 2nd Edition,2019.
2. Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, “Cell Biology and Genetics (Biology: The unity and diversity of life Volume I)”, Cengage Learning, 12th Edition,2008.
3. Gerard J. Tortora and Bryan H.Derrickson, “Principles of Anatomy and Physiology”,15thEdition,Wiley publications,2016.

SEMESTER IV

SEMESTER IV

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UMA422	Probability and Statistics	3	1	0	4	Basic Science
19UEC402	Electromagnetic Fields and Transmission Lines	3	0	0	3	Professional Core
19UEC403	Signals and Systems	3	1	0	4	Professional Core
19UEC404	Linear Integrated circuits	2	0	3	3.5	Professional Core
19UEC405	Analog and Digital Communication	3	0	3	4.5	Professional Core
19UIT429	Introduction to data structures and algorithms (Integrated course)	2	0	2	3	Professional Core
PRACTICAL						
19UGS433	Interpersonal Skills laboratory	0	0	3	1.5	Humanities and Social Science
MANDATORY						
19UGM431	Gender Equality	1	-	-	P/F	Mandatory Course
	TOTAL	**17**	**2**	**11**	**23.5**	

19UMA422	PROBABILITY AND STATISTICS (ONLY FOR ECE)	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide necessary basic probability concepts and standard distributions that can describe real life phenomena.
- To make the student acquire sound knowledge of fundamentals and applications of statistics which will greatly help at the data analysis stage of comparative experiments.
- To familiarize the student to analyze the response of random inputs to linear time invariant systems.

UNIT I	PROBABILITY & RANDOM VARIABLES	9 + 3

Axioms of probability - Conditional probability - Total probability - Discrete and continuous random variables - Moments - Moment generating functions and their properties. Binomial, Poisson, Normal and Exponential- Joint probability distributions - Marginal and Conditional distributions – Covariance - Correlation and Regression

UNIT II	TESTING OF HYPOTHESIS	9 + 3

Sampling distributions - Normal, t, Chi-square and F distributions **-** Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes

UNIT III	DESIGN OF EXPERIMENTS	9 + 3

Completely Randomized Design – Randomized Block Design – Latin Square Design

UNIT IV	CORRELATION AND SPECTRAL DENSITIES	9 + 3

Auto Correlation Functions - Cross Correlation Functions – Properties - Power Spectral density - Cross spectral density - Applications of correlations and Spectral Densities.

UNIT V	LINEAR SYSTEMS WITH RANDOM INPUTS	9 + 3

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

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of concepts of probability to acquired knowledge of standard Distributions.	Apply
CO2	Apply the concept of testing of hypothesis for small and large samples in Real life Problems	Analyze
CO3	Analyze a process, to find its significance using design of experiments	Analyze
CO5	Apply the knowledge on random process to analyze the linear system with random inputs in the areas of communication and signal processing	Apply
CO6	Apply basic probability techniques and models in linear systems	Apply

CO7	Understand the basic concept of probability , Random Variable and statistics	Understand

TEXT BOOKS:

1 . GREWAL B.S, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 42nd Edition,
(2012).

2. GUPTA S.C , KAPOOR V.K. “Fundamental of Mathematical Statistics” 10th Edition ,Sultan Chand and Sons, New Delhi, 2002.

3. VEERARAJAN.T “ Probability and Random Processes” 4th Edition Tata McGraw-Hill, New Delhi,
(2015).

REFERENCE BOOKS:

1. SHARMA J.N , GOEL J.K “ Mathematical statistics “ 7th Edition Krishna Prakasham Mandis, Mearut 1998
2. Venkatarama Krishnan, “Probability and Random Processes“, Wiley-Interscience Publication, 2006.
3. John A. Gubner., “Probability and Random Processes For Electrical and Computer Engineers”, Cambridge University Press, (2006).
4. Alberto Leon-Garcia., “Probability, Statistics and Random Processes For Electrical Engineering”, 3rd Edition, Prentice Hall publisher, (2008).

19UEC402	ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the relation between the fields under Static and Time varying situations
- To give an idea about symmetrical networks and various transmission line parameters
- To explain about EM propagation in guided systems and resonators

UNIT 1	STATIC AND TIME VARYING ELECTRIC AND MAGNETIC FIELDS	9

Review of Electromagnetic fields and its formulas - Poisson's and Laplace's equation- Capacitance of various geometries using Laplace's equation- Faraday's law – Maxwell's Second Equation in integral form from Faraday's Law – Equation expressed in point form -Modified form of Ampere's circuital law as Maxwell's first equation in integral form and point form, Maxwell's four equations in integral form and differential form.

UNIT II	ELECTROMAGNETIC WAVES	9

Derivation of Wave Equation – Uniform Plane Waves – Maxwell's equation in Phasor form – Wave equation in Phasor form – Plane waves in free space and in a homogenous material-Wave equation for a conducting medium – Plane waves in lossy dielectrics – Propagation in good conductors – Skin effect – Reflection of Plane Wave from a conductor – normal incidence – Reflection of Plane Waves by a perfect dielectric – normal and oblique incidence, Brewster angle.

UNIT III	FILTERS AND TRANSMISSION LINE PARAMETERS	9

Characteristic impedance of Symmetrical Networks – Filter fundamentals – Constant K Filters - Low pass, High pass, band pass, band elimination filters - m-derived sections – Filter circuit design – A line of cascaded T sections - Transmission lines - General Solution.

UNIT IV	THE LINE AT RADIO FREQUENCY	9

Line constants for dissipation - voltages and currents on the dissipation less line - standing waves – nodes - standing wave ratio - input impedance of open and short circuited lines - power and impedance measurement on lines –$\lambda/4$ line,$\lambda/2$ line,$3\lambda/4$ line Impedance matching – single and double-stub matching circle diagram, smith chart and its applications – Problem solving using Smith chart. Reflection on a line not terminated in Zo, Reflection Coefficient, Open and short circuited lines, Insertion loss.

UNIT V	GUIDED WAVES BETWEEN PARALLEL PLANES	9

Transmission of TM waves between Parallel planes – Transmission of TE waves between Parallel planes. Transmission of TEM waves between Parallel planes – TE, TM waves in Rectangular waveguide – Circular waveguides. The TEM wave in coaxial lines. Excitation of wave guides. Guide termination and resonant cavities.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Formulate Maxwell's equations for static and time varying fields.	Understand
CO2	Analyze the EM wave propagation parameters in different mediums.	Analyze
CO3	Design the constant K-filter& m-derived filter for the given cutoff frequency	.Apply
CO4	Analyze the transmission lines and their parameters using the Smith Chart	. Analyze
CO5	Analyze the TE ,TM waves in different waveguides.	Analyze

TEXTBOOKS:

1. Hayt.W.H., BuckJ.A, "Engineering Electromagnetics" , TATA McGraw-Hill, 7th Edition , 2007
2. .C.Jordan, K.G. Balmain, "E.M.Waves & Radiating Systems",Pearson Education, 2006
3. John D.Ryder, "Networks, lines and fields" , Prentice Hall of India, 2nd Edition, 2006.

REFERENCE BOOKS:

1. Joseph Edminister, "Schaum's Series, Electromegnetics" , Tata Mc-graw Hill,2007
2. G S N Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education,2006.
3. Matthew, Sadiku.N.O.,"Elements of Engineering Electromagnetics" , Oxford University Press, 4th edition, 2007.
4. Philip C. Magnusson, Andreas Weisshaar, Vijai K. Tripathi, Gerald C. Alexander, "Transmission Lines and Wave Propagation" , CRC Press, Fourth Edition, 2006
5. Ramo, Whineery and Van Duzer, "Fields and Waves in Communication Electronics" , John Wiley, 2003.

19UEC403	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the concept of continuous and discrete signals and systems
- To introduce the tolls like Fourier series, Fourier transform, Laplace transform, Discrete time Fourier Transform and Z transform in the analysis of CT and DT signals and systems
- To explain about the CT signal to DT signal conversion process

UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9+3

Classification of signals: Continuous time (CT) and Discrete Time (DT) signals - Standard signals - Basic operations on signals - properties of signals - Periodic & Aperiodic signals, Deterministic & Random signals, Even and Odd signals, Energy & Power signals,
Classification of systems: CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, static and Dynamic, Causal & Non-causal, Stable & Unstable. - Linear Time invariant Systems and properties.

UNIT II	FOURIER SERIES AND FOURIER TRANSFORM	9+3

Fourier Series Signal Analysis: Introduction – Trigonometric Fourier Series for Periodic Signals –Exponential Fourier Series – Symmetry Properties – Properties of Fourier Series - Parseval's Theorem.
Fourier Transform: Introduction – Fourier Integral – Energy Spectral Density – Fourier Transform Properties – System Analysis – Impulse response and Steady-state response of Linear System.

UNIT III	CONTINUOUS TIME SIGNALS AND SYSTEM ANALYSIS USING LAPLACE TRANSFORM	9+3

Laplace Transform - Inverse Laplace Transform- Laplace transform properties-LTI CT System Analysis – Frequency Domain solution – Frequency, Impulse and steady state response– Analysis of Electrical Circuits - Convolution Integral-Block Diagram realization - State-Variable Techniques - State matrix representation of systems.

UNIT IV	DISCRETE TIME SIGNALS AND SYSTEM ANALYSIS USING DTFT	9+3

Sampling and aliasing - DTFT - Properties of DTFT-LTI DT System Analysis – Frequency Domain solution - Frequency, Impulse and steady state response – Convolution sum.

UNIT V	DISCRETE-TIME SIGNALS AND SYSTEMS ANALYSIS USING Z TRANSFORM	9+3

Z-Transform –– Inverse Z-Transform -Properties– LTI DT System Analysis – Frequency Domain solution – Frequency, Impulse and steady state response– Convolution Sum - Block Diagram realization.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply engineering knowledge to classify the CT/DT signals/systems according to their properties	Apply
CO2	Apply the knowledge of Fourier series and Fourier Transform to analyze the characteristic of CT signals and systems	Analyze

CO3	Analyze Continuous time signals and systems using Laplace transform	Analyze
CO4	Identify the required sampling rate for CT to DT signal conversion and represent the DT signals/systems using DTFT	Apply
CO5	Apply the knowledge of Z Transform to analyze the characteristic of DT signals and Systems	Analyze

TEXT BOOKS:

1. Simon Haykins, Barry Van Veen, " Signals and Systems ", John Wiley & sons Inc, 2004
2. Allan V.Oppenheim, S.Wilsky, S.H.Nawab ,"Signals and Systems ", Pearson Education ,2nd Edition, 2007.

REFERENCES

1. H P Hsu, Rakesh Ranjan, "Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007.
2. M J Roberts, "Signals and Systems – Analysis using Transform Methods and MATLAB", TataMcGraw-Hill, 2003.
3. Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin, "Signals & systems", Pearson Education, Fourth Edition, 2002.
4. Steven T. Karris, "Signals and Systems: With Matlab Applications", Orchard Publications, 2003.

19UEC404	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		2	0	3	3.5

OBJECTIVES:

- To impart knowledge in basic building blocks of linear integrated circuits
- To make the students to learn the linear and non-linear applications of operational amplifiers
- To familiarize some special function ICs
- To prepare the students to learn the types of ADC and DAC

UNIT 1	BASICS OF OPERATIONAL AMPLIFIERS	10

Current sources, Voltage sources, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations with different input configurations – JFET Operational Amplifiers.

UNIT 2	OPERATIONAL AMPLIFIERS APPLICATIONS AND SPECIAL FUNCTION ICs	10

Sign Changer, Scale Changer, Phase Shift Circuits, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, peak detector, clipper and clamper, filters, Sine-wave generators, Multivibrators ,Saw-tooth wave generator, ICL8038 Function generator, Timer IC 555, IC Voltage regulators.

UNIT 3	DATA CONVERTERS	10

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

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the suitable techniques to fabricate ICs with Op-amp and JFET	Apply
CO2	Design OP – AMP circuits for different linear and nonlinear applications along with special function ICs	Apply
CO3	Analyze the various types of data converters.	Apply
CO4	Design amplifiers, oscillators, D-A converters using operational amplifiers.	Analyze
CO5	Design filters using op-amp and verify the frequency response.	Analyze
CO6	Analyze the performance of filters, multivibrators and A/D converter using SPICE.	Analyze

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Ramakant A. Gayakwad, —OP-AMP and Linear ICs‖, 4th Edition, Prentice Hall / Pearson Education, 2015.
2. S.Salivahanan & V.S. Kanchana Bhaskaran, —Linear Integrated Circuits‖, TMH,2nd Edition, 4 th Reprint, 2016.
3. Gray and Meyer, —Analysis and Design of Analog Integrated Circuits‖, Wiley International,5th Edition 2009

LIST OF EXPERIMENTS

DESIGN AND TESTING OF THE FOLLOWING CIRCUITS

1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass and band-pass filters.
5. Schmitt Trigger using op-amp.
6. Phase shift and Wien bridge oscillators using Op-amp.
7. Astable and Monostable multivibrators using NE555 Timer.
8. R-2R Ladder Type D- A Converter using Op-amp.
9. Study of SMPS simulation using SPICE: Filters using Op-amp
10. Multivibrators using NE555 Timer.

TOTAL: 45 PERIODS

19UEC405	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

- To introduce the basic concepts of information and Digital Communication in baseband and pass band domains
- To illustrate the signal space representation of signals and discuss the process of sampling, quantization and coding that are fundamental to the digital transmission o analog signals
- To impart the knowledge on spread spectrum communication

UNIT I	**ANALOG MODULATION SYSTEMS**	**9**
	Baseband and Carrier Communication, Amplitude Modulation, Double Side Band Suppressed Carrier, Single Side Band, Vestigial Side Band, Frequency Division Multiplexing, Angle Modulation: Generalized concept of Angle Modulation, Narrow-Band and Wide-band FM, Phase Modulation, Generation and Demodulation of Analog Modulations	
UNIT II	**DIGITAL DATA TRANSMISSION**	**9**
	Pulse Modulation: Sampling Theorem, Pulse Code Modulation, Quantization, Differential Pulse Code Modulation, Delta Modulation	
UNIT III	**INFORMATION THEORY AND CODING**	**9**
	Measure of Information, Entropy, Source Coding, Compact (Huffman) Code, Discrete Memoryless Channels, Channel Coding Theorem, Information Capacity Theorem. Error Correcting Codes: Linear Block Code, Cyclic Code, Convolutional Codes, Viterbi Algorithm	
UNIT IV	**DIGITAL MODULATION TECHNIQUES**	**9**
	Carrier Systems: Amplitude Shift Keying, Phase Shift Keying, Frequency Shift Keying, Differential Phase Shift Keying, Coherent Detection and Non-Coherent Detection, BER Analysis, M-Ary Communication	
UNIT V	**SPREAD SPECTRUM TECHNIQUES**	**9**
	PN Sequence Generation, Direct Sequence SS, Frequency Hop SS, Near/Far Problem, Multipath Propagation.	

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of mathematical theory to characterize and construct analog modulation schemes in time and frequency domain	Apply
CO2	Apply the knowledge of line coding techniques and information theory for efficient baseband signaling and construction of efficient source and error control coding scheme	Apply
CO3	Compare the performance of different types of analog modulation and analog to digital conversion techniques	Analyze
CO4	Analyze the performance of spread spectrum system in the presence of interference and multipath propagation. (Analyze)	Analyze
CO5	Evaluate the performance of different digital modulation techniques in terms of bandwidth, signal to noise ratio and probability of error.	Evaluate

CO6	Design analog and digital communication system for a given specification.	Create

TEXT BOOKS:

1. Simon Haykin and Michael Moher, “Communication Systems” John Wiley & Sons, Fifth Edition, 2016.
2. B.P. Lathi and Zhi Ding, “Modern Digital and Analog Communication” Oxford University Press, Fifth Edition, 2018.

REFERENCE BOOKS:

1. John G Proakis, and Masoud Salehi, “Fundamentals of Communication Systems” Pearson, 2nd Edition, 2014.
2. Sam Shanmugam, “Digital and Analog Communication systems” John Wiley, 2nd edition, 1992.
3. Herbert Taub, Donald L Schilling, and Goutam Saha, “Principles of Communication Systems” McGraw-Hill, Third Edition, 2008.

LIST OF EXPERIMENTS

1. Generation of standard signals in continuous and discrete time domain
2. Modulation and Demodulation of Amplitude Modulation.
3. Modulation and Demodulation of Frequency Modulation
4. Verification of Sampling theorem.
5. Pulse Code Modulation.
6. Delta modulation
7. Simulation of Linear block codes and cyclic codes
8. Simulation of convolutional codes and decoding algorithm
9. Bit error rate analysis of error control coding.
10. Digital modulation and Demodulation techniques – ASK, PSK and FSK (Hardware and Software simulation)
11. Simulation of M-ary modulation systems
12. Bit Error Rate analysis of digital modulation schemes using simulation software.
13. Line coding
14. Simulation of direct sequence Spread Spectrum
15. Simulation of frequency hop spread spectrum

19UIT429	INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To develop Programs to implement arrays and list using basic programming constructs
- To develop Programs to implement stack and queue using basic programming constructs
- To develop Programs to implement tree and graphs using basic programming constructs

UNIT I	**–LINEAR DATA STRUCUTRE – ARRAYS, LIST**	**10+10**
	Abstract Data Type – Approaches to design an Algorithm – Complexity – Arrays: Accessing Elements – Operations – List ADT: Memory Allocation and De-allocation – Singly linked lists – Circular linked lists – Doubly linked lists – Applications of lists – Polynomial Manipulation **Experiments:** 1. Program to implement Arrays. 2. Program to implement List ADT 3. Program to implement Polynomial Arithmetic using Linked List	
UNIT II	**LINEAR DATA STRUCUTRE – STACK, QUEUE**	**10+10**
	Stack ADT: Array & Linked Representation – Applications of Stack – Balancing Parenthesis – Arithmetic expressions (Conversion & Evaluation) – Recursion - Queue ADT: Array & Linked Representation – Circular Queue – Applications of Queue. **Experiments:** 1. Program to implement stack ADT using array and linked list 2. Program to implement stack and use it to Evaluate postfix expression 3. Program to implement queue ADT use array and linked list	
UNIT III	**NON-LINEAR DATA STRUCUTRE – TREE AND GRAPH**	**9+9**
	Tree – Basic Terminology – Traversal – Operations: Binary trees – Expression Tree – Binary Search tree – AVL tree – Graph Terminology – Representation of Graphs – Graph Traversal – Topological sort – Minimum Spanning Tree – Shortest path algorithm. **Experiments:** 1. Program to implement binary search tree 2. Program to implement insertion and deletion in AVL trees 3. Program to implement Prim's and Kruskal's algorithm using priority queues to find MST of an undirected graph.	
UNIT IV	**NON-LINEAR DATA STRUCTURE – GRAPH**	8+8
Introduction – Graph Terminology – Representation of Graphs – Graph Traversal – Topological sort– Minimum Spanning Trees – Prim's and Kruskal's Algorithm – Shortest path algorithm – Dijkstra's algorithm – Floyd's Algorithm – Warshall's		

algorithm. **Experiments:** 1. Program to implement Prim's algorithm using priority queues to find MST of an undirected graph 2. Program to implement Kruskal's algorithm using priority queues to find MST of an undirected graph	
UNIT V **SEARCHING, SORTING AND HASHING**	8+8
Searching: Linear Search – Binary Search, Sorting: Selection Sort – Bubble Sort – Insertion Sort – Merge sort – Quick sort – Hashing: Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing. **Experiments:** 1. Program to implement searching technique. 2. Program to implement sorting technique. 3. Program to implement hashing technique.	

TOTAL : 90 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the various applications like linear and non-linear data structures to solve the problems in relevant applications	Understand
CO2	Apply the linear and non-linear data structures to solve variety of computational problems.	Apply
CO3	Analyze the different Program to implementations of various data structure algorithms and to calculate the efficiency of algorithms.	Analyze
CO4	Design and develop efficient linear, non-linear, data structure algorithms to solve problems	
CO5	Evaluate the problems and find solutions using various linear and non-linear applications.	Evaluate
CO6	Select and apply appropriate data structures to design algorithms using modern tool	Modern Tool Usage

TEXT BOOKS

1. Reema Thareja, "Data Structures Using C", Oxford University Press, Second Edition, 2014.
2. Weiss. M.A, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition, 2012

REFERENCE BOOKS

1. Y. Langsam, M. J. Augenstein and A. M. Tenenbaum," Data Structures using C", Pearson Education Asia, 2004
2. Aho.V, Hopcroft.J.E, Ullman.J.D, "Data Structures and Algorithms", Pearson Education, 1st Edition Reprint, 2006.
3. Gilberg.R.F, Forouzan.B.A, "Data Structures", Thomson India Education, 2nd Edition, 2005.
4. Sara Baase and A.VanGelder, "Computer Algorithms", Pearson Education, 3rd Edition, 2005.
5. Cormen.T.H, C.A.Leiserson.B.A, R.L.Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2009.

19UGM431	GENDER EQUALITY	L	T	P	C
		2	0	0	P/F

OBJECTIVES:

To introduce basic concepts relating to gender and to provide logical understanding of gender roles.

UNIT I	**GENDER SENSITIZATION**	**10**
	Definition of gender, Perspectives-Gender sensitive approach-Gender and sex- Social construction of gender and gender roles-Socialization- institutions of socialization- changing content and context of gender-need for re-socialization. Gender Stereotyping and Gender Discrimination	
UNIT II	**GENDER EQUALITY AND CONSTITUTION**	**10**
	Indian constitution related to equality - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation - cultural and educational rights - the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers- Internal Complaints Committee - Legal AID cells, Help line, State and National Level Commission	
UNIT III	**GENDER ROLES & EQUALITY**	**10**
	Gender & Morality – Structural and functionalist views of Gender-Gender in the Classroom-Beyond access for girls and boys- Gender equality in schools- Gender equality and adult basic education-Developing capacity to achieve gender equality in education-Individuality and removal of gender stereotypes- Respect for each other's-Promote equal Opportunity	

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO 1	Describe the social construction of gender and sexuality and their influence in social context.	Understand
CO 2	Analyze how the concepts of gender equality are created, maintained, and/or challenged	Analyze
CO 3	Apply concepts of gender roles and equality in classroom, school, disciplinary or interdisciplinary creative, scholarly, and/or activist project	Apply

REFERENCE BOOKS:

1. Sheila Aikman and Elaine Unterhalter, "Practicing Gender Equality in Education", Oxfam GB, 2007.
2. Pasadena and Hackensack, "Gender roles and Equality", Salem Press,2011.

19UGS433	INTERPERSONAL SKILLS LAB	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To demonstrate signal processing techniques using DSP processor
- To demonstrate signal processing functions using Simulation Software.

LIST OF EXPERIMENTS:

List of Exercises

Part - A : Communication and Leadership Projects

I) Speech Projects

1. The Open up Speech (Prepared Speech)
2. Speech Organizing to the Point (Prepared Speech)
3. Table Topics Speech

II) Evaluation Projects

4. Speech Evaluation
5. TAG (Timer, Ah Counter and Grammarian) Evaluation

III) Leadership Roles

6. Speech Master of the Day
7. General Evaluator
8. Table Topics Master

Part - B : Problem-Solving and Decision- Making Project

IV) Quality Circle Project

TOTAL : 30 PERIODS

SEMESTER V

SEMESTER V

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
19UEC501	Digital Signal Processing	3	1	0	4	Professional Core
19UEC502	Microprocessors, Microcontrollers and Applications	3	0	0	3	Professional Core
19UEC503	Data Communication and Networks	3	0	0	3	Professional Core
19UEC504	Antenna and Wave Propagation	3	0	0	3	Professional Core
	Professional Elective I	3	0	0	3	Professional Elective
	Open Elective I	3	0	0	3	Open Elective
19UGS531	Reasoning and Aptitude	1	0	0	1	Basic Engineering
PRACTICALS						
19UEC505	Microprocessors, Microcontrollers and Applications lab	0	0	2	1	Professional Core
19UEC506	Digital Signal Processing lab	0	0	2	1	Professional Core
19UEC507	Creative Thinking and Innovation	0	0	2	1	Project Work
19UGS532	Soft Skills Laboratory	0	0	3	1.5	Humanities and Social Science
	TOTAL	**19**	**1**	**9**	**24.5**	

19UEC501	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce about DFT and its computation techniques
- To impart knowledge on design techniques of digital filters
- To outline the concept of finite word length effects and digital signal processor

Unit – 1	DISCRETE FOURIER TRANSFORM	9+3

Introduction to DFT – Properties of DFT - Circular Convolution – Filtering methods based on DFT- Linear Filtering of long data sequences - Overlap-add and save methods- FFT Algorithms - Decimation in time and Decimation in frequency algorithms- Use of FFT in linear filtering

Unit – 2	INFINITE IMPULSE RESPONSE DIGITAL FILTERS	9+3

Analog Butterworth and Chebyshev filter design- Discrete time IIR filter from analog filter- IIR filter design by Impulse Invariance, Bilinear transformation, pre warping- Structures of IIR filter

Unit – 3	FINITE IMPULSE RESPONSE DIGITAL FILTERS	9+3

Linear phase FIR filter -Fourier Series -Filter design using windowing - Techniques (Rectangular Window, Hamming Window, Hanning Window)- Frequency sampling techniques-Structures of FIR

Unit – 4	FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS	9+3

Binary fixed point and floating point number representations – Comparison Quantization noise – truncation and rounding -Quantization noise power- input quantization error, coefficient quantization error -limit cycle oscillations-dead band - Overflow error-signal scaling

Unit – 5	ADVANCE DSP TECHNIQUES AND DSP PROCESSOR	9+3

Multirate Signal Processing: Decimation, Interpolation -Sampling rate conversion by rational factor -Architecture of DSP Processors & applications: Introduction to Programmable DSPs -Architecture of TMS320C5x -TMS320C6xx DSP processors - Assembly language Instructions - Addressing Modes - Applications

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the functions and fundamental concepts of various DSP algorithms and processor.	Understand
CO2	Apply the knowledge of digital signal processing to design and simulate digital filters using various transformation techniques.	Apply

CO3	Analyze various digital signal processing and multirate signal processing systems.	Analyze
CO4	Compare and evaluate various signal transformation techniques and the impact of finite word length effects	Evaluate
CO5	Design multirate signal processing applications using DSP processor with appropriate software.	Create
CO6	Develop various DSP algorithms for real time applications using open source/freeware software	Apply

TEXT BOOKS:

2. John G Proakis and, Dimitris G Manolakis," Digital Signal Processing- Principles, Algorithms and Applications", Prentice Hall India, New Delhi, 2010.
3. S.Salivahanan, A.Vallavaraj, C.Gnanapriya " Digital Signal Processing ", Tata McGraw Hill, 2007.

REFERENCES:

4. Oppenheim A V," Discrete Time Signal Processing", Prentice Hall India, New Delhi, 2010.
5. Mitra S K," Digital Signal Processing – A Computer based Approach", Tata McGraw Hill, New Delhi, 2010.
6. David J. Defatta, Joseph G. Lucas, William S. Hodgkiss," Digital signal processing: a system design approach", John Wiley, 1995.
7. B.Venkataramani, M.Bhaskar," Digital Signal Processor, Architecture, Programming and Applications", Tata McGraw Hill, 2011.

19UEC502	MICROPROCESSORS MICROCONTROLLERS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop an in-depth understanding of the operation of microprocessors and Microcontrollers, assembly language programming & interfacing techniques
- To introduce the hardware architecture, instruction set, programming and interfacing of 8051 microcontroller and PIC microcontroller

UNIT 1	INTEL 8086 ARCHITECTURE	9

Introduction to Microprocessor-Architectural advancement of microprocessors-Evolution of Microprocessors-Introduction to Intel 8085-Architecture of INTEL 8086 (Bus Interface Unit, Execution unit)-Pin Description-Bus cycles -8086 System configuration and Memory –Interfacing-Minimum mode -Maximum mode configurations-Interrupt processing-Direct Memory Access -Comparison between 8086 and 8088

UNIT 2	INTEL 8086 MICROPROCESSOR – INSTRUCTION SET AND PROGRAMMING	9

Programmer Model of Intel 8086,Operand types -Operand Addressing -Intel 8086Assembler Directives -Instruction Set -Data transfer group-Arithmetic group -Logical group-Control transfer group -Miscellaneous Instruction group(string, processor control group)

UNIT 3	MICROCONTROLLERS	9

INTEL8-bit and 16 bit Microcontrollers :INTEL 8051Internal Architecture-Memory organization -Special function registers and Pins and signals -Timing and control-port operations -Memory interfacing, I/O Interfacing- Programming 8051 resources Interrupts, Measurement of frequency period and pulse width of a signal, Interrupts -Instruction set :Data transfer Instructions, Arithmetic group, Logical group, Control transfer group-Introduction to 16 Microcontrollers,INTEL 8096 Architecture, Special function registers and Pins and signals, Multiprocessor communication -Operand addressing and Instruction set, Data transfer Instructions, Arithmetic group, Logical group, Control transfer group

UNIT 4	PERIPHERAL INTERFACING WITH MICROPROCESSOR AND MICROCONTROLLER	9

Programmable peripheral interface(8255)-Keyboard display controller(8279)-Programmable interval timers /Counter,(8253and 8254)-Digital to analog converter, analog to Digital Converter

Traffic light control,-Washing machine control -Stepper motor control

UNIT 5	APPLICATIONS OF MICROPROCESSOR AND MICROCONTROLLER	9

The Arduinouno hardware and software development environment **-** Arduino based Heart rate monitor -Pulse rate monitor –Oxymeter -EEG monitors and Breathe analyzer -Case studies using Node MCU, Arduino Uno- EMU 8086,,Coldfire microprocessor,MASM tool for microprocessor and microcontroller based application.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the architecture of 8086 microprocessors and 8051,8096 Microcontrollers.	Understand
CO2	Write an ALP to program the microprocessors and microcontrollers and to interface peripheral devices	Apply
CO3	Apply the modern tools for various microprocessor and microcontroller-based application development	Apply
CO4	Analyze the functioning of microprocessor and microcontroller for the given condition	Analyze
CO5	Develop an application using microprocessor or microcontrollers	Create

TEXT BOOKS:

1. Krishna Kant, “Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096”,PHI, 2011
2. The 8051 Microcontroller architecture ,Programming and Applications Ayala J.K Penram International (2005) 3rd Edition
3. Massimo Banzi,Getting Started with Arduino , First Edition, pub. O’Reilly, 2008.

REFERENCES:

1. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and Application with 8085”, Penram International Publishing, 4th Edition, New Delhi, 2005 3rd edition.
2. Mohammed Ali Mazidi and Janice GillispieMazidi,“The 8051 Microcontroller and Embedded Systems” ,Pearson Education Asia, New Delhi, 2006.
3. A.K. Ray and K.M. Bhurchandi Advanced Microprocessors and Peripherals, third Edition, Tata McGraw Hill, 2012

Web Resources

1. https://technobyte.org/8051-stepper-motor-interfacing
2. https://www.youtube.com/watch?v=yo2CW8qOdZE
3. http://duino4projects.com/projects/medical-health-based-projects/

19UEC503	DATA COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an overview of the functions of different layers
- To impart knowledge on IEEE standards employed in computer networking
- To familiarize the students with different protocols and network components

UNIT 1	PHYSICAL LAYER	8

Data communication Components – Data representation and Data flow -Types of -Connections – Topologies-Protocols and Standards – OSI model, TCP/IP model - Transmission Media

UNIT 2	DATA LINK LAYER	10

Framing -Flow Control and Error control – Stop and Wait – Go back – N ARQ – Selective Repeat -ARQ – Sliding Window – Piggybacking – Random Access – controlled access - LAN –Wired -LANs and Wireless LANs

UNIT 3	NETWORK LAYER	10

Logical addressing – IPV4, IPV6-Address mapping–ARP, RARP, BOOTP -ICMP, IGMP and DHCP -Routing-Unicast Routing protocols

UNIT 4	TRANSPORT LAYER	8

Process to Process Delivery -User Datagram Protocol -Transmission Control Protocol - Congestion Control with Examples. QoS and techniques to improve QoS.

UNIT 5	APPLICATION LAYER	9

Domain Name Space -EMAIL – FTP -WWW – HTTP -Cryptography – Basic concepts, symmetric key and public key cryptography.
Introduction to NS2 and OPNET

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the concepts of data communication and networks	Understand
CO2	Apply the knowledge of network models to compute the network parameters	Apply
CO3	Analyze the parameters of the network protocols used in different layers	Analyze
CO4	Analyze the performance parameter of computer network using any network simulation software	Analyze
CO5	Evaluate Level: Evaluate the performance of computer networks	Evaluate
CO6	Design and simulate the given network using network simulation software	Create

TEXT BOOKS:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw– Hill, Fourth Edition,2011
2. Andrew S. Tenanbaum, Computer Networks, 5th Edition, 2010.

REFERENCES:

1. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2007.

2. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012
3. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

19UEC504	ANTENNA AND WAVE PROPAGATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the various parameters of an antenna.
- To impart knowledge on aperture antennas and frequency independent antennas.
- To give knowledge on Radio Wave Propagation.

UNIT 1	ANTENNA FUNDAMENTALS	9

Antenna Parameters: Radiation pattern, Beam solid angle, Return loss, VSWR-Directivity, Gain, Input impedance -Polarization, Bandwidth Reciprocity -Equivalence Radiation Pattern, Equivalence of Impedances -Effective aperture -Vector effective length -Antenna temperature -Friss transmission equation

UNIT 2	WIRE ANTENNAS AND ANTENNA ARRAYS	9

Wire antennas: Hertizian dipole -Half wave Dipole, Radiation resistance and Directivity -Monopole -Radiation resistance and Directivity -Small loop antennas -Antenna Arrays: Linear Array -Pattern Multiplication -Two element array -Uniform Array with non-uniform Excitation-. Binomial Array

UNIT 3	APERTURE ANTENNAS	9

Magnetic current and its fields -Uniqueness theorem -Field equivalence principle -Slot antenna -Horn Antenna, Pyramidal Horn Antenna -Reflector Antenna-Flat reflector -Corner Reflector -Common curved reflector shapes -, Lens Antenna

UNIT 4	SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS	9

Special Antennas: Yagi-Uda Antenna, Helical Antenna – Axial mode helix, Normal mode helix -Log -periodic dipole array -Spiral antenna, Microstrip patch antenna -Wearable antennas, Mobile phone antenna -Introduction to software related to antennas-Antenna Measurements : Radiation Pattern measurement -Gain and Directivity Measurements-Anechoic Chamber measurement-RF Safety Precautions.

UNIT 5	RADIO WAVE PROPAGATION	9

. Ground Wave Propagation -Free-space Propagation, Ground Reflection-Surface waves, Diffraction-Wave propagation in complex Environments.-Tropospheric Propagation, Tropospheric Scatter -Ionospheric propagation, Structure of Ionosphere -Sky waves, Skip distance, Virtual height, Critical frequency, MUF-Electrical properties of ionosphere, Effects of earth's magnetic fields -Faraday rotation, Whistlers

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Explain the fundamental characteristics of antenna and wave propagation	Understand

CO2	Apply the knowledge of antennas to calculate the basic antenna parameters	Apply
CO3	Apply the knowledge of wave propagation to determine the radiation characteristics	Apply
CO4	Analyze the parameters of various antennas for the given specification	Analyze
CO5	Evaluate the radiation characteristics of the given antennas for different substrates using simulation software	Evaluate
CO6	Design antennas for the given specification	Create

TEXT BOOKS:

1. K.D Prasad, "Antennas and Wave Propagation", Sathya Prakasan Publications, 4 th Edition,2009.
2. Constantine A. Balanis, "Antenna Theory Analysis and Design, John Wiley India", 4thEdition, 2016.
3. E.C.Jordan and Balmain, "Electromagnetic waves and Radiating systems",Pearson Education,2015.

REFERENCES:

1. John D.Kraus, Ronald J.Marhefka and Ahmad S.Khan "Antennas and wave propagation" TataMCGraw-Hill Book company,4 th Edition,2010
2. G.S.N.Raju, "Antenna Wave Propagation", Pearson Education, 2004.
3. A .R.Harish, M.Sachidanada, "Antennas and wave propagation "Oxford University Press, Ist Edition,2007
4. Wearableantenna https://www.researchgate.net/publication/224089551_A_review_of_wearableantenna

19UGS531	REASONING AND APTITUDE	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To make the student acquire sound knowledge of the characteristic of quantitative and qualitative aptitude.
- To familiarize the student with various principles involved in solving mathematical problems.
- To develop an understanding of the basic concepts of reasoning skills

Unit – I	QUANTITATIVE APTITUDE	

Ratio and Proportion - Averages –Percentages – Problems on ages – Profit and Loss – Simple and Compound Interest -– Time – Speed –Distance -Time and Work – Permutation and Combination - Alligation or Mixture – Probability – Clocks – Calendars.

Unit – II	VERBAL AND NON VERBAL REASONING	

Analytical Reasoning – Circular and Linear arrangement – Direction problems – Blood relations – Analogy – Odd Man Out – Venn Diagrams - Data Sufficiency – Data interpretation –– Syllogism - Coding – Decoding.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Select an appropriate technique to solve the quantitative problems within the stipulated time	Apply
CO2	Apply Verbal and Non Verbal Reasoning skills to solve the problems based on the logical and analytical reasoning	Apply
CO3	Analyze the direction to solve equations involving one are more unknowns	Analyze

TEXT BOOKS:

1. Dr. R.S.AGARWAL, “Quantitative Aptitude”, S. Chand Publications, New Delhi, 20th Edition, (2013).
2. ABIJIT GUHA, “Quantitative Aptitude for Competitive Examinations”, Tata McGraw Hill Publication, New Delhi, 4th Edition, (2011).
3. R.V.Praveen, “Quantitative Aptitude and Reasoning”, PHI Learning Pvt. Ltd., Delhi, 2nd Edition, (2013).

REFERENCES:

1. ASHISH AGGARWAL, “Quick Arithmetic”, S. Chand Publications, New Delhi, 6th Revised Edition, (2014).
2. Dr.V.A.SATHGURUNATH’S “A Guide for Campus Recruitment”, Sagarikka Publications, Thiruchirapalli, 3rd Edition, (2011).

WEBSITES:

www.m4maths.com, www.indiabix.com, www.fresherworld.com, www.campusgate.co.in,

www.indianstudyhub.in, www.tcyonline.com.

19UEC505	MICROPROCESSORS, MICROCONTROLLERS AND APPLICATIONS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop knowledge in assembly language programming with microprocessor and microcontrollers.
- To give knowledge in various peripheral interfacing with microprocessor and microcontrollers.
- To introduce modern tools for programming the microprocessor and microcontroller.

LIST OF EXPERIMENTS

1. Arithmetic Operations. (in 8086 and 8051).
2. Logical Operations(in 8086 and 8051).
3. Array processing And Matrix operations (in 8086).
4. Code Conversions (in 8086).
5. String Manipulations (in 8086).
6. Interfacing with 8255 PPI.
7. Serial communication (Study of 8253/8251)
8. 8279 Keyboard & display using 8086.
9. ADC and DAC using 8086.
10. Stepper motor control using 8051 controller.

Project based Learning

Mini project: Any application using Node MCU, Arduino uno and MASM, EMU 8086.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the programming knowledge of microprocessor and microcontroller to perform various functions.	Apply
CO2	Interface peripheral devices with microprocessor and microcontroller to develop applications.	Apply
CO3	Modern Tool Usage to develop applications using modern tools like MASM, EMU 8086.	Create

19UEC506	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To demonstrate signal processing techniques using DSP processor
- To demonstrate signal processing functions using Simulation Software.

LIST OF EXPERIMENTS:

Using Simulation Software:

1. Linear convolution between two sequences.
2. Circular convolution between two sequences.
3. Linear convolution using circular convolution.
4. Program to perform N-point DFT. Also to perform the IDFT on the result obtained to verify the result.
5. Linear convolution using (a) overlap save method (b) overlap add method.
6. Perform FFT on a sequence using the following methods. (a) Decimation in time (b) Decimation in frequency.
7. Design an FIR filter using windowing techniques.
8. Design an Butterworth/ Chebychev IIR filter using impulse invariant method.
9. Design an Butterworth/ Chebychev IIR filter using bilinear transformation method.

Using Digital Signal Processor:

10. Study of various addressing modes of DSP using simple programming examples
11. Implementation of Linear Convolution using Digital Signal Processor
12. Implementation of Circular Convolution using Digital Signal Processor
13. Waveform generation using Digital Signal Processor

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Develop various DSP Algorithms using Simulation Software.	**Apply**
CO2	Analyze the frequency response characteristics of digital FIR and IIR filters.	**Analyze**
CO3	Implement the DSP algorithms in digital signal	**Apply**

19UEC507	CREATIVE THINKING AND INNOVATION	L	T	P	C
		0	0	2	1

PREAMBLE:

Creativity is vital in nearly every industry and occupation. Creativity and innovation are key to generation of new ideas and methods of improving goods and services for customer satisfaction. This course enhances the creative thinking and innovation skills of the students. Being creative helps one to be a better problem solver in all areas of life and work.

COURSE OBJECTIVES:

- To develop next generation Entrepreneurs and Creative Leaders to resolve live challenges.
- To transform innovative ideas into successful businesses
- To use a range of creative thinking tools to develop Out of the Box Ideas

Course Content

Introduction to Creativity and Innovation- Creative Techniques - Problem Identification through Brain Storming - Solution Identification through Creative Techniques - Presentation on the Innovative Idea - Market Analysis - Revenue and Business Model - Preparation of promotional aids - Customer Feedback Analysis.

List of Activities

Duration	What does the Faculty do?	What do the students do?
Week 1	Explains creativity and innovation	Team Formation (Team Size: 3)
Week 2	Explains the Creative Techniques (Through Video / Presentation)	Discovering Consumer Need through Need Analysis (Customer Segment)
Week 3	Facilitates the brain storming	Problem Identification through brain storming
Week 4	Facilitates problem solving	Identify the solution for the chosen problem through creative techniques
Week 5	Evaluates the presentation	Presentation on the Innovative Idea and Value Proposition
Week 6	Evaluates the presentation	Presentation on the Innovative

		Idea and Value Proposition
Week 7	Explains about the Market Research / Competitor Analysis, Revenue Model and Business Model	Market Analysis after the explanation
Week 8	Facilitates the students work	Preparation of Innovation Development Plan, Business Development Plan and Financial Plan
Week 9	Facilitates the students work	Preparing product promotional material
Week 10	Facilitates the students work	Improvement through Feedback

Total Hours: 30 Periods

Assessment Pattern

1. Internal Assessment: Presentation on the Innovative Idea
2. End Semester Assessment:
    - Submission of Business Plan
    - Presentation on My Startup Idea (Evaluator : From Industry)

Course Outcomes:

After successful completion of the course students will be able to:		
CO1	Demonstrate the ability to assess societal, health and safety issues and the consequent responsibilities relevant to the professional engineering practice	Valuing – Affective Domain
CO2	Examine impact on environment and society in the proposed innovative idea and provide solutions for sustainable development	Organization – Affective Domain
CO3	Adapt themselves to work in a group as a member or a leader for efficiently executing the given task	Organization – Affective Domain

19UGS532	SOFT SKILLS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To develop a requisite knowledge in Communication skills and Soft skills.
- To enhance the students' acumen in honing the skills to meet the Global changes and Industrial needs.

Unit – 1	**SPEAKING SKILLS**	

Conversational Skills - Self Introduction - Group Discussion - Public Speaking - Presentation Skills

Unit – 2	**WRITING SKILLS**	

Letter Writing – Report Writing – Email Writing – Job Application – Resume Preparation

Unit – 3	**READING AND LISTENING SKILLS**	

Reading Comprehension – Enriching Vocabulary – Error Spotting – Listening and Note Taking

Unit – 4	**SOFTSKILLS**	

Professional Ethics – Interpersonal Skills – Stress Management – Leadership Qualities – Time Management – Conflict Resolution

Unit – 5	**INTERVIEW SKILLS**	

Types of Interview – Body Language – Professional Grooming – Basic Etiquette

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Answer the queries precisely after carefully listening to the conversation or speech.(Affective domain - Responding)	**Responding**
CO2	Communicate orally with fluency and clarity in a given contextual situation (Affective domain - Responding)	**Responding**
CO3	Debate with clarity of thought and expression to convey their ideas politely to others (Affective domain - Valuing)	**Valuing**
CO4	Apply correct usage of English grammar in writing, fluent speaking and comprehending. (Cognitive Domain - Apply)	Apply

REFERENCES:

4. Skills for Success, Listening and Speaking – Level 4 by Brooks and Margret – Oxford University Press, Oxford 2011 Edition.
5. Professional Communication by Raman, Meenakshi and Sangeetha Sharma – Oxford University Press, 2014 Edition.
6. Developing Soft Skills by Sherfield, Robert M, R J Montgomery and Patricia G Moody – Pearson Education Publishers.

SEMESTER VI

SEMESTER VI

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UEC601	Wireless Communication	3	0	0	3	Professional Core
19UEC602	VLSI Design	3	0	0	3	Professional Core
19UEC603	Internet of Things	3	0	0	3	Professional Core
	Professional Elective II	3	0	0	3	Professional Elective
	Professional Elective III	3	0	0	3	Professional Elective
	Open Elective II	3	0	0	3	Open Elective
PRACTICAL						
19UEC607	Product development Project	0	0	8	4	Project work
19UEC608	VLSI Design Laboratory	0	0	2	1.5	Professional Core
19UEC609	Networks Laboratory	0	0	3	1.5	Professional Core
MANDATORY						
19UGM632	Indian Constitution	1	-	-	P/F	Mandatory Course
	TOTAL	**19**	**0**	**10**	**25**	
Total Credits : 25						

19UEC601	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on characteristic of wireless channel and various cellular architectures.
- To introduce the concepts behind various digital signalling schemes for fading channels
- To familiarize the various multipath mitigation techniques and wireless system standards

Unit – 1	INTRODUCTION TO WIRELESS COMMUNICATION & CELLULAR CONCEPT	8

Introduction to Wireless Communication - Cellular concept- Frequency reuse- Channel assignment Strategies-Hand off Strategies- Interference & system capacity- Trunking and Grade of Service- Improving Coverage and Capacity in Cellular Systems

Unit – 2	TWO DIMENSIONAL RANDOM VARIABLES	10

Introduction to Radio Wave Propagation – Free Space Propagation model-Relating Power to Electric Field-The Three Basic Propagation Mechanisms- Ground Reflection (Two-Ray) Model-Diffraction-Scattering- Practical Link Budget Design Using Path Loss Models-Longley–Rice Model-Reflection-Log-distance Path Loss Model- Small-Scale Multipath Propagation-Impulse Response Model of a Multipath Channel-Small-Scale Multipath Measurements- Parameters of Mobile Multipath Channels-Types of Small-Scale Fading- Rayleigh and Ricean Distributions-Clarke's Model for Flat Fading

Unit – 3	DIGITAL SIGNALING FOR FADING CHANNELS	9

Linear Modulation Techniques – Constant Envelope Modulation- Combined Linear and Constant Envelope Modulation Techniques- Spread Spectrum Modulation Techniques-Modulation Performance in Fading and Multipath Channels

Unit – 4	MULTIPATH MITIGATION TECHNIQUES	9

Introduction, Fundamentals of Equalization-Training A Generic Adaptive Equalizer – Equalizers in a Communications Receiver- Survey of Equalization Techniques-Linear Equalizers-Nonlinear Equalization-Algorithms for Adaptive Equalization- Diversity Techniques-RAKE Receiver-Interleaving

Unit – 5	ADVANCEMENTS IN WIRELESS COMMUNICATION	9

Bluetooth and IEEE 802.15 376– Cellular Wireless Networks- Fourth Generation Systems and LTE-Advanced- Requirements of 5G-5G standards-Impact of radiations in 4G & 5G-Millimeter Wave Technology- Cognitive Radio- Long Range Communications-WiMAX-Smart Grid- NB-IoT-LoraWAN

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the fundamental concepts of wireless communication systems	Understand

CO2	Apply the knowledge of cellular concept to compute the parameters of cellular services	Apply
CO3	Apply the knowledge of channel characteristics to compute the different parameters of multipath channels	Apply
CO4	Apply the knowledge of digital filter to design Equalizers for the given specifications	Apply
CO5	Apply the knowledge of 4G and 5G in real time applications.	Apply
CO6	Analyze the error performance of various signaling schemes for fading channels	Analyze

TEXT BOOKS:

1. Rappaport,T.S., “Wireless communications”, Second Edition, Pearson Education, 2014.
2. Cory.Beard,William Stallings, “Wireless Communication Network and Systems”, Pearson Education, 2016.

REFERENCES:

1. Andrea Goldsmith, “Wireless communications: principles and practice”, second edition, PHI,2006.
2. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
3. UpenaDalal, “ Wireless Communication”, Oxford University Press, 2009.
4. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks” Wiley Publications, 2015.

19UEC602	VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of CMOS Technologies and testing
- To outline the formal procedures for the design of combinational and sequential circuits

UNIT 1	INTRODUCTION TO VERILOG HDL	9

VLSI Circuit Design Flow- Hierarchical modeling concepts-Basic concepts-Gate level modeling-
Dataflow modeling-Behavioral modeling-Design examples of Combinational and Sequential
circuits.

UNIT 2	CMOS TECHNOLOGY	9

MOS Transistor theory -I-V Characteristics-C-V Characteristics-Non -Ideal I-V Characteristics-DC
Transfer characteristics-CMOS Technology-Layout design rule

UNIT 3	CIRCUITS CHARACTERIZATION	9

Delay estimation-Logical effort and Transistor sizing-Power dissipation-Interconnect-Design
Margin-Reliability-Scaling

UNIT 4	COMBINATIONAL AND SEQUENTIAL CIRCUITS DESIGN	9

Static CMOS logic Design-Dynamic CMOS logic Design-Circuit families-Circuit design of latches
and flip-flop

UNIT 5	DESIGNING ARITHMETIC BUILDING BLOCKS	9

Adder circuits-Ripple carry adder-Carry look ahead adder-High speed adder-Multiplier

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the different modelling and characteristics of MOS transistor	Understand
CO2	Apply MOS logic and analyze the factors influencing the operation of CMOS transistor	Apply
CO3	Design and Simulate the layouts of Digital & Analog IC Blocks using EDA tools	Apply
CO4	Analyze the concepts of digital building blocks using MOS transistor	Analyze
CO5	Design and construct combinational and sequential MOS circuits using HDL	Create

TEXT BOOKS:

1. Samir Palnitkar “Verilog HDL a guide to digital design and Synthesis”, Prentice Hall, 2nd edition, 2003
2. Weste and Harris: CMOS VLSI DESIGN (fourth edition) Pearson Education, 2013
3. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley & Sons, Reprint 2009

REFERENCES:

1. Neil H.E Weste & Kamaran Eshraghian, Principles of CMOS VLSI Design,2ndEdition,Pearson Education,2010
2. Jan Rabaey.M,Digital Integrated Circuits :A design Perspective, second Edition fifth reprint Prentice Hall 2002..
3. Pucknell. D.A&K.Eshraghian Basic VLSI Design, Third edition, PHI, 2003.

19UEC603	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain about Internet of Things .
- To impart basic knowledge of RFID Technology, Sensor Technology.
- To make students aware of resource management and security issues in Internet of Things.

Unit – 1	INTRODUCTION TO IOT	9

Genesis of IoT-IoT and Digitization-IoT Impact-Convergence of IT and OT-IoT - Challenges-IoT Network Architecture and Design: Drivers Behind New Network Architectures-Comparing IoT Architectures-A Simplified IoT Architecture-The Core IoT Functional Stack-IoT

Data Management and Compute Stack

Unit – 2	IOT NETWORKS	9

Smart Objects: The “Things” in IoT: Sensors, Actuators, and Smart Objects, Sensor Networks

Connecting Smart Objects: “Communications Criteria” -Range, Frequency Bands, Power Consumption, Topology, Constrained Devices, Constrained-Node Networks. “IoT Access Technologies”- IEEE 802.15.4, IEEE 802.15.4g and IEEE 802.15.4e, IEEE 1901.2a, LoRaWAN,

NB-IoT and Other LTE Variations

Unit – 3	IOT PROTOCOLS	9

IP as the IoT Network Layer: The Business Case for IP, The Need for Optimization, Optimizing IP for IoT, Optimizing IP for IoT- Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods

Unit – 4	DATA ANALYTICS AND SECURITY FOR IOT	9

Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics-Securing IoT: Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures, The Phased Application of Security in an Operational Environment

Unit – 5	IOT IN INDUSTRY &APPLICATIONS	9

Manufacturing: An Introduction to Connected Manufacturing, An Architecture for the Converged Factor, Industrial Automation Control Protocols, Connected Factory Security-Smart and Connected Cities: An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Use-Case Examples-Transportation: Transportation and Transports, Transportation Challenges, IoT Use Cases for Transportation, An IoT Architecture for Transportation-Public Safety: Overview of Public Safety, An IoT Blueprint for Public Safety, Emergency Response IoT Architecture, Emergency Response IoT Architecture, School/college Bus Safety-IoT use cases in agriculture: Monitoring of climate conditions, Cropmanagement, Precision farming, Agricultural drones, Predictive analytics for smart farming, End-to-end farm management systems

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to:

CO1	Explain the concepts of IoT technology	Understand
CO2	Apply the knowledge of IoT for practical applications	Apply
CO3	Apply the knowledge of communication protocols to develop IoT applications	Apply
CO4	Analyze the impact of IoT in various sectors	Analyze
CO5	Analyze the performance of IoT applications using simulation software	Analyze
CO6	Design IoT based real life applications	Create

TEXT BOOKS:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014

REFERENCES:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2. Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer,2011.

19UEC607	PRODUCT DEVELOPMENT PROJECT	L	T	P	C
		0	0	8	4

OBJECTIVES:

The focus of Product Design and Development is integration of the marketing, design, and manufacturing functions of the firm in creating a new product. The course is intended to provide you with the following benefits:

- Competence with a set of tools and methods for product design and development.
- Confidence in your own abilities to create a new product.
- Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).
- Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.
- Reinforcement of specific knowledge from other courses through practice and reflection in an action-oriented setting.

Enhanced team working skills

Expectations

This is a 12-unit graduate course. Accordingly, the course has been designed to demand approximately 12 hours per week of your time. It is expected that each student will prepare for and attend all of the class sessions and will regularly enhance class discussions. Most important though are substantial and continuous contributions to the progress of the team project. Experience with project-based design courses is that students often develop high expectations for their projects and devote substantially more time than is required by the instructors. Faculty applaud this enthusiasm, but this course will not penalize students who establish a twelve hour per week average time constraint for their efforts.

TOTAL : 90 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the basic engineering knowledge to Design/Develop sustainable solutions for environmental and societal issues	**Create**
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion	**Analyze**
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice	**Apply**

19UEC608	VLSI DESIGN LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To implement verilog coding for combinational and sequential circuits
- To provide the knowledge of synthesis, simulation and generation of configuration file for combinational and sequentialcircuits

LIST OF EXPERIMENTS:

1. Design an adder (min 8 bit) using HDL.Simulate using Xilinx software and implement by Xilinx FPGA
2. Design a Multiplexer, demultiplexer using HDL.Simulate using Xilinx software and implement in Xilinx FPGA
3. Design a multiplier (min 4 bit) using HDL.Simulate using Xilinx software and implement in Xilinx FPGA
4. Design an ALU using HDL.Simulate using Xilinx software and implement in Xilinx FPGA
5. Design a flip-flop using HDL.Simulate using Xilinx software and implement in Xilinx FPGA
6. Design a Universal shift register using HDL.Simulate using Xilinx software and implement in Xilinx FPGA
7. Design a finite state machine using HDL.Simulate using Xilinx software and implement in Xilinx FPGA
8. Design a counter using HDL.Simulate using Xilinx software and implement in Xilinx FPGA
9. Simulate minimum dimension CMOS inverter, NAND, NOR and XOR circuits using SPICE. Design and simulate AOI and OAI CMOS logic and generate GDS II /CIF file using EDA tool and also report the performance
10. Design and simulate Static CMOS, Dynamic CMOS and generate GDS II /CIF file using EDA tool and also report the performance
11. Design and simulate differential amplifier for a voltage gain of 10 and generate GDS II /CIF file using EDA tool and also report the performance

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Design and Simulate digital circuits using VLSI Software	Apply
CO2	Design and implement combinational and sequential circuit using FPGA.	Apply
CO3	Design, build and debug complex combinational and sequential circuits based on an abstract functional specification	Create
CO4	Design and Simulate the layouts of Digital & Analog IC Blocks using EDA tools	Create

19UEC609	NETWORKS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To create the scenario and study the performance of different network protocol through simulation
- To understand the fundamental concepts of routing protocols and their algorithms.

LIST OF EXPERIMENTS:

1. Ethernet LAN protocol
2. Wireless LAN protocol
3. Implementation and study of stop and wait protocol
4. Implementation and study of Go back-N and selective repeat protocols
5. Implementation of distance vector routing algorithm
6. Implementation of Link state routing algorithm
7. Implementation of Data encryption and decryption
8. Study the performance of token bus and token ring protocols through simulation
9. Study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
10. Examine influence TCP on application performance by changing the receiver window and maximum segment size using opnet.
11. Study of UDP Performance

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Analyze the performance of LAN protocols	Analyze
CO2	Apply the knowledge of different routing algorithms to implement network layer routing	Apply
CO3	Design and simulate the given network to study the network performance using simulation software	Create

19UGM632	INDIAN CONSTITUTION	L	T	P	C
		1	-	-	P/F

OBJECTIVES:

- The students will be exposed to fundamental rights & duties in Indian Constitution.
- The students will be given knowledge on the components of the parliamentary system to prepare for the process of their career development.
- The student will have knowledge on powers and functions of Local bodies and Indian polity to appear for various competitive exams such as UPSC, TNPSC and RRB
- The student will know about the functions of judiciary and electoral process followed in the country.

UNIT 1	INTRODUCTION ON INDIAN CONSTITUTION	

Preamble - Salient features of the Constitution of India. Fundamental Rights - its restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) - Fundamental Duties: its Scope and significance in Nation building - Constitution components: schedule, parts and articles of constitution- important Amendments of constitution.

UNIT 2	PARLIAMENTARY SYSTEM	

Parliamentary System – parliamentary system of other countries - Indian parliamentary system- Federal System – LS and RS, Centre-State Relations-Election of member of parliaments- Union Executive - President, Prime Minister, Union Cabinet. State Legislature -State Executives – election of MLA- Governor, Chief Minister, State Cabinet.

UNIT 3	JUDICIARY AND ELECTION COMMISSION	

Supreme Court of India: Structure, Power and Functions of Supreme Court-Judicial Reviews - Judicial Activism. High Court and Subordinate Courts: Structure, Power and Functions. – Lok adhalats. Elections- Electoral Process - Election Commission of India - Election Laws – Emergency Provisions - types of Emergencies and its consequences.

UNIT 4	LOCAL ADMINISTRATION	

Local Administration: Powers and functions of Municipalities and Panchayats System-Panchayat Raj- Co–operative Societies and Constitutional and Non-constitutional Bodies.

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply knowledge of the fundamental rights and duties prescribed by Indian Constitution to prepare for various competitive examinations.
CO2	Manage complex societal issues in society with the knowledge of judiciary and local administration.
CO3	Interpret the societal, health, safety, legal and cultural issues with understanding of parliamentary system and electoral process through self-learning skills.
CO4	Understand the ethical responsibilities of Municipalities, Panchayats and co-operative societies.
CO5	Understand and distinguish the functioning of the parliamentary system followed in various countries.

TEXT BOOKS:

1. Shubham Singles, Charles E. Haries, et al., “Constitution of India and Professional Ethics” by Cengage Learning India Private Limited, 2018.
2. Subhash C. Kashyap,”Our Constitution: An Introduction to India’s Constitution and constitutional Law”, NBT, 2018.
3. Brij Kishore Sharma,“Introduction to the Constitution of India”, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. M.V.Pylee, “An Introduction to Constitution of India”, Vikas Publishing, 2002.
5. Durga Das Basu, “Introduction to the Constitution on India”, Prentice Hall, 2001.

Semester VII

Semester VII (Draft Syllabus)

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UME701	Project Management and Finance	3	0	0	3	Professional Core
19UEC702	Optical and Microwave communication	3	0	0	3	Professional Core
19UEC703	Image processing and Machine learning	3	0	0	3	Professional Core
	Professional Elective IV	3	0	0	3	Professional Elective
	Professional Elective V	3	0	0	3	Professional Elective
	Open Elective III	3	0	0	3	Open Elective
PRACTICAL						
19UEC707	Summer Internship	-	-	-	1	Project work
19UEC708	Optical and Microwave communication laboratory	0	0	2	1	Professional Core
19UEC709	Image processing laboratory	0	0	3	1.5	Professional Core
MANDATORY						
19UGM731	Professional Ethics and Human Values (common to all Branches)	2	-	-	P/F	Mandatory Course
	TOTAL	**20**	**0**	**5**	**21.5**	

19UME701	PROJECT MANAGEMENT AND FINANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge to find solutions and approaches for various projects.
- To familiarize the utilization of project within time, resource and financial constraints

Unit – 1	PROJECT MANAGEMENT CONCEPTS	9

Concept and characteristics of a project, importance of project management, types of project, project organizational structure, project life cycle, Statement of Work, Work Breakdown Structure.

Unit – 2	PROJECT PLANNING	9

Project Planning and Scheduling techniques - developing the project network using CPM/PERT, Limitations of CPM/PERT, Precedence Diagramming Method, constructing diagram and computations using precedence diagramming method, PERT/CPM simulation, reducing project duration

Unit – 3	RESOURCE SCHEDULING & CRITICAL CHAIN SCHEDULING	9

Resource Scheduling - Resource allocation method, splitting and multitasking, Multi project resources scheduling - Critical Chain Scheduling -Concept of critical chain scheduling - critical chain scheduling method, application of Critical chain scheduling and limitations

Unit – 4	PROJECT QUALITY MANAGEMENT	9

Concept of project quality, responsibility for quality in projects, quality management at different stages of project, tools and techniques, Quality Management Systems, TQM in projects - Project Performance Measurement and Control - Monitor and assess project performance, schedule, and cost.Earned Value Management, performance measurement methods to monitor, evaluate and control planned cost and schedule performance - Project Closure/ Termination - Meaning of closure/ termination, project audit process, termination steps, final closure.

Unit – 5	FINANCIAL ACCOUNTING	9

Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis – Comparative financial statements. Investments- Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Analyze different types of projects and identify the suitable project for the given constraints	Analyze
CO2	Analyze and identify Critical Path using PERT/CPM for the given project	Analyze
CO3	Analyze Theory of Constraints, Multi project scheduling and heuristic methods for allocating resources to a project	Analyze
CO4	Apply the knowledge of Quality Management and TQM Concepts to different stages of project and design a suitable Quality Management System	Apply

CO5	Investigate the financial data such as balance sheet, income expenditure statement, cash flow statement and budget to interpret, synthesize to provide valid solution for a variety of business problems	Analyze

TEXT BOOKS:

4. Prasanna Chandra, "'Fundamentals of Financial Management' ", Tata Mcgraw-Hill Publishing Ltd, 2005.
5. Jack Meredith, Samuel J.Mantel, "Project Management- A Managerial Approach", John Wiley and Sons

REFERENCES:

8. Clifford F Gray, Erik W Larson, "Project Management-The Managerial Process ", Tata Mcgraw-Hill Publishing Co Ltd.
9. John M Nicholas, "Project Management For Business And Technology", Prentice Hall of India Pvt Ltd.
10. Paresh Shah, "Basic Financial Accounting for Management", Oxford University Press, 2007.

19UEC702	OPTICAL AND MICROWAVE COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	OPTICAL RAY THEORY AND OPTO ELECTRONIC DEVICES	10

Introduction, Ray theory transmission- Total Internal Reflection Acceptance angle, Numerical Aperture. Types of fibers - Step index, graded index, single mode & multimode Sources-LED & Laser Diode .Detectors- Photo detectors-PIN & Photo diode. Applications and simulation software of fiber optics in communication.

Unit – 2	CHARACTERISTICS OF OPTICAL TRANSMITTER AND RECEIVER	9

Attenuation – Material absorption losses in silica glass fibers – Linear and Nonlinear Scattering losses - Fiber Bend Losses - Intra and inter Modal Dispersion . Fundamental receiver operation,
Pre amplifiers, Receiver Configuration – Probability of Error – Quantum limit.Recent trends in optical communication.

Unit – 3	MICROWAVE DEVICES AND MICROWAVE TUBES	10

Microwave frequencies (IEEE Standards), Properties of S-parameters, S-matrix calculations of E-plane, H-plane and Magic Tee, Directional Couplers, Microwave Circulators and Isolators, Gunn Diodes-GaAs Diode- Reflex klystron- Traveling-Wave Tubes (TWTs)- Magnetron Oscillators.

Unit – 4	MONOLITHIC MICROWAVE INTEGRATED CIRCUITS	8

Introduction, Definition, characteristics, comparison with conventional circuits, fields of application and limitations and criteria for the choice of substrate material; Conductor Materials, Dielectric Materials, Resistive Materials,Monolithic Microwave Integrated Circuit Growth, MMIC Fabrication Techniques-Fabrication of microwave circuit.

Unit – 5	MICROWAVE MEASUREMENTS AND APPLICATIONS	8

Microwave measurements - guide wavelength VSWR, frequency and impedance,
practical perspective of microwaves: Microwave oven, Radar, wireless applications, Microwave radiation hazards

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Compare the different fabrication techniques used to construct microwave circuits.	
CO2	Apply the fundamental principles of optics and light wave to design optical fiber communication systems.	

CO3	Apply the knowledge of microwave devices for various microwave applications.	
CO4	Analyze a microwave system for the given specifications	
CO5	Develop an optical communication system to find their suitability for different applications.	
CO6	Compute the error probability of an optical communication system for a given specification using simulation software.	

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communications, Tata McGraw-Hill India, 5th edition, 2017.
2. Senior John M., Optical Fiber Communications, Pearson Education India, 4th edition, 2014.
3. Samuel Y Liao," Microwave devices and circuits", Pearson Education India, 3rd edition 2015

REFERENCES:

1. Govind P. Agrawal, "Fiber-optic communication systems", John Wiley & sons, 5th Edition,2021.
2. Annapurna Das, Sisir K. DAS, "Microwave Engineering", Tata McGraw-Hill, 4th edition,2020.

19UEC703	IMAGE PROCESSING AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	Image Formation and Image Processing	

Introduction and Goals of Computer Vision, Image Formation and Radiometry, Geometric Transformation, Geometric Camera Model, Image Reconstruction from a series of Projections

Unit – 2	Image Processing Concepts	

Fundamentals of Image Processing: Point, Geometric, and Spatial Operations, Image Transforms: DFT, DCT, KL, Wavelet, Ridgelet, Contourlet Transform, Image Filtering: Spatial domain filtering, Frequency domain filtering, Homomorphic filtering and Wiener Filtering for image restoration

Unit – 3	Image Segmentation and Features	

Morphological operations: Binary, Grayscale, and Distance Transform Image Segmentation: Thresholding, Region-based segmentation, Edge detection- based segmentation, Deformable models form image segmentation, Image Descriptors and Features: Texture Descriptors, Color Features, Edge detection, Object boundary and shape representation, Scale Invariant Feature Transform.

Unit – 4	Fundamentals of Machine Learning Concepts: Pattern Recognition	

Introduction to Pattern Recognition, Linear Regression and Decision theory, Parameter Estimation and Dimension Reduction ,Artificial Neural Network for Pattern Classification, Convolutional Neural Networks

Unit – 5	Applications of Computer Vision	

Machine Learning Algorithms and Their Applications in Medical Image Segmentation, Face and Facial Expression Recognition, Gesture Recognition,Simulation Examples

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1		
CO2		
CO3		
CO4		
CO5		
CO6		

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communications, Tata McGraw-Hill India, 5th edition, 2017.
2. Senior John M., Optical Fiber Communications, Pearson Education India, 4th edition, 2014.
3. Samuel Y Liao," Microwave devices and circuits", Pearson Education India, 3rd edition 2015

REFERENCES:

1. Govind P. Agrawal, "Fiber-optic communication systems", John Wiley & sons, 5th Edition,2021.
2. Annapurna Das, Sisir K. DAS, "Microwave Engineering", Tata McGraw-Hill, 4th edition,2020.

19UEC708	OPTICAL AND MICROWAVE COMMUNICATION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To demonstrate the characteristics of Microwave sources
- To study the characteristics of Microwave Components
- To train the students about fiber optic components used in optical communication.

LIST OF EXPERIMENTS:

MICROWAVE EXPERIMENTS

1. Reflex Klystron–Mode characteristics
2. Gunn Diode–Characteristics
3. VSWR, Frequency and Wave Length Measurement
4. Directional Coupler – Directivity and Coupling Coefficient–S –parameter measurement
5. Isolator and Circulator–S – parameter measurement
6. Attenuation and Power measurement
7. S-matrix Characterization of E-PlaneT, H-PlaneT and MagicT.
8. Radiation Pattern of Antennas.
9. Antenna Gain Measurement

OPTICAL EXPERIMENTS:

1. DC characteristics of LED and PIN Photo Diode.
2. Mode Characteristics of Fibers
3. Measurement of Connector and Bending Losses.
4. Fiber Optic Analog and Digital Link
5. Numerical Aperture Determination for Fibers
6. Attenuation Measurement in Fibers
7. Simulation of Analog and Digital Fiber Optic Link
8. BER analysis of optical fiber link.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Analyze the characteristic of microwave generators, optical fibers, LED and Photodiode.	**Analyze**
CO2	Analyze microwave components and circuits in terms of scattering parameters	**Analyze**
CO3	Analyze various losses in fiber optic communication systems	**Analyze**
CO4	Evaluate the performance of optical fiber using analog and digital link.	**Evaluate**
CO5	Design and analyze optical communication system using simulation software.	**Modern tool usage**

Semester VIII

Semester VIII (Draft Syllabus)

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
	Professional Elective VI	3	0	0	3	Professional Elective
	Open Elective IV	3	0	0	3	Open Elective
PRACTICAL						
19UEC801	Project Work	0	0	16	8	Project work
	TOTAL	**6**	**0**	**16**	**14**	

19UEC801	PROJECTWORK	L	T	P	C
		0	0	16	8

OBJECTIVES:

- To deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer based project or management project.

PROJECT DESCRIPTION:

Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project. The progress of the project is evaluated based on a minimum of three reviews.

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge	**Create**
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion	**Analyze**
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice	**Apply**
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools	**Evaluate**
CO5	Apply management principles to function effectively in the project team for project execution	**Affective Domain**
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	**Affective Domain**
CO7	Write effective reports and make clear presentation to the engineering community and society	**Psychomotor Domain**

LIST OF PROFESSIONAL ELECTIVES

LIST OF PROFESSIONAL ELECTIVES (* Draft Syllabus)

Sl.No.	Course Code	Course Name	L	T	P	C
1.	19UEC901	Principles of Artificial Intelligence*	3	0	0	3
2.	19UEC902	Principles of Robotics	3	0	0	3
3.	19UEC903	Biomedical Signal and Image Processing	3	0	0	3
4.	19UEC904	Control Engineering	3	0	0	3
5.	19UEC905	5G Technology*	3	0	0	3
6.	19UEC906	ARM System Development*	3	0	0	3
7.	19UEC907	Real Time System Design*	3	0	0	3
8.	19UEC908	Soft Computing Techniques*	3	0	0	3
9.	19UEC909	Image Analysis and Video Processing*	2	0	2	3
10.	19UEC910	Multimedia Compression and communication*	3	0	0	3
11.	19UEC911	IOT Architecture and protocols*	3	0	0	3
12.	19UEC912	RF Circuit Design*	3	0	0	3
13.	19UEC913	Introduction to MEMS and NEMS*	3	0	0	3
14.	19UEC914	AI in VLSI Design Automation*	3	0	0	3
15.	19UEC915	Embedded Systems in Medical Devices	3	0	0	3
16.	19UEC916	Satellite Communication Principles and Applications	3	0	0	3
17.	19UEC917	Speech and Audio Signal Processing	3	0	0	3
18.	19UEC918	Remote Sensing and Information system	3	0	0	3
19.	19UEC919	Nano Electronics*	3	0	0	3
20.	19UEC920	Adaptive and Smart Antennas*	3	0	0	3
21.	19UEC921	Software Defined and Cognitive Radio Networks*	3	0	0	3
22.	19UEC922	Biomedical Instrumentation	3	0	0	3
23.	19UEC923	ASIC and FPGA Based Design*	3	0	0	3
24.	19UEC924	Cyber Physical System (Industry Designed)*	3	0	0	3
25.	19UEC925	Block Chain (Industry Designed)*	3	0	0	3
26.	19UEC926	Sensors for IOT*	3	0	0	3
27.	19UEC927	Smart sensor networks*	3	0	0	3
28.	19UEC928	Tele Medicine*	3	0	0	3

19UEC901	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	PROBLEM SOLVING	

Introduction – Agents, Problem formulation, Uninformed search strategies, Heuristics– informed search strategies.

Unit – 2	LOGICAL REASONING	

Logical agents, Propositional Logic, Inferences, First-Order Logic, Inferences In First Order, Logic, Forward Chaining, Backward Chaining, Unification, Resolution

Unit – 3	PLANNING	

Planning With State-Space Search, Partial-Order Planning, Planning Graphs, Planning and Acting In The Real World -Hierarchical Planning.

Unit – 4	UNCERTAIN KNOWLEDGE AND REASONING	

Uncertainty, Review of probability, Probabilistic Reasoning- Bayesian Networks, Syntax And Semantics Of Bayesian Networks, Bayesian Nets With Continuous Variable, Inferences In Bayesian Networks

Unit – 5	LEARNING	

Forms of Learning , Learning From Observation-Inductive Learning, Decision Trees, Statistical Learning Methods, Artificial Neural Networks , Support Vector Machine

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply various search strategies to find solutions to real world scenarios	**Apply**
CO2	Derive new facts from existing knowledge base using resolution and unification for agent based intelligence systems	**Apply**
CO3	Apply the knowledge of planning to derive actions for agent based intelligence systems.	**Apply**
CO4	Use probabilistic reasoning to infer decisions from Belief networks under uncertain environment	**Apply**
CO5	Apply learning algorithms to derive facts from the given data set	**Apply**

TEXT BOOKS:

1.D. Poole and A. Mackworth. Artificial Intelligence:Foundations of Computational Agents,Cambridge University Press, 2010.

2.S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education, 2003.

REFERENCES:

David Poole, Alan Mackworth, Randy Goebel, ”Computational Intelligence : a logical approach”, Oxford University Press, 2004.

2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education, 2002.

3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers, 1998.

4. R. Brachman, H. Levesque. Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.

19UEC902	PRINCIPLES OF ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide basic knowledge in robotics
- To make students aware of technologies used in robotics
- To implement various programming techniques for robotics design

Unit – 1	INTRODUCTION	9

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and Control issues- Various manipulators – Sensors - work cell - Programming languages.

Unit – 2	ROBOT MOTION ANALYSIS AND CONTROL	9

Mathematical representation of Robots - Position and orientation – Homogeneous transformation- Various joints- Representation using the Denavit Hattenberg parameters - Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

Unit – 3	MANIPULATOR DIFFERENTIAL MOTION AND STATICS	9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse - Wrist and arm singularity - Static analysis - Force and moment Balance. Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

Unit – 4	PATH PLANNING	9

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

Unit – 5	ROBOT PROGRAMMING	9

Methods of Robot programming; lead through programming methods; a robot program as a path in space; motion interpolation; weight, signal and delay commands; Branching, capabilities and limitations of lead through methods.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the basic concept of robotics.	Understand
CO2	Apply the knowledge of the dynamics and control in robotics industries.	Apply
CO3	Analyze the various path planning techniques in robotics	Analyze
CO4	Apply the knowledge of basic programming to analyze various controls on robots for various applications.	Analyze
CO5	Evaluate the manipulator differential motion and various path planning techniques in robotics.	Evaluate

TEXT BOOKS:

1. R.K. Mittal and I.J. Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2.Mikell P.Groover, Michell wein,Roger N. Nagal and Nicholas G.Ordey, "Industrial Robotics, technology, Programming and applications" Mc Graw Hill.

REFERENCES:

1.Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. V.Damel Hunt, "Smart Robots", Chappan and Hall
4. S.Ghoshal, "Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

19UEC903	BIOMEDICAL SIGNAL AND IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic signal in the field of biomedical.
- To describe the methods for analyzing speech and other vocal signals.
- To help students learn the fundamentals and various techniques of biomedical image processing

Unit – 1	Biomedical Signals and Images	9

ECG: Cardiac electrophysiology, relation of electrocardiogram (ECG) components to cardiac events, clinical applications. Speech Signals: The source-filter model of speech production, spectrographic analysis of speech.Speech Coding: Analysis-synthesis systems, channel vocoders, linear prediction of speech, linear prediction vocoders.Imaging Modalities: Survey of major modalities for medical imaging: ultrasound, X-ray, CT, MRI, PET, and SPECT.MRI: Physics and signal processing for magnetic resonance imaging. Surgical Applications: A survey of surgical applications of medical image processing.

Unit – 2	Fundamentals of Deterministic Signal and Image Processing	9

Data Acquisition: Sampling in time, aliasing, interpolation, and quantization.Sampling Revisited: Sampling and aliasing in time and frequency, spectral analysis.Image processing I: Extension of filtering and Fourier methods to 2-D signals and systems.Image processing II: Interpolation, noise reduction methods, edge detection, homomorphic filtering.

Unit – 3	Probability and Random Signals	9

PDFs: Introduction to random variables and probability density functions (PDFs).Classification: Bayes' rule, detection, statistical classification.Random signals I: Time averages, ensemble averages, autocorrelation functions, crosscorrelation functions.Random signals II: Random signals and linear systems, power spectra, cross spectra.Blind source separation: Use of principal component analysis (PCA) and independent component analysis (ICA) for filtering.

Unit – 4	Image Segmentation and Registration	9

Image Segmentation: statistical classification, morphological operators, connected components. Image Registration I: Rigid and non-rigid transformations, objective functions.Image Registration II: Joint entropy, optimization methods.

Unit – 5	Application of modern tool usage in Biomedical Signal and Image Processing	9

ECG Filtering and Frequency Analysis,Speech Coding Implement, test, and compare two speech analysis-synthesis systems,Image Segmentation Process clinical MRI scans of the human brain to reduce noiselabel tissue types, extract brain contours, and visualize 3-D anatomical structures,ECG: Blind Source Separation Separate fetal and maternal ECG signals using techniques based on second- and higher-order statistical methods. Techniques include Wiener filtering, principal component analysis, and independent

component analysis.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the relevant aspects of digital image representation and their practical implications	Understand
CO2	Apply the fundamental concepts of filtering and Fourier methods for image Processing	Apply
CO3	Analyze the characteristics of Speech and other Vocal signals.	Analyze
CO4	Differentiate and analyze the applications of each modality for specific pathologies	Analyze
CO5	Apply different methods of signal processing techniques in analyzing the ECG signals	Analyze
CO6	Develop a mathematical model of various image segmentation, enhancement and registration techniques and analyze their performance	Analyze

TEXT BOOKS:

1. Clifford, G., F. Azuajae, and P. McSharry. *Advanced Methods and Tools for ECG Data Analysis*. Norwood, MA: Artech House, 2006. ISBN: 9871580539661.
2. Rabiner, L. R., and R. W. Schafer. *Digital Processing of Speech Signals*. Upper Saddle River, NJ: Prentice-Hall, 1978. ISBN: 9780132136037.
3. Quatieri, T. F. *Discrete-Time Speech Signal Processing: Principles and Practice*. Upper Saddle River, NJ: Prentice-Hall, 2001. ISBN: 9780132429429.
4. Lim, J. S. *Two-Dimensional Signal and Image Processing*. Upper Saddle River, NJ: Prentice Hall, 1989. ISBN: 9780139353222.

REFERENCES:

1. Gonzalez, R., and R. E. Woods. *Digital Image Processing*. 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 2002. ISBN: 9780201180756.
2. Epstein, C. L. *Mathematics of Medical Imaging*. Upper Saddle River, NJ: Prentice Hall, 2003. ISBN: 9780130675484.
3. Webb, S. *The Physics of Medical Imaging*. New York, NY: Taylor & Francis, 1988. ISBN: 9780852743492.
4. Macovski, A. *Medical Imaging Systems*. Upper Saddle River, NJ: Prentice Hall, 1983. ISBN: 9780135726853.

19UEC904	CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concept of open loop and closed loop (feedback) systems
- To provideknowledgeoftimedomainandfrequencydomainanalysisofcontrolsystems required for stability analysis
- To present the compensation technique that can be used to stabilize control systems

Unit – 1	CONTROL SYSTEMS MODELING	9

Control System: Terminology and Basic Structure, Open loop and Closed Loop Systems
Feed forward and Feedback control theory, Mechanical and Electrical Transfer Function Models, Block diagram Models, Signal flow graphs models,Synchronous - Multivariable control system
DC and AC servo Systems

Unit – 2	TIME RESPONSE ANALYSIS	9

Transient response-Steady state response, Measures of performance of the standard first order and second order system,Effect on an additional zero and an additional pole,Steady error constant and system- type number,PID control-Analytical design for PD, PI,PID control systems

Unit – 3	FREQUENCY RESPONSE AND SYSTEM ANALYSIS	9

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

Unit – 4	STABILITY ANALYSIS	9

Concept of stability, Bounded - Input Bounded - Output stability, Routh stability criterion,
Root locus concept-Guidelines for sketching root locus, Nyquist stability criterion.

Unit – 5	CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS	9

State variable representation,Conversion of state variable models to transfer functions,Conversion of transfer functions to state variable models,Solution of state equations,Concepts of Controllability and Observability,Stability of linear systems-Equivalence between transfer function and state variable representations,State variable analysis of digital control system-Digital control design using state feedback.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe mathematical models of feedback control systems in terms of differential equations, transfer functions and state-space representation.	Understand

CO2	Apply Laplace transform to illustrate different specifications of the control system using transfer function model.	Apply
CO3	Analyze the stability and system performance in time , frequency and state space domain.	Analyze
CO4	Assess the techniques for improving the system performance in time and frequency domain.	Evaluate
CO5	Design PID controllers and compensators for real-world applications.	Create
CO6	Design mechanical and electrical control systems using Matlab /Simulink with control system	Create

TEXT BOOKS:

1. M.Gopal, ―Control System – Principles and Design‖, Tata McGraw Hill, 4th Edition, 2012.
2. J.Nagrath and M.Gopal, ―Control System Engineering‖, New Age International Publishers, 5th Edition, 2009.

REFERENCES:

3. Norman S. Nise, Control Systems Engineering, 6th edition, Wiley, 2011.
4. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 12th Edition, Prentice Hall, 2011.
5. Benjamin.C.Kuo, ” Automatic control systems”, Prentice Hall ofIndia,6thEdition ,2013

19UEC905	5G TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	OVERVIEW OF 5G BROADBAND WIRELESS COMMUNICATIONS	

Evaluation of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro) , An Overview of 5G requirements, Regulations for 5G,Spectrum Analysis and Sharing for 5G.

Unit – 2	THE 5G WIRELESS PROPAGATION CHANNELS	

Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mm Wave MIMO Systems.

Unit – 3	TRANSMISSION AND DESIGN TECHNIQUES FOR 5G	

Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques – orthogonal frequency division multiple accesses (OFDMA), generalized frequency division multiple accesses (GFDMA), non-orthogonal multiple accesses (NOMA). .

Unit – 4	5G ARCHITECTURE	

Introduction – High level requirements for 5G architecture –Fundamentals architecture and 5G flexibility – Physical Architecture and 5G deployment.

Unit – 5	5G SPECTRUM	

Access design principles for multiuser communications – Multicarrier with filtering; a waveform – Non – orthogonal schemes for efficient multiple access – Radio access for dense deployments – Radio access
for V2x communication – Radio access for massive machine type communications. – 5G spectrum landscape and requirements – Spectrum access modes and sharing scenarios.5G spectrum technologies – value of spectrum for 5G : a techno – economic perspectives **.**

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the 5G Technology advances and their benefits	Understand
CO2	Apply the knowledge of RF, PHY, MAC and air interface changes required to support 5G	Analyze
CO3	Analyze the various multiple access techniques for 5G communications.	Analyze

CO4	Understand the basic concepts of 5G Architecture..	Understand
CO5	Design 5G spectrum for multicarrier Signaling	Create

TEXT BOOKS:

1. Martin Sauter “From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband”, Wiley-Blackwell.
2. Afif Osseiran, Jose.F.Monserrat, Patrick Marsch, “Fundamentals of 5G Mobile Networks” , Cambridge University Press.
3. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos, “New Directions in Wireless Communication Systems from Mobile to 5G”, CRC Press.
4. Theodore S.Rappaport, Robert W.Heath, Robert C.Danials, James N.Murdock “Millimeter Wave Wireless Communications”, Prentice Hall Communications.

References

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, John Wiley

REFERENCES:

1. Fundamentals of 5G mobile Networks, edited by Jonathan RodisQuez and Wiley
2. 5G Mobile and Wireless Communications Technologyby AfifOsseiran(ed.) ; Jose F. Monserrat(ed.) ; Patrick Marsch(ed.) ; Mischa Dohler(other) ; Takehiro Nakamura(other) june 2016.
3. William Stallings, “Wireless Communication and Networks”, Pearson Education,2003.

19UEC906	ARM SYSTEM DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	ARM EMBEDDED SYSTEM FUNDAMENTALS	

The RISC and ARM Design Philosophy, Embedded system Hardware, Embedded system Software, ARM processor Fundamentals, Current Program status Registers, Pipeline, Exceptions, Interrupts and Vector Table, ARM processor families, Instruction Set

Unit – 2	ARM CORTEX M3 ARCHITECTURE	

Architecture, Registers, operating Modes, Exception and interrupts, vector table, Stack memory operations, Instruction set, Bus Interfaces, Interrupt Behavior

Unit – 3	MEMORY SYSTEMS	

Memory hierarchy and cache memory, Cache Architecture, ARM MMU, Page Tables, Translation Lookaside buffer, Cache and write Buffer, Coprocessor 15 and MMU configuration

Unit – 4	ARM PROGRAMMING	

Efficient C programming, ARM assembly code writing, FIIR and IIR filter design

Unit – 5	SYSTEM DEBUGGING	

Debugging feature, Core sight overview, Debug modes and events, Breakpoints in the Cortex M3, Accessing Registers, Debugging Components

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the function of ARM and Cortex M3 systems	Understand
CO2	Apply the various data types of ARM and Cortex M3 systems to develop various codes.	Apply
CO3	Examine the different types of programming mode for ARM and Cortex M3 systems	Analyze
CO4	Asses the ARM and Cortex M3 systems using its various functions.	Evaluate
CO5	Design the real time system using ARM and Cortex M3 systems	Create
Co6	Design the project Motor Speed Controlling through Voice & LabVIEW	Modern Tool Usage

TEXT BOOKS:

1. ARM System Developer's Guide, Designing and Optimizing system software, Elsevier,Andrew N Sloss, Dominic Symes, Chris Wright.
2. The Definitive Guide to the ARM® Cortex-M3, Second Edition, Joseph Yiu.

REFERENCES:

19UEC907	REAL TIME SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	INTRODUCTION TO EMBEDDED ARCHITECTURE	

Complex systems and Microprocessors, Embedded system design process, Formalisms for system design, Design example: Model train controller, Instruction sets preliminaries, ARM Processor, CPU: Programming input and output, Supervisor modes, Exception and traps-coprocessors-Memory system mechanism, CPU Performance-CPU power consumption, Testing tools

Unit – 2	COMPUTING PLATFORM AND DESIGN ANALYSIS	

CPU Buses Memory devices I/O Devices, Component interfacing, Design with microprocessors, Development and debugging, Components for embedded programs, Model of programs, Assembly, linking and loading, Basic compilation techniques, Program optimization, Program validation and testing, Productivity tools.

Unit – 3	PROCESSES AND OPERATING SYSTEMS	

Multiple tasks and multi processes, Preemptive real time operating systems, Priority based scheduling, Inter process communication mechanisms, Evaluating operating system performance, Power management, Optimization for processes, Assembly language programming.

Unit – 4	HARDWARE ACCELERATORS AND NETWORKS	

CPUs and accelerators, Multiprocessor performance analysis, Consumer electronics architecture, Distributed embedded architecture, Network for embedded systems, Network based design, Internet enabled systems, Vehicles as networks, Sensor networks, Video accelerator

Unit – 5	SYSTEM DESIGN TECHNIQUES	

Design methodologies, Requirement analysis, Specifications, System analysis and architecture design, Quality assurance, Software tools for embedded system development, Design example: Alarm clock, Software Modem, Elevator Controller, Telephone PBX

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Explain and work on Real time operating systems	Understand
CO2	Apply the concepts of embedded system.	Apply
CO3	Design and program for Embedded Systems.	Analyze

TEXT BOOKS:

1. Wayne Wolf, “Computers as Components; Principles of Embedded Computing System Design”, Morgan
2. Kaufmann Publisher, 2nd Edition, 2011.
3. Raj Kamal, “Embedded Systems Architecture Programming and Design” 2nd Edition TMH, 2008.

REFERENCES:

1. David E Simon “An Embedded Software Primer ” Pearson Education ,2007.
2. K.V.K.K.Prasad “Embedded Real-Time Systems: Concepts, Design and Programming” Dreamtech press 2005.
3. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, TMG, 2004.
4. Tammy Noergaard, “Embedded System Architecture”, Elsevier, 2006.

19UEC908	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- .

UNIT I	ARTIFICIAL NEURAL NETWORK - I	9

Fundamental concept - Evolution of Neural Networks -Basic Models of Artificial Neural – networks -Important Terminologies of ANNs -McCulloch-Pitts Neuron -Linear Separability - Hebb Network -.Supervised Learning Network: Perceptron Networks –Adaline -Multiple Adaptive -Linear Neurons -Back-Propagation Network -Radial Basis Function Network

UNIT II	ARTIFICIAL NEURAL NETWORK-II	9

Associative Memory Networks: Training Algorithms for Pattern Association - Auto associative Memory –Network -Hetero associative Memory Network - Bidirectional Associative Memory - Hopfield Networks- Iterative Auto associative Memory Networks- Temporal Associative Memory Network -Learning Networks: : Fixed weight Competitive Nets, Unsupervised – Kohonen Self- Organizing Feature Maps -Learning Vector Quantization- Counter propagation Networks -Adaptive Resonance Theory Networks – Special Networks.

UNIT III	FUZZY SET THEORY I	9

Introduction to Classical Sets -Fuzzy sets -Classical Relations -Fuzzy Relations- Tolerance and Equivalence Relations –Non interactive Fuzzy sets -Membership Functions-Fuzzification – Methods of Membership Value Assignments-Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations -Defuzzification Methods.

UNIT IV	FUZZY SET THEORY II	9

Fuzzy Arithmetic Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning - Truth values and Tables in Fuzzy logic -Fuzzy Propositions -Formation of Rules- Decomposition and Aggregation of rules -Fuzzy Reasoning -Fuzzy Inference Systems (FIS) -Fuzzy Decision Making

UNIT V	OPTIMIZATION AND GENETIC ALGORITHMS	9

Derivative-based Optimization – Descent Methods – The Method of Steepest Descent Classical Newton‘s Method -Step Size Determination -Derivative-free Optimization Genetic algorithms – Basic Operators and Terminologies in Gas-Simple GA – General Genetic Algorithm-The Scheme Theorem -Classification of Genetic Algorithm – Holland Classifier Systems -Genetic Programming and applications

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1		
CO2		

CO3		
CO4		
CO5		

TEXT BOOKS:

1. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007.ISBN: 10: 81-265-1075-7.

REFERENCES:

1. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill,1997.
2. J.S.R.Jang, C.T.S.Un and E.Mizutani, Neuro - Fuzzy and Soft Computing, PHI,2004, Pearson Education.
3. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI 2010.
4.Kaushik Kumar, Supriyo Roy, J. Paulo Davim,”Soft Computing Techniques for Engineering Optimization”CRC Press,2019

19UEC909	IMAGE ANALYSIS AND VIDEO PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

-

UNIT 1	INTRODUCTION TO IMAGE ANALYSIS AND IMAGE TRANSFORMS	9

Introduction to Image Analysis and Visualisation -Course Objective and Outcomes -Review on Image Processing -Order Statistics Filter -Image Transforms– Fourier,Haar transforms Slant, Wavelet -Restoration-Blind Deconvolution -Weiner Filtering, Inverse Filtering -Spatio-Spectral- Wavelet, Ridgelet transforms -Curvelet Transform

UNIT II	SEGMENTATION	9

Color based segmentation -Histogram based segmentation -Cluster based – segmentation -Morphology based segmentation

UNIT III	CLASSIFICATION	9

Introduction toProbabilistic Classifiers -Navie Bayes Classifier -Logistic Regression Introduction to Deterministic Classifiers -KNN Classifier -Random Forests Classifier.

UNIT IV	DIGITAL VIDEO FORMATION	9

Introduction to digital video and digital video processing -Analog versus Digital, Analog to digital -Digital Video Standards- Video acquisition -CCD and CMOS -sensors Video sampling and interpolation -Interlaced and Progressive scanning -Video file formats- Storage devices –NVR -DVR- Different types of Video Cameras, IP Camera

UNIT V	MOTION ANALYSIS	9

Introduction to Motion Detection –--- Hypothesis testingwith Fixed/Adaptive – thresholding -Introduction to Motion Estimation -Pixel based approaches -Block matching approaches -Motion compensation for videos

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply Level: Examine different transforms and analyse their merits and demerits with specific image processing applications	
CO2	Apply Level: Apply various restoration techniques in spatial domain as well as in frequency domain for image enhancement	
CO3	Analyze Level: Select and apply deterministic or probabilistic classifiers for image analysis	
CO4	Understand Level: Demonstrate how digital videos are acquired, stored, different video file formats and spatio-temporal imagery	
CO5	Apply Level: Perform techniques for motion analysis such as motion detection, estimation and compensation.	
CO6	Analyze Level -Compare image analysis techniques and classifiers for real world image processing applications	

TEXT BOOKS:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall,2008.
2. Yao Wang, Jorn Ostermann, and Ya-Qin Zhang, Video Processing and Communications, Prentice- Hall, ISBN0-13-017547-1
3.

REFERENCES:

1. A.K.Jain, Fundamentals of Digital Image Processing, Prentice- l, 1989.
2. A.Bovik, ed., The Essential Guide to Image Processing, Academic Press, 2009.
3. R.C. Gonzalez, R.E. Woods, S.L. Eddins, Digital Image Processing using MATLAB, Prentice-Hall, 2004, ISBN 0-13-008519-7.
4. W. Pratt, Digital Image Processing, 3rd edition, John Wiley & Sons, 2001, ISBN 0-471-37407-5.

19UEC910	MULTIMEDIA COMPRESSION AND COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

-

UNIT 1	MULTIMEDIA COMPONENTS	9

Introduction: Multimedia skills -Multimedia components -Multimedia components and their characteristics -Text, sound, images –graphics –animation -Video, hardware

UNIT II	AUDIO AND VIDEO COMPRESSION	9

Audio compression -DPCM ,Adaptive PCM -adaptive predictive coding -linear Predictive coding code excited LPC -perpetual coding Video compression, principles-H.261 -H.263-MPEG 1, 2, 4.

UNIT III	TEXT AND IMAGE COMPRESSION	9

Compression Principles -Source Encoders And Destination Encoders -Lossless And Lossy Compression -Entropy Encoding –Source Encoding -Text Compression -Static Huffman Coding Dynamic Coding, Arithmetic Coding -Lempel Ziv-Welsh Compression- -Image Compression

UNIT IV	VOIP TECHNOLOGY	9

Basics of IP transport, VoIP challenges -H.323/ SIP-Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service -CODEC Methods- VOIP applicability -Basics of IP transport, VoIP challenges

UNIT V	MULTIMEDIA NETWORKING	9

Multimedia networking,Applications -streamed stored and audio-making the best Effort service- protocols for real time interactive Applications-distributing multimedia-beyond best effort service -sechluding and policing Mechanisms-integrated services -Differentiated Services-RSVP -Recent application in multimedia

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the characteristic features of different multimedia components.	
CO2	Compare the efficiency of various compression techniques in terms of storage and compression ratio	
CO3	Apply various predictive coding techniques for audio and video compression.	
CO4	Compare H.323 and SIP network architecture for VoIP applications.	
CO5	Describe the operation and protocols of the different kinds of networks that are used to support streaming audio	

CO6	Compare the different Image Compression techniques	

TEXT BOOKS:

1. Fred Halshall “Multimedia communication - Applications, Networks, Protocols and standards”, Pearson Education, 2007.

REFERENCES:

1. Tay Vaughan, “Multimedia: Making it work”, 7 th Edition, TMH 2008
2. Kurose and W.Ross “Computer Networking “a Top Down Approach”, Pearson Education 2005
3. Marcus Goncalves “Voice over IP Networks”, McGraw hill 1999.
4. KR. Rao,Z S Bojkovic, D A Milovanovic, “Multimedia Communication Systems: Techniques, Standards, and Networks”, Pearson Education 2007.
5. R. Steimnetz, K. Nahrstedt, “Multimedia Computing, Communications and Applications”, Pearson Education Ranjan Parekh, “Principles of Multimedia”, TMH 2007.

19UEC912	RF CIRCUIT DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

-

UNIT 1	MATCHING NETWORK	9

Introduction, A valuable graphical aid: the smith chart, derivation and its types -The normalised impedance -Admittance(ZY)smith chart, Application of smith chart-distributed circuit applications-
Determination of admittance from impedance value-input impedance(Zin) -Definition of impedance matching, maximum power transfer -Design of matching circuits using lumped elements, L sections, Design rules -for matching networks -Lumped element, Matching network design using distributed
element, Choice of short- or open circuited stubs -Design steps for single stub matching(using the same characteristic impedance).

UNIT II	BASIC CONSIDERATION IN ACTIVE NETWORKS	9

Stability considerations, stability circles, Graphical and analytical solutions, Potential unstable case, Gain considerations -Power gain concepts, A special case: unilateral transistor, Maximum gain design, Unilateral case(maximum gain and constant gain circles), Gain compression third order intercept point, Noise consideration-Definition and sources, Definition of noise figure, Noise figure of cascade networks, Constant noise figure circles.

UNIT III	RF/MICROWAVE AMPLIFIERS	9

Small signal design, Types of amplifiers. Small-signal amplifiers-amplifiers DC-bias circuit design and amplifiers DC-bias RF/MW circuit design, Design of narrowband amplifier(NBA) design, Design of maximum gain amplifier (MGA) design, Design of low-noise amplifier (LNA) design, Commercially available Mixers and Amplifiers

UNIT IV	RF/MICROWAVE OSCILLATOR	9

Introduction-Oscillator versus amplifier design, Oscillation conditions, Two-port NR oscillator, A special case: one port NR oscillator, Condition of stable oscillations, Design of transistor oscillators.

UNIT V	RF/MICROWAVE MIXERS	9

Introduction, Mixer types-up converter and harmonic mixers, Mixer parameters, Conversion loss for SSB mixers-diode loss, mismatch loss and harmonic loss, SSB versus DSB mixers-conversion loss and noise figure, Single ended mixer. IntegratedRF front end–System level budgeting, Noise Figure and power budgets

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Evaluate matching networks using smith chart.	Evaluate
CO2	Apply the knowledge of RF circuits to design of Low Power RF Amplifiers	Apply
CO3	Apply the knowledge of RF circuits to design of one port RF Oscillators	Apply
CO4	Apply the knowledge of Microwave parameters to design of Single Ended Mixers	Apply

CO5	Calculate RF System level Parameters- Noise & Power budget for a Wireless RF front end system.	Understand Level
		TOTAL : 45 PERIODS

TEXT BOOKS:

1. Matthew M. Radmanesh, "Radio frequency and Microwave Electronics Illustrated", Pearson Education Asia, 2001.

REFERENCES:

1. David M Pozar: Microwave and RF design of wireless systems, John Wiley & Sons, 2001.
2. David M. Pozar," Microwave Engineering," John Wiley & Sons, Fourth Edition, 2015.
3. Les Besser and Rowan Gilmore, "Practical RF circuit Design for Modern Wireless Systems- Passive circuits and Systems", Vol.1, Artech House Publishers, Boston, London 2008

19UEC913	INTRODUCTION TO MEMS AND NEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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UNIT 1		9

New trends in Engineering and Science: Micro and Nanoscale systems, Introduction to Design of MEMS and NEMS, MEMS and NEMS – Applications, Devices and structures. Materials for MEMS: Silicon, silicon compounds, polymers, metals.

UNIT II		9

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA

UNIT III		9

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

UNIT IV		9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Micromechanical Motors and pumps.

UNIT V		9

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Discuss the basic principles of MEMS	Understand
CO2	Design the micro devices, micro systems using the MEMS fabrication process.	Apply
CO3	Classifying the different mechanisms of micro sensors and actuators. (Apply)	Apply
CO4	Comprehend the theoretical foundations of quantum mechanics and Nano systems. (Understand)	Understand
CO5	Discuss the basic principles of MEMS (Understand)	Understand

TEXT BOOKS:

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

19UEC914	AI IN VLSI DESIGN AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

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Unit – 1	INTRODUCTION TO AI	9

Computerized reasoning- Artificial Intelligence (AI)- characteristics of an AI problem-Problem representation in AI-State space representation-problem reduction-Concept of small talk programming

Unit – 2	SEARCH PROCESS	9

AI and search process-Brute force search techniques-Depth first, Breadth first search techniques,-Hill climbing,-Best first search-AND/OR graphs-A* algorithm

Unit – 3	EMBEDDED SYSTEMS IN HEALTH CARE MONITORING	9

Definition-Classification of optimization problems-Unconstrained and Constrained optimization -Optimality conditions ,Classical Optimization techniques-Linear and non - linear programming -Quadratic programming -Mixed integer programming

Unit – 4	EVOLUTIONARY COMPUTATION TECHNIQUES	9

Evolution in nature-Fundamentals of Evolutionary algorithms-Principle of Genetic Algorithm-Evolutionary Strategy and Evolutionary Programming-Genetic Operators - Selection, Crossover and Mutation-Issues in GA implementation-Differential Evolution technique

Unit – 5	PARTICLE SWARM OPTIMIZATION	9

Fundamental principle -Velocity Updation - Parameter selection- hybrid approaches-hybrid of GA and PSO-hybrid of EP and PSO-Binary, discrete and combinatorial PSO -- Implementation issues, Convergence issues-Fly Bee Algorithm

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	To apply knowledge representation techniques and problem solving strategies to common AI applications	Understand
CO2	Implement heuristic and iterative deepening search algorithms	Apply
CO3	Familiarize with the basic concept of optimization techniques.	Understand
CO4	Apply Genetic Algorithm for solving engineering problems.	Apply
CO5	Describe about swarm optimization algorithms and apply them to solve problems in classification, pattern recognition, and optimization problems	Apply

TEXT BOOKS:

1. Stuart Russel and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Prentice Hall, 2009.
2. Kalyanmoy Deb, “Optimization for Engineering Design - Algorithms and Examples”, Prentice Hall of India, 2012

. David Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, Reading, 1989

REFERENCES:

1.Patrick Henry Winston, “Artificial Intelligence”, Addison Wesley, 2000

2.Luger George F and Stubblefield William A, “Artificial Intelligence: Structures and Strategies for Complex Problem Solving”, Pearson Education, 2002.

3.Kwang Y.Lee, Mohammed A.ElSharkawi, “Modern heuristic optimization techniques”, John Wiley and Sons, 2008

19UEC915	EMBEDDED SYSTEMS IN MEDICAL DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To implement knowledge about various medical devices
- To provide basics about the controllers that can be embed in designing of medical devices
- To make students aware of applications of embedded systems in industries

Unit – 1	OVERVIEW OF MEDICAL DEVICES	9

Generalized medical instrumentation systems and classification,Bio potential amplifiers – inverting & non-inverting amplifier, Differential Amplifier, and logarithmic amplifier – Filters, Bio ensors – Displacement Measurement-Resistive sensors, Inductive sensors, Capacitive sensors & piezoelectric sensor – Temperature Measurement- Thermocouples, Thermistors, Radiation Thermometry, Fiber-Optic Temperature Sensors – Optical Measurement,Bio potential electrodes – Polarizable and Nonpolarizable Electrodes, Body-Surface Recording Electrodes, Internal Electrodes, Electrode Arrays, icroelectrodes ,Design criteria and development process of commercial medical devices

Unit – 2	MICROCONTROLLERS IN MEDICAL DEVICES	9

Basics of microcontroller – Embedded Medical System ,Selection of a Microcontroller – IoT-Based Medical Devices,ECG,EEG and EMG-Based Embedded Medical System

Unit – 3	EMBEDDED SYSTEMS IN HEALTH CARE MONITORING	9

Measurement of Blood Pressure and Sound – Direct Measurements, Measurement of System Response, Systems for Measuring Venous Pressure, Indirect Measurements of Blood Pressure, Heart Sounds, Phonocardiography ,Measurement of Flow and Volume of Blood ,Measurements of the Respiratory System – Modeling the Respiratory System – Measurement of Pressure – Measurement of Gas Flow – Lung Volume – Respiratory ,Plethysmography

Unit – 4	CHEMICAL BIOSENSORS AND EMBEDDED DEVICES FOR CLINICAL LABORATORY	9

Chemical bio sensors – Electrochemical Sensors, Chemical Fibrosensors, Ion-Sensitive Field-Effect Transistor (ISFET), Immunologically Sensitive Field-Effect Transistor (IMFET), Noninvasive Blood-Gas Monitoring, Blood-Glucose Sensors, Electronic Noses and Lab-on-a-chip,Clinical Laboratory Instrumentation – Spectrophotometry, Automated Chemical Analyzers, Chromatology, Electrophoresis, Hematology, Ethical issues related to clinical research

Unit – 5	HEALTHCARE AND WIRELESS SENSING	9

Introduction to m-health – Smart m-Health Sensing, m-Health Computing m-Health2.0, Social Networks, Health Apps, Cloud and Big Health Data ,Open source software & hardware for designing embedded based medical devices – The Future of m-Health – case study

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:		
CO1	Explain the basic concepts, the use of embedded systems in medical devices and m-health monitoring for various applications.	Understand
CO2	Apply the basic knowledge of sensors and m-health to design various healthcare devices.	Apply
CO3	Apply the fundamental principles of medical devices to implement healthcare device for a given problem.	Apply
CO4	Analyze various medical devices for a given specifications.	Analyze
CO5	Develop simple health care monitoring systems for various applications by considering all the ethical factors.	Create
CO6	Design simple health care monitoring systems using open source software	Create

TEXT BOOKS:

1. John G. Webster, Amit J. Nimunkar , " Medical Instrumentation - Application and Design", Fifth Edition, JohnWiley and Sons, 2020
2. Roberts. H. Istepanian and Bryan Woodward, "m-Health Fundamentals and Applications", Wiley, 2017
3. Subhas Chandra Mukhopadhyay and Aime Lay-Ekuakille, "Advances in BiomedicalSensing, Measurements, Instrumentation and Systems", Springer, 2010

REFERENCES:

1. Niezen G, Eslambolchilar P, Thimbleby H, "Open-source hardware for medical devices", BMJ Innovations 2016, Vol.2,pp-78-83.
2.Joseph D. Bronzino, "The Biomedical Engineering Handbook", Third Edition, CRC Press,Taylor & Francis Group, 2006

19UEC916	SATELLITE COMMUNICATION PRINCIPLES AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of satellite orbits.
- To understand the satellite segment and earth segment.
- To analyze the various methods of satellite access.
- To understand the applications of satellites

Unit – 1	SATELLITE ORBITS AND SYSTEMS	9

Orbits and Launching Methods:Kepler's Law, Orbital Elements , Apogee and Perigee Heights , Orbit Perturbations.The Geostationary Orbit: Introduction , Antenna Look Angles The Polar Mount Antenna , Limits of Visibility , Near Geostationary Orbits , Earth Eclipse of Satellite , Sun Transit Outage ,Launching Orbits.Radio Wave Propagation: Atmospheric Losses ,Ionospheric Effects , Rain Attenuation , Other Propagation Impairments

Unit – 2	SPACE SEGMENT AND SPACE LINK	9

The Space Segment: The Power Supply, Attitude Control, Station Keeping, Thermal Control ,TT&C Subsystem ,Transponders, The Antenna Subsystem, The Space Link: Equivalent Isotropic Radiated Power, Transmission Losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio, The Uplink, Downlink, Effects of Rain, Combined Uplink and Downlink C/N Ratio, Inter-modulation Noise, Inter-Satellite Links

Unit – 3	EARTH SEGMENT	9

The Earth Segment: Receive-Only Home TV Systems, Master Antenna TV System, Community Antenna TV System, Transmit-Receive Earth Stations,Direct Broadcast Satellite (DBS) Television, High Definition Television (HDTV), Video Frequency Bandwidth

Unit – 4	SATELLITE ACCESS	9

Satellite Access: Single Access , Preassigned FDMA Demand-Assigned FDMA , Spade System , Bandwidth Limited and Power-Limited TWT Amplifier Operation, TDMA, Satellite-Switched TDMA, Code-Division Multiple Access

Unit – 5	SATELLITE APPLICATION AND SERVICES	9

Satellite Mobile and Specialized Services: Satellite Mobile Services , VSATs , Radarsat , Remote sensing satellites ,Global Positioning Satellite System (GPS) , Orbcomm, Iridium

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the technologies involved in satellite communication.	Understand
CO2	Apply the knowledge of Satellite communication principles to determine the design parameters of satellite communication systems	Apply
CO3	Apply the knowledge of satellite link design to derive link Budget for satellite Communication	Apply

CO4	.Analyze the parameters of satellite communication systems for the given scenario	Analyze
CO5	Design and develop a cost-effective GPS tracker for various applications.	Create
CO6	Analyze the remote sensing data from satellites for various applications.	Analyze

TEXT BOOKS:

1. Dennis Roddy ,Satellite Communications , Fourth Edition, McGraw-Hill,2017
2. Timothy Pratt, Jeremy Allnutt Emeritus, Satellite Communications,Third Edition,Wiley,2020

REFERENCES:

1. B. Elbert, Introduction to Satellite Communications, 3rd ed., Artech House, 2008.
2. G.Maral, M. Bousquet, Satellite Communications systems, 2nd edition, John Wiley & Sons, 2002.

19UEC917	SPEECH AND AUDIO SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the anatomy and physiology of acoustic prodection and perception model
- To analyze the speech in time domain and extract various parameters.
- To study the concept of Homomorphic system and analyze various coding technique with applications

Unit – 1	MECHANICS OF SPEECH	9

Basics of speech production, LTI model, LTV model, Voiced and unvoiced decision making, Speech parameters, pitch and formants, Pitch frequency measurement using AMDF and autocorrelation, Parallel processing approach, Pitch period measurement using spectral domain, cepstral domain, Relation between formants and LPC, Evaluation of formants using cepstrum, log spectrum and Power spectral density estimate.

Unit – 2	TIME DOMAIN MODELS FOR SPEECH PROCESSING	9

Time Domain models for Speech Processing: Introduction – Window considerations,Short time energy, average magnitude,Short time energy average zero crossing rate,Speech vs Silence discrimination using energy and zero crossing,Pitch period estimation using a parallel processing approach,Short time average magnitude difference function,The short time autocorrelation function,Pitch period estimation using the autocorrelation function.

Unit – 3	LINEAR PREDICTIVE CODING SPEECH	9

Linear Predictive Coding (LPC) Analysis -Introduction -Basic principles of Linear Predictive Analysis-The Autocorrelation Method, The Covariance method,Solution of LPC Equations : Cholesky Decomposition Solution for Covariance Method,Durbin's Recursive Solution for the Autocorrelation Equations,Comparison between the methods of solution of the LPC Analysis Equations,Applications of LPC Parameters : Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

Unit – 4	HOMOMORPIC SPEECH PROCESSING	9

Homomorpic speech analysis : Definition of the ceptstrum and complex ceptstrum, Short time ceptstrum, Homomorphic filtering of speech, Application: pitch detection-pattern recognition

Automatic Speech Recognition: problem of automatic speech recognizer,Building a speech recognition system, decision recognition system, Decision process in ASR, Representation recognition performance ,challenges in ASR technology.

Unit – 5	APPLICATIONS	9

Audio Coding : Lossless Audio Coding, Lossy Audio coding, Psychoacoustics , ISO-MPEG-1 Audio coding , MPEG- 2 Audio coding, MPEG - 2 Advanced Audio Coding, MPEG - 4 Audio Coding

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the basic concept of speech signals ,speech production, speech analysis, speech coding and parameter representation of speech	Understand
CO2	Develop linear predictive coding algorithm for speech signal to synthesis or compress the speech.	Apply
CO3	Apply speech coding and enhancement algorithms on speech signals.	Apply
CO4	Design audio coding methods using existing code	Apply
CO5	Develop coding by implementing algorithms for processing audio and speech signals using Matlab	Apply
CO6	Analyze the speech in time domain and various coding technique to extract various parameters	Analyze

TEXT BOOKS:

1. Digital Processing of Speech Signals - L.R. Rabiner and S. W. Schafer. Pearson Education.(Module 2 and 3))
2. Introduction to Digital speech processing –Lawrence R.Rabiner and Ronald W.Schafer.
   (Module 4)
3. Digital Audio Signal Processing – Udo Zolzer, 2nd Edition, Wiley.(Module 5)
4. Dr. Shaila Apte- “Speech and audio processing”, Wiley India Publication, 2013 (Module1)

REFERENCES:

1. Discrete Time Speech Signal Processing: Principles and Practice - Thomas F. Quateri, 1st Ed., PE.
2. Speech & Audio Signal Processing- Ben Gold & Nelson Morgan, 1st Ed., Wiley

19UEC918	REMOTE SENSING AND INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on remote sensing and applications
- To explain different types of remote sensing
- To familiarize the students with GIS

Unit – 1	REMOTE SENSING	9

Definition ,Components of Remote Sensing, Energy, Sensor, Interacting Body ,Active andPassive Remote Sensing, Platforms , Aerial and Space Platforms, Balloons, Helicopters,Aircraft and Satellites , Synoptivity and Repetivity, Electro Magnetic Radiation (EMR) – EMRspectrum, Visible, Infra Red (IR), Near IR, Middle IR, Thermal IR and Microwave – BlackBody Radiation, Planck's law – Stefan-Boltzman law.

Unit – 2	EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS	9

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering EMR Interaction with Water vapour and ozone, Atmospheric Windows –Significance of Atmospheric windows, EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy, Reflectance –Specular and Diffuse Reflection Surfaces Spectral Signature – Spectral Signature curves, EMR interaction with water, soil and Earth Surface: Imaging spectrometry and spectral characteristics.

Unit – 3	OPTICALAND MICROWAVE REMOTE SENSING	9

Satellites – Classification, Based on Orbits and Purpose – Satellite Sensors , Resolution – Description of Multi Spectral Scanning, Along and Across Track Scanners – Description of Sensors in Landsat, SPOT, IRS series, Current Satellites - Radar – Speckle - Back Scattering

Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer, Geometrical characteristics; Sonar remote sensing systems.

Unit – 4	GEOGRAPHIC INFORMATION SYSTEM	9

GIS – Components of GIS, Hardware, Software and Organizational Context , Data – Spatial and Non-Spatial, COORDINATE SYSTEMS: Geographic Coordinate system; Approximation of Earth, Datum:Maps – Types of Maps – Projection – Types of Projection, Data Input –Digitizer, Scanner – Editing, Raster and Vector data structures – Comparison of Raster andVector data structure, Analysis using Raster and Vector data – Retrieval, Reclassification,Overlaying, Buffering – Data Output – Printers and Plotters

Unit – 5	APPLICATIONS	9

Applications in Agriculture, Forestry, Geology & Hydrology, cryospace studies, land use mapping and ocean related studies , military and surveillance applications, search and rescue operations

ground and air target detection and tracking

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to:

CO1	Explain the components of remote sensing and various EMR spectrum	Understand
CO2	Discuss the concept of Electromagnetic energy, spectrum and spectral signature curves in the practical problems	Apply
CO3	Analyze the characteristics of multi Spectral Scanning and Sensors in LANDSAT in practical applications.	Analyze
CO4	Analyze raster and vector data and modeling in GIS	Analyze
CO5	Evaluate the concepts of optical and microwave remote sensing using case studies	Evaluate
CO6	Develop MATLAB code for Satellite image processing applications	Create

TEXT BOOKS:

1. M.G. Srinivas, “Remote Sensing Applications”, Narosa Publishing House, first edition 2001.
2. Reddy, Anji., M.,” Textbook of Remote Sensing and Geographical Information Systems” 3rd Edition, BS Publications, Hyderabad, India,2006.

REFERENCES:

1. Jensen, J.R, “Remote sensing of the environment”, Prentice Hall, 2000.
2. Kang-Tsung Chang, “Introduction to Geographic Information Systems”, Tata McGraw Hill, 2002.
3. Lillesand T.M. and Kiefer R.W, “Remote Sensing and Image Interpretation”, John Wiley and Sons, Inc, New York, 1987.
4. Burrough P A, “Principle of GIS for land resource assessment”, Oxford MischaelHord, 1986

19UEC919	NANO ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	INTRODUCTION	

Nano electronics in recent scenario - Crystal Structure - Face Centered Cubic Nano particles –Lattice Vibrations, Energy Bands , Localized Particles – Donors - Acceptors and Deep traps –Mobility – Excitons, Structure. Atomic Structure – Crystallography – XRD - Particle Size determination – Surface Structure, Microscopy.Transmission Electron Microscopy – Field Ion Microscopy. Scanning Microscopy, Spectroscopy.Infrared and Raman Spectroscopy – Photoemission. X-Ray Spectroscopy – Magnetic Resonance.

Unit – 2	PROPERTIES OF INDIVIDUAL NANOPARTICLES	

Introduction, Metal Nanoclusters – Magic Numbers – Theoretical Modeling of Nanoparticles –Geometric Structure – Electronic Structure – Reactivity – Fluctuations – Magnetic Clusters – Bulk to Nanotransition, Semiconducting Nanoparticles – Optical Properties – Photo fragmentation –Columbic Explosion, rare Gas and Molecular Clusters – Inert Gas Clusters – Superfluid Clusters –Molecular Clusters, Methods of Synthesis – RF Plasma – Chemical Methods – Thermolysis –Pulsed Laser Methods

Unit – 3	CARBON NANOSTRUCTURES & FUEL CELLS	

Introduction, Carbon Molecules – Nature of the Carbon Bond – New Carbon Structures, Carbon Clusters – Small Carbon Clusters – Discovery of C60 – Structure of C60 and Its Crystal – Alkali-Doped C60 – Superconductivity in C60 – Larger and Smaller Fullerenes – Other Buckyballs , Carbon Nanotubes – Fabrication – Structure – Electrical Properties – Vibrational Properties – Mechanical Properties, Application of Carbon Nanotubes – Field Emission and Shielding – Computers – Fuel Cells – Chemical Sensors – Catalysis – Mechanical Reinforcement.

Unit – 4	NANO ORGANIC MATERIALS AND SENSORS	

Introduction, Forming and Characterizing Polymers - Polymerization – Size of Polymers, Nano Crystals in nano electronics and design of MOSFET-design and working-OFETS and OLEDS-Nucleic acids - DNA - Sensor – Transducer -,Nano Structure studies for Advanced Sensors and Applications.

Unit – 5	NANOSTRUCTURED DEVICE APPLICATIONS	

Application of Nano Ferrite Material – Deposition of thin films by CVD – Plasma ace electro depositing – Monolithography, Microstrip Patch Antenna, Photonic band Gap Antenna – simulation for antenna design - EMI, Absorption of Electro Magnetic Waves in Ferrites, Study of absorption coefficient, Giant and Colossal magneto resistance, Ferro fluids, quantum dots, Solar cell – Organic Solar Cell and Green Solar cell.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understanding the basics of nano electronics and properties of nano particles	Understand
CO2	Summarize the impact of carbon based nano electronic devices	Apply
CO3	Analyze the various nano organic materials and their application as advanced sensor.	Analyze
CO4	Evaluate the characteristics of nano ferrite material for various applications	Evaluate
CO5	Undersanding the implementation of Spintronics using nano materials.	Understand
CO6	Design real time applications for nano electronics by nano structured device.	Apply

TEXT BOOKS:

1. Charles P. Poole, Jr. and Frank J. Owens, “Introduction to Nano Technology” , John Wiley & Sons, 2006.
2. Raguse, “Nanotechnology: Basic Science and Emerging Technologies” Chapam & Hall / CRC, 2007.

REFERENCES:

1. Rainer Waser (Ed.), “Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices’’, Wiley-VCH, 2003.
2. T.Pradeep, “NANO: The Essentials-Understanding Nanoscience and Nanotechnology” , Tata McGraw Hill, 2007.
3. George W. Hanson, “ Fundamentals of Nanoelectronics” , Prentice Hall ,2008.
4. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, “Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications” , Cambridge University Press 2008.

19UEC920	ADAPTIVE AND SMART ANTENNAS	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	INTRODUCTION-SMART ANTENNAS	

Introduction, Historical development of smart antennas, Fixed weight beam forming basics, Maximum signal to interference ratio, Minimum mean square error,Maximum likelihood

Unit – 2	ADAPTIVE ANTENNAS	

INTRODUCTION, Adaptive antenna array theory, Channel modeling, Adaptive antenna methods, Adaptive algorithms , Network Implementation of Adaptive antenna Intelligence Adaptive antenna performance, Network planning with adaptive antennas-Beam forming and Diversity considerations

Unit – 3	Array Fundamentals	

Linear arrays, Array Weighting, Circular Arrays , Rectangular Planar Arrays, Fixed beam arrays, Fixed side lobe cancelling , Retrodirective Arrays

Unit – 4	ADAPTIVE BEAMFORMING TECHNIQUES	

Least mean squares, Sample matrix Inversion, Recursive Least Square, Constant modules, Least squares constant modules, Conjugate gradient method, Spreading, sequence array weight, SDMA Receiver,

Unit – 5	SIMULATION AND MEASUREMENT	

Introduction to Simulation tools for smart antenna design, ADS, CST Microwave Studio, and ANSYS, Antenna measurement and instrumentation-Intro, Gain, Impedance and antenna factor measurement, Introduction to Vector Network Analyzer, Antenna test range Design.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	**Explain the antenna terminologies and their radiation characteristics**	Understand
CO2	Apply the knowledge of antenna parameters, Friss equation is used to predict the receive power in simple communication system	Apply
CO3	Calculate the fields and radiation resistance of various antennas and antenna arrays .	Apply
CO4	Choose appropriate antenna for a given application	Apply

CO5	Design yagi-uda antenna and Planar antennas for given specifications	Analyze
CO6	**Design Planar antennas using CST software**	Apply

TEXT BOOKS:

1. Frank Gross, " Smart Antennas for wireless Communication", McGra-Hill, 2006.
2. S. Chandran, "Adaptive antenna arrays, trends and applications", Springer, 2009.
3. T. S. Rappaport, "Smart antennas: Adaptive arrays, algorithms and wireless position location", IEEE Press, 1998.

REFERENCES:

1. R.Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Springer, Second Edition, 2008.
2. Bronzel, "Smart Antennas", John Wiley and Sons, First Edition, 2004.

19UEC921	Software Defined and Cognitive Radio Networks	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	SOFTWARE RADIO	

Software Radio Aspects, The Software Communications Architecture (SCA),The Operating Environment, The SCA Specification Structure

Unit – 2	COGNITIVE RADIO AND NETWORKS	

Cognitive Radio - Introduction to cognitive radios , Economics of cognitive Radio-spectrum awareness, spectrum subleasing, spectrum sharing
Cognitive Networks - Motivation &Requirements , Related works in cognitive radios Cognitive Radio implementation.

Unit – 3	COGNITIVE RADIO ARCHITECTURE(CRA)	

Cognitive Radio Architecture - SDR technology underlies cognitive radio , CR Architecture- components, design rules, cognitive cycle , Building CRA on SDR architecture , Software Based Radio Architecture for Cognitive Radio SDR & Cognitive relationship.Ideal SDR architecture, realistic SDR architecture. Software Tunable Analog Radio Components - Antenna systems, Comparison of Reconfigurable, Digital Hardware Technologies

Unit – 4	DYNAMIC SPECTRUM ACCESS OF COGNITIVE RADIO	

Impact of QoS & interference, Codes for dynamic spectrum access , Spectrum sensing methods for Cognitive radios , Spectrum sensing in current wireless standards , OFDM-Based Cognitive Radio

Unit – 5	COGNITIVE RADIO APPLICATIONS	

Cognitive radios in wireless communication , Mobility management , location Estimation & Sensing ,UWB Cognitive Radio

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the concept of Software Defined Radio and Cognitive Radio	Understand
CO2	Design the architecture of Software Defined Cognitive Radio Systems	Apply
CO3	Apply and implement the Cognitive Radio design methodologies in the wireless applications.	Apply
CO4	Analyze the QoS of Dynamic Spectrum Access of Cognitive Radio	Analyze
CO5	Analyze the various cognitive radio techniques for spectrum holes detection	Analyze

CO6	Compare the various sensing techniques in cognitive radio networks using MATLAB	Analyze

TEXT BOOKS:

1. John Bard, Vincent J, Kovarik Jr, “Software Defined Radio : The Software Communications Architecture” Wiley 2007.
2. Huseyin Arslan, “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems”, Springer, 2007.

REFERENCES:

1. Ekram Hossain, Dusit Niyato, Zhu Han, “Dynamic Spectrum Access and Management in Cognitive Radio Networks”, Cambridge University Press, 2009.
2. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive Radio Networks”, John Wiley &Sons Ltd., 2009.
3. Bruce Fette, “Cognitive Radio Technology - Second Edition”, Elsevier, 2009.

19UEC922	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

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Unit – 1	FUNDAMENTAL, TRANSDUCER, BIOELECTRIC POTENTIAL AND ELECTRODE	9

Introduction to biomedical instrumentation systems, Overview of anatomy and physiological systems of body, Transducers for Biomedical Applications, Source of bioelectric potential: Resting and Action Potentials, Propagation of Action Potentials, Bioelectric potential examples(ECG, EEG, EMG, ERG, EOG, EGG, etc introduction only), Electrode :Electrode Theory, Biopotential Electrode

Unit – 2	THE CARDIOVASCULAR SYSTEM AND MEASUREMENTS	9

The Heart and Cardiovascular System, Electro conduction system of heart, Electrocardiography, ECG machine block diagram, ECG lead configurations, ECG recording system, Einthoven triangle, analysis of ECG signals. Measurement of blood pressure: Direct, indirect and relative methods of blood pressure, measurement, auscultatory method, oscillometric and ultrasonic non-invasive pressure measurements,Measurement of blood flow: Electromagnetic blood flow meters and ultrasonic blood flow meters.

Unit – 3	BIOMEDICAL RECORDERS	9

Physiology of respiratory system (brief discussion), Respiratory parameters, spirometer, body plethysmo graphs, gas exchange and distribution.Temperature Measurements.The human nervous system. Neuron, action potential of brain, brain waves, types of electrodes, placement of electrodes, evoked potential, EEG recording, analysis of EEG. Electromyography: Nerve conduction velocity, instrumentation system for EMG.

Unit – 4	MODERN IMAGING SYSTEMS	9

X-ray imaging - Properties and production of X-rays, X-ray machine, applications of X-rays in medicine. Computed Tomograpy: Principle, image reconstruction, scanning system and applications.Ultrasonic imaging systems: Basic pulse echo system, propagation of ultrasonic through tissues and reflections, display types, A-Scan, B-Scan, M-Scan, applications, real-time ultrasonic imaging systems and probes. Magnetic Resonance Imaging – Basic NMR components, Biological effects and advantages of NMR imaging

Unit – 5	CLINICAL LABORATORY,THERAPEUTIC EQUIPMENT AND PATIENT SAFETY	9

Colorimeter, Spectrophotometer.Therapeutic Equipments:Principle, block schematic diagram, working and applications of : Pacemakers .Defibrillators Ventilators. Patient Safety: Electric shock hazards, leakage current, safety codes for electro medical equipments

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Explain the working principle of Biomedical instruments, Imaging and sources of electrical hazard and safety techniques.	Understand
CO2	Apply electronic concepts for the design of various biomedical instrumentation.	Apply
CO3	Analyze different parameters applicable in the development of instrumentation for healthcare applications.	Analyze
CO4	Analyze various ECG Signals Using MATLAB simulation software	Analyze
CO5	Evaluate the effect of different diagnostic and therapeutic methods.	Evaluate

TEXT BOOKS:

1.Leslie Cromwell, Biomedical Instrumentation and measurement, 2nd edition, Prentice hall of India, New Delhi, 2015.

2. Khandpur R.S, Handbook of Biomedical Instrumentation, 3rd edition, Tata McGraw-Hill New Delhi, 2014

REFERENCES:

1.John G. Webster, Medical Instrumentation Application and Design, 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.

2. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education, 2004.

3. Myer Kutz, Standard Handbook of Biomedical Engineering and Design, McGraw Hill Publisher, 2003.

19UEC923	ASIC AND FPGA BASED DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1		**9**

Types of ASICs - Design flow – CAD tools used in ASIC Design, Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices : ROMs and EPROMs – PLA –PAL, Gate Arrays – CPLDs and FPGAs

Unit – 2		**9**

System partition -partitioning - partitioning methods, interconnect delay models and measurement of delay, floor planning – placement, Routing : global routing - detailed routing - special routing - circuit extraction - DRC

Unit – 3		**9**

Design systems - Logic Synthesis, Half gate ASIC -Schematic entry - Low level design language, PLA tools -EDIF- CFI design representation

Unit – 4		**9**

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow, technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs

Unit – 5		**9**

Design Methodologies – Processes and Flows - Embedded software development for SOC –Techniques for SOC Testing – Configurable SOC – Hardware / Software co-design Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the design flow, types and the programming technologies of an ASIC and its construction.	Understand
CO2	Describe the algorithms of partitioning then apply those algorithms to partition the network to meet the objectives.	Apply
CO3	Design a digital circuit with ASIC design flow steps, then analyses the ASIC to meet the performance in terms of area, speed and power.	Analyze
CO4	Investigate the issues and discover solutions in each step of physical design flow of an ASIC.	Evaluate
CO5	Demonstrate VLSI design flow and appreciate FPGA architecture	Create

TEXT BOOKS:

1. M.J.S. Smith : Application Specific Integrated Circuits, Pearson, 2003
2. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
3. FarzadNekoogar and FaranakNekoogar, —From ASICs to SOCs: A Practical Approachǁ, Prentice Hall PTR, 2003.

REFERENCES:

1. S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications, 1994.
2. John V.Oldfield, Richard C Dore, Field Programmable Gate Arrays, Wiley Publications1995.
3. Parag.K.Lala, Digital System Design using Programmable Logic Devices, BSP, 2003

19UEC926	SENSORS FOR IoT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the applications of sensors in IoT
- To explain MEMS and smart sensors
- To impart knowledge on interfacing for IoT devices

Unit – 1	INTRODUCTION	9

Analogue and digital quantities, Classification of sensing devices,Sensors, transducers and actuators, Types of transducers, Transducer parameters, Classification of Sensors and Actuators, General Requirements for Interfacing

Unit – 2	PERFORMANCE CHARACTERISTICS OF SENSORS	9

Input and output characteristics Transfer Function,Impedance and Impedance Matching, Range, Span, Input and Output Full Scale, Resolution, and Dynamic Range-Accuracy, Errors, and Repeatability, Sensitivity and Sensitivity Analysis, Hysteresis, Nonlinearity, and Saturation, Frequency Response, Response Time, and Bandwidth-Calibration, Excitation, Deadband, Reliability

Unit – 3	SENSORS	9

Thermoresistive Sensors: Thermistors, Resistance Temperature Sensors, and Silicon Resistive Sensors, Resistance Temperature Detectors, Self-Heat of RTDs, Response Time, Silicon Resistive Sensors, Thermistors, Thermoelectric Sensors, p-n Junction Temperature Sensors , Optical sensors-Quantum-Based Optical Sensors, Photoelectric Sensors, Active Far Infrared (AFIR) Sensors, Electric and Magnetic Sensors: Inductive Sensors, Magnetohydrodynamic (MHD) Sensors, Magnetoresistance and Magneto resistive Sensors, Mechanical sensors: Force Sensors, Pressure Sensors, Inertial Sensors: Gyroscope

Unit – 4	MEMS AND SMART SENSORS	9

Electrochemical Sensors, Potentiometric Sensors, Humidity and Moisture Sensors
MEMS Sensors, Pressure Sensors, Mass Air Flow Sensors, Inertial Sensors, Angular Rate Sensors , Wireless Sensors and Actuators and Issues Associated with their use

Unit – 5	INTERFACING	9

General Requirements for Interfacing Sensors, Input Signal Conditioning, Output Signals, Error, Case study: Home temperature monitoring system, Arduino Irrigation control system

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the characteristics of sensors	Understand
CO2	Apply the various properties of sensors to develop solutions for real world problems.	Apply

CO3	Analyze different types of sensors and its characteristics.	Analyze
CO4	Assess the function of various sensors.	Evaluate
CO5	Design a IoT system to solve real world problems using sensors.	Create

TEXT BOOKS:

1.N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCES:

1.Sensors and Transducers Characteristics, Applications, Instrumentation, Interfacing M..J. Usher and D.A. Keating
2. The IoT: Do it yourself projects with Arduino, Raspberry pi, Donald Norris, Mc Graw Hill.

19UEC927	SMART SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the applications of sensors in IoT
- To explain MEMS and smart sensors
- To impart knowledge on interfacing for IoT devices

Unit – 1	WIRELESS SENSOR NETWORKS	9

Introduction-Goals for Real-Time Distributed Network Computing for Sensor Data Fusion -The Convergence of Networking and Real-Time Computing - Network Resource Management-Management Challenges and Dimensions-MANNA as an Integrating Architecture-Conclusion

Unit – 2	PROGRAMMING IN SENSOR NETWORK	9

Introduction-Differences between Sensor Networks and Traditional Data Networks-Aspects of Efficient Sensor Network Applications-Need for Sensor Network Programmability- Major Models for System-Level Programmability-Frameworks for System-Level Programmability- Conclusion

Unit – 3	SENSOR NETWORK ARCHITECTURE AND APPLICATIONS	9

Introduction-Sensor Network Applications-Functional Architecture for Sensor Networks-Sample Implementation Architectures-SNs — Global View and Requirements-Individual Components of SN Nodes-Wireless SNs as Embedded Systems

Unit – 4	COMMUNICATION PROTOCOLS FOR SENSOR NETWORK	9

Introduction-Application Layer Protocols-Localization Protocols-Time Synchronization Protocols-Transport Layer Protocols-Network Layer Protocols-Data Link Layer Protocols

Unit – 5	DYNAMIC POWER MANAGEMENT AND SECURITIES IN SENSOR NETWORKS	9

Introduction-Idle Power Management-Active Power Management-System Implementation-Unique Security Challenges in Sensor Networks and Enabling Mechanisms-Security Architectures-Future work and Challenges

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the technology involved in Wireless Sensor Network.	Understand
CO2	Apply the Knowledge of programming in Sensor Network for various sensor network application	Apply
CO3	Apply knowledge of WSN Architecture to develop various application.	Apply
CO4	Analyze the performance of Various Communication Protocols.	Analyze
CO5	Analyze the performance of various Securities protocol in WSN	Analyze

TEXT BOOKS:

1. Mohammad Ilyas, Imad Mahgoub - Smart Dust_ Sensor Network Applications, Architecture and Design
2. Fatos Xhafa, Fang-Yie Leu and Li-Ling Hung, “Smart Sensor Networks – Communication technologies and Intelligent Application

REFERENCES:

1. Salahddine Krit, Valentina Emilia Bălas, Mohamed Elhoseny, Rachid Benlamri, Marius M. Bălaș-Sensor Methodologies for Smart Application IGI Global Publisher

2. Luger George F and Stubblefield William A, “Artificial Intelligence: Structures and Strategies for Complex Problem Solving”, Pearson Education, 2002.

LIST OF OPEN ELECTIVES

LIST OF OPEN ELECTIVES

Sl. No.	Course Code	Course Name	L	T	P	C
1.	19UEC951	Consumer Electronics	3	0	0	3
2.	19UEC952	Remote Sensing and its Applications	3	0	0	3
3.	19UEC953	Embedded Systems and Programming	3	0	0	3
4.	19UEC954	Fundamentals of Digital Image Processing	3	0	0	3
5.	19UEC955	Introduction to R programming	3	0	0	3
6.	19UEC956	Anatomy of Smart Phones and Laptops	3	0	0	3
7.	19UEC957	IOT based Automation and Monitoring System	3	0	0	3
8.	19UEC958	Design thinking for innovations	3	0	0	3

19UEC951	CONSUMER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the working principles of consumer electronic devices
- To introduce the fundamental concepts of electronics and communication in electronic gadgets

Unit – 1	LOUD SPEAKER AND MICROPHONE	9

Loud speaker, Basic Loud speaker, Types of loud speaker, Loud speaker system, Multiway system, Microphone, Types of Microphone

Unit – 2	AUDIO SYSTEM	9

AM/FM Basics, Tuner, AM Tuner, FM Tuner, Disc, Mono, Stereo

Unit – 3	VIDEO SYSTEM	9

Element of TV System, Monochrome TV, Television as a system, Color TV, Color TV System, Television Control, Remote Control

Unit – 4	ELECTRONIC GADGETS	9

Telecommunication system, Mobile Radio System, VHF/UHF Radio System, Cellular Phone , Types of Mobile phones, Facsimile, Calculator

Unit – 5	APPLICATIONS	9

In Car Computers, Microwave Oven, Air Conditioners , Refrigerator , Air Line, Reservation, ATM, Set top box

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the fundamentals of audio and video systems	Understand
CO2	Explain the basic functions of various Electronic Gadgets	Understand
CO3	Apply the knowledge of electronic circuits to compute the component values of electronic devices	Apply
CO4	Apply the knowledge of modulation to determine the parameters of communication system	Apply
CO5	Construct simple consumer electronic circuits	Create

Text Book

1. S.P.Bali, “Consumer Electronics”, Pearson Education,4th impression, 2011.

REFERENCES:

1. R.G.Gupta, “Audio and Video Systems”, Tata McGraw Hill, 2010.
2. R.R Gulati, “Complete Satellite & Cable Television”, New age International Publisher, 2008
3. Philip Hoff, ”Consumer Electronics for Engineers”, Cambridge University Press ISBN 9780521582070, 1998

19UEC952	REMOTE SENSING AND INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of remote sensing
- To impart the knowledge of optical &Microwave Remote sensing and its application
- To impart the knowledge on GIS

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UNIT 1	REMOTE SENSING	9

Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body – Active andPassive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters,Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMRspectrum – Visible, Infra Red (IR), Near IR, Middle IR, Thermal IR and Microwave – BlackBody Radiation – Planck's law – Stefan-Boltzman law.

UNIT II	EMR INTERACTION WITH ATMOSPHERE ANDEARTHMATERIALS	9

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy – Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface: Imaging spectrometry and spectralcharacteristics.

UNIT III	OPTICAL AND MICROWAVEREMOTESENSING	9

Satellites - Classification – Based on Orbits and Purpose – Satellite Sensors - Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners – Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle - Back Scattering– Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics; Sonar remote sensing systems.

UNIT IV	GEOGRAPHICINFORMATION SYSTEM	9

GIS – Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial - COORDINATE SYSTEMS: Geographic Coordinate system; Approximation of Earth, Datum:– Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster andVector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification,Overlaying, Buffering – Data Output – Printers and Plotters

UNIT V	APPLICATIONS	9

Applications in Agriculture, Forestry, Geology, Hydrology, cryospace studies, land use mapping andocean related studies, military and surveillance applications, search and rescue operations, ground andair target detection and tracking - case studies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the fundamental principles of remote sensing, includingelectromagnetic spectrum	Understand
CO2	Apply the concepts of scattering of EMR and spectral characteristics	Apply
CO3	Discuss Multi Spectral Scanning and Sensors in Remote Sensing	Understand
CO4	Analyze about optical and microwave remote sensing	Analyze
CO5	Analyze raster and vector data and modeling in GIS	Analyze
CO6	Develop code for various applications of remote sensing and GIS	Apply

TEXT BOOKS:

REFERENCES:

19UEC953	EMBEDDED SYSTEMS AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	An Introduction to Embedded systems	

Embedded Systems – An Instruction Set View, Execution Flow, Embedded Systems – A Register View, Register Transfer Language, Register View of a Microprocessor

Unit – 2	Embedded Systems Design and Development	

System Design and Development, Life-Cycle Models, Problem Solving – Six Steps To Design, Hardware–Software Co-Design, Co-Design Process Overview, The Co-Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Requirements Versus System Design Specifications, Executing the Hardware–Software Co-Design Process

Unit – 3	Hardware Test and Debug	

Module Debug and Test, Debugging and Testing, Testing and Debugging Combinational Logic , Path Sensitizing, Masking and Un testable Faults, Single Variable–Multiple Paths Bridge Faults, Debugging – Sequential Logic, Scan Design Testing, Boundary-Scan Testing, Memories and Memory Systems, Subsystem and System Test, Testing for Customer, Self-Test

Unit – 4	Operating Systems and Task Management	

The Real-Time Operating System (RTOS), Operating System Architecture, Tasks and Task Control Blocks, Time, Time-Based Systems and Reactive Systems Task Scheduling, Scheduling Algorithms

Unit – 5	Embedded C Programming	

An Embedded C Program, Developing Embedded Software, C Building Blocks, C Program Structure, Bitwise Operators, Pointer Variables and Memory Addresses, The Function, Pointers to Functions, Structures,Interrupt

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the concept of Software Defined Radio and Cognitive Radio	Understand
CO2	Design the architecture of Software Defined Cognitive Radio Systems	Apply
CO3	Apply and implement the Cognitive Radio design methodologies in the wireless applications.	Apply
CO4	**Analyze the QoS of Dynamic Spectrum Access of Cognitive Radio**	Analyze

CO5	Analyze the various cognitive radio techniques for spectrum holes detection	Analyze
CO6	Compare the various sensing techniques in cognitive radio networks using MATLAB	Analyze

TEXT BOOKS:

1. James K. Peckol, “Embedded Systems A Contemporary Design Tool” second edition, Wiley Publications, 2019
2. Embedded C, Michael J Pont, Addison-Wesley Professional, 2002

REFERENCES:

1. Embedded Systems: Architecture and programming, Raj Kamal, TMH, 2008.
2. Embedded Systems Architecture - A comprehensive guide for Engineers and programmers, Tammy
   Noergaard, Elsevier Publication, 2005.
3. Programming for Embedded Systems, Dream tech Software Team, John Wiely India pvt.Ltd, 2008.

19UEC954	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamentals of digital image processing
- To impart knowledge on image processing techniques
- To describe applications of image processing algorithms

Unit– 1	FUNDAMENTALS OF DIGITAL IMAGE	9

Need for DIP, Digital Image model, Illuminance and Reflectance, Image formats, Image Sampling and Quantization, Basic relationship between pixels Connectivity and Distance measures. , 2D Transforms- DFT, DCT. Hadamard Transform,Introduction to Discrete Wavelet Transform .Image Compression.

Unit – 2	IMAGE ENHANCEMENT	9

Histogram processing, Arithmetic and logic operations, Smoothing, sharpening spatial filters, Smoothing, sharpening using frequency domain filters, Homomorphic filtering, Color Image Enhancement, Image Enhancement Applications

Unit – 3	IMAGE RESTORATION	9

Introduction of Image restoration, Model of image degradation –noise models , Spatial filtering: Mean, orderstatistics, adaptive filters Estimating degradation, Constrained least square filtering
Geometricmean filter, Geometric transformations

Unit– 4	IMAGE SEGMENTATION	9

Segmentation, Thresholding–Threshold selection, Point, Line and Edge detection, Edge linking -Laplacian Mask based operations, Region based segmentation – Region growing, Region splitting & merging

Unit – 5	MORPHOLOGICAL IMAGE PROCESSING	9

Basic morphological operations, Erosion, dilation, opening, closing, Structuring elements, Hit-or-Miss transform, Basic Morphological, Algorithms: hole filling, connected components, thinning, skeletons, Reconstruction by erosion and dilation

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the relevant aspects of digital image representation and their practical implications	Understand
CO2	Apply the fundamental concepts of images and 2D transforms for image Processing	Apply
CO3	Develop a mathematical model of various image enhancement techniques and analyze their performance	Analyze

CO4	Develop a mathematical model of various image restoration techniques and analyze their performance	Analyze
CO5	Analyze the different methodologies for image segmentation	Analyze
CO6	Analyze various morphological techniques for an application	Analyze

Text Book

1. Rafael.C.Gonzalez and Richard.E. Woods, “Digital Image Processing”, Third Edition, Prentice Hall, 2008.

REFERENCES:

2. Rafael.C.Gonzalez, Richard.E. Woods and Steven L. Eddins, “Digital Image Processing using MATLAB”, 2nd Edition, Gatesmark Publishing, 2009.
3. Al.Bovik, “The Essential Guide to Image Processing”, Academic Press, 2009.
4. Anil K.Jain, “Fundamentals of Digital Image Processing”, Pearson Education 2003.
5. William K. Pratt, “Digital Image Processing”, Third Edition, John Wiley, 2001.
6. www.imageprocessingplace.com.
7. https://www.coursera.org/course/images.
8. http://www.mathsworks.com

19UEC955	INTRODUCTION TO R PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	History and overview of R	9

Introduction of R and S, Basic features of R, Design of the R system, Limitations of R, R sources, Getting started with R Interface

Unit – 2	R Nuts and Bolts	9

R Objects Numbers ,attributes, Matrices, Lists, Data frames and Names, Getting data in and out of R, Using textual and binary formats for storing data, Interfaces to the outside world

Unit – 3	Sub-setting R Objects	9

Sub- setting vectors, matrix and lists, Operations on dates and times, Managing data frames, Control structures

Unit – 4	Functions and Coding standards in R	9

Functions in R, Scoping rules of R, Coding standards of R , Loop functions

Unit – 5	Debugging and Simulation	9

Debugging rules in R, Profiling R code, Simulating a linear model

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Explain the design of the R system using basic features and R sources.	Understand
CO2	Apply the knowledge of R objects, numbers, attributes and matrices to design and develop code for appropriate applications	Apply
CO3	Analyze the various control structures and setting vectors to develop code for real time applications.	Analyze
CO4	Develop a code using debugging and simulation rules	Evaluate
CO5	Design a profiling R code based on debugging rules and simulation model	Create
CO6		

TEXT BOOKS:

1. RProgramming for data science, Roger D. Peng, 20-7-2015.
2. R For Dummies , Andrie de Vries, 21 -7-2015

REFERENCES:

1. The Art of R, R for Programming: A Tour of Statistical Software Design, Norman Matloff , 11- 10- 2011.
2. Hands on Programming With R: Write Your Own Functions and Simulations, Garrett Grolemund, 1 -1- 2014.
3. The Book of R: A First Course in Programming and Statistics, Tilman M. Davies, 16 -7- 2016.

19UEC956	ANATOMY OF MOBILE PHONE AND LAPTOPS	L	T	P	C
		3	0	0	3

OBJECTIVES:

Unit – 1	Introduction to Mobile phone Technology	

Introduction, History of a mobile phone, Growth of the Mobile Phone Market- Past, Present, and Future of Mobile Communication Devices- Building blocks of a smart phone Evolution of Mobile Cellular Networks- 1G,2G,3G,4G and 5G technologies
Anatomy - GSM Mobile Handset- UMTS Mobile Handset- Key Challenges in Designing 4G Mobile Systems

Unit – 2	Mobile Phone Repair and Maintenance	

Types of Mobile phones – parts of a conventional mobile phones- Potential hazards associated with mobile phone repair- Disassembling and assembling a mobile cell phone Diagnosing and repairing mobile phone faults- repair of common mobile phone faults.

Unit – 3	Introduction to Laptop	

Introduction-History of laptop-Types-comparison with desktop computer-Advantages Hardware-operating system –BIOS-CMOS setup-Drivers and Device manager-Motherboard-Central Processing unit of Laptop -RAM – Hard drive-LCD Monitor-USB drive-

Unit – 4	Basic Laptop Troubleshooting and maintenance I	

Assembly and dis-assembly of laptop parts Troubleshooting- Power problems, Battery problems, Laptop overheating, Hard drives, Wireless connectivity Troubleshooting Motherboard, CPU and Memory –Laptop dial-up Modems, wired network connectivity, Keyboard, pointer, USB

Unit – 5	Basic Laptop Troubleshooting and maintenance II	

Troubleshooting by Replacing Parts- by the Bootstrap Approach- Problems During the POST- Hardware Problems After Booting- Problems Running Software- Laptop Not Powering On Issues & Resolutions – video related ,Motherboard issue Upgrading memory modules like RAM, hard disk & BIOS. system recovery & security.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Identify the different types of mobiles and laptops with components for the proper maintenance of the device.	Understand
CO2	Identify the Fault diagnoses procedure, Inspection procedure, Trouble Shooting procedure of mobile phones and laptop.	Understand
CO3	Apply the knowledge of basic science and engineering fundamentals to troubleshoot the issues in mobile and laptop	Apply

CO4	Apply appropriate techniques, resources, and modern engineering and IT tools for the upgradation of the new technologies in mobile and laptop.	Apply
CO5	Develop a mobile phone that meets the specified needs with appropriate consideration for the public health and safety, and the societal and environmental considerations.	Create
CO6	Demonstrate the assembling and disassembling the internal parts of the mobile handset and laptop.	Modern Tool Usage

TEXT BOOKS:

1. Sajal Kumar Das," Mobile Handset Design",John Wiley & Sons Singapore Pte. Ltd,2010.
2. Morris Rosenthal," The Laptop Repair Workbook: An Introduction to Troubleshooting and Repairing Laptop Computers" Foner Books; 5.2.2008 edition, ISBN-10/ASIN: 0972380159.
3. Garry Romaneo," Laptop Repair Complete Guide: Including Motherboard and Component Level Repair"New York Create Space Publishing, 2011.

REFERENCES:

1. Sajal Kumar Das," Mobile Terminal Receiver Design LTE and LTE-Advanced",John Wiley & Sons Singapore Pte. Ltd,2017.
2. Muasya Douglas," Repair and Maintenance of Mobile Cell Phones",© 2015 common wealth of Learning.
3. Scott Mueller,"Upgrading and Repairing Laptops", Que Publishing,2003.

19UEC957	IOT BASED AUTOMATION AND MONITORING SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamentals of Internet of things
- To impart knowledge on various automation and monitoring applications in Internet of things
- To introduce the concept of various softwares used in IoT

Unit – 1	IoTFUNDAMENTALS &BUILDING BLOCKS	9

Introduction-Evolution of IoT Concept-IoT Vision & Definition-IoT Basic Characteristics-IoT Distinction & General Enablers -IoT Architectures: Three, Five ,Six and Seven Layered architecture-IoT Building Blocks-The Smart Things, The IoT Gateway,Network Infrastructure-IoT Cloud-IoT Analytics, IoT and Smart Home

Unit – 2	SENSING PRINCIPLES & APPLICATIONS IN IOT	9

Sensor Fundamentals, Sensor Classification, Anatomy of Sensors, WSN-Sensing Domain and Architecture of IoT Gateway, Selection of Gateway-IoT and Smart Home & Framework-IoT and Healthcare, IoT and Smart Mobility, Car Parking System-IoT and Agriculture- IoT Architecture of Smart Agriculture-Smart Grid, IoT-based Smart Cities, IoT and Smart Education, Industrial IoT

Unit – 3	IOT AUTOMATION	9

The need for new technology, From DCS to SCADA-Automation System Architectures, Current trends in automation systems-Next Generation automation and digitisation technology-The Local Cloud Concept-Local cloud establishment-Automation support-Automation application engineering in local clouds-Latency and security in clouds

Unit – 4	IOT PLATFORMS AND TOOLS	9

Packet Tracer Programming Environment- Visual Programming Language -Hello World Program, Simple Smart Light Project-Open source IoT Platforms and Tools

Unit – 5	CASE STUDIES,PARADIGMS,CHALLENGES AND THE FUTURE OF IOT	9

Agricultural IoT-Vehicular IoT-Healthcare IoT-Evolution of New IoT Paradigms-Challenges Associated with IoT-Emerging Pillars of IoT

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the fundamental concepts of Internet of Things.	Understand
CO2	Apply the knowledge of architectural IoT and sensing principles concept to build the blocks in various applications of IoT	Apply
CO3	Apply the knowledge of IoT concepts and sensors to implement IoT in various applications using available open source software tools	Apply

CO4	Analyze the different automotive applications in IoT	Analyze
CO5	Analyze various state of the art IoT based automation systems for different case studies	Analyze

Text Book

1. Muhammad AzharIqbal, SajjadHussain, Huanlai Xing, Muhammad Ali Imran," Enabling The Internet of Things", IEEE Press, John Wiley & Sons, 2021.
2. Jerker Delsing,"IoT Automation", CRC Press Taylor & Francis Group,2017.
3. SudipMisra,Anandrup Mukherjee, Arjit Roy, "Introduction to IoT", Cambridge University Press,2020

REFERENCES:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", ISBN:978-1-118-47347-4, Wiley Publications
2. Bernd Scholz-Reiter, Florian Michahelles,"Architecting the Internet of Things", ISBN978-3- 642-19156-5 e-ISBN978-3-642-19157-2, Springer
3. HakimaChaouchi,"The Internet of Things Connecting Objects to the Web"ISBN:978-1- 84821-140-7,Wiley Publications

Web Resources:

https://www.netacad.com/courses/packet-tracer

https://www.tinkercad.com/

19UEC425	MICROPROCESSOR AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop an in-depth understanding of the operation of microprocessors and Microcontrollers, assembly language programming & interfacing techniques
- To introduce the hardware architecture, instruction set, programming of 8051 microcontroller and Advanced microcontroller

Unit – 1	8086 MICROPROCESSOR ARCHITECTURE AND PROGRAMMING	9

Introduction to Microprocessor - 8086 Microprocessor architecture – Signals – Maximum & Minimum mode Configuration - Addressing modes - Instruction set and assembler directives – Assembly Language Programming –Procedures – Macros – Interrupts and interrupt service routines

Unit – 2	PERIPHERAL INTERFACING	9

Memory interfacing and I/O interfacing - Serial Communication Interface (8251)- parallel port Interface (8255) - Keyboard and Display controller (8279) – Programmable Interval Timer(8253/8254) – Programmable Interrupt Controller(8259) - DMA Controller(8237).

Unit – 3	8051 MICROCONTROLLER ARCHITECTURE AND PROGRAMMING	9

8051 Architecture– Memory organization - Special Function Registers (SFRs) - I/O Pins / Ports – Instruction sets and Addressing modes - 8051 Modes and Programming – Timer, Interrupts, Serial ports- Assembly Language Programming

Unit – 4	8051 INTERFACING AND APPLICATIONS	9

8051 Interfacing: LCD & Keyboard interfacing - ADC, DAC & Sensor interfacing, External Memory Interfacing - Stepper Motor and Wave form generation-Traffic light controller.

Unit – 5	ADVANCE MICROCONTROLLER	9

Introduction to Arduino –AVR Atmega8 Microcontroller Architecture –Pin Configuration – Instruction set- Addressing modes – Programming- Case Study: DC Motor Controller and Real time clock- PIC16f877a Architecture- Difference between Arduino and PIC microcontroller.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of 8086 processor to design and develop code for appropriate applications	Apply
CO2	Analyze the various interfacing techniques to develop real time applications	Analyze
CO3	Apply the knowledge of 8051 micro controller to design and develop code for appropriate applications	Apply
CO4	Analyze the various interfacing techniques to develop Microcontroller based real time Application	Analyze
CO5	Develop code for real time control applications using Arduino Microcontroller	Apply

TEXT BOOK:

1. Douglas V Hall, “Microprocessors and Interfacing, Programming and Hardware”,Tata McGraw Hill,2006.
2. Kenneth J Ayala, “The 8051 Microcontroller Architecture Programming and Application” , Penram International Publishers (India), 2nd Edition,1996
3. Mazidi M. A., McKinlay R. D., Causey D “PIC Microcontroller And Embedded Systems”, Pearson Education International, 2008

REFERENCES:

1. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and Application with 8085”, Penram International Publishing, 4th Edition, New Delhi, 2000
2. Krishna Kant, “Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096”, PHI, 2007
3. Mohammed Ali Mazidi and Janice GillispieMazidi,“The 8051 Microcontroller and Embedded Systems” ,Pearson Education Asia, New Delhi, 2003
4. Ajay V Deshmukh , “Microcontrollers : Theory and Applications”, Tata McGraw-Hill Education, 2005

19UEC426	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To introduce ALP concepts and features
- To write ALP for Arithmetic and logical operation in 8086 and 8051
- To differentiate serial and parallel interface
- To interface different I/Os with Microprocessor and Microcontroller.

LIST OF EXPERIMENTS

Microprocessor -8086

1.Basic Arithmetic and Logical operation

2.Code conversion and Matrix operation

3.Searching and Sorting Operation

4.Floating point operations and string manipulations

5. Move a data block without overlap

Microcontroller-8051

6. Basic Arithmetic and Logical Operation

7. Square and cube Program, Find 2's compliment of a number

8. Unpacked BCD to ASCII

9.Programming and verifying Timer, Interrupts and UART operations

Interfacing

10. A/D and D/A interfacing and waveform generation

11. Keyboard and Display interfacing

12. Stepper Motor interfacing

13. Traffic light controller

14. Simple applications using Arduino

TOTAL : 45 Periods

COURSE OUTCOMES: At the end of the course the student will be able to:		
CO1	Develop assembly language programs to perform arithmetic and logical operations using 8086 and 8051	Apply
CO2	Develop assembly language programs for various applications using 8086 microprocessor & 8051 microcontroller	Apply
CO3	Analyze the data transfer information through serial & parallel ports	Analyze
CO4	Analyze the various interfacing techniques to develop real time applications using 8086 microprocessor & 8051 Microcontroller	Analyze

19UEC621	DIGITAL SIGNAL PROCESSING FOR ELECTRICAL ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concept of signals and systems
- To explain the different transform techniques to analyze the discrete time systems
- To provide a thorough understanding of the design techniques for digital filters and digital signal processors

Unit – 1	INTRODUCTION TO SIGNALS AND SYSTEMS	9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; Operation on signals. spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

Unit – 2	DISCRETE TIME SYSTEM ANALYSIS	9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution - Analysis of LTI Systems in z-domain. .

Unit – 3	DISCRETE FOURIER TRANSFORM & COMPUTATION	9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm –DIT & DIF - FFT using radix 2 – Butterfly structure – Application of DSP in power quality analysis.

Unit – 4	DESIGN OF DIGITAL FILTERS	9

FIR design: Windowing Techniques (Rectangular, Hamming, Hanning window only)s – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design –Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation -Warping, prewarping - Frequency transformation.

Unit – 5	DIGITAL SIGNAL PROCESSORS	9

Introduction– Architecture – Features – Instruction sets – Addressing Formats – Functional modes – Introduction to commercial Digital Processor – TMS320C5X – TMS320C54X - Simple Programs

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Describe the functions and fundamental concepts of DT signals and systems and processors	Understand
CO2	Apply Engineering knowledge and FFT algorithms to classify DT signals and system and efficient computation of DFT	Apply
CO3	Apply appropriate engineering knowledge to design digital filters and DSP processors to develop programs	Apply
CO4	Apply Z transform and various transformation techniques to analyze DT systems and digital filters	Analyze
CO5	Evaluate DT system response of a system using Z-transform, DFT and Digital filters	Evaluate
CO6	Develop various DSP algorithms for real time applications	Create

TEXT BOOKS:

4. J.G. Proakis and D.G. Manolakis, “Digital Signal Processing Principles, Algorithms and Applications” , Pearson Education, New Delhi, 2010.
5. S.K. Mitra, “Digital Signal Processing – A Computer Based Approach” , Tata McGraw Hill, New Delhi 2013

REFERENCES:

5. Alan V. Oppenheim, Ronald W. Schafer,“Discrete time signal processing” Third Edition, 2010.
6. E.C. Ifeachor and B.W. Jervis, “Digital signal processing – A practical approach” Fourth Edition, 2007.
7. S. Salivahanan, A. Vallavaraj And C. Gnanapriya, “Digital Signal Processing” First Edition, Tata McGraw Hill, New Delhi 2008
8. B.Venkataramani, M.Bhaskar “ Digital Signal Processors: Architecture Programming and Application”, Tata McGraw Hill, 2011.

19UEC959	PRINCIPLES OF COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have understanding about different types of Analog and digital Communication systems
- To understand the knowledge of information theory in communication system.
- To know the spread spectrum modulation techniques and different multiple access methods.
- To impart the knowledge of satellite and optical fiber communication

Unit – 1	**ANALOG COMMUNICATION**	10

Introduction: Overview of Communication system, Communication channels, Need for modulation,generation of Amplitude Modulation – DSB,DSB/SC, SSB, VSB AM-Transmitter & Receiver; FM and PM – generation and reception : NBFM & WBFM.

Unit – 2	**DIGITAL COMMUNICATION**	10

Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM,quantization and coding: PCM, DM, ADM, DPCM,Modulation schemes– ASK, FSK,PSK, BSK, QPSK, QAM, MSK, GMSK

Unit – 3	**INFORMATION THEORY**	9

Uncertainty, Information and entropy, source coding theorem, Discrete Memory less channels, Mutual Information, Channel capacity, Channel coding theorem, Differential entropy, Information capacity theorem, Linear block codes, cyclic codes, convolutional codes.

Unit – 4	**SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES**	8

Spread Spectrum techniques :PN Sequences- properties- Design principles- Direct sequence (DS) and Frequency Hopping (FH) spread spectrum –Multiple Access techniques -FDMA, TDMA, CDMA, SDMA

Unit – 5	**RECENT TRENDS IN COMMUNICATION SYSTEMS**	8

Recent trends in communication: Mobile Telephone communication-cellular concept,Optical communication,RADAR system, Satellite communication

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of mathematical theory to characterize and construct analog Modulation schemes in time and frequency domain	Apply
CO2	Evaluate the performance of different digital modulation techniques in terms of bandwidth, Signal to noise ratio and probability of error	Evaluate
CO3	Apply the knowledge of line coding techniques and information theory for efficient baseband signalling and construction of efficient source and error control coding scheme	Apply
CO4	Analyze the performance of spread spectrum system in the presence of interference and Multipath propagation	Analyze
CO5	Design analog and digital communication system for a given	Create

	specification	
CO6	Summarize the recent trends in communication system	Understand

TEXT BOOKS:

4. Wayne Tomashi,"Electronic Communications systems", Pearson –Prentice hall publications, 5th edition, 2000.
5. B.P. Lathi and Zhi Ding, "Modern Digital and Analog Communication" Oxford University Press, 5th edition, 2018.

REFERENCES:

4. Simon Haykin and Michael Moher, "Communication Systems" John Wiley & Sons, Fifth Edition, 2016.
5. Herbert Taub, Donald L Schilling, and GoutamSaha, "Principles of Communication Systems" McGraw-Hill,Third Edition, 2008.

19UEC960	FIBER OPTIC COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart basic concepts in optical fiber communication
- To introduce the concepts in sources, detectors and other fiber optic components.
- To impart the knowledge of Links in optical fiber communication

Unit – 1	OPTICAL FIBER AND THEIR PROPERTIES	9

Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations), single mode fiber, cutoff wave length, and mode filed diameter. Wave guiding principles, Theory of optical wave propagation, Types and classification of optical fibers, loss and bandwidth

Unit – 2	TRANSMISSION CHARACTERISTICS OF OPTICAL FIBER	9

Attenuation, absorption, linear and nonlinear scattering losses, bending losses, modal dispersion, waveguide dispersion, dispersion and pulse broadening, dispersion shifted and dispersion flattened fibers. General Overview of nonlinearties , Stimulated Raman Scattering, Stimulated Brillouin Scattering , Self Phase modulation , Cross –Phase modulation , Solitons. Measurements of attenuation, dispersion and OTDR

Unit – 3	SOURCES AND DETECTORS	9

Opticalsources:LightEmittingDiodes-LEDstructures-surfaceandedgeemitters,internal-quantum efficiency ,injection laser diode structures-comparison of LED and ILD Optical Detectors: PIN Photo detectors Avalanche photodiodes, construction, characteristics and properties, Comparison of performance, Photodetector noise– Noise sources ,Signal to Noise ratio, Detector response time

Unit – 4	FIBER OPTIC COMPONENTS	9

Fiber fabrication (VAD,MCVD), fiber joints, fiber connectors, splices Couplers, multiplexers, filters, fiber gratings, Fabry Perot filters, switches and wavelength converters, Optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

Unit – 5	OPTICAL LINK	9

Introduction, Point to point links, system considerations, link power budget, and rise time budget. RF over fiber, key link parameters, Radio over fiber links, microwave photonics

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Apply the knowledge of transmission characteristics of light signal to compute various losses in optical fibers	Apply
CO2	Apply the knowledge of optical sources and detectors to find their suitability for different applications	Apply
CO3	Apply laser theory for the selection of lasers for a specific Industrial and medical application	Apply

CO4	Analyze and deign optical fiber link with encapsulation of different system components	Analyze
CO5	Analyze the different optical components for suitable applications	Analyze
CO6	Understand the concept of optical fiber and their properties	Understand

Text Book

1. Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008.
2. Optical Fiber Communications– – John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCES:

1. Fiber optics communications-Harold Kolimbiris
2. ntroduction to optical fibers, Cheri, McGraw Hill.
3. An introduction to fiber optics, A. Ghatak and K.Thyagrajan, Cambridge Univ, press 10
4. Optical fiber communication and sensors-M. Arumugam Agencies, 20002 optic sensors.
5. Fiber optic communication– Joseph C Palais: 4th Edition, Pearson Education.