

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	HSS
19UMA102	Engineering Mathematics – I (Common to all Branches)	3	1	0	4	BS
19UPH103	Engineering Physics (Common to all Branches)	3	0	0	3	BS
19UCY105	Applied Chemistry (Common to CSE,ECE,BME,IT,EEE)	3	0	0	3	BS
19UCS108	Problem solving and Python Programming (Common to all Branches)	3	0	0	3	ES
19UME109	Engineering Graphics (Common to all Branches)	3	1	0	4	ES
PRACTICAL						
19UCS110	Problem solving and Python Programming Lab (Common to all Branches)	0	0	3	1.5	ES
19UCS112	Engineering Fundamentals Lab (Common to CSE,ECE,IT, BME)	0	0	3	1.5	ES
19UGS113	Basic Sciences Lab (Common to all Branches)	0	0	2	1	BS
MANDATORY						
19UGM131	Induction program	-	-	-	-	MC
	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	HSS
19UMA204	Calculus, complex analysis and numerical methods for Electronics and Communication Engineering	3	1	0	4	BS
19UPH205	Electromagnetic theory	3	0	0	3	BS
19UCY204	Environmental Science (Common to all Branches)	3	0	0	3	HSS
19UEC205	Introduction to Electronics and Communication Engineering	3	0	0	3	PC
19UEC206	Electronic Devices	3	0	0	3	PC
PRACTICAL						
19UGS210	Energy and Environmental Science Laboratory (Common to all Branches)	0	0	3	1.5	BS
19UEC211	Electronic Devices Laboratory	0	0	3	1.5	PC
	TOTAL	16	1	7	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	BS
19UEC302	Digital Electronics and Design	3	0	3	4.5	PC
19UEC303	Circuit Theory	3	0	0	3	PC
19UEC304	Basic Electrical and Instrumentation Engineering	3	0	0	3	PC
19UEC305	Analog circuits	3	0	3	4.5	PC
19UIT326	Fundamentals of C Programming	2	0	2	3	PC
PRACTICAL						
19UEC307	Seminar	0	0	2	1	PW
MANDATORY						
19UGM332	Biology for Engineering Applications	2	-	-	P/ F	MC
	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	BS
19UEC402	Electromagnetic Fields and Transmission Lines	3	0	0	3	PC
19UEC403	Signals and Systems	3	1	0	4	PC
19UEC404	Linear Integrated circuits	2	0	3	3.5	PC
19UEC405	Analog and Digital Communication	3	0	3	4.5	PC
19UIT429	Introduction to data structures and algorithms (Integrated course)	2	0	2	3	PC
PRACTICAL						
19UGS433	Interpersonal Skills laboratory	0	0	3	1.5	HSS
MANDATORY						
19UGM431	Gender Equality	1	-	-	P/F	MC
	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	PC
19UEC502	Microprocessors, Microcontrollers and Applications	3	0	0	3	PC
19UEC503	Data Communication and Networks	3	0	0	3	PC
19UEC504	Antenna and Wave Propagation	3	0	0	3	PC
	Professional Elective I	3	0	0	3	PE
	Open Elective I	3	0	0	3	OE
19UGS531	Reasoning and Aptitude	1	0	0	1	BE
PRACTICALS						
19UEC505	Microprocessors, Microcontrollers and Applications lab	0	0	2	1	PC
19UEC506	Digital Signal Processing lab	0	0	2	1	PC
19UEC507	Creative Thinking and Innovation	0	0	2	1	PW
19UGS532	Soft Skills Laboratory	0	0	3	1.5	HSS
	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	PC
19UEC602	VLSI Design	3	0	0	3	PC
19UEC603	Internet of Things	3	0	0	3	PC
	Professional Elective II	3	0	0	3	PE
	Professional Elective III	3	0	0	3	PE
	Open Elective II	3	0	0	3	OE
PRACTICAL						
19UEC607	Product development Project	0	0	8	4	PW
19UEC608	VLSI Design Laboratory	0	0	3	1.5	PC
19UEC609	Networks Laboratory	0	0	3	1.5	PC
MANDATORY						
19UGM631	Indian Constitution	1	-	-	P/F	MC
	TOTAL	19	0	14	25	

Semester VII

Course Code	Course Title	L	T	P	C	Type of course
THEORY						
19UME701	Project Management and Finance	3	0	0	3	PC
19UEC702	Optical and Microwave communication	3	0	0	3	PC
19UEC703	Image processing and Machine learning	3	0	0	3	PC
	Professional Elective IV	3	0	0	3	PE
	Professional Elective V	3	0	0	3	PE
	Open Elective III	3	0	0	3	OE
PRACTICAL						
19UEC707	Summer Internship	-	-	-	1	PW
19UEC708	Optical and Microwave communication laboratory	0	0	2	1	PC
19UEC709	Image processing laboratory	0	0	3	1.5	PC
MANDATORY						
19UGM731	Professional Ethics and Human Values (common to all Branches)	2	-	-	P/F	MC
	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	PE
	Open Elective IV	3	0	0	3	OE
PRACTICAL						
19UEC801	Project Work	0	0	16	8	PW
	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	3	0	0	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
29.	19UGE711	Professional readiness for innovation, Employability and Entrepreneurship	0	0	6	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 Phone 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/VALUE ADDED COURSES

Sl. No.	Course Code	Course Name	Course
1.	19UEC861	PIC Embedded Programming	One Credit
2.	19UEC862	PCB Design	One Credit
3.	19UEC863	Python Programming	One Credit
4.	19UEC864	Android Programming	One Credit
5.	19UEC865	Programming In R	One Credit
6.	19UEC866	Arduino Programming	One Credit
7.	19UEC867	Programming in C++: For Beginners to Expert	One Credit
8.	19UEC868	Java Programming	One Credit
9.	19UEC869	Basics of CCNA Networking	One Credit
10.	19VEC01	Programming in C	Value added Course
11.	19VEC02	Programming in C++	Value added Course
12.	19VEC03	Java Programming for Ece	Value added Course
13.	19VEC04	CCNA Networking	Value added Course

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
6.	19UEC225	Principles of Electronics Engineering	CSBS	3	0	0	3
7.	19UEC227	Electronics and Engineering Laboratory	CSBS	0	0	3	1.5

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
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
MANDATORY						
19UGM131	Induction program	-	-	-	-	Mandatory Course
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:					
<ul style="list-style-type: none"> 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	PRESENTING ESSENTIALS OF CORRESPONDENCE	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	COMMUNICATION SKILLS	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	CORRESPONDENT AND VOCATION DEVELOPMENTS	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	PORTRAYAL AND SAMMASIONS	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: <ul style="list-style-type: none"> 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) - McLaren'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			
Double integration - Cartesian and Polar coordinates - Change of order of integration - Area as a double integral - Change of variables between Cartesian and Polar coordinates - Triple integration in Cartesian coordinates - Volume as triple integral.					
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 Periods					
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	Analyze functions using limits, continuity, derivatives and to solve Physical application problems.	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 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. Bali. N. P and Manish Goyal, - a text book of Engineering MathematicsII, Laxmi Publications Private Ltd, New Delhi, 8th edition,(2011).
2. Veerarajan.t – Engineering MathematicsII Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3. Grewal. B.S, - Higher Engineering MathematicsII, Khanna Publications, New Delhi, 42nd edition, (2012).

REFERENCES:

1. Ramana B.V, - Higher Engineering MathematicsII, Tata Mcgraw Hill Publishing Company, New Delhi, 11th reprint, (2010).
2. Glynjames, - Advanced Engineering MathematicsII, Pearson Education, New Delhi, 7th edition,(2007).
3. Jainr.k and Iyengars.R.K. Advanced Engineering Mathematics II, Narosa Publishing House, New Delhi, 3rd edition, (2007).
4. Kreyszig. E, - Advanced Engineering MathematicsII, John Wiley & Sons, Newyork, 10th edition, (2011).

19UPH103	ENGINEERING PHYSICS (Common to All Branches - Except CSBS)	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> 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, Engineering Physics, Dhanam Publications, Edition, 2018,					

Chennai.

2. Rajendran.V, Engineering Physics,Tata Mc-Graw Hill Publishing Company limited, New Delhi,RevisedEdition2018.
3. Palanisami P.K., - Physics For Engineers II, Scitech Publications(India), Pvt Ltd., Chennai,2018.

REFERENCES:

1. Raghuvenshi. G. S., — Engineering Physics, PHI Learning Private Limited, New Delhi, Revised Edition2018.
2. Aruldoss.G., — Engineering Physics, PHI Learning Limited, New Delhi, Revised Edition 2018.
3. Marikani.A., — Engineering Physics, PHI Learning Private Limited, New Delhi, Revised Edition2017.
4. Sankar.B.N., and Pillai.S.O., — A Textbook of Engineering Physics, New Age International Publishers Private Limited, New Delhi, Revised Edition 2017.
5. AvadhanuluM.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:					
<ul style="list-style-type: none"> 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 ¹ , sp ² , sp ³) (CH,CH,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 super capacitors: Types of batteries - primary battery (dry cell) Secondary battery (lead acid battery, lithium-ion-battery) fuel cells - H ₂ - O ₂ 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. Jain P.C. and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2002.
2. Dr.Sunita Rattan, A Textbook of Engineering Chemistry II S.K.Kataria & Sons., New Delhi, 2013.

REFERENCES:

1. Derek P Letcher and Frank C. Walsh, - Industrial Electro chemistry II, Chapman and Hall, New York, 1993.
2. Peter Grundler, Chemical Sensors, An introduction for Scientists and Engineers II, 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:					
<ul style="list-style-type: none"> 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			
Definition and basic organization of computers - classification of computers - Software - Types of software - types of programming paradigms - Translators: compiler and interpreter - Problem solving tools: Algorithms – Flowchart - Pseudo code					
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-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, list parameters; 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	Solve mathematical expressions involving sequential logic in python	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 Namdev Kamthane & Amit Ashok Kamthane, Problem solving and python programming II, McGraw Hill Education, 2018(copyright)
2. Anurag Gupta & G P Biswas, Python Programming - Problem solving, packages and libraries II, McGraw Hill Education, 2020(copyright).

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.
6. PaulGries, Jennifer Camp bell 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:							
<ul style="list-style-type: none"> To develop student's graphics 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 (NOT FOR 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	Apply the knowledge of First angle projection to draw the projection of points, 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. Natarajan K.V – A Textbook of Engineering GraphicsII, Dhanalakshmi Publishers, (2006).
2. Bhatt N.D – Engineering DrawingII, 46th Edition, Charotar Publishing House, (2003).

REFERENCES:

1. Venugopal K and PrabhuRaja V., Engineering GraphicsII, New Age International (P) Limited, (2008).
2. Gopala krishnan K. R, Engineering Drawing (Vol.I&II), Subhas Publications. (1998).
3. Dhananjay A. Jolhe, Engineering Drawing with an introduction to AutoCADII, Tata McGraw Hill Publishing Company Limited, (2008).

19UGM131	INDUCTION PROGRAMME	L	T	P	C
		0	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> • 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			
Vaigai Dam - Theni - VOC - Port - Tuticorin - Madurai Radio City - Madurai - Aavin Milk - Madurai - NSS Activities					
UNIT 7	FAMILIARIZATION OF THE DEPARTMENT AND INNOVATION	2			
Department Introduction and Purpose of Course - Eminent speakers Scope and Feature of the 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.	Understand			
CO2	Implement creativity in drawing and waste material	Understand			
CO3	Communicate their ideas effectively.	Understand			
CO4	Identify inputs and outputs of different industry process	Understand			
CO5	Describe the scope and features of their Programme of study	Understand			
TEXT BOOKS:					
Student Induction Programme: A Detailed Guide by AICTE, New Delhi.					

19UCS110	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY (Common to ALL Branches)	L	T	P	C
		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. Write a Python program to process the mark processing system (Record as the following Fields: Name, Reg.no, Mark1, Mark 2, Mark 3, Mark 4, Total, average). Print the student details and find the total and average mark.
2. Write a Python program to compute the +2 Cut off mark, given the Mathematics, physics and Chemistry marks. A college has decided to admit the students with a cut off marks of 180. Decide whether the student is eligible to get an admission in that college or not.
3. A pizza in a circular shape with 8 inches and which is placed in a square box whose side length is 10 inches. Find how much of the box is 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 based on the following scenario:
 - 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.
 - Ticket amount for a Single person is Rs:950.
 - If all the seats are filled, what would be the result?.
 - If only 15 seats are filled, what would be the result?
5. Consider the person 'X' has some amount in his hand and the person 'Y' has some amount in his hand. If they wish to exchange the amount among them, how they can exchange the amount by using the third party '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

7. 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)

9. 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.

10. 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:

- Move a tower of height-1 to an intermediate pole, using the final pole
- Move the remaining disk to the final pole.
- Move the tower of height-1 from the intermediate pole to the final pole using original pole

Problems involve List and Nested List

11. 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 Roll.no, Reg.no, Name, Dept, and Batch, Contact no, Nativity (Indian/NRI) as key value pairs. Do the following operations:

- i.Display the complete student details on giving Roll no 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, and Year published, Publisher Name. He wishes to retrieve the book details in the following scenario:

- Retrieve the complete details of the book on giving ISBN.
- Retrieve the details of the book which published after the year2015.
- Retrieve the details of the book whose author name is ' Andrew'.
- 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:

- Name of the album starts with 's' or 'S'.
- Name of the album which contains 'jay' as substring.
- 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

19UCS112	ENGINEERING FUNDAMENTALS LABORATORY (Common to CSE, ECE, IT & BME Branches)	L	T	P	C
		0	0	3	1.5
OBJECTIVES:					
<ul style="list-style-type: none"> To familiarize the Hardware components of Computer To practice the installation of operating systems and other software. 					
LIST OF EXPERIMENTS:					
<p>GROUP A (COMPUTER) 24 Periods</p> <ul style="list-style-type: none"> 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 <p>GROUP B (ELECTRICAL & ELECTRONICS) 21Periods</p> <ul style="list-style-type: none"> Study of electronic components and equipment's- <ul style="list-style-type: none"> Resistor color coding 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 microcontroller Switch control with microcontroller Temperature measurement with microcontroller 					
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	Apply appropriate software tools to make measurements of physical quantities.	Apply			
CO5	Demonstrate proficiency in using discipline-specific tools	Apply			
CO6	Function effectively as an individual for efficiently executing the given task	Organize			
<p>HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS</p> <p>HARDWARE LAN SYSTEM WITH 30 NODES (OR) STAND ALONE PCS – 30 NOS.</p>					

SOFTWARE

OS – UNIX CLONE (License free Linux)

EQUIPMENTS:

S.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	3

19UGS113	BASIC SCIENCES LABORATORY	L	T	P	C
		0	0	2	1
	PHYSICS LABORATORY (Common to All Branches)				
OBJECTIVES: <ul style="list-style-type: none"> 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: <ol style="list-style-type: none"> Laser - Determination of particle size and wavelength of Laser source using Diode Laser. Ultrasonic Interferometer - Determination of velocity of sound and compressibility of liquid. Poiseuille's method - Determination of Coefficient of viscosity of liquid. Spectrometer - Determination of dispersive power of a prism. Air Wedge method - Determination of thickness of a thin wire. Uniform bending method - Determination of Young's modulus of the given rectangular beam. <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> To impart knowledge on basic concepts in applications of chemical analysis. Train the students to handle various instruments. To acquire knowledge on the chemical analysis of various metal ions. 					
LIST OF EXPERIMENTS: <ol style="list-style-type: none"> Preparation of molar and normal solutions of the following substances - Oxalic acid, Sodium Carbonate, Sodium Hydroxide and Hydrochloric acid. Conductometric Titration of strong acid with strong base. 					

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 weight of polymer 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:					
<ul style="list-style-type: none"> • 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			
<ul style="list-style-type: none"> • 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			
<ul style="list-style-type: none"> • 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			
<ul style="list-style-type: none"> • 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			
<ul style="list-style-type: none"> • 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			
<ul style="list-style-type: none"> • 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:					
<ol style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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 Solenoid vector fields - Vector integration - Green's theorem in a plane, Gauss divergence theorem and Stroke's theorem (excluding proofs) - Simple applications involving cubes and rectangular parallelepiped.					
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 / Application of 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 knowledge of higher order ordinary differential equations in real life engineering problems	Apply			
CO2	Apply the concept vector identities in problem solving and evaluate the line, surface and volume integrals	Apply			

CO3	Apply the knowledge of analytic function and conformal mapping in various Engineering fields	Apply
CO4	Apply the knowledge of singularities, residues in complex integration	Apply
CO5	Apply various techniques to solve linear, nonlinear equations and Eigen value problems of a Matrix by Numerically	Apply
CO6	Understand the knowledge of ODE, directional derivatives, scalar potentials and poles	Understand

TEXT BOOKS:

1. VEERARAJAN.T - Engineering Mathematics for First year II, 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 II, New Age International Publishers 7th Edition 2019.
3. GREWAL. B.S, Higher Engineering Mathematic II, Khanna Publications, New Delhi, 43rd Edition, (2014).

REFERENCES:

1. RAMANA B.V, Higher Engineering Mathematics II, 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 II, Narosa Publishing House Pvt. Ltd., New Delhi, 3rd Edition, (2007).

19UEC205	INTRODUCTION TO ELECTRONICS AND COMMUNICATION ENGINEERING (QUALITATIVE TREATMENT ONLY)			L	T	P	C
				3	0	0	3
OBJECTIVES:							
<ul style="list-style-type: none"> 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 different digital circuits						Apply
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:							
<ol style="list-style-type: none"> SalivahananS., SureshkumarN. And VallavanrajA., - Electronic Devices and CircuitsII, Tata McGraw Hill., 4th Edition,2017. MorrisMano.M, Digital Design II, 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 II, Penram International Publishing, 4th Edition, New Delhi, 2000.

19UEC206	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3
OBJECTIVES: <ul style="list-style-type: none"> 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 (V _{dc}) 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	Describe the fundamental concept of various electronic Devices.	Understand
CO2	Apply the knowledge of PN Junctions in semiconductor devices for various applications	Apply
CO3	Design voltage regulators and simple rectifiers using Diodes.	Apply
CO4	Design simple BJT circuits for real time applications.	Apply
CO5	Analyze the various parameters of transistors for suitable applications	Analyze
CO6	Analyze the parameters of FET for suitable applications	Analyze

TEXT BOOKS:

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

REFERENCES:

1. Robert T. Paynter, Introducing Electronics Devices and Circuits II, Pearson Education, Seventh Edition, 2010.
2. Millman J. & Halkins and Satyabranta Jit, Electronic Devices & Circuits II, Tata McGraw Hill, Second Edition, 2008.

19UGS210	ENERGY AND ENVIRONMENTAL SCIENCE LABORATORY	L	T	P	C
		0	0	3	1.5
	PHYSICS LABORATORY (Common to All Branches)				
OBJECTIVES:					
<ul style="list-style-type: none"> To analyze the Band gap, moment of inertia, thermal conductivity and rigidity modulus of the materials. To gain knowledge in Photonics 					
LIST OF EXPERIMENTS:					
<ol style="list-style-type: none"> Determination of Energy band gap of a semiconductor. Torsion pendulum – Determination of Moment of inertia of a metallic disc and rigidity modulus of a given metallic wire. Spectrometer - Determination of wavelength of mercury spectrum using grating. Laser – Determination of numerical aperture and acceptance angle of an optical fiber Newton's rings – Determination of radius of curvature of a convex lens Lee's Disc - Determination of thermal conductivity of a bad conductor. Determination of Solar cell Characteristics using optical transducers kit. <ul style="list-style-type: none"> 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 All Branches)				
OBJECTIVES:					
<ul style="list-style-type: none"> 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:					
<ol style="list-style-type: none"> Estimation of hardness of water by EDTA method. Estimation of alkalinity of water sample. Estimation of Chloride in water sample (Argento metric method) Determination of DO in water Estimation of chromium in tannery wastes Estimation of available chlorine in bleaching powder Estimation of iron by Spectro photometry. Determination of acidity of industrial effluents. <ul style="list-style-type: none"> A minimum of FIVE experiments shall be offered for every course <p>Laboratory classes on alternate weeks for Physics and Chemistry.</p>					
TOTAL : 45 PERIODS					

19UEC211	ELECTRONIC DEVICES LABORATORY	L	T	P	C
		0	0	3	1.5
OBJECTIVES:					
<ul style="list-style-type: none"> To familiarize with different active and passive electronic devices components. 					
LIST OF EXPERIMENTS:					
<ol style="list-style-type: none"> Characteristics of PN diode. Characteristics of Zener diode and voltage regulator using Zener diode. Half wave rectifier and full wave rectifier with capacitor filter. Bridge rectifier with capacitor filter. Characteristics of CE configuration. Characteristics of CB configuration. Characteristics of UJT and SCR. Characteristics of JFET and MOSFET. Characteristics of phototransistor. 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			
CO4	Apply appropriate software tools to make measurements of physical quantities.	Apply			
CO5	Demonstrate proficiency in using discipline-specific tools	Apply			
CO6	Function effectively as an individual for efficiently executing the given task	Organize			

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 (IC)	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 (IC)	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:					
<ul style="list-style-type: none"> 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 vectorspace 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 II, 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 II 4th Edition Published by Addison Wesley / Pearson, 2011.

REFERENCES:

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

19UEC302	DIGITAL ELECTRONICS AND DESIGN (IC)	L	T	P	C
		3	0	3	4.5
OBJECTIVES: <ul style="list-style-type: none"> 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 I	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 subtract or – 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 - MagnitudeComparator.					
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 fundamentalmode 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–ProgrammableLogicDevices–ProgrammableLogicArray(PLA)-Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation ofcombinational logic circuits using ROM, PLA, PAL.					
COURSE OUTCOMES: At the end of the course the student will be able to:					
CO1	Describe the functions of the various building blocks of digital circuits				Understand
CO2	Apply the fundamental concepts of digital electronics to design digital circuits				Apply
CO3	Analyze the digital circuits to verify their functionalities				Analyze
CO4	Evaluate the function of digital circuits using the fundamental concepts				Evaluate

CO5	Design digital circuits for real time applications	Create
CO6	Simulate logic circuits using a software that is used to design and simulate logic circuits	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 Subtract or 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 IC7483
4. Design and implementation of 2 bit Magnitude Comparator using logic gates, 8Bit 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 IC7445 and 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: <ul style="list-style-type: none"> 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 – Super node 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	Describe the basic properties of circuit elements				Understand
CO2	Apply the basic laws to compute voltage and current in AC and DC circuits				Apply
CO3	Apply the various 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	Evaluate the various parameters of two port networks				Evaluate

TEXT BOOKS:

1. A.Sudhakar, Shyam Mohan S P —Circuits and Networks: Analysis & SynthesisII, TataMcGraw - Hill, 5th edition,2015.
2. WilliamH.Hyte,J.E.Kemmerly,StevenM.Durban—EngineeringCircuitAnalysisII,Tata McGraw – Hill, 8thedition.

REFERENCES:

1. Joseph Edminister, —Electric circuitsII, Schaums Outline Series, McGraw-Hill, 6thedition, 2013.
2. M.Arumugam,N.Premkumar—ElectriccircuitTheoryII,KhannaPublishers,NewDelhi 2006.
3. M.L.Soni,J.CGupta—ElectricalCircuitAnalysisII,DhanpatRaiandSons,NewDelhi 2006.
4. Charles K. Alexander, Mathew N.O.Sadiku, —Fundamentals of Electric CircuitI, McGraw-Hill's New York,2003

19UEC304	BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING	L	T	P	C
		3	0	0	3
OBJECTIVES: <ul style="list-style-type: none"> To explain the methods of biasing of transistors. To familiarize the students about the midband 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	ELECTROMECHANICAL 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	Explain the working principles in electrical generators and motors.	Understand			
CO2	Compare the different types of signals generators and oscilloscope	Understand			
CO3	Apply the knowledge of various electronics instruments to measure the physical quantities	Apply			

CO4	Apply the Knowledge of AC fundamental and principles to compute the parameters of electrical machines	Apply
CO5	Analyze the parameter of various measuring instruments for given application	Analyze
CO6	Apply the knowledge of Signal Generators to measure the unknown quantities	Apply

TEXT BOOKS:

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

REFERENCES:

1. .L.TherajaandA.K.Theraja,—Atextbookofelectricaltechnology-Volume1 —S.Chand& company limited,2005.
2. B Helfric AD and Cooper WD, —Modern Electronic Instrumentation and MeasurementTechniquesII, PHI,1992.

19UEC305	ANALOG CIRCUITS (IC)	L	T	P	C
		3	0	3	4.5
OBJECTIVES: <ul style="list-style-type: none"> 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	Describe the functions of the various amplifiers and Oscillators.	Understand
CO2	Apply the fundamental concepts of analog circuits to design various amplifiers and oscillators	Apply
CO3	Analyze the frequency response of different amplifiers for various specifications	Analyze
CO4	Evaluate the functionalities of analog circuits using active and passive components	Evaluate
CO5	Design an analog circuit for real time applications	Create
CO6	Design and simulate the amplifier and oscillator circuit by using SPICE tool / open source.	Modern tool

TEXT BOOKS:

1. Salivahanan. S,SureshKumar. N,Vallavaraj. A—Electronic Devices andCircuitsII, TMH, 4th Edition, 2017.
2. RobertL.Boylestad, LouisNashelsky,—Electronic Devices and Circuit TheoryI, Pearson Education/ PHI, 11thEdition, 2013.
3. R.S.SedhaA textbookofElectronicCircuitsII,S.Chand, 4th edition,2014.

REFERENCES:

1. Millman.J,Halkias.C,—IntegratedElectronicsI,TMH,2ndedition,2010.
2. DavidA.Bell,— ElectronicDevices&CircuitsII,PHI,4thEdition,2007.
3. Floyd,— ElectronicDevicesII,PearsonEducation,6thEdition,2002.
4. Nagrath.I.J, —Electronic Devices and CircuitsII, 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 R_E) 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: <ul style="list-style-type: none"> 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: <ol style="list-style-type: none"> Implement Simple C Programs Implement C programs using Operators Implement C Programs using Decision Control statements 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: <ol style="list-style-type: none"> Implement C Programs using Arrays Implement C Programs using Strings 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: <ol style="list-style-type: none"> Implement C Programs using Pointers Implement C Programs using array of Pointer 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 problems concepts of C for solving program	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. Reema Thareja, ||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. Pradip Dey, Manas Ghosh, —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: <ul style="list-style-type: none"> To engage the student in integrated activities of reading, research, discussion and presentation around a designated subject. 					
<p>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.</p>					
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 edgetechnologies.	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: <ul style="list-style-type: none"> • To provide a basic understanding of biological mechanisms of living organisms and the human biology from the perspective of engineers. • To encourage engineering students to think about solving biological problems with engineering principles and tools. 					
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,—AText book of Biotechnologyll,S.Chand Higher Academic Publications,2013.
2. R.Khandpur,—Biomedicalinstrumentation-Technologyandapplicationsll,McGraw HillProfessional,2004.

REFERENCES:

1. ArthurT.Johnson, Biology for Engineersll,CRCPress,Taylor and Francis, 2nd Edition,2019.
2. Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, —Cell Biology andGenetics (Biology:The unity and diversity of life Volumel)ll,CengageL earning, 12thEdition,2008.
3. Gerard J.Tortora and Bryan H.Derrickson, —Principles of Anatomy and Physiologyll, 15thEdition, Wileypublications,2016.

SEMESTER IV

SEMESTER IV

CourseCode	Course Title	L	T	P	C	Type ofcourse
THEORY						
19UMA422	Probability and Statistics	3	1	0	4	Basic Science
19UEC402	Electromagnetic Fields and Transmission Lines	3	0	0	3	ProfessionalCore
19UEC403	Signals and Systems	3	1	0	4	ProfessionalCore
19UEC404	Linear Integrated circuits (IC)	2	0	3	3.5	ProfessionalCore
19UEC405	Analog and Digital Communication (IC)	3	0	3	4.5	ProfessionalCore
19UIT429	Introduction to data structures and algorithms(IC)	2	0	2	3	ProfessionalCore
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:						
<ul style="list-style-type: none"> 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 input 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
CO4	Apply the knowledge on random process to analyze the linear system with random inputs in the areas of communication and signal processing					Apply
CO5	Apply basic probability techniques and models in linear systems					Apply
CO6	Understand the basic concept of probability , Random Variable and statistics					Understand

TEXT BOOKS:

1. GREWAL B.S, —Higher Engineering MathematicsII, Khanna Publishers, New Delhi,42ndEdition,(2012).
2. GUPTAS.C,KAPOORV.K.—FundamentalofMathematicalStatisticsII10thEdition,Sultan Chand and Sons, New Delhi,2002.
3. VEERARAJAN.T—ProbabilityandRandomProcessesII4thEditionTataMcGraw-Hill,New Delhi,(2015).

REFERENCE BOOKS:

1. SHARMA J.N , GOEL J.K — Mathematical statistics — 7th Edition Krishna PrakashamMandis, Mearut1998
2. Venkatarama Krishnan, —Probability and Random Processes—, Wiley-IntersciencePublication,2006.
3. John A. Gubner., —Probability and Random Processes For Electrical and ComputerEngineersII, Cambridge University Press,(2006).
4. Alberto Leon-Garcia., —Probability, Statistics and Random Processes For ElectricalEngineeringII, 3rd Edition, Prentice Hall publisher,(2008).

19UEC402	ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES	L	T	P	C
		3	0	0	3
OBJECTIVES: <ul style="list-style-type: none"> 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 Z_0 , 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.					

COURSE OUTCOMES:

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

CO1	Explain the principles of Electromagnetic fields	Understand
CO2	Describe the fundamental concepts of Transmission lines	Understand
CO3	Design filters for various cutoff frequencies.	Apply
CO4	Analyze the transmission lines and their parameters using the Smith Chart	Analyze
CO5	Analyze the wave propagation parameters in different mediums	Analyze
CO6	Analyze different waveguides for TE ,TM waves	Analyze

TEXTBOOKS:

1. Hayt.W.H.,BuckJ.A,—EngineeringElectromagneticsII,TATAMcGraw-Hill,7thEdition, 2007
2. C.Jordan,K.G.Balmain,-E.M.Waves&RadiatingSystemsI,PearsonEducation, 2006
3. JohnD.Ryder,—Networks,linesandfieldsII,PrenticeHallofIndia,2ndEdition,2006.

REFERENCE BOOKS:

1. JosephEdminister,—Schaum'sSeries,ElectromagneticsII,TataMc-grawHill,2007
2. G S NRaju, -Electromagnetic Field Theory and Transmission LinesI, PearsonEducation,2006.
3. Matthew,Sadiku.N.O.,—ElementsofEngineeringElectromagneticsII,OxfordUniversity Press, 4th edition, 2007.
4. Philip C. Magnusson, Andreas Weisshaar, Vijai K. Tripathi, Gerald C.Alexander,-TransmissionLinesandWavePropagationI,CRCPress, FourthEdition,2006
5. Ramo,WhineeryandVanDuzer, -FieldsandWavesinCommunicationElectronicsII, John Wiley,2003.

19UEC403	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4
OBJECTIVES: <ul style="list-style-type: none"> To introduce the concept of continuous and discrete signals and systems. To introduce the tools 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	Describe the fundamental concepts of continuous time and Discrete time (CT/DT) signals and systems	Understand			
CO2	Determine the classifications of the CT/DT signals and systems according to their properties	Apply			

CO3	Apply various transformation techniques to derive Continuous time and Discrete time signals and linear time invariant systems	Apply
CO4	Analyze the time-domain and frequency domain approaches of continuous and discrete systems	Analyze
CO5	Evaluate the characteristics of CT/DT systems using properties of convolution	Evaluate
CO6	Comment on various kinds of canonical block diagram realization for any given systems	Evaluate

TEXT BOOKS:

1. SimonHaykins, Barry VanVeen, -Signals and Systems |, John Wiley &sons Inc, 2004
2. Allan V.Oppenheim,S.Wilsky,S.H.Nawab , -Signals and Systems|,Pearson Education
3. ,2nd Edition, 2007.

REFERENCES

1. HP 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. RodgerE.Ziemer,WilliamH.Tranter,D.RonaldFannin,-Signals&systems|PearsonEducation, Fourth Edition, 2002.
4. Steven T.Karris,-Signals and Systems:With Matlab Applications| OrchardPublications,2003.

19UEC404	LINEAR INTEGRATED CIRCUITS (IC)	L	T	P	C
		2	0	3	3.5
OBJECTIVES: <ul style="list-style-type: none"> 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	Describe the concepts of the circuit configuration for the design of linear integrated circuits				Understand
CO2	Design the linear and nonlinear applications of an Op-Amp along with special function ICs				Apply
CO3	Analyze the various types of waveform generators, timers and data converters.				Apply
CO4	Design amplifiers, oscillators, D-A converters using operational amplifiers.				Create
CO5	Design filters using op-amp for a given specification and develops skills to solve engineering problems				Evaluate
CO6	Analyze the performance of filters, multivibrators and A/D converter using SPICE.				Analyze
TEXT BOOKS:					
<ol style="list-style-type: none"> D.Roy Choudhry, Shail Jain, —Linear Integrated CircuitsII, New Age International Pvt.Ltd., 2018, Fifth Edition. Sergio Franco, —Design with Operational Amplifiers and Analog Integrated CircuitsII,4thEdition, Tata Mc Graw-Hill,2016 					

REFERENCE BOOKS:

1. Ramakant A. Gayakwad, —OP-AMP and Linear ICs II, 4th Edition, Prentice Hall/Pearson Education, 2015.
2. S. Salivahanan & V. S. Kanchana Bhaskaran, —Linear Integrated Circuits II, TMH, 2nd Edition, 4th Reprint, 2016.
3. Gray and Meyer, —Analysis and Design of Analog Integrated Circuits II, 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 (IC)	L	T	P	C
		3	0	3	4.5
OBJECTIVES:					
<ul style="list-style-type: none"> 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 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 Digital Data Transmission: Line coding, Power spectral density of various line codes, Inter Symbol Interference, Nyquist Criterion for Zero ISI, Regenerative Repeater, Eye Diagram.					
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	Understand the basic concepts of different modulation techniques in baseband and passband communication systems.				Understand
CO2	Apply the knowledge of mathematical theory to characterize and construct analog and digital transmission schemes in time and frequency domain..				Apply
CO3	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
CO4	Compare the performance of different types of analog modulation and analog to digital conversion techniques.				Analyze
CO5	Analyze the performance of spread spectrum system in the presence of interference and multipath propagation.				Analyze
CO6	Evaluate the performance of different digital modulation techniques in terms of bandwidth, signal to noise ratio and probability of error.				Evaluate

C07	Design analog and digital communication system for a given specification.	Create
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Simon Haykin and Michael Moher, — Communication Systems II John Wiley & Sons, Fifth Edition, 2016. 2. B.P. Lathi and Zhi Ding, — Modern Digital and Analog Communication I Oxford University Press, Fifth Edition, 2018. <p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. John G. Proakis and Masoud Salehi, — Fundamentals of Communication Systems Pearson, 2nd Edition, 2014. 2. Sam Shanmugam, — Digital and Analog Communication Systems II John Wiley, 2nd edition, 1992. 3. Herbert Taub, Donald L. Schilling, and Goutam Saha, — Principles of Communication Systems II McGraw-Hill, Third Edition, 2008. <p style="text-align: center;">LIST OF EXPERIMENTS</p> <ol style="list-style-type: none"> 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 (IC)	L	T	P	C
		2	0	2	3
OBJECTIVES: <ul style="list-style-type: none"> To develop Programs to implement arrays and list using basic programming constructs To develop Programs to implement stack and queue using basic programming constructs. 					
UNIT I	LINEAR DATA STRUCTURE – 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: <ol style="list-style-type: none"> Program to implement Arrays. Program to implement List ADT. Program to implement Polynomial Arithmetic using Linked List. 					
UNIT II	LINEAR DATA STRUCTURE – 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: <ol style="list-style-type: none"> Program to implement stack ADT using array and linked list. Program to implement stack and use it to Evaluate postfix expression. Program to implement queue ADT use array and linked list. 					
UNIT III	NON-LINEAR DATA STRUCTURE – 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: <ol style="list-style-type: none"> Program to implement binary search tree. Program to implement insertion and deletion in AVL trees. 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: <ol style="list-style-type: none"> Program to implement Prim’s algorithm using priority queues to find MST of an undirected graph. 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: <ol style="list-style-type: none"> Program to implement searching technique. Program to implement sorting technique. Program to implement hashing technique. 					

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	Analyze
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. ReemaThareja,—DataStructuresUsingC++,OxfordUniversityPress,SecondEdition, 2014.
2. Weiss. M.A, —Data Structures and Algorithm Analysis in C", Pearson Education, 2ndEdition, 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:							
CO1	Describe the social construction of gender and sexuality and their influence in social context.						Understand
CO2	Analyze how the concepts of gender equality are created, maintained, and/or challenged						Analyze
CO3	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 Educationl, Oxfam GB,2007.							
2. PasadenaandHackensack,—GenderrolesandEqualityll,SalemPress,2011.							

19UGS433	INTERPERSONAL SKILLS LAB	L	T	P	C
		0	0	3	1.5
<p>OBJECTIVES:</p> <ul style="list-style-type: none"> • To demonstrate signal processing techniques using DSP processor • To demonstrate signal processing functions using Simulation Software. 					
<p>LIST OF EXPERIMENTS:</p>					
<p style="text-align: center;">List of Exercises</p> <p>Part - A : Communication and Leadership Projects</p> <p>I) Speech Projects</p> <ol style="list-style-type: none"> 1. The Open up Speech (Prepared Speech) 2. Speech Organizing to the Point (Prepared Speech) 3. Table Topics Speech <p>II) Evaluation Projects</p> <ol style="list-style-type: none"> 4. Speech Evaluation 5. TAG (Timer, Ah Counter and Grammarian)Evaluation <p>III) Leadership Roles</p> <ol style="list-style-type: none"> 6. Speech Master of the Day 7. General Evaluator 8. Table Topics Master <p>Part - B : Problem-Solving and Decision- Making Project</p> <p>IV) Quality Circle Project</p>					
<p>TOTAL : 30 PERIODS</p>					

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:					
<ul style="list-style-type: none"> 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:

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

REFERENCES:

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

19UEC502	MICROPROCESSORS MICROCONTROLLERS AND APPLICATIONS	L	T	P	C	
		3	0	0	3	
OBJECTIVES: <ul style="list-style-type: none"> 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 Arduino uno hardware and software development environment - Arduino based Heart rate monitor -Pulse rate monitor –Oximeter -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	Develop an ALP for general purpose programming using 8086 and 8051	Apply
CO3	Develop an ALP to interface peripheral devices with 8086 and 8051	Apply
CO4	Develop an ALP to interface peripheral devices with 8086 and 8051	Apply
CO5	Analyze the functioning of microprocessor and microcontroller for the given condition	Analyze
CO6	Develop an application using ALP programming softwares and IDEs	Create
TEXT BOOKS:		
<ol style="list-style-type: none"> 1. Krishna Kant, —Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096II,PHI,2011 2. The 8051 Microcontroller architecture, Programming and Applications Ayala J.K Penram International (2005) 3rdEdition. 3. Massimo Banzi, Getting Started with Arduino, First Edition, pub. O'Reilly, 2008. 		
REFERENCES:		
<ol style="list-style-type: none"> 1. Ramesh S Gaonkar, —Microprocessor Architecture, Programming and Application with 8085II, Penram International Publishing, 4th Edition, New Delhi, 2005 3rd edition. 2. Mohammed Ali Mazidi and Janice Gillispie Mazidi,—The 8051 Microcontroller and Embedded SystemsII ,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		
<ol style="list-style-type: none"> 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:					
<ul style="list-style-type: none"> 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 II,Tata Mc Graw – Hill, Fourth Edition, 2011
2. Andrew S. Tenanbaum, Computer Networks, 5th Edition, 2010.

REFERENCES:

1. William Stallings, —Data and Computer CommunicationII, Eighth Edition, Pearson Education, 2007.
2. Larry L .Peterson, Peter S. Davie,—Computer NetworksII,Elsevier,FifthEdition,2012
3. James F. Kurose, Keith W. Ross,—Computer networking: A Top–Down Approach Featuring the InternetII, Pearson Education, 2005.

19UEC504	ANTENNA AND WAVE PROPAGATION	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> 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: Hertzian 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 PropagationII, Sathya Prakasan Publications, 4th Edition, 2009.
2. Constantine A. Balanis, —Antenna Theory Analysis and Design, John Wiley India II, 4th Edition, 2016.
3. E.C. Jordan and Balmain,— Electromagnetic waves and Radiating systems II, Pearson Education, 2015.

REFERENCES:

1. John D.Kraus, Ronald J.Marhefka and Ahmad S.Khan —Antennas and wave propagationITataMCGraw-HillBookcompany,4thEdition,2010
2. G.S.N. Raju,—Antenna Wave Propagation II,Pearson Education,2004.
3. R. Harish, M. Sachidanada,—Antennas and wave propagation—Oxford University Press, 1stEdition,2007
4. Wearable antenna https://www.researchgate.net/publication/224089551_A_review_of_wearable_antenna

19UGS531	REASONING AND APTITUDE	L	T	P	C
		1	0	0	1
OBJECTIVES:					
<ul style="list-style-type: none"> 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:					
<ol style="list-style-type: none"> Dr. R.S.Agarwal, -Quantitative Aptitude II,S. Chand Publications, New Delhi, 20th Edition,(2013). Abijitguha, — Quantitative Aptitude for Competitive Examinations II, Tata Mc Graw Hill Publication, New Delhi, 4th Edition, (2011). R.V.Praveen, —Quantitative Aptitude and Reasoning II, PHI Learning Pvt. Ltd., Delhi, 2nd Edition,(2013). 					

REFERENCES:

1. Ashish aggarwal, — Quick Arithmetic II, S.Chand Publications, New Delhi, 6th Revised Edition, (2014).
2. Dr.V.A.Sathgurunath'S —A Guide for Campus RecruitmentII, 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:					
<ul style="list-style-type: none"> 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					
<ol style="list-style-type: none"> Arithmetic Operations. (8086 and 8051). Logical Operations (8086 and 8051). Array processing And Matrix operations (8086). Code Conversions (8086). String Manipulations (8086). Interfacing with 8255 PPI. Serial communication (Study of 8253/8251) 8279 Keyboard & display using 8086. ADC and DAC using 8086. 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 Microcontroller to perform various functions.	Apply			
CO2	Interface peripheral devices with microprocessor Micro - controller to develop applications.	Apply			
CO3	Modern Tool Usage to develop applications using modern tools like MASM, EMU 8086.	Create			
CO4	Apply appropriate software tools to make measurements of physical quantities	Apply			

CO5	Demonstrate proficiency in using discipline-specific tools	Apply
CO6	Function effectively as an individual for efficiently executing the given task	Organize

19UEC506	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	2	1
OBJECTIVES:					
<ul style="list-style-type: none"> To demonstrate signal processing techniques using DSP processor To demonstrate signal processing functions using Simulation Software. 					
LIST OF EXPERIMENTS:					
Using Simulation Software:					
<ol style="list-style-type: none"> Linear convolution between two sequences. Circular convolution between two sequences. Linear convolution using circular convolution. Program to perform N-point DFT. Also to perform the IDFT on the result obtained to verify the result. Linear convolution using (a) overlap save method (b) overlap add method. Perform FFT on a sequence using the following methods. (a) Decimation in time (b) Decimation in frequency. Design an FIR filter using windowing techniques. Design an Butterworth/ Chebychev IIR filter using impulse invariant method. Design an Butterworth/ Chebychev IIR filter using bilinear transformation method. 					
Using Digital Signal Processor:					
<ol style="list-style-type: none"> Study of various addressing modes of DSP using simple programming examples Implementation of Linear Convolution using Digital Signal Processor Implementation of Circular Convolution using Digital Signal Processor 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			

CO4	Apply appropriate software tools to make measurements of physical quantities.	Apply
CO5	Demonstrate proficiency in using discipline-specific tools	Apply
CO6	Function effectively as an individual for efficiently executing the given task	Organize

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		
<ol style="list-style-type: none"> 1. Internal Assessment: Presentation on the Innovative Idea 2. End Semester Assessment: <ul style="list-style-type: none"> ○ 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:					
<ul style="list-style-type: none"> 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:

1. Skills for Success, Listening and Speaking – Level 4 by Brooks and Margret – Oxford University Press, Oxford 2011Edition.
2. Professional Communication by Raman, Meenakshi and Sangeetha Sharma – Oxford University Press, 2014Edition.
3. 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						
19UGM631	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:					
<ul style="list-style-type: none"> To impart knowledge on characteristic of wireless channel and various cellular architectures. To introduce the concepts behind various digital signaling 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	MOBILE RADIO PROPAGATION				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-Lora WAN					
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 Systemsll, Pearson Education,2016.

REFERENCES:

1. Andrea Goldsmith, - Wireless communications: principles and practice ll, second edition, PHI, 2006.
2. David Tse and Pramod Viswanath, — Fundamentals of Wireless Communicationll, Cambridge University Press, 2005.
3. Upena Dalal, —Wireless Communication ll, Oxford University Press, 2009.
4. Jonathan Rodriguez, — Fundamentals of 5G Mobile Networksll Wiley Publications, 2015.

19UEC602	VLSI DESIGN	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the basic concepts of CMOS Technologies and testing To outline the formal procedures for the design of combinational and sequential circuits 					
UNIT1	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.					
UNIT2	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					
UNIT3	CIRCUITS CHARACTERIZATION	9			
Delay estimation-Logical effort and Transistor sizing-Power dissipation-Interconnect-Design Margin-Reliability-Scaling					
UNIT4	COMBINATIONAL AND SEQUENTIAL CIRCUITS DESIGN	9			
Static CMOS logic Design-Dynamic CMOS logic Design-Circuit families-Circuit design of latches and flip-flop					
UNIT5	DESIGNING ARITHMETIC BUILDING BLOCKS	9			
Adder circuits -Ripple carry adder-Carry look ahead adder-High speed adder-Multiplier					
TOTAL:45PERIODS					
COURSEOUTCOMES:					
At the end of the course the student will be able to:					
CO1	Describe the concepts of MOS transistor technology	Understand			
CO2	Design the different CMOS logic using MOS transistor	Apply			
CO3	Design the layouts for various logic circuits	Apply			
CO4	Analyze the various characteristics of MOS transistor	Analyze			
CO5	Analyze the various techniques for MOS transistor optimization	Analyze			
CO6	Design a combinational and sequential MOS circuits using suitable programming languages	Create			

TEXT BOOKS:

1. Samir Palnitkar—Verilog HDL a guide to digital design and SynthesisII, 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 II, John Wiley & Sons, Reprint 2009

REFERENCES:

1. Neil H.E Weste & Kamaran Eshraghian, Principles of CMOS 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:					
<ul style="list-style-type: none"> To explain about Internet of Things. To impart knowledge of IoT networks and M2M Technology. To make students aware of security issues in application of Internet of Things. 					
Unit – 1	INTRODUCTION TO IOT				9
Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry					
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					
Unit – 3	IOT AND M2M				9
The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.					
Unit – 4	IoT PRIVACY, SECURITY AND GOVERNANCE				9
Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT.					
Unit – 5	APPLCIATIONS AND CASE STUDY				9
Over view – e-health monitoring – City automation – Automotive Application – Environmental monitoring - Agricultural and commercial management.					
TOTAL : 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Describe the basic concepts of IoT	Understand			
CO2	Apply the knowledge of IoT in commercial applications	Apply			
CO3	Apply the knowledge of communication network in IoT system management.	Apply			

CO4	Analyze various IoT security challenges to mitigate the related risks.	Analyze
CO5	Analyze the challenges in developing IoT applications	Analyze
CO6	Design IoT based real time applications	Create

TEXT BOOKS:

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things A Hands-On- Approach", 2014
2. 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.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving
4. World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

REFERENCES:

1. Parikshit N. Mahalle & Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things", ISBN 9780124076846, Academic Press 2014.

19UEC607	PRODUCT DEVELOPMENT PROJECT	L	T	P	C
		0	0	8	4
OBJECTIVES: <ul style="list-style-type: none"> To develop competency with a set of tools and methods for product design, manufacturing and marketing functions in creating a new product. 					
Project Description: <p>Product development is the process of delivering a new product or improving an existing product for customers. This course helps students to convert an idea into a product. Eight periods per week will be allotted in the time table and this time shall be utilized by the students to receive directions from the guide, for library reading, laboratory work, computer analysis and field work as assigned by the guide. There shall be periodical seminar presentations about the progress made in the project. The progress of the project is evaluated based on a minimum of three reviews.</p>					
TOTAL : 90 PERIODS					
COURSE OUTCOMES: <p>At the end of the course the student will be able to:</p>					
CO1	Design and develop sustainable innovative solutions for societal issues with consideration for public health, safety and environment.	Create - Cognitive Domain			
CO2	Analyze the market potential and evolve the product strategy	Analyze - Cognitive Domain			
CO3	Apply modern engineering and IT tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice	Apply - Cognitive Domain			
CO4	Test and evaluate the performance of the developed innovative product using appropriate techniques and tools	Evaluate- Cognitive Domain			
CO5	Organize effectively as a team for executing the project	Organize - Affective Domain			
CO6	Write effective reports and make clear presentations	Respond - Affective Domain			

19UEC608	VLSI DESIGN LABORATORY	L	T	P	C
		0	0	3	1.5
OBJECTIVES:					
<ul style="list-style-type: none"> To implement Verilog coding for combinational and sequential circuits To provide the knowledge of synthesis, simulation and generation of configuration file for combinational and sequential circuits 					
LIST OF EXPERIMENTS:					
<ol style="list-style-type: none"> Design an adder (min 8 bit) using HDL. Simulate using Xilinx software and implement by Xilinx FPGA Design a Multiplexer, demultiplexer using HDL. Simulate using Xilinx software and implement in Xilinx FPGA Design a multiplier (min 4 bit) using HDL. Simulate using Xilinx software and implement in Xilinx FPGA Design an ALU using HDL. Simulate using Xilinx software and implement in Xilinx FPGA Design a flip-flop using HDL. Simulate using Xilinx software and implement in Xilinx FPGA Design a Universal shift register using HDL. Simulate using Xilinx software and implement in Xilinx FPGA Design a finite state machine using HDL. Simulate using Xilinx software and implement in Xilinx FPGA Design a counter using HDL. Simulate using Xilinx software and implement in Xilinx FPGA Simulate minimum dimension CMOS inverter, NAND, NOR and XOR circuits using EDA tools. Design and simulate Static CMOS, Dynamic CMOS using EDA tool and also report the performance Design and simulate differential amplifier 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	Develop Verilog code for real time applications.	Create
CO4	Apply appropriate software tools to make measurements of physical quantities	Apply
CO5	Demonstrate proficiency in using discipline-specific tools	Apply
CO6	Function effectively as an individual for efficiently executing the given task	Organize

19UEC609	NETWORKS LABORATORY	L	T	P	C
		0	0	3	1.5
OBJECTIVES:					
<ul style="list-style-type: none"> 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:					
<ol style="list-style-type: none"> Ethernet LAN protocol Wireless LAN protocol Implementation and study of stop and wait protocol Implementation and study of Go back-N and selective repeat protocols Implementation of sliding window protocol Implementation of ARP / RARP Implementation of distance vector routing algorithm Implementation of Link state routing algorithm Implementation of Data encryption and decryption Implementation of network with CSMA / CA protocol and compare with CSMA/CD protocols. 					
TOTAL : 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Apply the knowledge of different routing algorithms to implement network layer routing	Apply			
CO2	Analyze the performance of LAN protocols	Analyze			
CO3	Design and simulate the given network to study the network performance using simulation software	Create			
CO4	Apply appropriate software tools to make measurements of physical quantities	Apply			
CO5	Demonstrate proficiency in using discipline-specific tools	Apply			
CO6	Function effectively as an individual for efficiently executing the given task	Organize			

19UGM631	INDIAN CONSTITUTION	L	T	P	C
		1	-	-	P/F
OBJECTIVES: <ul style="list-style-type: none"> 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 Ethicsl by Cengage Learning India Private Limited, 2018.
2. Subhash C. Kashyap, Our Constitution: An Introduction to India's Constitution and constitutional Lawl, NBT, 2018.
3. Brij Kishore Sharma, -Introduction to the Constitution of India I, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. M.V.Pylee, -An Introduction to Constitution of India I, Vikas Publishing,2002.
5. DurgaDas Basu, -Introduction to the Constitution on Indial, Prentice Hall, 2001.

SEMESTER VII

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	

19UME701	PROJECT MANAGEMENT AND FINANCE	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> 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:

1. Prasanna Chandra, –Fundamentals of Financial Management II, Tata Mcgraw - Hill Publishing Ltd, 2005.
2. Jack Meredith, Samuel J. Mantel,—Project Management-A Managerial Approach II, John Wiley and Sons

REFERENCES:

1. Clifford F Gray, Erik W Larson, —Project Management-The Managerial Process II, Tata Mcgraw- Hill Publishing Co. Ltd.
2. John M Nicholas, —Project Management for Business and Technology II, Prentice Hall of India Pvt. Ltd.
3. Paresh Shah, —Basic Financial Accounting for Management II, Oxford University Press, 2007.

19UEC702	OPTICAL AND MICROWAVE COMMUNICATION	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To familiarize the students about the basic elements of optical fiber transmission link, fiber modes, configurations and structures To explain the various optical sources and detectors To impart knowledge on optical network 					
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	Explain the concept of optical communication system.	Understand
CO2	Compare the different fabrication techniques used to construct microwave circuits.	Understand
CO3	Apply the fundamental principles of optics and light wave to design optical fiber communication systems.	Apply
CO4	Apply the knowledge of optical characteristics to compute the losses and error probability	Apply
CO5	Apply the knowledge of microwave devices for various microwave applications.	Apply
CO6	Analyze a microwave system for the given specifications.	Analyze

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 II, Pearson Education India, 3rd edition 2015

REFERENCES:

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

19UEC708	OPTICAL AND MICROWAVE COMMUNICATION LABORATORY	L	T	P	C
		0	0	2	1
OBJECTIVES: <ul style="list-style-type: none"> 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 Study of Microwave Test Bench Setup <ol style="list-style-type: none"> Reflex Klystron–Mode characteristics Gunn Diode–Characteristics Frequency and Wave Length Measurement Directional Coupler–Directivity and Coupling Coefficient–S–parameter measurement S-matrix Characterization of E-Plane T & H-Plane T. 					
OPTICAL EXPERIMENTS: <ol style="list-style-type: none"> DC characteristics of LED. Measurement of Losses in fiber optic communication. Fiber Optic Analog Link Numerical Aperture Determination for Fibers DC characteristics of LASER Diode. 					
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				Analyze
CO2	Analyze microwave components and circuits in terms of scattering parameters				Analyze
CO3	Evaluate the performance of optical fiber using analog and digital link.				Evaluate
CO4	Apply appropriate software tools to make measurements of physical quantities				Apply

CO5	Demonstrate proficiency in using discipline-specific tools	Apply
CO6	Function effectively as an individual for efficiently executing the given task	Organize

19UEC703	IMAGE PROCESSING AND MACHINE LEARNING	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To understand the basic concepts of digital image processing. To learn about image enhancement and segmentation techniques. To study the fundamental of machine learning concepts in pattern recognition. To get exposed to various applications of computer vision. 					
Unit – 1	IMAGE FORMATION AND IMAGE PROCESSING				9
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				9
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				9
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				9
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				9
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	State the fundamental concepts and transform domain operations associated with digital image processing	Understand			

CO2	Apply the mathematical concepts to enhance and compress to improve the quality of images	Apply
CO3	Analyze and utilize different image segmentation techniques	Analyze
CO4	Analyze different machine learning techniques used for pattern recognition	Analyze
CO5	Evaluate the performance of various machine learning algorithms used in computer vision applications	Evaluate
CO6	Simulate machine learning based pattern recognition algorithms using modern engineering tools	Modern Tools Usage

TEXT BOOKS:

1. Manas Kamal Bhuyan, "Computer Vision and Image Processing: Fundamentals and Applications," CRC Press, Taylor & Francis Group, 2020
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision," Cengage Learning, Fourth Edition, 2015.

REFERENCES:

1. Rafael C. Gonzalez, Richard. E. Woods, "Digital Image Processing," Pearson Education, 2003.
2. Anil K.Jain, "Fundamentals of Digital Image Processing" PH Education, 2003.
3. Kenneth R. Castleman, "Digital Image Processing," Pearson, 2006.
4. William K. Pratt, "Digital Image Processing," John Wiley, New York, 2002

19UEC709	IMAGE PROCESSING LABORATORY	L	T	P	C
		0	0	3	1.5
OBJECTIVES:					
<ul style="list-style-type: none"> To give hands on training to the students to understand the basic concept of digital image processing. To apply the image processing algorithms to real world problems. 					
LIST OF EXPERIMENTS:					
MICROWAVE EXPERIMENTS					
<ol style="list-style-type: none"> Display of color and gray scale images Conversion of images into different color spaces Mathematical operations on an image Histogram equalization Edge detections using standard operators DFT and DCT Filtering in Frequency domain DWT of images Segmentation using watershed transforms. Image Morphological operators. Medical Image Compression 					
TOTAL : 30 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Apply the knowledge of image processing concept to improve the quality of images	Apply			
CO2	Explore and perform image compression using different transforms	Apply			
CO3	Analyze the performance of different segmentation techniques	Analyze			
CO4	Apply appropriate software tools to make measurements of physical quantities	Apply			
CO5	Demonstrate proficiency in using discipline-specific tools	Apply			
CO6	Function effectively as an individual for efficiently executing the given task	Organize			

19UGM731	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
		2	0	0	P/F
OBJECTIVES:					
<ul style="list-style-type: none"> To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others 					
Unit – 1	HUMAN VALUES	7			
Morals- Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage - Valuing Time - Co-operation –Commitment – Empathy- self-Confidence –Character					
Unit – 2	ENGINEERING ETHICS	7			
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues –Uses of Ethical Theories					
Unit – 3	UNIVERSAL HARMONY	4			
Engineering Harmony in the family – Harmony in the society – Trust and Respect – Universal harmonious order					
Unit – 4	SAFETY, RESPONSIBILITIES AND RIGHTS	6			
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.					
Unit – 5	GLOBAL ISSUES	6			
Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development– Engineers as Managers – Consulting Engineers – Honesty – Moral Leadership – Sample Code of Conduct.					
TOTAL : 30 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.	Apply			
CO2	Illustrate the basic perception of profession, professional ethics and various m issues	Understand			

CO3	Describe the code of ethics and role of professional ethics in engineering field	Understand
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004. 2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003. 		
<p>REFERENCES</p> <ol style="list-style-type: none"> 1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004. 2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009. 3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001. 4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003 5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd. New Delhi, 2013. 6. World Community Service Centre, 'Value Education', Vethathiri publications, Erode, 2011. 		

SEMESTER VIII

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	

19UEC801	PROJECTWORK	L	T	P	C
		0	0	16	8
OBJECTIVES:					
<ul style="list-style-type: none"> 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

SI.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 (Industry Designed)	3	0	0	3

19UEC901	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the fundamental concepts in Artificial Intelligence. To impart the make the students to apply the artificial intelligence techniques in applications which involve perception, reasoning and learning. To give an idea about the basics of designing intelligent agents that can solve general purpose problems. 					
Unit – 1	PROBLEM SOLVING				9
Introduction – Agents, Problem formulation, Uninformed search strategies, Heuristics–informed search strategies.					
Unit – 2	LOGICAL REASONING				9
Logical agents, Propositional Logic, Inferences, First-Order Logic, Inferences in First Order, Logic, Forward Chaining, Backward Chaining, Unification, Resolution					
Unit – 3	PLANNING				9
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				9
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				9
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	Describe the basic concepts of Artificial Intelligence.	Understand			
CO2	Apply the basic principles of AI in solutions that require problem solving and learning.	Apply			
CO3	Analyze the various planning methods in intelligence systems.	Analyze			
CO4	Apply the knowledge of Bayesian networks under uncertain environment.	Apply			
CO5	Apply learning algorithms to derive facts from the given data set.	Apply			
CO6	Analyze the various reinforcement Learning in intelligence systems	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 II, Second Edition, Pearson Education,2003.

REFERENCES:

1. David Poole, Alan Mackworth, Randy Goebel, Computational Intelligence: a logical approachII, Oxford University Press,2004.
2. G. Luger, —Artificial Intelligence: Structures and Strategies for complex problem solvingII, 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:					
<ul style="list-style-type: none"> 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 Hatten berg 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	Discuss the various concepts of motion control and statics				Apply
CO3	Apply the knowledge of the dynamics in robotics control				Apply
CO4	Analyze the various path planning techniques in robotics				Analyze
CO5	Apply the knowledge of basic programming for various controls on robots.				Apply
CO6	Evaluate the manipulator differential motion and various path planning techniques in robotics.				Evaluate

TEXT BOOKS:

1. R.K. Mittal and J. Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.
2. Mikell P. Groover, Mitchell 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. Daniel Hunt, —Smart Robots, Chapman 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: <ul style="list-style-type: none"> 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, cross correlation 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 noise label tissue types, extract brain contours, and visualize 3- D anatomical structures: 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:					
<ul style="list-style-type: none"> To introduce the concept of open loop and closed loop (feedback) systems To provide knowledge of time domain and frequency domain analysis of control systems 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:		
<ol style="list-style-type: none"> 1. M.Gopal, —Control System—Principles and DesignII, TataMcGrawHill,4th Edition, 2012. 2. J.Nagrath and M.Gopal,—Control System Engineering II,New Age International Publishers, 5th Edition,2009. 		
REFERENCES:		
<ol style="list-style-type: none"> 1. Norman S. Nise, Control Systems Engineering, 6th edition, Wiley,2011. 2. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 12th Edition, Prentice Hall, 2011. 3. Benjamin.C. Kuo, IIAutomatic control systems II, Prentice Hall of India,6th Edition,2013 		

19UEC905	5G TECHNOLOGY	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To explain the basic concepts of 5G Technology. To impart knowledge on RF, PHY, MAC to support 5G. To impart knowledge on various multiple access techniques for 5G communications. 					
Unit – 1	OVERVIEW OF 5G BROADBAND WIRELESS COMMUNICATIONS				9
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				9
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				9
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				9
Introduction – High level requirements for 5G architecture –Fundamentals architecture and 5G flexibility – Physical Architecture and 5G deployment.					
Unit – 5	5G SPECTRUM				9
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 perspective					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Explain the 5G Technology advances and their benefits				Understand
CO2	Explain the basic concepts of 5G Architecture.				Understand
CO3	Apply the knowledge of RF, PHY, MAC and air interface changes required to support 5G				Apply
CO4	Analyze the various multiple access techniques for 5G communications.				Analyze
CO5	Analyze the propagation scenarios and challenges in the 5G modeling				Analyze
CO6	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. 4th Edition
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, 2015.

REFERENCES:

1. Fundamentals of 5G mobile Networks, edited by Jonathan RodisQuez and Wiley
2. 5G Mobile and Wireless Communications Technology by 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:					
<ul style="list-style-type: none"> To introduce ARM fundamentals. To impart knowledge on ARM language and organization. To introduce the hardware architecture support and instruction set. 					
Unit-1	ARM EMBEDDED SYSTEM FUNDAMENTALS				9
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				9
Architecture, Registers, operating Modes, Exception and interrupts, vector table, Stack memory operations, Instruction set, Bus Interfaces, Interrupt Behavior					
Unit-3	MEMORY SYSTEMS				9
Memory hierarchy and cache memory, Cache Architecture, ARM MMU, Page Tables, Translation Look aside buffer, Cache and write Buffer, Coprocessor15 and MMU configuration					
Unit-4	ARM PROGRAMMING				9
Efficient C programming, ARM assembly code writing, FIIR and IIR filter design					
Unit-5	SYSTEM DEBUGGING				9
Debugging feature, Core sight overview, Debug modes and events, Break points in the CortexM3, Accessing Registers, Debugging Components					
TOTAL:45PERIODS					
COURSEOUTCOMES:					
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	Analyze the different types of programming mode for ARM and Cortex M3 systems				Analyze
CO4	Validate 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 using LabVIEW				Modern Tool Usage

TEXTBOOKS:

1. ARM System Developer 's Guide, Designing and Optimizing system software, Elsevier,2008, AndrewN Sloss, DominicSymes, ChrisWright.
2. The Definitive Guide to the ARM@Cortex-M3, Second Edition, Joseph Yiu.

REFERENCES:

1. ARM system on chip architecture, Steve Furber, Addison Wesley,2000
2. Assembly language Programming ARM Cortex-M3, Vincent Mahout, Wiley,2013

19UEC907	REAL TIME SYSTEM DESIGN	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce about the real time system concepts To impart knowledge about software and hardware requirements To make students to learn about software system design and optimization techniques 					
Unit-1	BASIC REAL-TIME CONCEPTS				9
Terminology - Systems Concepts, Real-Time Definitions, Events and Determinism, CPU Utilization. Real-Time System Design Issues, Example Real-Time Systems, Common Misconceptions. Brief History- Theoretical Advances, Early Systems, Hardware Developments, Early Software, Commercial Operating System Support.					
Unit-2	HARDWARE CONSIDERATIONS				9
Basic Architecture, Hardware Interfacing, Central Processing, Memory, Input/Output, Enhancing Performance, Other Special Devices, Non-von-Neumann Architectures					
Unit-3	SOFTWARE REQUIREMENTS ENGINEERING				9
Requirements-Engineering process, Types of Requirements, Requirements Specification for Real-Time Systems, Formal Methods in Software Specification, Structured Analysis and Design, Object-Oriented Analysis and the Unified Modeling Language, Organizing the Requirements Document, Organizing and Writing Requirements, Requirements Validation and Review					
Unit-4	SOFTWARE SYSTEM DESIGN				9
Properties of Software, Basic Software Engineering Principles, The Design Activity, Procedural-Oriented Design, Object-Oriented Design					
Unit-5	PERFORMANCE ANALYSIS AND OPTIMIZATION				9
Theoretical Preliminaries, Performance Analysis, Application of Queuing Theory, I/O Performance, Performance Optimization, Analysis of Memory Requirements, Reducing Memory Utilization					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Explain the concepts of real time system design				Understand
CO2	Explain the software and hardware requirements to design real time system design				Understand
CO3	Apply the knowledge of software and hardware requirements for system design				Apply
CO4	Apply the unified modelling language to design a system for real time applications				Apply
CO5	Analyze the performance of system design using various methods				Analyze
CO6	Design a real time system for a defined specification				Create

TEXT BOOKS:

1. Phillip A. Laplante, Real-Time Systems Design and Analysis, A John Wiley & Sons, Inc., Publication, IEEE Press, Third Edition 2013.

REFERENCES:

1. Phillip A. Laplante, Seppo J. Ovaska, Real-Time Systems Design and Analysis: Tools For The Practitioner, 4th Edition, Wiley-IEEE Press, November 2011

19UEC908	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce soft computing concepts. To explain the concepts of artificial neural network and fuzzy logic. To impart knowledge on optimization and genetic algorithms. 					
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 GA-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	Explain the difference between learning and programming and explore practical applications of Neural Networks	Understand			
CO2	Analyze the applications which can use fuzzy logic.	Analyze			
CO3	Apply the concepts of mathematical theory to design the Fuzzy Inference Systems	Apply			
CO4	Apply the optimization methods for its use in computer engineering fields and other domains	Apply			

CO5	Apply the traditional genetic algorithms for various applications.	Apply
CO6	Simulate Artificial Intelligence algorithms for real time applications	Apply

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. Rajasekar Anand G.A.V. Pai, —Neural Networks, Fuzzy Logic and Genetic Algorithms II, PHI 2010.
4. Kaushik Kumar, Supriyo Roy, J. Paulo Davim, II Soft Computing Techniques for Engineering Optimization II CRC Press, 2019

19UEC909	IMAGE ANALYSIS AND VIDEO PROCESSING	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the basic concepts of image analysis and image transforms To address how efficiently image can be restored and classified To impart the knowledge on video formation and motion analysis 					
UNIT 1	INTRODUCTION TO IMAGE ANALYSIS AND IMAGE TRANSFORMS				9
Introduction to Image Analysis and Visualisation, Course Objective and Outcomes, Review on Image Processing, Space- Order Statistics Filter, Frequency- Image Transforms– Fourier, Haar, Slant, Wavelet, Restoration-Blind Deconvolution, Weiner Filtering, Inverse Filtering, Spatio-Spectral- Wavelet, Ridgelet, Curvelet					
UNIT II	SEGMENTATION				9
Color, Histogram, Cluster and Morphology based segmentation					
UNIT III	CLASSIFICATION				9
Probabilistic Classifiers - Navie Bayes Classifier, Logistic Regression, Deterministic Classifiers - KNN Classifier and 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
Motion Detection – Hypothesis testing with Fixed/Adaptive thresholding 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	Examine different transforms and analyze their merits and demerits with specific image processing applications				Apply
CO2	Apply various restoration techniques in spatial domain as well as in frequency domain for image enhancement				Apply
CO3	Select and apply deterministic or probabilistic classifiers for image analysis				Analyze
CO4	Demonstrate how digital videos are acquired, stored, different video file formats and spatio-temporal imagery				Understand
CO5	Perform techniques for motion analysis such as motion detection, estimation and compensation.				Apply
CO6	Compare image analysis techniques and classifiers for real world image processing applications				Analyze

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

REFERENCES:

1. A.K. Jain, Fundamentals of Digital Image Processing, Prentice- I, 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: <ul style="list-style-type: none"> To understand the basic concepts of multimedia components. To be well known to the compression techniques. To understand the knowledge of VoIP technology. 					
UNIT 1	MULTIMEDIA COMMUNICATIONS				9
Introduction: Multimedia information, Multimedia networks Multimedia applications, Application, 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
VoIP Components, Voice Quality, Measuring Voice Quality, Testing VoIP, Case Studies VoIP Applications VoIP: Present and Future					
UNIT V	MULTIMEDIA NETWORKING				9
Multimedia networking, Applications, streamed stored and audio-making the best Effort service, Voice-over IP, Protocols for real time interactive Applications-distributing multimedia-beyond best effort service, Scheduling Mechanisms 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	Explain the compression techniques for different applications.	Understand			
CO2	Apply various predictive coding techniques for audio and video applications	Apply			
CO3	Apply the applications of modern multimedia compression techniques in the development of new wireless communication protocols.	Apply			
CO4	Analyze the performance metrics of various compression techniques	Analyze			
CO5	Analyze the QOS mechanisms for real-time online multimedia systems	Analyze			
CO6	Simulate Image Compression techniques for different images using MATLAB	Modern Tool Usage			

TEXT BOOKS:

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

REFERENCES:

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

19UEC911	IOT ARCHITECTURE AND PROTOCOLS	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce IoT and its applications To understand the concepts of IoT Architecture To analyze various IoT Application layer Protocols To impart knowledge on IoT-based system design 					
Unit – 1	INTRODUCTION TO IoT				9
Introduction to IOT, Sensing & Actuation Sensor Networks Design principles of connected devices IoT Architecture: Reference Models Physical design of IoT Logical design of IoT					
Unit – 2	IoT ARCHITECTURE				9
The IoT Architectural Reference Model as Enabler, IoT in Practice, IoT in Logistics and Health, IoT Reference Model: Domain, information, functional and communication models					
Unit – 3	IoT PROTOCOLS				9
IoT Reference Architecture: Architecture, Functional, information, deployment and operation views; SOA based Architecture, API-based Architecture, OPEN IoT Architecture for IoT/Cloud Convergence.					
Unit – 4	APPLICATION PROTOCOLS FOR IoT				9
Application Protocols for IoT: UPnP, CoAP, MQTT, XMPP. SCADA, Web Socket; IP-based protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4.					
Unit – 5	IoT BASED SYSTEMS				9
Case study: Cloud-Based Smart-Facilities Management, Healthcare, Environment Monitoring System.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Comprehend the essentials of IoT and its applications	Understand			
CO2	Understand the concepts of IoT Architecture Reference model and IoT reference architecture	Understand			
CO3	Analyze various IoT Application layer Protocols.	Analyze			
CO4	Apply the architecture concept in IoT to IP based protocols and Authentication Protocols for IoT	Apply			
CO5	Analyze the real time use of various IoT protocols	Analyze			
CO6	Design IoT-based systems for real-world problems.	Create			
TEXT BOOKS:					
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.					

REFERENCES:

1. Bassi, Alessandro, et al, "Enabling things to talk", Springer-Verlag Berlin An, 2016.
2. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011.
3. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

19UEC912	RF CIRCUIT DESIGN	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the fundamental Rf circuit design techniques. To impart knowledge on impedance matching networks. To explain the concepts of filters and Rf amplifier design. 					
UNIT I	MATCHING NETWORK	9			
Introduction, A valuable graphical aid: the smith chart, derivation and its types -The normalized 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. Integrated 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	Explain the basic concepts of matching networks.	Understand			
CO2	Apply the knowledge of RF circuits to design Low Power RF Amplifiers	Apply			
CO3	Apply the knowledge of RF circuits to design 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.	Apply
CO6	Evaluate matching networks using smith chart.	Evaluate
TOTAL: 45 PERIODS		
TEXT BOOKS:		
<ol style="list-style-type: none"> 1. Matthew M. Radmanesh, "Radio frequency and Microwave Electronics Illustrated", Pearson Education Asia, 2001. 2. David M Pozar: Microwave and RF design of wireless systems, John Wiley & Sons, 2001. 		
REFERENCES:		
<ol style="list-style-type: none"> 1. David M. Pozar," Microwave Engineering," John Wiley & Sons, Fourth Edition, 2015. 2. 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:						
<ul style="list-style-type: none"> To introduce the concept of Micro and Nano electromechanical devices. To know the fabrication process of micro system. To impart the knowledge in design of micro sensors and micro actuators. To gain knowledge on quantum mechanics and NANO systems. 						
UNIT 1	INTRODUCTION TO MEMS AND NEMS					9
New trends in Engineering and Science: Micro and Nano scale 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	MEMS FABRICATION TECHNOLOGY					9
Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA						
UNIT III	MICRO SENSOR					9
MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester						
UNIT IV	MICRO ACTUATORS					9
Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Micromechanical Motors and pumps.						
UNIT V	NANO DEVICES					9
Atomic Structures and Quantum Mechanics, Schrodinger 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	Describe the basic principles of MEMS					Understand
CO2	Apply the fundamental technological concepts in MEMS to fabricate the MEMS devices					Apply
CO3	Analyze the performance of electro mechanical transducers like sensors and actuators.					Analyze
CO4	Analyze the various applications of Micro Actuators					Analyze
CO5	Evaluate the theoretical foundations of quantum mechanics and Nano systems.					Evaluate
CO6	Design of micro devices, micro systems using the MEMS fabrication process					Create

TEXT BOOKS:

1. Marc Madou, —Fundamentals of Micro fabricationII, CRC press1997.
2. Stephen D.Senturia, IIMicrosystem DesignII, Kluwer AcademicPublishers,2001

REFERENCES

1. Chang Liu,—FoundationsofMEMSII,PearsoneducationIndialimited,2006.
2. Tai RanHsu,II MEMS and Microsystems Design and ManufactureII ,TataMcrawHill, 2002.
3. Sergey Edward Lyshevski, —MEMS and NEMS: Systems, Devices, and Structures II CRC Press, 2002

19UEC914	AI IN VLSI DESIGN AUTOMATION	L	T	P	C
		3	0	0	3
OBJECTIVES: <ul style="list-style-type: none"> • Understand the concepts of Artificial Intelligence in VLSI Design Automation • To study about various AI and search process • To gain knowledge in evolutionary computation techniques • Employ AI Technique to solve some of today's real-World Problems. 					
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, Brute force 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	Describe the relevant aspects of Artificial Intelligence and their applications.	Understand			
CO2	Apply the basic knowledge of Artificial Intelligence to determine the Brute force search techniques.	Apply			
CO3	Apply appropriate architectures for solving, modeling, optimizing and automizing VLSI design related options.	Apply			
CO4	Apply Genetic Algorithm for solving engineering problems.	Apply			
CO5	Apply principles for the design of Particle Swarm Optimization	Apply			
CO6	Analyze various optimization algorithms for classification, pattern recognition, and optimization problems.	Analyze			

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

REFERENCES:

1. Patrick Henry Winston, —Artificial Intelligencell, AddisonWesley,2000
2. Luger GeorgeF and Stubblefield William A, —Artificial Intelligence: Structures and Strategies for Complex Problem Solvingll, Pearson Education, 2002.
3. KwangY. 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:					
<ul style="list-style-type: none"> • 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 sensors – 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, Microelectrodes, 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 Fibro sensors, 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. JohnG.Webster,AmitJ.Nimunkar,—MedicalInstrumentation-Application and Design II, Fifth Edition, JohnWileyandSons,2020
2. Roberts. H. Istepanian and Bryan Woodward, —m-Health Fundamentals and ApplicationsII, Wiley,2017
3. Subhas Chandra Mukhopadhyay and Aime Lay-Ekuakille, —Advances in Biomedical Sensing, Measurements, Instrumentation and Systems II, Springer,2010

REFERENCES:

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

19UEC916	SATELLITE COMMUNICATION PRINCIPLES AND APPLICATIONS	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To understand the basics of satellite, orbits. To understand the satellite segment and earths 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, Radar sat 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:		
<ol style="list-style-type: none"> 1. Dennis Roddy, Satellite Communications, Fourth Edition, McGraw-Hill,2017 2. Timothy Pratt, Jeremy Allnut Emeritus, Satellite Communications, Third Edition, Wiley,2020 		
REFERENCES:		
<ol style="list-style-type: none"> 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:					
<ul style="list-style-type: none"> • Understand the anatomy and physiology of acoustic prediction 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
Homomorphic 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 and3))
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. (Module5)
4. Dr. Shaila Apte- —Speech and audio processingII, 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:					
<ul style="list-style-type: none"> • 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 and Passive Remote Sensing, Platforms, Aerial and Space Platforms, Balloons, Helicopters, Aircraft and Satellites, Synoptivity and Repetivity, Electro Magnetic Radiation (EMR) – EMR spectrum, Visible, Infra-Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation, Planck ‘s law – Stefan-Boltzmann 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	OPTICAL AND 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 and Vector 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 ApplicationsII, Narosa Publishing House, first edition 2001.
2. Reddy, Anji., M., IITextbook of Remote Sensing and Geographical Information SystemsII 3rd Edition, BS Publications, Hyderabad, India,2006.

REFERENCES:

1. Jensen, J.R, —Remote sensing of the environmentII, PrenticeHall,2000.
2. Kang-Tsung Chang, —Introduction to Geographic Information SystemsII, Tata McGraw Hill,2002.
3. Lilles and. and Kiefer R.W, —Remote Sensing and Image Interpretation II, John Wiley and Sons, Inc, New York,1987.
4. Burrough P A, —Principle of GIS for land resource assessmentII, Oxford Mischael Hord, 1986

19UEC919	NANO ELECTRONICS	L	T	P	C
		3	0	0	3
OBJECTIVES: <ul style="list-style-type: none"> • To introduce the concept of Nano electronics, Nano devices and molecular electronics. • To explain the properties of Nano particles, Carbon nanostructures. • To Understand the recent trends in Nano electronics and its applications. 					
Unit – 1	INTRODUCTION TO NANO ELECTRONICS				9
Nano electronics in recent scenario - Crystal Structure –Semiconductors-Band theory– Donors - Acceptors and Deep traps, Mobility – Excitons, one dimensional, two-dimensional, three-dimensional Nano structured materials, metal Oxides-Physical, Chemical and Optical properties.					
Unit – 2	SYNTHESIS AND PREPARATION OF NANOMATERIALS				9
Top-down Approaches-Grinding, high energy ball milling, Injection Molding-Bottom-up Approaches-Sol-gel, Self-assembled monolayer, Physical and Chemical vapour deposition, thin films, epitaxy-Lithography.					
Unit – 3	NANO MATERIALS CHARACTERIZATION				9
X-ray diffraction, Powder diffraction, Structural analysis, Scanning Electron Microscopy, FESEM, AFM, Transmission Electron Microscope, Spectroscopic techniques: UV-Visible, Infra-red Spectroscopy, rotational, vibrational photoluminescence (PL).					
Unit – 4	CARBON NANOSTRUCTURES				9
Introduction, Carbon Molecules – Nature of the Carbon Bond, New Carbon Structures, Carbon Clusters – Small Carbon Clusters, Alkali-Doped C60 – Superconductivity in C60 – Larger and Smaller Fullerenes – Other Buckyballs, Carbon Nanotubes – Fabrication – Structure – Electrical Properties – Vibrational Properties, Mechanical Properties, Graphene, Application of Carbon Nanotubes – Field Emission and Shielding –Computers – Fuel Cells – Chemical Sensors – Catalysis – Mechanical Reinforcement.					
Unit – 5	NANO DEVICES				9
Microelectromechanical systems (MEMSs), Nanoelectromechanical systems (NEMSs), Fabrication- Nanodevices and Nanomachines, Molecular and Supramolecular switches- Spintronics- Nano Crystals devices-Graphene based Liquid Crystal devices, Nano electronics in Energy- Nano sensors for biomedical applications- Nano biometrics - Nanobots- Smart dust sensor for the future, Nano medicine.					
TOTAL: 45 PERIODS					

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

CO1	Explain the concept of Nanomaterial	Understand
CO2	Describe the fundamentals of Nanostructures	Understand
CO3	Apply the knowledge of spatial distribution of molecules to determine the density of the Nanoparticles.	Apply
CO4	Apply the knowledge of Nanomaterials to determine the parameters of Carbon Nanotubes.	Apply
CO5	Apply the knowledge of Top down and Bottom-up approaches to prepare the Nanomaterials.	Apply
CO6	Analyze the various properties of the Nano structures in terms of its application.	Analyze

TEXT BOOKS:

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

REFERENCES:

1. George W. Hanson, “Fundamentals of Nanoelectronics”, Prentice Hall ,2008.
2. 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:					
<ul style="list-style-type: none"> To introduce the concept of adaptive and smart antennas. To impart knowledge about array fundamentals and Beam forming techniques. To familiarize the students with simulation of antennas. 					
Unit – 1	INTRODUCTION-SMART ANTENNAS				9
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				9
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				9
Linear arrays, Array Weighting, Circular Arrays, Rectangular Planar Arrays, Fixed beam arrays, Fixed side lobe cancelling, Retrodirective Arrays					
Unit – 4	ADAPTIVE BEAMFORMING TECHNIQUES				9
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				9
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, to predict the received 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	Create			
CO6	Design Planar antennas using CST software	Apply			

TEXT BOOKS:

1. Frank Gross, "Smart Antennas for wireless Communication", McGraw-Hill, 2006.
2. S.Chandran,"Adaptive antenna arrays, trends and applications", Springer, 2009.
3. 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:					
<ul style="list-style-type: none"> To introduce the basic concept of Software Radio Aspects To impart the knowledge of Cognitive Radio and Networks To introduce the different spectrum sensing technique for Cognitive Radio and Networks 					
Unit-1	SOFTWARE RADIO				9
Software Radio Aspects, the Software Communications Architecture (SCA), the Operating Environment, the SCA Specification Structure					
Unit-2	COGNITIVE RADIO AND NETWORKS				9
Cognitive Radio - Introduction to cognitive radios, Economics of cognitive Radio-spectrum awareness, spectrum sub leasing, spectrum sharing, Cognitive Networks - Motivation & Requirements, Related works in cognitive radio, Cognitive Radio implementation.					
Unit-3	COGNITIVE RADIO ARCHITECTURE (CRA)				9
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				9
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				9
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	Explain the concept of Software Defined Radio and Cognitive Radio				Understand
CO2	Apply appropriate techniques for the development of scientific and technological knowledge in designing software defined radios				Apply
CO3	Apply the Knowledge of Cognitive Radio design methodologies for wireless applications.				Apply
CO4	Analyze the Spectrum Access of Cognitive Radio				Analyze
CO5	Analyze the different cognitive radio techniques for spectrum Holes detection				Analyze

CO6	Compare the various sensing techniques in cognitive radio networks using MATLAB	Modern tool usage
<p>TEXTBOOKS:</p> <ol style="list-style-type: none"> 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 Systemsll, Springer,2007. 		
<p>REFERENCES:</p> <ol style="list-style-type: none"> 1. Ekram Hossain, Dusit Niyato, Zhu Han, —Dynamic Spectrum Access and Management in Cognitive Radio Networksll, Cambridge University Press, 2009. 2. Kwang-Cheng Chen, Ramjee Prasad, —Cognitive Radio Networksll, John Wiley & Sons Ltd., 2009. 3. Bruce Fette, —Cognitive Radio Technology - Second Editionll, Elsevier, 2009. 		

19UEC922	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To understand the different types of electrodes and its placement for various recordings To design bio amplifier for various physiological recordings To learn the different measurement techniques for non-physiological parameters. 					
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 flowmeters.					
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 Tomography: 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 Equipment: Principle, block schematic diagram, working and applications of: Pacemakers. Defibrillators Ventilators. Patient Safety: Electric shock hazards, leakage current, safety codes for electro medical equipment					
TOTAL: 45 PERIODS					

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

CO1	Explain the philosophy of biomedical measuring instruments.	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 biomedical Signals Using MATLAB simulation software	Analyze
CO5	Understand working principle of the medical assistance/techniques, robotic and therapeutic equipment	Understand
CO6	Analyze the performance of traditional and modern medical instrumentation using case studies	Apply

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:					
<ul style="list-style-type: none"> To study the design flow of different types of ASIC. To familiarize the different types of programming technologies and logic devices. To learn the architecture of different types of FPGA. 					
Unit – 1	OVERVIEW OF ASIC AND PLD	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	ASIC PHYSICAL DESIGN	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	LOGIC SYNTHESIS, SIMULATION AND TESTING	9			
Design systems - Logic Synthesis, Half gate ASIC -Schematic entry - Low level design language, PLA tools -EDIF- CFI design representation					
Unit – 4	FPGA	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	SOC DESIGN	9			
Design Methodologies – Processes and Flows - Embedded software development for SOC –Techniques for SOC Testing – Configurable SOC – Hardware / Software co-design Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB.					
TOTAL: 45 PERIODS					
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.	Understand			
CO2	Describe the basics of System on Chip and on chip communication architectures.	Understand			
CO3	Design a digital circuit with ASIC design flow steps.	Apply			
CO4	Apply the various partitioning algorithms to different digital networks.	Apply			
CO5	Analyze the high-performance algorithms available for ASICs	Analyze			
CO6	Analyze the various routing algorithms for IC fabrication	Analyze			
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. Farzad Nekoogar and Faranak Nekoogar, —From ASICs to SOCs: A Practical ApproachII, Prentice Hall PTR, 2003.					
REFERENCES:					
1. S. Trimmerger, 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					

19UEC924	CYBER PHYSICAL SYSTEM	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To explain the concept of Cyber Physical Systems To explain the concept of Synchronous Model and Asynchronous Model To explain the concept of Dynamical Systems 					
UNIT 1	INTRODUCTION TO CYBER PHYSICAL SYSTEMS	9			
Introduction, Cyber Physical System Requirements, Emergence of CPS, Cyber physical system on wireless sensor network, Key design drivers and quality attributes					
UNIT 2	SYNCHRONOUS MODEL	9			
Introduction, Reactive Components, Properties of Components, Composing Components, Synchronous Designs					
UNIT 3	ASYNCHRONOUS MODEL	9			
Introduction, Asynchronous Processes, Asynchronous Design Primitives, Asynchronous Coordination Protocols, Safety Specifications					
UNIT 4	DYNAMICAL SYSTEMS	9			
Introduction, Continuous-Time Models, Linear Systems, Designing Controllers, Analysis Techniques					
UNIT 5	HYBRID SYSTEMS	9			
Introduction, Hybrid Dynamical Models, Designing Hybrid Systems, Linear Hybrid Automata, Future work and Challenges					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Explain the basics concept of cyber physical systems	Understand			
CO2	Design synchronous models for Real Time applications	Apply			
CO3	Design Asynchronous models for Real Time applications	Apply			
CO4	Develop Deep Understanding on selection of hardware and software for designing dynamical systems	Analyze			
CO5	Come up with cost effective, reliable, robust and feasible designs for real world problems	Analyze			
CO6	Implement cyber physical system and address the problems and limitations for real world problems	Evaluate			
TEXT BOOKS:					
<ol style="list-style-type: none"> Rajeev Alur, Principles of Cyber Physical Systems, 1st Edition, MIT Press 2015. Raj Rajkumar, "Cyber Physical Systems," 2nd Edition, Elsevier 2015 					
REFERENCES:					
<ol style="list-style-type: none"> Edward D Lamie, "Computing Fundamentals of Cyber Physical Systems" ,2nd Edition, Newnes Elsevier Publication. E. A. Lee and S. A. Seshia, "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", 2011. 					

19UEC925	BLOCK CHAIN (Industry Desiged)	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To describe Blockchain's fundamental components, and examine decentralization using blockchain. To introduce the components of Ethereum and Programming Languages for Ethereum, Hyperledger and Web3. To impart the knowledge on working of cryptocurrency 					
UNIT 1	INTRODUCTION TO BLOCKCHAIN				9
History of Block Chain- Introduction to Block chain- Types of Block Chain- Consensus-Decentralization using Block Chain- Blockchain and Full Ecosystem Decentralization- Platforms for Decentralization					
UNIT II	INTRODUCTION TO CRYPTO CURRENCY				9
Bitcoin – Digital Keys and Addresses- Transactions – Mining- Bitcoin Networks and Payments – Wallets- Alternative Coins- Theoretical Limitations - Bitcoin limitations- Name coin – Prime coin- Zcash Smart Contracts – Ricardian Contracts					
UNIT III	ETHEREUM				9
The Ethereum Network- Components of Ethereum Ecosystem- Ethereum Programming Languages: Runtime, Byte Code- Blocks and Blockchain- Fee Schedule- Supporting Protocols					
UNIT IV	WEB3 AND HYPERLEDGER				9
Introduction to Web3- POST Requests- Development Frameworks- Hyperledger as a Protocol - The Reference Architecture- Hyperledger Fabric - Distributed Ledger- Corda					
UNIT V	ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS				9
Kadena – Ripple – Rootstock – Quorum-tender mint - Other Challenges– Scalability – Privacy- Blockchain Research- Notable Projects- Miscellaneous Tools.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Explain the technology components of Blockchain and how it works behind the scenes.				Understand
CO2	Apply the concept of blockchain technology in real time applications				Apply
CO3	Apply Hyperledger Fabric and Ethereum platform to implement the Block chain Application				Apply
CO4	Apply the knowledge acquired in blockchain in developing decentralized applications				Apply
CO5	Analyze alternative Blockchains and emerging trends in Blockchain				Analyze
CO6	Analyze major research challenges and technical gaps existing between theoretical and practical application of crypto currency domain				Analyze

TEXT BOOKS:

1. Imran Bashir, "Mastering Blockchain Distributed ledger technology, decentralization, and smart contracts", 2017.
2. Antonopoulos, Andreas M, "Mastering bitcoin unlocking digital crypto currencies", 2014.

REFERENCES:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies a Comprehensive Introduction", 2016
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain by Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger",2018

19UEC926	SENSORS FOR IoT	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce about the fundamentals of sensors and various topologies and types used in sensors To explain the basic sensing techniques in SloT and wearable sensors To impart knowledge on Software tool used in analysis of sensors in IoT 					
Unit – 1	IOT SENSING AND ACTUATION				9
Evolution of IoT, IoT Networking Components, Introduction to Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuators Types, Actuator Characteristics, Data Formats					
Unit – 2	IOT PROCESSING TOPOLOGIES AND TYPES				9
Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading, Offload location, Offload decision making, Offloading considerations, IEEE 802.15.4, Zigbee, Bluetooth, LoRa, NB-IoT					
Unit – 3	SENSING PRINCIPLES AND WIRELESS SENSOR NETWORK				7
Anatomy of Sensors, Physical Principles of Sensing, Use of Basic Sensing Principles in RFID Technology, Wireless Sensor Networks (WSNs), WSN Operating Systems, WSN OS Design Issues					
Unit – 4	SloT and WERABLE SENSORS				9
Social IoT, Smart Things to Social Things, The Epitome of SloT, Smart Thing Relationships in SloT, SloT Architecture, Features of SloT System, Social Internet of Vehicles (SloV), SloV Application Services, World of Wearables, Attributes of wearables, Textiles and Clothing: The Meta-Wearable, Challenges and Future Wearables					
Unit – 5	PACKET TRACER AND IOT				11
IoT and Packet Tracer, Packet Tracer Programming Environment, Visual (Blockly) Programming Language, Simple Smart Light Project, IoT Projects in Packet Tracer, Smart Things Directly Connected with Gateways, Smart Things and Sensors Directly Connected with MCUs (Without Gateways)					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Describe the characteristics of sensors and actuators				Understand
CO2	Explain the fundamental concepts of IoT Packet tracer software tool				Understand
CO3	Apply the various properties of sensors to process the devices in IoT and SloT				Apply
CO4	Analyze different types of sensors with respect to WSN and RFID				Analyze
CO5	Assess the function of various sensors.				Apply
CO6	Analyze various IoT system to solve real world problems using sensors.				Analyze

TEXT BOOKS:

1. Sudip Mishra, Anandarup Mukherjee, Arijit Roy: Introduction to IOT, Cambridge University Press,2014
2. Muhammad Azhar Iqbal, Sajjad Hussain, Huanlai Xing, Muhammad Alilmran, Enabling the Internet of Things, IEEEPress, John Wiley & Sons,2021.

REFERENCES:

1. Hiroto Yasuura, Smart Sensors at the IoT Frontier ,1st ed. 2018
2. Edward Sazonov, Michael R. Neuman, Wearable Sensors Fundamentals, Implementation and Applications, Academic Press,2014

19UEC927	SMART SENSOR NETWORKS	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce basic concepts of Sensor Networks To understand the knowledge of programming in Sensor Networks To explain the Applications in Communication fields 					
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	Explain the basics concepts of Sensor Networks.	Understand			
CO2	Describe the technology involved in Wireless Sensor Network.	Understand			
CO3	Apply the knowledge of programming in Sensor Network for various sensor network applications	Apply			
CO4	Apply the knowledge of WSN Architecture to develop various applications.	Apply			
CO5	Analyze the performance of various Communication protocols.	Analyze			
CO6	Analyze the performance of various Securities protocol in WSN	Analyze			
TEXT BOOKS:					
<ol style="list-style-type: none"> Mohammad Ilyas, Imad Mahgoub - Smart Dust- Sensor Network Applications, Architecture and Design Fatos Xhafa, Fang-Yie Leu and Li-Ling Hung, "Smart Sensor Networks – Communication technologies and Intelligent Application 					

REFERENCES:

1. Luger George F and Stubblefield William A, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, 2002.
2. Sensors and Transducers Characteristics, Applications, Instrumentation, Interfacing M. J. Usher and D.A. Keating

19UEC928	TELE MEDICINE (Industry Desiged)	L	T	P	C
		3	0	0	3
OBJECTIVES: <ul style="list-style-type: none"> • Explain basic parts of Teleradiology Systems like Image Acquisition System, Display System, Communication Network, Interpretation. • Impart the need of Various Communication Networks, Antennas in Designing the Telemedicine System 					
Unit – 1	INTRODUCTION TO TELE MEDICINE	9			
History and Evolution of telemedicine, Functional diagram of telemedicine system, Tele medicine, Tele health, Tele care, Organs of telemedicine, Global and Indian scenario, Scope, Benefits and limitations of Telemedicine.					
Unit – 2	TELE MEDICAL TECHNOLOGY	9			
Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Modulation techniques, Types of Antennas, Integration and operational issues, Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication. Mobile hand-held devices and mobile communication. Internet technology and telemedicine using world wide web (www). Video and audio conferencing. Clinical data – local and centralized.					
Unit – 3	TELE MEDICAL STANDARDS	9			
Audio, Video, still Images, text and data, Fax. Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications: GSM, satellite and Micro Wave. Different modulation techniques, Types of antennas depending on requirements, Integration and Operational issues: system integration, Store-and-forward operation, real-time Telemedicine.					
Unit – 4	MEDICAL INFORMATION MANAGEMENT	9			
Types of image formats, DICOM standard, PACS system: Block diagram, Storing & retrieving images, Algorithm for retrieving images, Compressions and its significance, Lossless data Storage and in-house communication, Computer aided diagnosis (CAD), Hospital information system - Doctors, paramedics, facilities available. Pharmaceutical information system.					
Unit – 5	ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE	9			
Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment, jurisdictional Issues, Intellectual property rights.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Describe the concept of telemedical system	Understand			
CO2	Apply the concept of communication system for the design of tele health applications	Apply			
CO3	Apply the concept of multimedia technologies in the healthcare applications.	Apply			

CO4	Compare the Relationship between data quality and standards development initiatives and uses of data in health care.	Apply
CO5	Describe the necessity for Patient Rights, Consents and IPR related to Health Records	Understand
CO6	Apply telemedicine technologies and practices in a variety of health care Environments	Apply
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Norris, A.C. "Essentials of Telemedicine and Tele care", Wiley, 2002 2. Olga Ferrer-Roca, M. Sosa Ludicissa, "Handbook of Telemedicine", IOS press 2002. 3. Wootton, R., Craig, J, Patterson, "Introduction to Telemedicine" Royal Society of Medicine Press Ltd. , (2nd ed.), 2006 		
<p>REFERENCES:</p> <ol style="list-style-type: none"> 1. H.K. Huang, "PACS and imaging informatics – Basic Principles & application", Wiley Blackwell 2. O'Carroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), "Public Health Informatics and Information Systems", Springer, 2003. 3. Ferrer-Roca, O., Sosa - Ludicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002. 4. Latifi, R. "Current Principles and Practices of Telemedicine and e-Health". Washington DC: IOHS, 2008. 5. Mohan Bansal, "Medical Informatics", Tata McGraw-Hill, 2004 		

19UEC929	PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP	L	T	P	C
		0	0	6	3
<p>OBJECTIVES:</p> <ul style="list-style-type: none"> • To empower students with overall Professional and Technical skills required to solve a real-world problem. • To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs. • To provide experiential learning to enhance the Entrepreneurship and employability skills of the students. 					
<p>This course is a four months immersive program to keep up with the industry demand and to have critical thinking, team-based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.</p>					
<p>To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from Industry and faculties. This is an EEC category course offered as an elective, under the type, “Experiential Project Based Learning”</p>					
<p>Highlights of this course:</p> <ul style="list-style-type: none"> • Students undergo training on emerging technologies • Students develop solutions for real-world use cases • Students work with mentors to learn and use industry best practices • Students access and use Self-Learning courses on various technologies, approaches and methodologies. • Collaborate in teams with other students working on the same topic • Have a dedicated mentor to guide 					
TOTAL: 45 PERIODS					
<p>COURSE OUTCOMES: At the end of the course the student will be able to:</p>					
CO1	Upskill in emerging technologies and apply to real industry-level use cases				
CO2	Understand agile development process				
CO3	Develop career readiness competencies, Team Skills / Leadership qualities				
CO4	Develop Time management, Project management skills and Communication Skills				
CO5	Use Critical Thinking for Innovative Problem Solving				
CO6	Develop entrepreneurship skills to independently work on products				

The course will involve 40-50 hours of technical training, and 40-50 hours of project development. The activities involved in the project along with duration are given in Table 1.

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud-based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		16 WEEKS

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:							
<ul style="list-style-type: none"> 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- Crystal, Electrostatic, Dynamic, Permanent Magnet Loud speakers, Loud speaker system, Multiway system, Microphone, Types of Microphones							
Unit – 2	AUDIO SYSTEM						9
AM/FM Basics, Anatomy of a Hi-Fi system, Source Units, Signal Propagation, Stereo Multiplex, Compatibility, 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, Canon Portable Video System, Laser vision—Video Disc System, Interactive Video Systems							
Unit – 4	ELECTRONIC GADGETS						9
Telecommunication system, Mobile Radio System, VHF/UHF Radio System, Cellular Phone, Types of Mobile phones, Facsimile, Calculator, Digital Clocks, microprocessors, Microcomputers and Microcontrollers							
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
CO6	Design and compare consumer electronic circuits						Create
TEXT BOOKS:							
1. S.P.Bali, —Consumer Electronics, Pearson Education, 4 th impression, 2011.							
REFERENCES:							
1. R.G. Gupta, —Audio and Video Systems, TataMcGrawHill,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:					
<ul style="list-style-type: none"> 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 					
UNIT 1	REMOTE SENSING				9
Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body – Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra-Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation – Planck 's law – Stefan-Boltzmann law.					
UNIT II	EMR INTERACTION WITH ATMOSPHERE ANDEARTH 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 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 and Vector 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 and ocean related studies, military and surveillance applications, search and rescue operations, ground and air 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, Including electromagnetic 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:

1. M.G. Srinivas, "Remote Sensing Applications", Narosa Publishing House, first edition 2001.
2. Anji Reddy, "Remote Sensing and Geographical Information Systems", BS Publications, 2001

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 Mischael Hord, 1986

19UEC953	EMBEDDED SYSTEMS AND PROGRAMMING	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the basic concept of Embedded Systems To impart the knowledge of Hardware Test and Debug in Embedded Systems design To introduce the basic concept of Embedded C Program 					
Unit 1:	AN INTRODUCTION TO EMBEDDED SYSTEMS				9
Introduction - The Core Level - 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				9
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					
Unit–3	HARDWARE TEST AND DEBUG				9
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					
Unit–4	OPERATING SYSTEMS AND TASK MANAGEMENT				9
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 - Time-Shared Systems - Priority Schedule					
Unit–5	EMBEDDED C PROGRAMMING				9
An Embedded C Program - Developing Embedded Software - C Building Blocks -C Program Structure - Bitwise Operators - Pointer Variables and Memory Addresses -The Function – Structures - The Interrupt					
TOTAL:45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Explain the basic concept of Embedded systems.				Understand
CO2	Apply the idea of Embedded System in Engineering.				Apply
CO3	Apply the concept of Embedded C to develop the embedded based application.				Apply
CO4	Analyze the real time application of embedded system.				Analyze
CO5	Test and validate the performance of the embedded hardware and software.				Analyze
CO6	Analyze the use of various embedded systems for the given problem.				Analyze

TEXTBOOKS:

1. James K. Peckol, "Embedded Systems a Contemporary Design Tool" second edition, Wiley Publications, 2019
2. Michael J Pont "Embedded C" 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 Wiley India pvt. Ltd, 2008.

19UEC954	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> 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, order statistics, adaptive filters Estimating degradation, Constrained least square filtering Geometric mean 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:		
1. Rafael.C. Gonzalez, Richard.E. Woods and Steven L. Eddins, —Digital Image Processing using MATLABII, 2 nd Edition, Gates mark Publishing,2009.		
2. Al. Bovik, —The Essential Guide to Image ProcessingII, Academic Press,2009.		
3. Anil K.Jain,—Fundamentals of Digital Image ProcessingII, PearsonEducation2003.		
4. William K. Pratt, —Digital Image ProcessingII, Third Edition, John Wiley,2001.		
5. www.imageprocessingplace.com .		
6. https://www.coursera.org/course/images .		
7. http://www.mathsworks.com		

19UEC955	INTRODUCTION TO R PROGRAMMING	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To introduce the basic concepts of R Programming To impart the knowledge of Test and Debug in R Programming To introduce the basic concepts of R objects and functions 					
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	Develop a code using R functions and scoping rules				Evaluate
TEXT BOOKS:					
<ol style="list-style-type: none"> R Programming for data science, Roger D. Peng,20-7-2015. 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 Golemund, 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:					
<ul style="list-style-type: none"> • To learn about the basics of mobile phone technology and Laptops. • To study the latest knowledge in mobile technology and Laptop. • To empower the students with the knowledge of mobile components, troubleshooting and repairing. • To learn about the Basic Laptop Troubleshooting and maintenance 					
Unit – 1	INTRODUCTION TO MOBILE PHONE TECHNOLOGY				9
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				9
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				9
Introduction-History of laptop-Types-comparison with desktop computer-Advantages Hardware-operating system –BIOS-CMOS setup-Drivers and Device Manager-Mother Board-Central Processing unit of Laptop -RAM – Hard drive-LCD Monitor-USB drive.					
Unit – 4	BASIC LAPTOP TROUBLESHOOTING AND MAINTENANCE I				9
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				9
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*, FonerBooks; 5.2.2008 edition, ISBN-10/ASIN: 0972380159.
3. Garry Romaneo, *Laptop Repair Complete Guide: Including Mother board 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:					
<ul style="list-style-type: none"> 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 soft wares used in IoT 					
Unit – 1	IoT FUNDAMENTALS & 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
CO6	Analyze an IoT based real time applications	Analyze
TEXT BOOK		
<ol style="list-style-type: none"> 1. Muhammad AzharIqbal, Sajjad Hussain, Huanlai Xing, Muhammad Alilmran, II Enabling the Internet of Things II, IEEE Press, JohnWiley&Sons,2021. 2. Jerker Delsing, IIo Automation, CRC Press Taylor & Francis Group,2017. 3. Sudip Misra, Anandrup Mukherjee, Arjit Roy, II Introduction to IoT II, Cambridge University Press,2020 		
REFERENCES:		
<ol style="list-style-type: none"> 1. Daniel Minoli, —Building the Internet of Things with IPv6 and MIPv6: The Evolving WorldofM2MCommunicationsII, ISBN:978-1-118-47347-4, Wiley Publications 2. Bernd Scholz-Reiter, Florian Michahelles, —Architecting the Internet of ThingsII, ISBN978-3- 642-19156-5 e-ISBN978-3-642-19157-2, Springer 3. Hakima Chaouchi, The Internet of Things Connecting Objects to the Web II ISBN:978-1- 84821-140-7,WileyPublications Web Resources: https://www.netacad.com/courses/packet-tracerhttps://www.tinkercad.com/ 		

19UEC958	DESIGN THINKING FOR INNOVATIONS	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> To explain the process of Design Ideas. To familiarize the students about the prototype and testing. To develop design ideas in Business. 					
UNIT 1	INTRODUCTION TO DESIGN THINKING				9
An insight into Design, origin of Design thinking, Design thinking Vs Engineering thinking, importance of Design thinking, Design Vs Design thinking, understanding Design thinking and its process models, application of Design thinking					
UNIT 2	EMPATHIZE IN DESIGN THINKING				9
Human-Centred Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate. Role of Empathy in design thinking, methods and tools of empathy, understanding empathy tools. Explore define phase state users' needs and problems using empathy methods					
UNIT 3	IDEATION, PROTOTYPING AND TESTING				9
Ideation methods, brain storming, advantages of brain storming, methods and tools of ideations, prototyping and methods of prototyping, user testing methods, Advantages and disadvantages of user Testing/ Validation					
UNIT 4	PRODUCT INNOVATION				9
Design thinking for strategic innovation, Definition of innovation, art of innovation, teams for innovation, materials and innovation in materials, definition of product and its classification. Innovation towards product design Case studies					
UNIT 5	DESIGN THINKING IN BUSINESS PROCESSES				9
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course the student will be able to:					
CO1	Explain the principles of design thinking and its approaches				Understand
CO2	Describe the empathy, define phases in human centred design problems				Understand
CO3	Apply the knowledge of design ideas to develop different technique				Apply
CO4	Apply the knowledge of idea generation, prototype and testing in design thinking context.				Apply
CO5	Apply design thinking techniques for product innovation				Analyze
CO6	Analyze the design thinking in business process in various models				Analyze

TEXT BOOKS:

1. "Change by design", Tim Brown, Harper Collins, 2009
2. Engineering design by George E Dieter

REFERENCES:

1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kumar
2. Human- Centered Design Toolkit: An Open-Source Toolkit to Inspire New Solutions in the Developing World by IDEO
3. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013).
4. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan

**LIST OF ECE DESIGNED COURSES
TO OTHER DEPARMENTS**

Courses offered to 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.	19UEC727	Signal Processing Laboratory	EEE	0	0	2	1
5.	19UEC959	Principles Of Communication	EEE	3	0	0	3
6.	19UEC960	Fiber Optic Communication	EEE	3	0	0	3
7.	19UEC225	Principles of Electronics Engineering	CSBS	3	0	0	3
8.	19UEC227	Electronics and Engineering Laboratory	CSBS	3	0	0	3

19UEC425	MICROPROCESSOR AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<ul style="list-style-type: none"> 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
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TEXT BOOK:

1. DouglasVHall,—MicroprocessorsandInterfacing,Programmingand Hardwarell, Tata McGrawHill,2006.
2. KennethJAyala,—The8051MicrocontrollerArchitectureProgrammingand Applicationll, Penram InternationalPublishers(India),2ndEdition,1996
3. MazidiM.A.,McKinlayR.D.,CauseyD—PICMicrocontrollerAndEmbedded Systemsll, Pearson Education International,2008

REFERENCES:

1. RameshSGaonkar,—MicroprocessorArchitecture,ProgrammingandApplication with8085ll, PenramInternationalPublishing,4thEdition,NewDelhi,2000
2. KrishnaKant,—MicroprocessorsandMicrocontrollersArchitecture,programming and system design using 8085, 8086, 8051 and 8096ll, PHI,2007
3. MohammedAliMazidiandJaniceGillispieMazidi,—The8051Microcontrollerand Embedded Systemsll ,Pearson Education Asia, New Delhi,2003
4. AjayVDeshmukh,—Microcontrollers:TheoryandApplicationsll,TataMcGraw-Hill Education, 2005

19UEC426	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	3	1.5
COURSE OBJECTIVES: <ul style="list-style-type: none"> 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 <ol style="list-style-type: none"> Basic Arithmetic and Logical operation Code conversion and Matrix operation Searching and Sorting Operation Floating point operations and string manipulations Move a data block without overlap Microcontroller-8051 <ol style="list-style-type: none"> Basic Arithmetic and Logical Operation Square and cube Program, Find 2's complement of a number Unpacked BCD to ASCII Programming and verifying Timer, Interrupts and UART operations Interfacing <ol style="list-style-type: none"> A/D and D/A interfacing and waveform generation Keyboard and Display interfacing Stepper Motor interfacing Traffic light controller 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:					
<ul style="list-style-type: none"> 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.ProakisandD.G.Manolakis,—DigitalSignalProcessingPrinciples,Algorithms and Applicationsll , Pearson Education, New Delhi,2010.
5. S.K.Mitra,—DigitalSignalProcessing—AComputerBasedApproach,Tata McGraw Hill, New Delhi2013

REFERENCES:

5. AlanV. Oppenheim,RonaldW.Schafer,—Discretetimesignalprocessing, Third Edition, 2010.
6. E.C.IfeachorandB.W.Jervis,—Digitalsignalprocessing—Apracticalapproach, Fourth Edition,2007.
7. S.Salivahanan,A.VallavarajAndC.Gnanapriya,—DigitalSignalProcessing, First Edition, Tata McGraw Hill, New Delhi2008
8. B.Venkataramani,M.Bhaskar—DigitalSignalProcessors:Architecture Programming and Application, Tata McGraw Hill,2011.

19UEC959	PRINCIPLES OF COMMUNICATION	L	T	P	C	
		3	0	0	3	
OBJECTIVES:						
<input type="checkbox"/> To have understanding about different types of Analog and digital Communications systems <input type="checkbox"/> To understand the knowledge of information theory in communication system. <input type="checkbox"/> To know the spread spectrum modulation techniques and different multiple access methods. <input type="checkbox"/> To impart the knowledge of satellite and optical fiber communication						
Unit – 1	ANALOG COMMUNICATION					1 0
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					1 0
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
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 4. Wayne Tomashi, ElectronicCommunicationssystems ,Pearson–Prentice hallpublications, 5th edition, 2000. 5. B.P.LathiandZhiDing,—ModernDigitalandAnalogCommunication, Oxford University Press, 5th edition,2018. 		
<p>REFERENCES:</p> <ol style="list-style-type: none"> 4. SimonHaykinandMichaelMoher,—CommunicationSystem, JohnWiley&Sons, Fifth Edition,2016. 5. HerbertTaub,DonaldLSchilling,andGoutamSaha,—Principlesof Communication System, McGraw-Hill,Third Edition,2008. 		

19UEC960	FIBER OPTIC COMMUNICATION	L	T	P	C
		3	0	0	3
OBJECTIVES:					
<input type="checkbox"/> To impart basic concepts in optical fiber communication <input type="checkbox"/> To introduce the concepts in sources, detectors and other fiber optic components. <input type="checkbox"/> 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 field 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 nonlinearities , 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
Optical sources: Light Emitting Diodes-LED structures-surface and edge emitters, 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 design 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 Kolimbris
2. Introduction to optical fibers, Cheri, McGrawHill.
3. An introduction to fiber optics, A. Ghatak and K.Thyagrajan, Cambridge Univ, press 10
4. Optical fiber communication and sensors-M. Arumugam Agencies, 2002 optic sensors.
5. Fiber optic communication– Joseph C Palais: 4th Edition, Pearson Education.

19UEC225	PRINCIPLES OF ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3
OBJECTIVES: <ul style="list-style-type: none"> To study the operation of semiconductor diodes and their characteristics. To enable the student to understand the bipolar junction transistor configurations and its characteristics. To introduce the structure and terminal characteristics of FET and MOSFET. To enable the students to understand the fundamentals of digital circuits. 					
Unit – 1	SEMICONDUCTORS	9			
Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers. Diodes and Diode Circuits: Formation of P-N junction, energy band diagram, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics, Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency.					
Unit – 2	BIPOLAR JUNCTION TRANSISTORS	9			
Formation of PNP / NPN junctions; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, current amplification factors for CB and CE modes					
Unit – 3	FIELD EFFECT TRANSISTORS	9			
Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles.					
Unit – 4	DIGITAL ELECTRONICS COMBINATIONAL CIRCUITS	9			
Number systems, Boolean algebra, Basic and Universal Gates, Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder , Multiplexer/Demultiplexer, code converters.					
Unit – 5	DIGITAL ELECTRONICS SEQUENTIAL CIRCUITS	9			
Latches, Flip-flops: SR, JK, D, T, and Master-Slave, Asynchronous Ripple or serial counter, Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Down counters, shift registers and its types.					
TOTAL : 45 PERIODS					
COURSE OUTCOMES: At the end of the course the student will be able to:					
CO1	Describe the fundamental concept of various electronic Devices.	Understand			
CO2	Describe the functions of the various building blocks of digital circuits.	Understand			
CO3	Apply the concepts of semiconductor devices to design electronic circuits.	Apply			
CO4	Apply the knowledge of logic gates to design digital circuits.	Apply			
CO5	Analyze different logic to identify suitable logic circuit for various applications.	Analyze			

CO6	Analyze the various parameters of diodes and transistors for suitable application.	Analyze
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Salivahanan S., Suresh kumar N. and Vallavanraj A., "Electronic Devices and Circuits", Tata McGraw Hill., 4th Edition, 2017. 2. Digital Logic & Computer Design, M. Morris Mano. Pearson Education. 		
<p>REFERENCE:</p> <ol style="list-style-type: none"> 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. 3. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013. 4. D.P.Kothari, J.S.Dhillon, 'Digital circuits and Design', Pearson Education, 2016 		

19UEC227	ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
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OBJECTIVES:

- To enable the students to identify the components and operation of semiconductor diodes and their characteristics.
- To enable the students to design digital logic circuits.

LIST OF EXPERIMENTS:

1. Characteristics of PN Junction diode
2. Characteristics of Zener diode
3. Half wave rectifier with capacitive filter.
4. Full wave rectifier with capacitive filter.
5. Bridge rectifier with capacitive filter.
6. Characteristics of CB Configuration.
7. Characteristics of CE Configuration.
8. Drain and transfer characteristics of JFET.
9. Drain and transfer characteristics of MOSFET.
10. Study of logic gates.
11. Design and implementation of Adder and subtractor.
12. Design and implementation of Code Converter.
13. Design and implementation of Multiplexer and Demultiplexer.
14. Design and implementation of Shift registers
15. Design and Implementation of Synchronous and Asynchronous counters.

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	Apply
CO3	Design Combinational and Sequential Logic circuits	Apply