VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005)
Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)

SYLLABUS

Approved in 13th Meeting of Executive Council held on 27th March 2023 subsequent to the 14th Meeting of Academic Council held on 20th March 2023

(For admission in 2022-23 and onwards)

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SYLLABUS

For

B.TECH

(Electronics & Communication Engineering)

2ND Year

Effective From – Session 2023-24

[B.Tech. Model Curriculum Structure]

SEMESTER-III														
Sl.No.	SubjectCodes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT006	BSC	Transformation and numerical method	3	1	0	30	20	50	100		150	4
2	AHT007	HSC	Technical Communication/ Universal Human Values	2	1	0	30	20	50	100		150	3
	AHT008			3	0	0							
3	ECT031	DC	Analog Electronic Circuit	3	1	0	30	20	50	100		150	4
4	ECT032	DC	Networks & Systems	3	1	0	30	20	50	100		150	4
5	ECT033	DC	Digital Electronics	3	1	0	30	20	50	100		150	4
6	ECP031	DLC	Analog Electronic Circuit Lab	0	0	2		25	25		25	50	1
7	ECP032	DLC	Networks Lab	0	0	2		25	25		25	50	1
8	ECP033	DLC	Digital Electronics Lab	1	0	2		25	25		25	50	1
9	ECP034	DLC	Internship-I/Mini Project-I*	0	0	2			50			50	1
10	CST005/006	MC	Cyber Security/Python Programming	2	0	0	15	10	25	50			
11	GP031	NC	General Proficiency						50				
			Total									950	23
12			Minor Courses (Optional) **	3	1	0	30	20	50	50			4
*The Mini Project-I or Internship-I (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester													
MOOCs course													

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance, **PS-**Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks,PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

[B.Tech. Model Curriculum Structure]

SEMESTER-IV														
Sl.No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1.	AHT008 AHT007	HSC	Universal Human Values /Technical Communication	3 2	0 1	0 0	30	20	50	100		150	3
2.	CST003	BSC	Data Structure	3	1	0	30	20	50	100		150	4
3.	ECT-041	DC	Analog Communication Systems	3	1	0	30	20	50	100		150	4
4.	ECT-042	DC	Microprocessor & Microcontroller	3	1	0	30	20	50	100		150	4
5.	ECT-043	DC	Electromagnetic field theory	3	1	0	30	20	50	100		150	4
6.	ECP-041	DLC	Analog Communication LAB	0	0	2		25	25		25	50	1
7.	ECP-042	DLC	Microprocessor & Microcontroller Lab	0	0	2		25	25		25	50	1
8.	**CSP-003**	DLC	Data Structure Lab	0	0	2		25	25		25	50	1
9.	CST006 CST005	MC	Python Programming/Cyber Security	2	0	0	15	10	25	50			
10.	GP031	NC	General Proficiency						50				
11.			Total									900	22
12.			Minor Courses (Optional) **	3	1	0	30	20	50	50			4
13.	ECP-044	DLC	Internship-II/Mini Project-II*	To be completed at the end of fourth semester (during Summer									
MOOCs course													

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance, **PS-**Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks,PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

L:T:P:: 3:1:0 **Credits-4**

AHT-006 : ADVANCED APPLIED MATHEMATICS

COURSE OBJECTIVES:

The students will learn:
1. The idea of Laplace transform of functions and their applications.
2. The idea of Fourier transform of functions and their applications.
3.To evaluate roots of algebraic and transcendental equations.
4. Interpolation, numerical differentiation& integration and the solution of differential equations.
5.Acquaintance with statistical analysis and techniques.

COURSE OUTCOME(S):

At the end of this course, the students will be able to:
1. Remember the concept of Laplace transform and apply in solving real life problems.
2. Apply the concept of Fourier transform to evaluate engineering problems.
3. Understand to evaluate roots of algebraic and transcendental equations.
4. Solve the problem related interpolation, differentiation, integration and the solution of differential equations.
5. Understand the concept of correlation, regression, moments, skewness and kurtosis and curve fitting.

COURSE CONTENTS:

Module 1: Laplace Transform:

Definition of Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve linear differential equations.

Module 2: Fourier Transforms:

Fourier integral, Fourier sine and cosine integral, Complex form of Fourier integral, Fourier transform,Inverse Fouriertransforms, Convolution theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations.

Module 3: Solution of Algebraic & Transcendental equations and Interpolation: (8 hours)

Number and their accuracy, Solution of algebraic and transcendental equations: Bisection method, Iteration method, Newton-Raphson method and Regula-Falsi method. Rate of convergence of these methods (without proof), Interpolation: Finite differences, Relation

between operators, Interpolation using Newton's forward and backward difference formula, Interpolation with unequal intervals: Newton's divided difference and Lagrange's formula.

Module 4: Numerical differentiation & Integration and Solution of ODE

Numerical Differentiation, Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8 rule,Runge-Kutta method of fourth order for solving first order linear differential equations, Milne's predicator-corrector method.

Module 5: Statistical Techniques:

Introduction: Measures of central tendency, Moments, Skewness, Kurtosis, Curve fitting: Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves. Correlation and rank correlation, Regression analysis: Regression lines of y on x and x on y, Regression coefficients, Properties of regressions coefficients and non-linear regression.

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons,10th ed.
2. B.V. Ramana: Higher Engineering Mathematics,McGrawHill.
3. Peter V.O'Neil: Advanced Engineering Mathematics, Cengage Learning,7th ed.
4. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th ed.
5. T.Veerarajan: Engineering Mathematics (for semester III), McGrawHill, 3rd ed.
6. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics,Narosa PublishingHouse,Std. ed.
7. P. Kandasamy, K. Thilagavathy, K. Gunavathi: Numerical Methods, S. Chand.
8. S.S. Sastry: Introductory methods of numerical analysis, Prentice Hall India, 5thed.
9. N.P. Bali and Manish Goyal: Computer Based Numerical and Statistical Techniques,Laxmi Publications, 5th ed.
10. J.N. Kapur: Mathematical Statistics, S. Chand &Company.
11. D.N.Elhance,V. Elhance&B.M. Aggarwal: Fundamentals of Statistics,Kitab Mahal.

L:T:P:: 2:1:0 **Credits-3**

AHT-007: TECHNICAL COMMUNICATION

COURSE OBJECTIVES:

Students should be able to:

1. To produce technical documents that use tools commonly employed by engineering and computer science professionals.
2. To communicate effectively in a professional context, using appropriate rhetorical approaches for technical documents, adhering to required templates, and complying with constraints on document format.
3. To clarify the nuances of phonetics, intonation and pronunciation skills.
4. To get familiarized with English vocabulary and language proficiency.

COURSE OUTCOMES:

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for the work place as Engineers.
2. Students will **utilize** the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
3. Students would imbibe inputs by presentation skills to **enhance** confidence in face of diverse audience.
4. Technical communication skills will **create** a vast know-how of the application of the learning to promote their technical competence.
5. It would enable them to **evaluate** their efficacy as fluent & efficient communicators by learning the voice-dynamics.

COURSE CONTENTS:

Unit -1 Fundamentals of Technical Communication:
Technical Communication: Introduction, Features; Distinction between General and Technical Communication; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication, Importance of communication

Unit - II Forms of Technical Communication:
Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Unit - III Technical Presentation: Strategies & Techniques
Presentation: Forms; interpersonal Communication; Class Room presentation; style;method, Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections

Unit - IV Technical Communication Skills
Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances, exposition, narration and description

Unit - V Kinesics & Voice Dynamics:
Kinesics: Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation, pronunciation, articulation, vowel and consonants sounds

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
6. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S.
7. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

L:T:P:: 3:0:0 **Credits-3**

AHT-008: UNIVERSAL HUMAN VALUES

COURSE OBJECTIVES : The objective of the course is four fold:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSE OUTCOMES:

1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)

2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

3. They would have better critical ability.

4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to- day settings in real life, at least a beginning would be made in this direction.

COURSE CONTENTS:

Module 1: Introduction - Value Education

Universal human values; self exploration, natural acceptance an experimental validation; Human aspirations, right understanding, relationship and physical facility, current scenario; Understanding and living in harmony at various levels.

Module 2: Harmony in the Human Being

Understanding human being, needs of self(I) and body; body as an instrument of 'I'; characteristics and activities of 'I' and harmony in 'I'; harmony of I with the Body: Sanyam and Health, Physical needs an prosperity; Programs to ensure Sanyam and Health.

Module 3: Harmony in the Family and Society

Values in human-human relationship; nine universal values in relationships; justice, truth, respect, trust; Difference between intention and competence; Respect and differentiation, Harmony in society: resolution, prosperity, fearlessness and coexistence; Universal harmonious order in society.

Module 4: Harmony in the Nature and Existence

Harmony in the nature. Four orders of nature; existence as co-existence, harmony at all levels of

existence.

Module 5: Harmony in the Professional Ethics

Natural acceptance of human values**,** Definitiveness of Ethical Human Conduct**;** Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case studies; transition from the present state to Universal Human Order: at individual level and societal level.

READINGS: Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karam chand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

L:T:P:: 3:1:0 **Credits-04**

CST-003: DATA STRUCTURES AND ALGORITHMS

COURSE OBJECTIVES: The objectives of this course is to:

1. Introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem-solving.
2. Analyze step by step and develop algorithms to solve real-world problems.
3. Implement various data structures, viz. Stacks, Queues, Linked Lists, Trees and Graphs.
4. Understand various searching & sorting techniques

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Compare functions using asymptotic analysis and describe the relative merits of worst-case, average-case, and best-case analysis.
2. Become familiar with a variety of sorting algorithms and their performance characteristics (e.g., running time, stability, space usage) and be able to choose the best one under a variety of requirements.
3. Understand and identify the performance characteristics of fundamental algorithms and data structures and be able to trace their operations for problems such as sorting, searching, selection, operations on numbers, and graphs.
4. Solve real-world problems using arrays, stacks, queues, and linked lists.
5. Become familiar with the major graph algorithms and their analyses. Employ graphs to model engineering problems when appropriate.

COURSE CONTENTS:

Unit 1-Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade-off.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Unit 2-Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Unit 3-Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from the linked list; Linked

representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and complexity analysis.

Unit 4-Trees and Graphs: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Graphs: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Unit 5-Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods,

Hashing: Symbol table, Hashing Functions, Collision-Resolution Techniques

TEXTBOOKS:

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
2. Ritika Mehra, Data Structures Using C, Pearson Education.
3. Data Structures using C & C++ -By Ten Baum Publisher – Prentice-Hall International.

REFERENCE BOOKS:

1. Schaum's Outlines Data structure Seymour Lipschutz Tata McGraw Hill 2nd Edition.
2. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub. 2001 ed.
3. Fundamentals of Data Structures in C++-By Sartaj Sahani.

Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher-Thomson Learning

L:T:P:: 3:1:0 **Credits-4**

ECT-031 ANALOG ELECTRONICS CIRCUITS

COURSE OBJECTIVES: This course enables the students to:

1. To help them understand the operation of Transistors for low frequency applications
2. To know the operation of multistage amplifiers and transistors for high frequency applications and tuned amplifiers
3. To help them understand the operation of feedback amplifiers and oscillators
4. To help them understand applications of op-amp
5. To help them understand sweep circuits and time base generators.

COURSE OUTCOMES: After completion of the course student will be able to:

1. Design and Analyze single and multistage amplifier circuits for small signal applications.
2. Understand the concepts used to design and analyze high frequency amplifier circuits.
3. Understand the linear and nonlinear application of operational amplifier.
4. Understand feedback concepts in amplifier and oscillator circuits.
5. Design and analyze power amplifier circuits.

COURSE CONTENTS:

UNIT 1: BIPOLAR JUNCTION TRANSISTOR: Review of BJT biasing circuits, biasing stabilization techniques, thermal runaway, Ebers-Moll model, π −model and T-model, Early effect, analysis of low frequency BJT amplifiers.
BJT AMPLIFIERS: Cascade amplifiers, coupling of amplifiers, RC coupled, direct coupled and transformer coupled amplifiers, differential amplifier, Darlington-amplifier, bootstrapping, tuned-amplifiers.

UNIT 2: HIGH FREQUENCY AMPLIFIERS: Hybrid $\pi -$ model, conductances and capacitances of hybrid π −model, high frequency analysis of CE amplifier, gain-bandwidth product, calculation of current gain at high frequencies, high frequency analysis of common-source, common-gate and common-drain FET amplifiers.

UNIT 3: OPERATIONAL AMPLIFIER APPLICATIONS: Integrator, Differentiator, Scaling and Averaging Amplifier, Instrumentation Amplifier, Non-linear applications of OP-AMP: zero-crossing detector, precision rectifier, peak detector, logarithmic amplifier, Schmitt trigger. Active filters: Low pass, high pass, band pass and band stop.

UNIT 4: FEEDBACK AMPLIFIERS: Classification, feedback concept, transfer gain with feedback, General characteristics of negative feedback amplifiers, analysis of voltage-series, voltage-shunt, current-series and current-shunt feedback amplifiers, stability criterion.
OSCILLATORS: Classification, criterion for sinusoidal oscillations, Hartley, Colpitts, Clapp, RC phase-shift, Wien-bridge and crystal oscillators, astable, monostable and bistable multivibrators using transistors.

UNIT 5: POWER AMPLIFIERS: Classification; class-A, class-B, class-AB and class C amplifiers, push-pull amplifier, complementary-symmetry amplifier, distortion in power amplifiers, thermal consideration and power dissipation in power amplifiers.

BOOKS:

1. Behzad Razavi, Fundamentals of Microelectronics, Wiley; 3rd edition ,2021
2. Sedra, Microelectronic Circuits, 5e (Intl. Version), Oxford, 2017.
3. Boylestad and Nashelsky, Electronic Devices and Circuit Theory, PHI, 2013.
4. Milman, Halkias & Jit, Electronic Devices and Circuits, TMH, 2007.
5. Deshpande, Electronic Devices and circuits, McGraw-Hill, 2007.
6. Kulshrestha, 'Electronic Devices and Circuits' PHI, 2007.
7. Bell,Electronic Devices and Circuits, Oxford, 2009.

L:T:P:: 3:1:0 **Credits-4**

ECT-032 NETWORKS & SYSTEMS

COURSE OBJECTIVES: This course enables the students to:

1. list the Properties and discuss the concepts of signals and system
2. list the Properties and discuss the concepts of graph theory
3. Solve electrical circuits using various network laws and theorems.
4. Analyze various transforms and their applications
5. Analyse different 2-port electrical networks and their parameters.
6. Synthesize an electrical network from the given network function.

COURSEOUTCOMES: After completion of the course student will be able to:

1. Solve electrical circuits using various network laws and theorems.
2. Design Different electrical circuits and passive filters for various applications
3. Analyse different 2-port electrical networks and their parameters.
4. Synthesize an electrical network from the given network function.
5. Analyze various transforms and their applications**.**

COURSE CONTENTS:

UNIT 1: CIRCUIT &SYSTEMS: Independent and dependent sources, signals and wave forms; periodic and singularity voltages, step, ramp, impulse, Doublet, Loop currents and loop equations, node voltage and node equations. Continuous-time and discrete-time signals, transformations of the independent variable, exponential and sinusoidal signals, continuous-time and discrete-Time LTI Systems and their properties.

UNIT 2: GRAPH THEORY: Graph of a network, definitions, tree, co-tree, link, basic loop and basic cut set, incidence matrix, cut set matrix, Tie set matrix, duality, loop and node methods of analysis.
AC NETWORK THEOREMS Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem.

UNIT 3: APPLICATIONS OF LAPLACE TRANSFORM: Transient analysis of RL series circuits, RC series circuits, RLC series circuits, RLC parallel circuits using Laplace Transform.

FOURIER TRANSFORMS: Fourier series representation of continuous-time, periodic signals and their properties, continuous time and discrete time Fourier transforms and their properties, system characterized by linear constant coefficient differential equations and difference equation.

UNIT 4: TWO PORT NETWORKS: Characterization of LTI two port networks, Z, Y, ABCD and h-parameters, reciprocity and symmetry, Inter-relationships between the parameters, inter-connections of two port networks, ladder and lattice networks; T and π representation.

UNIT 5: NETWORK SYNTHESIS: Network functions, impedance & admittance function, transfer functions, relationship between transfer and impulse response, poles & zeros and restrictions, network function for two terminal pair network, sinusoidal network in terms of poles & zeros, reliability condition for impedance synthesis of RL & RC circuits, network synthesis techniques for two-terminal network, foster and cauer forms.

BOOKS:

1. Choudhury, Network&Systems, NewAge,2013.
2. Valkenberg, Network Analysis &Synthesis, PHI,2014.
3. Mohan, Network Analysis and Synthesis,TMH, 2006.
4. Chakraborty,Circuit Theory, Dhanpat Rai,2007.
5. Oppenheim and Willsky, Signal andSystems,PHI,1997.
6. Haykin, Communication Signal and Systems, Wiley, 2003.

L:T:P:: 3:1:0 **Credits-4**

ECT-033 DIGITAL ELECTRONICS

COURSE OBJECTIVES: This course enables the students to:

1. Understand the basics of digital electronics.
2. Understand the basics of Logic family.
3. Apply the knowledge of digital electronics to construct various digital circuits.
4. Analyze the characteristics and explain the outputs of digital circuits.
5. Evaluate and asses the application of the digital circuits.
6. Understand the design flow of VLSI Circuits

COURSEOUTCOMES: After completion of the course student will be able to:

1. Understand the Boolean algebra and minimization of digital functions.
2. Design and implement various combinational circuits.
3. Design and implement various sequential circuits.
4. Understand the digital logic families, semiconductor memories,
5. Design the digital circuits using VHDL

COURSE CONTENTS:

UNIT 1: MINIMIZATION OF LOGIC FUNCTIONS: Review of logic gate and Boolean algebra, DeMorgan's Theorem,SOP&POSforms,canonicalforms,don'tcareconditions,K-mapsupto6variables, Quine-McClusky'salgorithm,X-OR&X-NORsimplification ofK-maps, binarycodes,codeconversion.

UNIT 2: COMBINATIONAL CIRCUITS: Combinational circuit design, half and full adders, subtractors, serialand parallel adders, code converters, comparators, decoders, encoders, multiplexers, de-multiplexer, parity checker, driver &multiplexed display, BCDadder, Barrelshifter and ALU.

UNIT 3: SEQUENTIAL CIRCUITS: Building blocks like S-R, JK and master-slave JK FF, edge triggered FF,ripple and synchronous counters, shift registers, finite state machines, design of synchronous FSM, algorithmic state machines charts, designing synchronous circuits like pulse train generator, pseudo random binary sequence generator, clock generation

UNIT 4: LOGIC FAMILIES & SEMICONDUCTOR MEMORIES: TTL NAND gate, specifications, noise margin, propagation delay, fan-in, fan-out, tri-state TTL, ECL, CMOS families and their interfacing, memory elements, concept of programmable logic devices like FPGA, logic implementation using programmable devices.

UNIT 5: VLSI DESIGN FLOW:Design entry: schematic, FSM & HDL, different modelling styles in VHDL,data types and objects, dataflow, behavioural and structural modelling, synthesis and simulation VHDL constructs and codes for combinational and sequential circuits.

BOOKS:

1. Mano, Digital electronics,TMH,2007.
2. Malvino, Digital Principle and applications, TMH,2014.
3. Jain, Modern digital electronics, PHI, 2012.
4. Tocci, Digital Electronics, PHI,2001.

5. W.H.Gothmann, “Digital Electronics-An introduction to theory and practice”,PHI,2nd edition,2006.

L:T:P:: 0:0:2 **Credits-1**

ECP-031 ANALOG ELECTRONICS CIRCUITS LAB

COURSE OBJECTIVES: This course enables the students to:

1. Realize the two-stage amplifier and simple tuned amplifier circuits.
2. Implement the Feedback amplifier circuits.
3. Realize the differential amplifier and oscillator.
4. Know the operation time base generator circuits.

COURSEOUTCOMES: After completion of the course student will be able to:

1. Plot characteristics of various electronics devices.
2. Analyze the feedback amplifier circuits..
3. Analyze and Characterize different oscillator circuits
4. Design and Analyze Multi-stage amplifier circuits.
5. Able to solving practical related to basic electronic circuits.

COURSE CONTENTS:

1. To design and verify various biasing techniques for BJTs.

2. To determine voltage-gain, Current Gain, Output impedance and output power of a Darlington pair compound amplifier.

3. To determine "h" parameters of a PNP transistor in common emitter mode.

4. To determine the frequency response of single stage CE amplifier and determine the mid-band gain and bandwidth.

5. To determine voltage-gain and plot the frequency response of a FET amplifier in Common source mode.

6. To study the effect of negative feedback on voltage gain & bandwidth in a two-stage amplifier.

7. To determine frequency of a Hartley Oscillator circuit with change in the capacitor of the tank circuit.

8. To determine frequency and wave shape of a Colpitt's oscillator circuit.

9. To determine frequency and wave shape of a crystal oscillator circuit.

10. To determine frequency and wave shape of a phase shift oscillator circuit.

11. To determine voltage-gain and plot the frequency response of a single stage, two stage RC coupled and direct coupled amplifiers.

12. Design and implementation of nonlinear oscillator (vander pol, doffing etc.)

L:T:P:: 0:0:2 **Credits-1**

ECP-032 NETWORKS LAB

COURSE OBJECTIVES: This course enables the students to:

1. To design and implement various theorems
2. To design and implement transient response of RLC circuits.
3. illustrate and outline the Multi-terminal network in engineering
4. select and design of filters
5.

COURSE OUTCOMES:

1. Students will be able to design and implement various theorems.
2. Students will be able to design and implement transient response of RLC circuits.
3. Students will be able to design the experiments, analyze and interpretation various two port network parameters
4. Students will be able to design the experiments, analyze and interpretation filters.
5. Students will acquire skills of teamwork, technical communication and effective report writing.

COURSE CONTENTS:

1. Implementation and verification of Maximum Power Transfer and Superposition theorems in ac circuits.
2. Implementation and verification of Thevnin's and Norton's theorem in ac circuits.
3. Implementation and verification of Tellegens theorem.
4. Implementation and verification of Reciprocity theorem.
5. Design and testing of transient analysis in RC/RL circuits.
6. Design and testing of transient analysis in RLC circuits.
7. To calculate Z, Y, ABCD parameters of a given two-port networks.
8. Implementation and verification of transfer function of two-port network.
9. To calculate image and characteristic impedance in T and π networks.
10. Implementation and verification of inter-connection i.e. cascade, series, parallel, effect of loading of two-port networks.
11. Design and implementation of K-derived LPF and HPF in T-sections.
12. Temperature dependent circuits and their analysis.

L:T:P:: 0:0:2 **Credits-1**

ECP-033 DIGITAL ELECTRONICS LAB

COURSE OBJECTIVES: This course enables the students to:

1. Understand the basics of logic gates, input, output, power supply, and gates IC's.
2. Apply the knowledge of digital electronics to construct combinational and sequential circuits.
3. Analyze controlled digital circuits with different Boolean function.
4. Evaluate combinational/sequential circuits and memories.
5. Translate real-world problems into digital logic formulations using VHDL.

COURSEOUTCOMES: After completion of the course student will be able to:

1. Design and implement various digital logic circuits using ICs.
2. Design and implement analog and digital circuits using TCAD tools and on FPGA boards.
3. Design the experiments, analyze and interpretation of data to achieve valid conclusions.
4. Acquire skills of team work, technical communication and effective report writing.
5. Capable of solving practical digital electronics circuits.

COURSE CONTENTS:

1. To verify the De-Morgan's theorems using NAND/NOR gates.
2. To design the full adder and half adder using AND, OR and X-OR gates.
3. To implement the logic circuits using decoder.
4. To implement the logic circuits using multiplexer.
5. To design parity generator and checker circuits.
6. To design and implement RS FLIP-FLOP using basic latches.
7. Realization and testing of basic logic gates using discrete components.
8. Realization and testing of CMOS IC characteristics.
9. Realization and testing of TTL IC characteristics.
10. Realization and testing of RAM circuit using IC 7489.
11. Realization and testing of Interfacing of CMOS-TTL and TTL-CMOS ICs.

CST-005: CYBER SECURITY

L:T:P:: 2:0:0 **Credits-0**

COURSE OBJECTIVES: The objectives of this course are to:

1. Familiarize with network security, network security threats, security services, and countermeasures.
2. Be aware of computer security and Internet security.
3. Study the defensive techniques against these attacks.
4. To familiarize with cyber forensics, cybercrimes, and Cyberspace laws.
5. Understand ethical laws of computers for different countries, Offences under cyberspace and the Internet in India.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Understand cyber-attacks and types of cybercrimes, and familiarity with cyber forensics
2. Realize the importance of cyber security and various forms of cyber-attacks and countermeasures.
3. Get familiar with obscenity and pornography in cyberspace and understand the violation of the Right to privacy on the Internet.
4. Appraise cyber laws and how to protect themselves and, ultimately, the entire Internet community from such attacks.
5. Elucidate the various chapters of the IT Act 2008 power of the Central and State Governments to make rules under IT Act 2008

COURSE CONTENTS:

UNIT – I: Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, the motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., CIA Triad

UNIT – II: Cyber Forensics: Introduction to cyber forensic, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle,

Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT – III: Cybercrime (Mobile and Wireless Devices): Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops and desktop.

UNIT – IV: Cyber Security (Organizational Implications): Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing, and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in cyberspace, the ethical dimension of cybercrimes, the psychology, mindset and skills of hackers and other cybercriminals.

UNIT – V: Cyberspace and the Law &Miscellaneous provisions of IT Act.: Introduction to Cyber Security Regulations, International Law. The INDIAN Cyberspace, National Cyber Security Policy. Internet Governance – Challenges and Constraints, Computer Criminals, Assets and Threats. Other offences under the Information Technology Act in India, The role of Electronic Evidence and miscellaneous provisions of the IT Act.2008.

TEXTBOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCE BOOKS:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.
3. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2ndEdition, O' Reilly Media, 2006.
4. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, New Delhi, 2006.
5. Cyberspace and Cybersecurity, George Kostopoulos, Auerbach Publications, 2012.
6. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, Second Edition, Albert Marcella, Jr., Doug Menendez, Auerbach Publications, 2007.
7. Cyber Laws and IT Protection, Harish Chander, PHI, 2013.

L:T:P:: 2:0:0 **Credits-0**

CST-006: PYTHON PROGRAMMING

Course Objectives: The objectives of this course is to:

1. Introduce the basic principles and concepts of python programming, and how python programming concepts are useful in problem-solving.
2. Write clear and effective python code.
3. To perform file operations to read and write data in files.
4. To create applications using Python Programming.

Course Outcomes: On successful completion of the course, the student will be able to:

1. Develop essential programming skills in computer programming concepts like data types.
2. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
3. Illustrate the process of structuring the data using lists, tuples, and dictionaries.
4. Demonstrate using built-in functions and operations to navigate the file system.
5. Interpret the concepts of modules and user-defined functions in Python.

COURSE CONTENTS:

UNIT – I: Introduction and Syntax of Python Program: Features of Python, Interactive, Object-oriented, Interpreted, platform-independent, Python building blocks -Identifiers, Keywords, Indention, Variables, Comments, Python environment setup – Installation and working of IDE, Running Simple Python scripts to display a welcome message, Python variables.

Python Data Types: Numbers, String, Tuples, Lists, Dictionary. Declaration and use of datatypes, Built-in Functions.

UNIT – II: Python Operators and Control Flow statements: Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence.

Control Flow: Conditional Statements (if, if...else, nested if), Looping in python (while loop, for loop, nested loops), loop manipulation using continue, pass, break, else.

UNIT – III: **Data Structures in Python: String:** Concept, escape characters, String special operations, String formatting operator, Single quotes, Double quotes, Triple quotes, Raw String, Unicode strings, Built-in String methods.

Lists: Defining lists, accessing values in lists, deleting values in lists, updating lists, Basic List Operations, and Built-in List functions.

Tuples: Accessing values in Tuples, deleting values in Tuples, and updating Tuples, Basic Tuple operations, and Built-in Tuple functions.

Sets: Accessing values in Set, deleting values in Set, and updating Sets, Basic Set operations, Built-in Set functions.

Dictionaries: Accessing values in Dictionary, deleting values in Dictionary, and updating Dictionary, Basic Dictionary operations, Built-in Dictionaries functions.

UNIT – IV: Python Functions, modules, and Packages: Use of Python built-in functions (e.g., type/data conversion functions, math functions etc.).

User-defined functions: Function definition, Function call, function arguments and parameter passing, Return statement, **Scope of Variables:** Global variable and Local Variable.

Modules: Writing modules, importing modules, importing objects from modules, Python built-in modules (e.g., Numeric, mathematical module, Functional Programming Module), Packages.

UNIT – V: File Handling: Opening files in different modes, accessing file contents using standard library functions, Reading, and writing files, closing a file, Renaming, and deleting files, File related standard functions.

TEXTBOOKS:

1. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, CreateSpace Independent Publishing Platform, 2016.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2015.
3. Ch Satyanarayana, “Python Programming”, 1st Edition, universities press (India) private limited 2018.

REFERENCE BOOKS:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, “Programming Python”, 4th Edition, O’Reilly Media, 2011.ISBN-13: 978-9350232873
3. Wesley J Chun, “Core Python Applications Programming”, 3rd edition, Pearson Education India, 2015. ISBN-13: 978-9332555365
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, “Data Structures and Algorithms in Python”,1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
5. Reema Thareja, “Python Programming using problem-solving approach”, Oxford university press, 2017.

L:T:P:: 3:1:0 **Credits-4**

ECT-041 ANALOG COMMUNICATION SYSTEMS

COURSE OBJECTIVES: This course enables the students to:

1. Explain analog communication system and representation of signals.
2. Explain different methods of amplitude modulation and demodulation schemes, their design, operation and applications.
3. Explain different methods of angle modulation and demodulation schemes, their design, operation and applications.
4. Explain different methods of pulse modulation, their design, operation and applications.
5. Evaluate the performance of analog communication system in the presence of noise

COURSE OUTCOMES:

1. Student will be able to design and analyze various continuous modulation schemes.
2. Student will be able to analyse the noise performance of continuous modulation systems.
3. Students will acquire knowledge of digital base band transmissions.
4. Students will be able to understand different modulation techniques used in digital communications.
5. Students will be capable of solving engineering problems related to communication systems.

COURSE CONTENTS:

UNIT 1: CW MODULATION SYSTEMS: Review of signals and systems, Frequency domain representation of signals, principles of amplitude modulation systems-DSB, SSB and VSB modulations. Angle modulation, representation of FM and PM signals, spectral characteristics of angle modulated signals.

UNIT 2: NOISE IN CW MODULATIONS: Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems, Pre-emphasis and De-emphasis, threshold effect in angle modulation.

UNIT 3: PULSE MODULATIONS: Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

UNIT 4: DETECTION THEORY: Elements of detection theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations, Base band Pulse Transmission- Inter symbol Interference and Nyquist criterion, Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

UNIT 5: Digital Modulation tradeoffs, Optimum demodulation of digital signals over band-limited channels-Maximum likelihood sequence detection (Viterbi receiver), Equalization Techniques, Synchronization and Carrier Recovery for Digital modulation.

BOOKS:

1. Haykin, Communication Systems,JohnWiley&Sons,2003.
2. Lathi, Modern Digital and Analog Communication System,Oxford,2012.
3. Haykin, Digital Communications,Wiley,2013.
4. Thomes and Cover, Elements of information theory,Wiley,2005.
5. Taub & Schilling, Principles of Communication Systems,TMH,2013.
6. Sklar & Ray, Digital Communication, Pearson,2009.
7. Glover, Digital Communication, Pearson, 2009.
8. Shanmugam, Digital and Analog Communication Systems, Wiley,2006.
9. Tomasi, Electronic communications systems, Pearson Education,2004.

L:T:P:: 3:1:0 **Credits-4**

ECT-042 MICROPROCESSORS & MICROCONTROLLERS

COURSE OBJECTIVES : This course enables the students to:

1. To explain the basic building blocks of a Microprocessor/ Microcontroller architecture and the operation with relevant timing diagrams.
2. To demonstrate the knowledge of different addressing modes and instruction set of a Microprocessor/ Microcontroller in developing efficient programing logic.
3. To develop the interfacing circuits for different applications with appropriate peripherals.
4. To analyze the evolution of Microprocessor/Microcontroller and compare the different features.
5. To design a Microprocessor/ Microcontroller based system suitable for industrial applications.

COURSE OUTCOMES:

1. Students will be able to understand the architecture and develop program of Intel 8085/8086.
2. Students will be able to understand the working and use of different peripherals of microprocessors.
3. Students will be able to understand the architecture of microcontroller and programming.
4. Students will be able to interface a microcontroller system to other electronic systems.
5. Students will be capable of solving engineering problems related to microprocessors and microcontrollers.

COURSE CONTENTS:

UNIT 1: 8085 MICROPROCESSOR: Microprocessors evolution, basic microcomputer architecture and components.8085 microprocessor: pin diagram, internal architecture and register organization, interrupts flags, instruction set and writing program using assembly language.

UNIT 2: 8086 MICROPROCESSOR: 8086 microprocessor pin diagram internal architecture and register organization, 8086 Interrupts, Physical memory organization, General bus operation, I/O addressing capabilities, addressing modes, Instruction set description, writing programs using assembly language, Memory and I/O interfacing.

UNIT 3: INTERFACING: Direct Memory Access and DMA controlled I/O, Interfacing of microprocessors with 8255, 8254, 8259, 8251, 8279.

UNIT 4: 8051 MICROCONTROLLER: Evolution of microcontrollers, 8051 architecture and pin diagram, 8051 flag bits and the PSW register, 8051 register banks and stack, addressing modes and accessing memory using various addressing modes, arithmetic and logic instructions and programs, 8051 assembly programming.

UNIT 5: INTERFACING TO MICROCONTROLLER: 8051 connections to RS-232, 8051 serial communication programming, Interrupt structure in 8051, timer/counter programming of 8051, Serial I/O interface, Parallel I/O ports interface, LCD and keyboard interfacing, sensor interfacing.

BOOKS:

1. Nagoorkani, Microprocessors & Microcontrollers, TMH, 2010.
2. Gaonkar, Microprocessor Architecture, Programming, Wiley, 2007.
3. Barry, Intel Microprocessors, PHI, 2014.
4. Liu & Gibson, Microprocessor Systems, PHI, 2000.
5. Ray and Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 2006.
6. Hall, Microprocessors and Interfacing, TMH, 2006.
7. Mazidi&Mazidi, 8051 Microcontroller and Embedded Systems, Pearson, 2007.

L:T:P:: 3:1:0 **Credits-4**

ECT-043 ELECTROMAGNETIC FIELD THEORY

COURSE OBJECTIVE : This course envisions to impart to students to

1. To apply the basic skills of mathematics, physics and science to understand, design and develop various engineering problems involving electromagnetic fields.
2. To lay the foundations of electromagnetic engineering and its applications in modern communications involving both wireless and guided wave medium.
3. To analyse the electromagnetic wave propagation in guided and unguided medium having different medium properties and different boundary conditions.
4. To develop an ability to identify, formulate, and solve electromagnetic engineering problems.
5. To review and present the literature ethically and also develop the skill to work individually or in a team.

COURSE OUTCOMES:

1. Students will be able to understand principles, theorems of electromagnetic, and their applications.
2. Students will beabletoapplytheknowledgeofelectromagneticfortime-varyingfields.
3. Students will eabletounderstandtheworkingoftransmissionlinesandtheirapplications.
4. Students will be able to understand the propagation of EM waves through waveguides.
5. Students will be able to solve engineering problems related to electromagnetic.

COURSE CONTENTS:

UNIT 1: VECTOR ANALYSIS: Vector algebra, dot and cross products, Coordinate systems, Relation in rectangular, cylindrical, and spherical coordinate systems, concept of differential line, differential surface and differential volume in different coordinate systems

ELECTROSTATICS: Coulomb's law, electric field intensity, fields due to different charge distributions, electric flux density, gauss law of electrostatics, divergence theorem, electric potential, relations between E and V, Maxwell's equations for electrostatic fields, energy density, convection and conduction currents, continuity equation, boundary conditions, dielectric materials, boundary conditions, capacitance – parallel plate, coaxial, spherical capacitors, Poisson's and Laplace's equations.

UNIT 2: MAGNETOSTATICS: Biot-Savart law, Ampere's circuital law, magnetic flux density, curl, Stoke's theorem, Maxwell's equations for static EM fields, magnetic scalar and vector potentials, forces due to magnetic fields,Ampere's Force law, inductances and magnetic energy.

MAXWELL'S EQUATIONS (TIME VARYING FIELDS): Faraday's law and emf, concept of displacement current density, Maxwell's equations in integral and differential forms, retarded potential.

UNIT 3: TRANSMISSION LINES: Definition of characteristic impedance and propagation constant, general solution of the transmission line; two standard forms for voltage and current of a line terminated by impedance, input impedance of a lossless line terminated by impedance, meaning of reflection coefficient, wavelength and velocity of

propagation, distortion less transmission line, standing wave ratio on a line, the quarter wave line and impedance matching, single stub matching and double stub matching, Smith chart, application of the smith chart, conversion from impedance to reflection coefficient and vice-versa.

UNIT 4: ELECTROMAGNETIC WAVES: Wave propagation in free space, conducting and perfect dielectric media, Skin effect, Poynting vector and Poynting theorem, wave polarization

UNIT 5: PLANE WAVES REFLECTION AND DISPERSION: Reflection of wave at normal incidence and multiple interfaces wave propagation in general direction, reflection at oblique incident angles, Brewster angle, total reflection and transmission of obliquely incident wave, wave propagation and pulse broadening in dispersive media.

BOOKS:

1. Hayt andBuck, Engineering Electromagnetic,TMH,2014.
2. Sadiku, Elements of Electromagnetics, Oxford, 2007.
3. Liao, Microwave Devices & Circuits; PHI,2003.
4. Kraus,Electromagnetic with Applications,TMH,2010.
5. Prasad, Antenna and wave propagation, Satya Prakashan, 2012.

L:T:P:: 0:0:2 **Credits-1**

ECP-041 ANALOG COMMUNICATION LAB

COURSE OBJECTIVES: This course enables the students to:

1. Understand the fundamentals to explain the functionality of modulation and demodulation.
2. Analyze the concepts, write and simulate the concepts of AM and AM Demodulation process in Communication.
3. Know FM and FM-Demodulation process in communication.
4. Discriminate the AM and FM functionalities. Interpret with various angle modulation and demodulation systems.
5. Create the simulation environments in PAM, PWM, PPM and verification of circuit and waveform in software platform.

COURSE OUTCOMES:

1. Students will be able to design and test different modulation and demodulation schemes of analog communication.
2. Students will be able to implement various digital modulation techniques using hardware circuits.
3. Students will be able to design the experiments, analyze and interpret the measured data.
4. Students will acquire skills of teamwork, technical communication and report writing.
5. Students will be capable of solving practical communication engineering problems.

COURSE CONTENTS:

1. Design and testing of an amplitude modulator & demodulator circuit and determine the depth of modulation.
2. Design and testing of a frequency modulator & demodulator circuit and determine the modulation index.
3. Design and tracing the signals at various points of a PAM, PWM, PPM modulator and demodulator circuits.
4. Design and tracing the signals at various points of a DSB-SC, SSB-SC modulator and demodulator circuits.
5. Design and tracing the signals at various points of a Delta modulation & demodulation modulator and demodulator circuit.
6. Implementation and verification of ASK, FSK, PSK modulation and demodulation techniques.
7. Implementation and verification of the pulse code modulation and demodulation systems.
8. Implementation and verification of delta modulation and demodulation techniques and observe the effect of slope overload.

9. Verification of communication signals between a TDM-PCM transmitter and receiver.
10. Verification of analog signal transmission using sampling & reconstruction Transceiver.
11. Implementation and verification of delta sigma modulation & demodulation techniques.

L:T:P:: 0:0:2 **Credits-1**

ECP-042 MICROPROCESSOR & MICROCONTROLLER LAB

COURSE OBJECTIVES:

1. To develop efficient 8085 based program for different tasks.
2. To develop efficient 8086 based program for different tasks.
3. To develop efficient 8051μc based program for different tasks.
4. To build interfacing circuits for different tasks.
5. To be able to develop microprocessor and microcontrollers based systems for industrial applications.

COURSE OUTCOMES:

1. Students will able to write assembly language program in 8085 & 8086 microprocessor.
2. Students will get the knowledge of Memory and peripheral interfacing with Microprocessors (8085/8086).
3. Students will be able to write program for 8051 microcontrollers.
4. Students will acquire skills of teamwork, technical communication and effective report writing.
5. Students will be capable of solving practical engineering problems related to application of microprocessors and microcontrollers.

COURSE CONTENTS:

1. Write and implement a program for adding two 8- bit numbers using 8085 microprocessor.
2. Write and implement a program for subtracting two 8- bit numbers using 8085 microprocessor.
3. Write and implement a program for finding the smallest number from a given set of numbers using 8085 microprocessor.
4. Write and implement a program for finding the largest number from a given set of numbers using 8085microprocessor.
5. Write and implement 8086 assembly language program to add, sub of two 8-bit numbers.
6. Write and implement 8086 assembly language program to ascending order, descending order of an array of numbers.
7. Write and implement 8086 assembly language program for multiplication of the given numbers.
8. Write and implement 8086 assembly language program for division of the given numbers.
9. Write and implement assembly language program for stepper motor interfacing to 8086.
10. Write and implement a program for arithmetic operation of two 8-bit numbers using 8051 microcontroller.
11. Write and implement a program for interfacing sensor with microcontroller 8051.
12. Write and implement a program for interfacing keyboard with microcontroller 8051.

L:T:P:: 0:0:2 **Credits-1**

CSP-003: DATA STRUCTURES AND ALGORITHMS LAB

COURSE OBJECTIVES: The objectives of this course is to:

1. Analyze step by step development of algorithms to solve real-world problems.
2. Implement various data structures, viz. Stacks, Queues, Linked Lists, Trees and Graphs.
3. Understand various data searching & sorting techniques.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Develop programs using dynamic memory allocation and linked list ADT.
2. Apply Stack and Queue to solve problems.
3. Implement the concept of hashing in real-time dictionaries.
4. Identify and implement suitable data structures for the given problem.
5. Solve real-world problems by finding the minimum spanning tree and the shortest path algorithm.

LIST OF EXPERIMENTS:

1. Write programs to implement the following using an array.
   a) Stack ADT
   b) Queue ADT
2. Write programs to implement the following using a singly linked list.
   a) Stack ADT
   b) Queue ADT
3. Write a program to implement the deque (double-ended queue) ADT using a doubly linked list.
4. Write a program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
5. Write a program to implement circular queue ADT using an array.
6. Write a program to implement all the functions of a dictionary (ADT) using hashing.
7. Write a program to perform the following operations on B-Trees and AVL-trees:

a) Insertion.

b) Deletion.

8. Write programs for implementing BFS and DFS for a given graph.

9. Write programs to implement the following to generate a minimum cost-spanning tree:

a) Prim's algorithm.

b) Kruskal's algorithm.

10. Write a program to solve the single source shortest path problem.

(Note: Use Dijkstra's algorithm).

11. Write a program that uses non-recursive functions to traverse a binary tree in:

a) Pre-order.

b) In-order.

c) Post-order.

12. Write programs for sorting a given list of elements in ascending order using the following sorting methods:

a) Quick sort.

b) Merge sort.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005) Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)

SYLLABUS

For

B.TECH

(Electronics & Communication Engineering)

3RD Year

Effective From – Session 2024-25

SEMESTER-V													
Sl.No.	SubjectCodes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1.	ECT-051	DC	Antenna & Wave Propagation	3	1	0	30	20	50	100		150	4
2.	ECT-052	DC	Digital Communication	3	1	0	30	20	50	100		150	4
3.	ECT-053	DC	Semiconductor Devices	3	0	0	30	20	50	100		150	3
4.	EEC-01X	PEC	PEC-1	3	1	0	30	20	50	100		150	4
5.	EEC-02X	PEC	PEC-2	3	0	0	30	20	50	100		150	3
6.	ECP-051	DLC	Integrated Circuit Lab	0	0	2		25	25		25	50	1
7.	ECP-052	DLC	Circuit Simulation Lab	0	0	2		25	25		25	50	1
8.	ECP-053	DLC	Soft Computing Lab	0	0	2		25	25		25	50	1
9.	ECP-054	DLC	Mini Project-II or Internship-II*	0	0	2			50			50	1
10.	AST009 AST010	MC	Constitution of India / Essence of Indian Traditional Knowledge	2	0	0	15	10	25	50			
11.	GP005	NC	General Proficiency						50				
12.			Total	17	3	8						950	22
13.			Minor Courses (Optional) **	3	1	0	30	20	50	50			4
*The Mini Project-II or Internship-II (4-6 weeks) conducted during summer break after IV semester and will be assessed during V semester													
MOOCs course													

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week,
CT-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance,
PS-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**-
Theory Examination Marks,PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

Program Elective-1

EEC-011 Multimedia Communication
EEC-012 Embedded Systems
EEC-013 Computer Networks
EEC-014 Design of Analog CMOS Integrated Circuits.

Program Elective-2
EEC-021 Power Electronics
EEC-022 Artificial Neural Network and Fuzzy Logic
EEC-023 IoT & Machine learning
EEC-024 Electronics Measurement

SEMESTER-VI													
Sl.No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1.	ECT-061	DC	Control Systems	3	1	0	30	20	50	100		150	4
2.	ECT-062	DC	Digital Signal processing	3	1	0	30	20	50	100		150	4
3.	ECT-063	DC	Microwave Engineering	3	1	0	30	20	50	100		150	4
4.	EEC-03X	PEC	Departmental Elective - 3	3	0	0	30	20	50	100		150	3
5.	AHT011	HSC	Open Elective-1	3	0	0	30	20	50	100		150	3
6.	ECP-061	DLC	Control Systems Lab	0	0	2		25	25		25	50	1
7.	ECP-062	DLC	Digital Signal processing Lab	0	0	2		25	25		25	50	1
8.	ECP-063	DLC	Microwave Lab	0	0	2		25	25		25	50	1
9.	AST010 AST009	MC	Essence of Indian Traditional Knowledge/ Constitution of India	2	0	0	15	10	25	50			
10.		NC	General Proficiency						50				
11.			Total	17	3	6						900	21
12.			Minor Courses (Optional) **	3	1	0	30	20	50	50			4
13.	ECP-064	DLC	Mini Project-III or Internship-III*	To be completed at the end of sixth semester (during Summer									
MOOCs course													

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week,

CT-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance,

PS-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**-

Theory Examination Marks,PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

Program Elective-3

EEC-031 Probability Theory and Stochastic Processes
EEC-032 Information Theory & Coding
EEC-033 Radar and Navigation
EEC-034 Analog Filter Design

L:T:P:: 3:1:0 **Credits-4**

ECT-051 ANTENNA AND WAVE PROPAGATION

COURSE OBJECTIVES: This course enables the students

1. To impart knowledge on the fundamental antenna parameters .
2. To develop the concept of mechanism of radio wave propagation and applications.
3. To Analyze the concepts associated with operating principles of antenna theory, antenna performance, operation ,classification and applications.
4. To explain the concept and basic principles associated with the implementation of antenna arrays.
5. To Apply the Antenna measurement techniques using microwave equipment setup.

COURSEOUTCOMES: After completion of the course student will be able to:

1. Understand various performance parameters of antenna and their applications.
2. Understand principles of various practical antenna and antenna arrays.
3. Underst and different aspects of wave propagation.
4. Measure various antenna parameters.
5. Solve engineering problems related to antenna and propagation.

COURSE CONTENTS:

UNIT1: REVIEWOFELECTROMAGNETICTHEORY

Functions and properties of antennas, basic antenna elements, radiation mechanism, radiated power and radiation resistance of current element/Hertzian dipole, radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, beam width, bandwidth, polarization, antenna input impedance, elementary idea about self and mutual impedance ,radiation efficiency, effective aperture, antenna temperature.

UNIT2: ANTENNA ARRAYS

Introduction, array of two point sources, n-element linear array with uniform amplitude and spacing, analysis of broad side array, ordinary end-fire array, Hansen-Woodyard end fire array, n-element linear array with non-uniform spacing, analysis of binomial and Dolph-Tschebyscheff array, scanning array, super directive array.

UNIT3: TYPES OFANTENNA

HF, VHF and UHF antennas: folded dipole, V-antenna, rhombic antenna, Yagi-Uda antenna, log-periodic antenna, loop antenna, radiation field from short magnetic dipole, microwave antennas, helical antenna, horn antenna,parabolicdish,micro-stripantenna:rectangularpatch,circular patch, circular polarization, array and feed networks.

UNIT4: WAVEPROPAGATION

Friis free space equation, reflection from earth‟s surface, surface and space wave propagation, field strength of space wave, range of space wave propagation, effective earth's radius, effect of earth imperfections and atmosphere on space wave propagation, modified refractive index, duct propagation, tropospheric propagation, structure ofionosphere,propagationofradiowavesthroughionosphere,refractiveindexofionosphere,reflectionandrefraction of waves by ionosphere, critical frequency, maximum usable frequency, optimum working frequency, lowest usable frequency, virtual height, skip

distance, effect of earth's magnetic field.

UNIT5: ANTENNA MEASUREMENT

Antenna ranges**,** reflection, free-space ranges, near field/far field, measurement of radiation pattern, gain measurement, directivity measurement, radiation efficiency, impedance measurement, current measurement, polarization and scale model measurement, basics of wireless energy transfer.

BOOKS:

1. Balanis, Antenna Theory: Analysis and Design, John Wiley&Sons, 2015.
2. Jordan, Electromagnetics and radiating systems, PHI, 2003.
3. Collins, Antenna and radio wave propagation, McGrawHill,2013.
4. Krauss, Antenna Theory, TMH, 2013.
5. Gautam, Antenna and wave propagation ,Katson books,2014.

L:T:P:: 3:1:0 **Credits-4**

ECT052 DIGITAL COMMUNICATION

COURSE OBJECTIVES: This course envisions to impart to students to

1. To know the principles of sampling, Quantization and various waveform coding schemes.
2. To learn the various baseband transmission schemes
3. To learn the different digital modulation techniques
4. To know the elements of information theory
5. To know spread spectrum techniques

COURSE OUTCOMES: After completion of the course student will be able to:

1. Design PCM systems
2. Design and implement base band transmission schemes
3. Design and implement band pass signaling schemes
4. Analyze the spectral characteristics of band pass signaling schemes and their noise performance
5. Design error control coding schemes

COURSE CONTENTS:

UNIT I INFORMATION THEORY

Discrete Memoryless source, Information, Entropy, Mutual Information - Discrete Memoryless channels – Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - Source coding theorem - Shannon - Fano & Huffman codes.

UNIT II WAVEFORM CODING & REPRESENTATION

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester

UNITIII BASEBAND TRANSMISSION & RECEPTION

ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding - Eye pattern – Receiving Filters- Matched Filter, Correlation receiver, Adaptive Equalization

UNIT V DIGITAL MODULATION SCHEME

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers - Principle of DPSK.

UNIT V ERROR CONTROL CODING

Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

TEXT BOOK:

1. S. Haykin, ―Digital Communications‖, John Wiley, 2005 (Unit I –V)

REFERENCES:

1. B. Sklar, ―Digital Communication Fundamentals and Applications‖, 2nd Edition, Pearson

Education, 2009
2. B.P.Lathi, ―Modern Digital and Analog Communication Systems‖ 3rd Edition, Oxford University Press 2007.
3. H P Hsu, Schaum Outline Series - ―Analog and Digital Communications‖, TMH 2006
4. J.G Proakis, ―Digital Communication‖, 4th Edition, Tata Mc Graw Hill Company, 2001.

L:T:P:: 3:1:0 **Credits-4**

ECT-053 SEMICONDUCTOR DEVICES

COURSE OBJECTIVES : This course envisions to impact to students to

1. Understand Atoms, Electrons, Energy Bands and Charge Carriers in Semiconductors.
2. Grasp the impact of Excess Carriers in Semiconductors, Optical Absorption, Carrier Lifetime, Photoconductivity and Diffusion of Carriers and apply the obtained knowledge.
3. Appraise and analyse the characteristics of PN Junction and Junction Diodes.
4. Evaluate the characteristics of Bipolar Junction Transistor (BJT).
5. Comprehend the characteristics of Field-Effect Transistors and create their structures.

COURSEOUTCOMES: After completion of the course student will be able to:

1. Describe and illustrate the Energy Bands,Charge Carriers and Carrier Transport Phenomena in semiconductor.
2. Illustrate with the sketch of the structure of PN Junction and Junction Diodes. diagram their characteristics and analyse them.
3. Appraise the principle of operation BJTs, schematize their characteristics, assess and summarize their features.
4. Understand the design and performance parameters of MOSFETs
5. Acquire knowledge about working principles of advance semiconductor devices.
6. Solve engineering problems related to Semiconductor Devices..

Syllabus:

UNIT 1: FUNDAMENTALS OF SEMICONDUCTORS: Semiconductor materials, elemental and compound semiconductors, energy band diagram, carrier concentration, drift and diffusion currents, conductivity, Effect of temperature and doping on mobility, The Hall Effect, relation between the energy band diagram and electric field, Einstein relations, Direct and Indirect recombination of electrons and holes , Steady-state carrier generation, Quasi-Fermi level; generation, recombination and injection of carriers and lifetime, transient response, Deby length, Continuity equations.

UNIT 2: JUNCTIONS AND INTERFACES: PN junctions: contact potential, electrical field, Potential and charge density at the junction, energy band diagram, PN junction under bias, junction capacitance, minority carrier distribution, current voltage characteristics: Shockley Equation, temperature dependence of I-V characteristics, small signal and switching transients in diodes.

UNIT 3: BIPOLAR JUNCTION TRANSISTORS: Fundamentals of BJT Operation, Amplification with BJTs, Minority Carrier Distributions and Terminal Currents, Drift in the Base Region, Base Narrowing, Avalanche Breakdown, Gummel–Poon Model, Kirk Effect; Frequency Limitations of Transistors, High-Frequency Transistors, Heterojunction Bipolar Transistors.

UNIT 4: METAL INSULATOR SEMICONDUCTOR DEVICES: The ideal MOS capacitor, accumulation, depletion and inversion band diagrams, CV characteristics, threshold voltage, MOSFET-structure, types, Drain current equation (derive)- linear and saturation region, Drain characteristics, transfer characteristics, Threshold Voltage, Body

Bias concept.

UNIT 5: MOSFET scaling – need for scaling, constant voltage scaling and constant field scaling, Sub threshold conduction in MOS. Short channel effects: Channel length modulation, Drain Induced Barrier Lowering, Velocity Saturation, Threshold Voltage Variations, Drain punch through and Hot Carrier Effects,etc.
ADVANCE SEMICONDUCTOR DEVICES: Structure, working principle and I-V characteristics of Tunnel FETs, Junctionless Field Effect Transistor and HEMTs.

BOOKS:

1. Robert F.Pierret,"Semiconductor DeviceFundamentals",Pearson,2006.
2. Streetman and Banerjee,"Solidstateelectronicsdevices",PHI,2015.
3. Neamen, Semiconductor Physics and Devices,TMH,2015.
4. Chenming Hu, Modern Semiconductor Devices for Integrated Circuits, Pearson India,2009
5. Sze, Semiconductor devices Physics and technology,Wiley,2008,
6. Dutta" Semiconductor Devices and circuits"Oxford,2008.

L:T:P:: 3:0:0 **Credits-3**

EEC-011 MULTIMEDIA COMMUNICATION

COURSE OBJECTIVES:

1. Understanding the multimedia communications systems, application and basic principles, analysis of the multimedia streaming,
2. Performing and establishing multimedia communication terminals, presentation of multimedia communications.

COURSEOUTCOMES: After completion of the course student will be able to:

1. Understand aspects multimedia communication system.
2. Understand the coding techniques used in multimedia communication.
3. Understand the standards of multimedia communication.
4. Understand transmission links and applications of multimedia communication.
5. Solve engineering problems related to multimedia communication.

COURSE CONTENTS:

UNIT 1: Introduction: Multimedia, definition, different types of multimedia products in different fields, introduction to making of multimedia, stages of the projects, the hardware and software requirements, authoring tools, categories of authoring tools.

UNIT 2: Lossless and lossy compression, run length coding, statistical coding, transform coding, text compression using static Huffman technique, dynamic Huffman technique and arithmetic coding techniques.

UNIT 3: Distributed multimedia systems, resource management of DMS, IP networking, multimedia operating systems, distributed multimedia servers, distributed multimedia applications, multimedia file formats.

UNIT-4: Multimedia communication standards, making of JPEG, making of MPEG, MPEG-1, MPEG-2, MPEG-4Audio/Video, MPEG-4 Visual Texture coding (VTC), Multimedia communication across networks, compression techniques; JPEG, MPEG.

UNIT-5: Transmission media: Twisted pair cable, coaxial cable, optical fiber, infrared, radio link, microwave link and satellite link.
Multimedia Application: Education (use of CAI tool), Entertainment, Edutainment, Virtual Reality, Digital Libraries, Information Kiosks, Video on Demand, Web Pages Video phone, Video conferencing and Health care.

BOOKS:

1. Rao, Bojkovic, Milovanovic, Multimedia Communication Systems,PHI,2002.
2. Andleigh, Thakrar, Multimedia System Design, PHI,2002.
3. Sharda, Multimedia Information Networking, PHI,2003.
4. Vaughan, Multimedia making it Work, TataMcGraw Hill,2006.

L:T:P:: 3:0:0 **Credits-3**

EEC-012 EMBEDDED SYSTEM

Course Objectives : This course enables the students to:

1. Define the fundamental of embedded systems
2. Show the correlation between hardware & software in embedded system
3. Show the application of embedded system in present market
4. Design the highly secure optimized embedded systems
5. Develop the suitable software for embedded system

COURSE OUTCOMES: After completion of the course student will be able to:

1. Understand various techniques of embedded systems.
2. Understand the device drivers and interrupt services.
3. Understand inter-process communication and synchronization.
4. Understand the concepts of real time operating systems.
5. Solve Engineering problems related to embedded systems

COURSE CONTENTS:

UNIT 1: INTRODUCTION TO EMBEDDED SYSTEMS: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT 2: CORE OF THE EMBEDDED SYSTEM: General Purpose and Domain Specific Processors, ASICs, PLDs, Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT 3: DEVICE AND COMMUNICATION BUS FOR DEVICES NETWORK: Serial communication devices, Parallel Device ports, Wireless Devices, Timer and Counting Devices, Watch dog timer, Real time clock, Serial Bus Communication Protocols, parallel Bus Devices protocol Parallel communication Network using ISA, PCI, PCI-X and advanced buses.

UNIT 4: DEVICE DRIVERS AND INTER-PROCESS COMMUNICATION: Device Driver, ISR Concept, Interrupt Sources, Interrupt Servicing (Handling) Mechanism, Multiple Interrupts, Context and the Periods for Context Switching, Interrupt Latency and Deadline, CPU Scheduling, Threads and Tasks, Shared Data, Inter process Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions.

UNIT 5: REAL TIME OPERATING SYSTEM: Introduction to Real Time Operating Systems, Process management, process scheduling, co-operating processes, Timer function, Event function, Memory management, Device, File and I/O subsystem management, RTOS Task Scheduling Models, Interrupt routine in RTOS environment and handling of interrupt Sources calls, hands-on for basic embedded project.

BOOKS:

1. Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata McGraw-Hill.
2. Designing Embedded Systems with PIC Microcontrollers: principles and applications by Tim Wilmshurst, Elsevier.
3. Embedded Systems Design by Steve Heath, II edition, Newnes publications.
4. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers by Tammy Noergaard, Elsevier.
5. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
6. Embedded Systems–Lyla, Pearson, 2013
7. An Embedded Software Primer - David E. Simon, Pearson Education.

L:T:P:: 3:0:0 **Credits-3**

EEC-013 COMPUTER NETWORKS

COURSE OBJECTIVES : This course envisions to impart to students to

1. Understand the different network topologies, transmission media and different MAC sub-layers used in the design of a Local Area Network (LAN) and Wireless LAN's.
2. Familiarize the layer of operation and working of different intermediate devices, network layer protocols and internet addressing mechanism.
3. Familiarize with the transport layer protocols to be used as an end-to-end service provider.
4. Illustrate different encryption and message authentication schemes to provide security at different layers.
5. To outline the functioning of the Application layer and different protocols of application layers e.g. HTTP, SMTP, WWW, FTP, VOIP etc.

COURSEOUTCOMES: After completion of the course student will be able to:

1. Understand aspects various layers used in data communication networks.
2. Understand switching systems.
3. Understand protocols used in data communication networks
4. Understand cryptography and algorithms.
5. Solve engineering problems related to computer networks.

COURSE CONTENTS:

UNIT 1: INTRODUCTION: Goals and Applications of Networks, Network structure and architecture layering, design issues for layering, reference models and their comparison, network topology.
PHYSICAL LAYER: Transmission media and channel impairments, modulation, multiplexing, digital channels, mobile telephone systems

UNIT 2: DATA LINK LAYER: Design issues, framing, error control, elementary data link protocols and sliding window protocols, HDLC, data link layer in internet.
MEDIUM ACCESS CONTROL: Channel allocation problem, MAC protocols; Aloha, CSMA, collision free protocols, limited contention protocol, Ethernet, IEEE 802.3 standards.

UNIT 3: NETWORK LAYER: Design issues, VC and datagram subnets, routing algorithms for wired and wireless hosts, congestion prevention policies, load shedding, connectivity of networks, connectionless inter-networking, inter-network routing, fragmentation, IP protocols, IP addressing, OSPF, IPv6.

UNIT 4: TRANSPORT LAYER: Transport service and primitives, addressing, connation establishment and release, flow control, buffering, multiplexing and crash recovery, introduction of UDP, modeling TCP connection management, TCP congestion control and performance issues.

UNIT 5: DNS and name space, overview of www, http, introduction of cryptography, substitution cipher and transposition cipher, DES, cipher methods, public key algorithms, social issues; privacy, freedom of speech &copyright.

BOOKS:

1. Tanenbaum "Computer Networks", Pearson Education,2012.

2. B.A.Forouzan “Data Communications and Networking (3rdEd.)“–TMH
3. Kumar, Manjunath, Kuri, Communication Networking: An Analytical Approach, 2004.
4. Stallings,” Data and Computer Communication”,PHI,2007.
5. Kuros and Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Addison Wesley, 2000.

L:T:P:: 3:0:0 **Credits-3**

EEC-014 DESIGN OF ANALOG CMOS INTEGRATED CIRCUITS

COURSE OBJECTIVE: This course envisions imparting to students to:

1. To understand most important building blocks of all CMOS analog Ics.
2. To study the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design common to all analog CMOS ICs.
3. To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
4. To understand the design of differential amplifiers, current amplifiers and OP AMP

OUTCOMES: After completion of the course student will be able to:

1. Realize the concepts of Analog MOS devices and current mirror circuits.
2. Design different configuration of Amplifiers and feedback circuits.
3. Analyze the characteristics of frequency response of the amplifier and its noise.
4. Analyze the performance of the stability and frequency compensation techniques of Op- Amp Circuits.
5. Construct switched capacitor circuits and PLLs

COURSE CONTENTS:

UNIT I INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS:

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

UNIT II AMPLIFIERS AND FEEDBACK

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response- Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

UNIT III FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

UNIT IV OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- General consideration of stability and frequency compensation- Multipole system- Phase margin- Frequency compensation- Compensation of two stage op Amps-

Other compensation techniques.

UNIT V **SWITCHED CAPACITOR CIRCUITS AND PLLS**

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback. Phase Locked Loops- Simple PLL- Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

BOOKS:

1. Behzad Razavi, ―Design of Analog CMOS Integrated Circuits‖, Tata McGraw Hill, 2001, 33rd re-print, 2016.
2. Phillip Allen and Douglas Holmberg ―CMOS Analog Circuit Design‖ Second Edition, Oxford University Press, 2004.
3. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
4. Grebene, ―Bipolar and MOS Analog Integrated circuit design‖, John Wiley & sons, Inc., 2003

L:T:P:: 3:0:0 **Credits-3**

EEC-021 POWER ELECTRONICS

COURSE OBJECTIVE: This course envisions imparting to students to:

1. To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
2. To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
3. To provide strong foundation for further study of power electronic circuits and systems

COURSEOUTCOMES: After completion of the course student will be able to:

1. Understand principles and working of power semiconductor devices.
2. Design the thyristor firing circuits and their applications.
3. Design the inverters circuits and their applications.
4. Understand the cyclo-converters circuits and their applications.
5. Solve engineering problems related to power electronics.

COURSE CONTENTS:

UNIT 1: POWER SEMICONDUCTOR DEVICES: Two-transistor model of thyristor, methods of triggering a thyristor, thyristor types, triggering devices; triggering devices, uni-junction transistor, characteristics and applications of UJT, programmable uni-junction transistor, DIAC, silicon-controlled switch, silicon unilateral switch, silicon bilateral switch, Shockley diode, Opto-isolators.

UNIT 2: THYRISTOR FIRING CIRCUITS TURN ON SYSTEMS: Requirements for triggering circuits, thyristor firing circuits, full wave control of ac with one thyristor, light activated SCRs (LASCR) control circuit, pulse transformer triggering, firing SCR by UJT, TRIAC firing circuit, phase control of SCR by pedestal and ramp controlled rectifier; types of converters, effect of inductive load, commutating diode or free-wheeling diode, controlled rectifiers, bi-phase half wave (single way), single-phase full wave phase controlled converter using bridge principle (double way), single phase fullwave phase controlled converter using bridge principle (double way) harmonics.

UNIT 3: INVERTERS: Types of inverters, bridge inverters, voltage source inverters (VSI)and pulse width modulated inverters, current source inverter ac voltage controllers; types of ac voltage controllers, ac phase voltage controllers, single-phase voltage controller with R-L load, harmonic analysis of single-phase full-wave controller with R-L load, gating signals.
DC to DC Converters (Choppers): dc choppers, chopper classification, two quadrant chopper, four quadrant chopper, and Morgan chopper.

UNIT 4: CYCLOCONVERTERS: Types of cyclo-converters, single-phase cyclo-converterand three-phase cyclo-converter.
Protection: Protection, *dv/dt* protection, *di/dt* protection and over voltage protection.

UNIT 5: INDUSTRIAL APPLICATIONS: Industrial applications of power electronics

components; one-shot thyristor trigger circuit, overvoltage protection, simple battery charger, battery charging regulator, ac static switches, dc static switchesand microprocessor based applications**.**

BOOKS:

1. Rashid, Power Electronics:Circuits, Devices & Applications, PHI,2003
2. Sen ,Power Electronics, TMH,2001
3. Rai, Power Electronics Devices, Circuits, Systems and Application, Galgotia, 2003.
4. Bimbhara,Electrical Machinery, Theory Performance and Applications ,Khanna publication, 2000.

L:T:P:: 3:0:0 **Credits-3**

EEC-022 ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC

COURSE OBJECTIVES: The main objectives of this course are to:

1. Introduce students to the various neural network and fuzzy systems models.
2. Reveal different applications of these models to solve engineering and other problems.
3. Introduce the theory and applications of artificial neural network and fuzzy systems to engineering applications with emphasis on image processing and control.
4. Discuss neural networks and fuzzy systems, architectures, algorithms and applications, including Back-propagation, BAM, Hopfield network, Competitive Learning, ART, SOFM, Fuzzy inference methods and expert systems..

COURSE OUTCOMES: After completion of the course student will be able to:

1. Understand the applications of neural networks.
2. Understand the different aspects of neural networks.
3. Understand the perceptron neural network.
4. Understand the fuzzy set theory and fuzzy mapping.
5. Solve engineering problems related to neural networks.

COURSE CONTENTS:

UNIT 1: NEURAL NETWORKS-1(INTRODUCTION & ARCHITECTURE): Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture; single layer and multilayer feed forward networks, recurrent networks, various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

UNIT 2: NEURAL NETWORKS-II (BACK PROPAGATION NETWORKS): Architecture; Perceptron model solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule coefficient, back propagation algorithm, factors affecting back propagation training, applications.

UNIT 3: FUZZY LOGIC-I (INTRODUCTION): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory versus probability theory, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT 4: FUZZY LOGIC–II (FUZZY MEMBERSHIP, RULES): Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications&De-fuzzifications, Fuzzy Controller.

UNIT 5: APPLICATION OF NEURAL NETWORK AND FUZZY LOGIC: Application of neural network, case study, Inverted pendulum, Image processing,introduction to neuro & fuzzy logic controller.

BOOKS:

1. Simon Haykin - Neural Networks. A Comprehensive Foundation. 3rd edtion" Prentice Hall of India
2. Yegna Narayanan,"Artificial Neural Networks" Prentice Hall India.
3. TimothyJ.Ross," Fuzzy Logic with Engineering Applications, 3ed, Wiley,2011

4. S.N.Sivanandam, S.N Deepa,"Principles of Soft Computing" Wiley; 3rd edition 2018
5. Jack M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishing Co., Boston, 2002.

L:T:P:: 3:0:0 **Credits-3**

EEC-023 IOT AND MACHINE LEARNING

COURSE OBJECTIVES : This course envisions to impart students to:

1. Understand the Atrificial neural work and different learning strategies.
2. Develop and design various machine learning techniques such as MLP, RBFNN,
3. FLANN, deep Learning
4. Understand the concept of fuzzy logic and its scope.
5. Develop and design fuzzy logic techniques for control, clustering and classification tasks.
6. Develop and analyze real time applications using machine learning and fuzzy logic techniques.

COURSE OUTCOMES:

1. Understand the fundamentals of IoT and machine learning.
2. Understand the Architecture of an IoT
3. Understand design methodology and hardware platforms involved in IoT.
4. Implement the IOT in Industry & real world

COURSE CONTENTS:

Unit 1: Fundamental of IoT: Introduction and evolution of IoT, industrial IoT, conceptual framework (connectivity layer, access layer, abstraction layer, service layer), cloud infrastructure, architectural view, technology behind IoT (RFID, wireless sensor networks, addressing schemes, data storage and analytics, visualization), source of IoT, characteristics of IoT, sensor and actuators.

Unit II: IoT Protocols: IoT system layers – IoT system architecture, end to end interaction between IoT layers, interoperability, design consideration for IoT, attributes, M2M communication, communication technologies for IoT – Zigbee, low energy Bluetooth, Wi-Fi, LoRa. IoT networks, wireless sensor network, MAC (medium access control) layer, Routing protocol.

Unit 3: Embedded platforms for IoT: Embedded computing basics (microcontrollers, system-on-chips, platform). IoT supported hardware platforms – Arduino, Raspberry Pi, Intel Galileo. Arduino IDE-coding, emulator, libraries.Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Interoperability in IoT.

Unit 4: Design and development: Introduction to python programming, Introduction to Raspberry Pi, Integration of Sensors and Actuators with Raspberry Pi, Implementation of IoT with Raspberry Pi, Introduction to SDN, SDN for IoT, Data Handling and Analytics, Cloud Computing, Sensor-Cloud, Fog Computing. Pervasive computing, Application of IoT.

Unit 5:Introduction To machine learning: Classic machine and adaptive machine, basics of training and testing phase, Over-fitting and under-fitting, Feature Selection Techniques, Multi-Class classification approaches, Principal component analysis(PCA), Application of machine learning.

Books:

1. Internet-of-Things (IoT) Systems - Architectures, Algorithms, Methodologies: DimitriosSerpanos Marilyn Wolf, Springer International Publishing AG 2018
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. Decentralized Internet of Things – A. Khan, T. Quasim, F. Algarni, Springer , 2020.
4. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press, 2015
5. Internet of Things- Architecture, Design Principles And Applications, Rajkamal, McGraw Hill, 2017
6. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013

L:T:P:: 3:0:0 **Credits-3**

EEC 024 ELECTRONICS MEASUREMENT

COURSE OBJECTIVES :This course enables the students to

1. Understand the need and concept of measurement, calibration, standards, errors, static and dynamic performance characteristics of measuring instruments.
2. Demonstrate the operating principles of different analog and digital instruments.
3. Experiment and analyze various a.c. and d.c. bridges for the measurement.
4. Explain the operation and construction of analog and digital CRO used for different parameter measurement in the department laboratory.
5. Solve the problems of measuring non-electrical parameters using different transducers.

COURSE OUTCOMES:

1. Students will have knowledge of various measuring instruments and their applications.
2. Students will be able to understand principles of different AC and DC bridges and their applications.
3. Students will be able to understand about different types of signal generators and signal analysistechniques.
4. Students will be able to understand various types of transducers.
5. Students will be able to solve engineering problems related to measurements and instrumentation.

COURSE CONTENTS:

UNIT 1: Sensors & Transducers: Role of sensors in measurement system, Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT, RVDT and Piezo Electric. Resistance Thermometer, Thermistors, Thermocouples and Strain Gauge Transducer: Basic principle of operation of Resistance strain gauge.

UNIT 2: Oscilloscope: Basic principle & construction, CRT, sweep modes, applications in measurement of voltage , freq. (Lissajous pattern), Dual Trace Oscilloscope, sweep modes, active, passive probes, delay line, analog storage oscilloscope, principle of secondary emission, Digital Storage Oscilloscope, sampling rate, sampling oscilloscope, application of the CRO in instrumentation and measurement, sampling oscilloscope. Comparison between analog and digital oscilloscope

UNIT 3: Bridges: Measurement of Resistance; Low, Medium and High using; Kelvin Double Bridge, Ammeter-Voltmeter method, substitution method, Wheat Stone Bridge, Loss of Charge and Megger. Measurement of Inductance and Capacitance using; Maxwell Inductance, Hay's, Anderson and Schering Bridges. Measurement of frequency by Wein bridge method

UNIT 4: Analyzers: Wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, applications of wave analyzer, Distortion analyzer, spectrum analyzer. **Digital Voltmeter**: Types of DVM; Ramp, Integrating, Successive approximation and Atomization in DVM. **Digital Frequency Meter**: Basic circuit, Frequency Measurement Circuit, High Frequency Measurement.

UNIT 5: Instrumentation: Strip Chart Recorders, X-Y Recorders, Ultraviolet Recorders, Magnetic Tape Recorders. **Display Devices**: Digital display methods, Seven Segment LED display, Dot Matrix display and LCD Display, Geiger Muller Tube, Ionization Chamber, Scintillation Counter, Anechoic chamber.

BOOKS:

1. Kalsi, Electronic Instrumentation, TMH, 2010.
2. Sawhney, A Course In Electrical & Electronic Measurement & Instrumentation, Dhanpatrai, 2004.
3. Nakra & Chaudhry, Instrumentation Measurement & Analysis, TMH, 2009.
4. Bernard Oliver, Electronic Measurements & Instrumentation, TMH, 1971.
5. Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI, 1992.
6. Bell, Electronic Instrument and Measurement, Oxford, 2009.

L:T:P:: 0:0:2 **Credits-1**

ECP 051 INTEGRATED CIRCUITS LAB

COURSE OBJECTIVES : This course enables the students to

1. To apply operational amplifiers in linear and nonlinear applications.
2. To acquire the basic knowledge of special function ICs.

COURSE OUTCOMES:

1. Students will be able to simulate the electronic circuits using Op-amp.
2. Students will be able to implement the filters using Op-amp.
3. Students will be able to design and implement multivibrator circuits using Timer IC 555.
4. Students will acquire skills of teamwork, technical communication and effective report writing.
5. Students will be capable of solving practical engineering problems in the field of integrated circuits

COURSE CONTENTS:

1. To design and verify the op-amp working as:
   i. Unity Gain amplifier.
   ii. Inverting amplifier.
   iii. Non-Inverting amplifier.
2. Design & test a difference amplifier using operational amplifier.
3. Design & test Integrator and Differentiator using operational amplifier.
4. Design an active second order low pass filter using operational amplifier & plot the Frequency response characteristics.
5. Design an active second order high pass filter using operational amplifier and plot the frequency response characteristics.
6. Design and test a square wave generator using operational amplifier.
7. Design and test a triangular wave generator using operational amplifier.
8. Design and test a mono stable multivibrator using Timer IC 555.
9. Design and test an Astable multivibrator using Timer IC 555.
10. Design and test IC voltage regulator circuits using ICs 723/7805/7905.
11. Determine the locking and capture range of a PLL IC 565.

L:T:P:: 0:0:2 **Credits-1**

ECP-052 CIRCUIT SIMULATION LAB

COURSE OBJECTIVE: The objective of this lab is to appreciate and the use software tools in Electronics engineering for modeling and simulation of Electronics and Communication circuits in lesser time

COURSE OUTCOMES:

1. Students will be able to simulate the electronic circuits using CAD tools.
2. Students will be able to implement the electronic circuits on nano boards.
3. Students will be able to perform the experiments, analyze and interpretation of data.
4. Students will acquire skills of teamwork, technical communication and effective report writing.
5. Students will be capable of solving practical engineering problems using MATLAB.

COURSE CONTENTS:

1. Experiments based on Simulation and Implementation of Electronic Circuits:
2. Design simulation and analysis of two input NAND and NOR gate.
3. Design, simulation and analysis of NMOS and CMOS inverter.
4. Design, simulation and analysis of full adder circuit.
5. Design, simulation and analysis of push-pull amplifier.
6. Design, Simulation and analysis of different amplifier.
7. Design, Simulation and analysis of amplitude modulation using MATLAB.
8. Design, Simulation and analysis of frequency modulation using MATLAB.
9. Design, Simulation and analysis of phase modulation using MATLAB.
10. Design, Simulation and analysis of ASK using MATLAB.
11. Design, Simulation and analysis of FSK using MATLAB.
12. Design, Simulation and analysis of PSK using MATLAB.

L:T:P:: 0:0:2 **Credits-1**

ECP-053 SOFT COMPUTING LAB

COURSE OBJECTIVES: The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing. .Upon completion of this course, the student should be able to get an idea on

1. Artificial Intelligence, Various types of production systems, characteristics of production systems.
2. Neural Networks, architecture, functions and various algorithms involved.
3. Fuzzy Logic, Various fuzzy systems and their functions. 4. Genetic algorithms, its applications and advances.

COURSE OUTCOMES:

1. Understand components of Soft Computing and differentiate between hard & soft computing.
2. Understand the difference between learning and programming and explore practical applications of Neural Networks (NN)
3. To analyse and appreciate the applications which can use fuzzy logic.
4. Understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various applications and they will be able to design inference systems.
5. Appreciate the importance of optimizations and its use in computer engineering fields and other domains.

COURSE CONTENTS:

1. Study of MATLAB software and its toolboxes & write a program to solve mathematical functions/operators like arithmetic, complex, trigonometric operator.
2. Write a program to plot the following activation functions: Sigmoidal,log sigmoidal, linear, saturating linear, etc.
3. Generate XOR function using McCulloch-Pits Neural Network by MATLAB program.
4. Write a MATLAB program for perceptron net for an AND function with bipolar inputs and targets.
5. Write a program to calculate simple addition and subtraction of fuzzy sets, Union Intersection and Complement operation.
6. Write a program in MATLAB to implement De-Moragan's Law.
7. Write a Program in MATLAB to plot various membership functions.
8. Case Study: Write a MATLAB program to train and simulate Multilayer perceptron neural network(Back-propagation neural network)
9. Case Study: Design a Fuzzy logic controller(Air conditioning system/ water level control)
10. Case study: Pattern recognition/alphabet recognition/number recognition

L:T:P:: 3:1:0 **Credits-4**

ECT-061CONTROL SYSTEMS

COURSE OBJECTIVES: This course envisions to impart to students to:

1. Basic understanding of control system and its types.
2. Represent any Linear system to using transfer function concept.
3. Explain the concept of system modelling.
4. Explain the time domain analysis to understand the behavior of linear system/Nonlinear system.
5. Analyze the system using Frequency domain approach.

COURSEOUTCOMES:

1. Students will be able to understand the block diagram representation and reductions techniques of control system and its application to find the transfer function.
2. Students will be able to understand the time and frequency response analysis as well as stability concepts of first and second order control systems.
3. Students will be able to use the graphical techniques to analyze and design the control systems.
4. Students will be able to understand the system equations invariable form.
5. Students will be capable of solving engineering problems related to control systems.

COURSE CONTENTS:

UNIT-1: GENERAL INTRODUCTION TO CONTROL SYSTEM: Historical background, open loop and closed loop control systems, basic elements of a feedback control system, types of feedback control systems, and effects of feedback.
TRANSFER FUNCTION: Laplace transform and inverse Laplace transform, differential equations of physical systems, poles and zeros, characteristic equation; Block diagrams: representation and reduction; Signal flow graphs: definitions, properties, gain formula; analogous systems.

UNIT-2: TIME RESPONSE ANALYSIS: standard test signals, response of first and second order systems, time response specifications, steady state errors, types of control systems, static error constants; effects of addition of poles and zeros.
CONCEPT OF STABILITY: definition, absolute and relative stability, asymptotic stability; Routh-Hurwitz stability criterion: stability conditions, Hurwitz criterion, Routh-array, special cases, relative stability analysis and design applications. Root-locus technique: root-locus, complementary root-locus and root contours, basic fundamentals, construction rules, effects of addition of poles and zeros.

UNIT-3: FREQUENCY DOMAIN ANALYSIS: frequency response specifications, correlation between time and frequency response, Bode plot, Polar plot, Nyquist stability criterion, gain and phase margins; Closed-loop frequency response: M-circles, N-circles, closed-loop frequency response for unity and non-unity feedback systems.

UNIT-4: AUTOMATIC CONTROLLERS: Basic control actions, PD, PI and PID controllers, effect on the time response.
Compensation techniques: classifications, lead, lag and lag-lead compensations.

Digital control systems: Introduction, sampling theorem, Jury's stability criterion.

UNIT-5: STATE SPACE ANALYSIS: Concepts of states, state variables and state model, state models of linear systems, state-transition matrix; solution of state equations, various canonical forms, transfer matrix, characteristic equation,Eigen-values and Eigen-vectors, derivation of transfer function from state model, Introduction of state space representation of digital system, Controllability and observability tests, Introduction to Stochastic system, model, analyze and simulate stochastic systems.

BOOKS:

1. Nagrath & Gopal,"Control System Engineering", New age International, 2000.
2. Ogata,"Modern Control Engineering",Prentice Hall of India,2016
3. Kuo & Golnaraghi,"Automatic Control System",Wiley India Ltd, 2012
4. Choudhary,"Modern Control Engineering",Prentice Hall of India,2005

L:T:P:: 3:1:0 **Credits-4**

ECT-062 DIGITAL SIGNAL PROCESSING

COURSE OBJECTIVES: The course teaches Introduction to DSP; Digital Systems – Characterization, Description and Testing; FIR and IIR: Recursive and Non Recursive; Discrete Fourier Transform; Z Transform; Discrete Time Systems in Frequency Domain; Simple Digital Filters; Digital Processing of Continuous Time Signals; Analog Filter Design; Digital Filter Structure, Synthesis and Design.

COURSEOUTCOMES:

1. Students will be able to understand discrete Fourier transform and its applications.
2. Students will be able to understand filter structures and its applications.
3. Students will be able to design of FIR filters and IIR filters for various applications.
4. Students will be able to understand the advance DSP processors and their applications.
5. Students will be capable of solving engineering problems related to digital signal processing.

COURSE CONTENTS:

UNIT 1: DISCRETE FOURIER TRANSFORM: Discrete Fourier transform, DFT as a linear transformation, relationship of the DFT to other transforms, properties of the DFT: periodicity, linearity, and symmetry, multiplication of two DFTs and circular convolution, additional DFT properties, frequency analysis of signals using DFT, The Goertzel algorithm, Chirp z-transform algorithm, introduction to MATLAB (Coding of Implementation of LTI using DFT).

UNIT 2: EFFICIENT COMPUTATION OF DFT: Efficient computation of DFT: FFT algorithms, direct computation of the DFT, Radix-2 FFT algorithms, efficient computation of the DFT of two real sequences, computations, efficient computation of the DFT of 2N-point real sequences (Coding of FFT algorithms).
FILTER STRUCTURES: Direct form (I & II), Lattice for FIR & IIR filters.

UNIT 3: DESIGN OF FIR FILTERS: Properties of non-recursive filters, rectangular, Hamming, Blackman, Chebyshev and Kaiser windowing, optimum approximation of FIR filters, multistage approach to sampling rate concession (Coding of windowing for FIR filters).

UNIT4: DESIGN OF IIR FILTERS: Impulse invariant and bilinear transformation techniques for Butterworth and Chebyshev filter; cascade and parallel (Coding of Butterworth and Chebyshev filters).

UNIT5: APPLICATION OF DSP AND CODING: Sampling frequency conversion, quadrature-mirror-image filter banks, Hilbert transforms, Adaptive digital filters, two dimensional filter designs, Audio and Video coding, MPEG coding standardization, DCT, Walsh and Hadamard Coding.
DSP PROCESSOR ARCHITECTURE FUNDAMENTALS: Study of ADSP and TMS series of processor architectures.

BOOKS:

1. Proakis & Manolakis, D.G., "Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall (India),2007.
2. Apte,"Digital Signal Processing",2nd Edition, John Wiley (India),2009.
3. Rabiner and Gold, "Theory and Applications of DSP", PHI, 2011.
4. Oppenhein, "Digital Signal Processing, PHI,1997.

L:T:P:: 3:1:0 **Credits-4**

ECT-063 MICROWAVE ENGINEERING

COURSE OBJECTIVES:

1. To analyze and study rectangular and circular wave guides using field theory.
2. To understand the theoretical principles underlying microwave devices and networks.
3. To design microwave components such as power dividers, hybrid junctions, Directional couplers, microwave filters, Microwave Wave-guides and Components, Ferrite Devices.
4. To study about Microwave Solid-State Microwave Devices and Microwave Tubes.
5. To Study about Microwave Measurement Techniques.

COURSEOUTCOMES:

1. Students will be able to understand the propagation of electromagnetic waves through waveguides.
2. Students will be able to understand the function of various microwave components.
3. Students will be able to understand the measurements of various microwave parameters.
4. Students will be able to understand the principle and operation of microwave tubes and microwave solid-state devices.
5. Students will be able to solve engineering problems related to microwave applications.

COURSE CONTENTS:

UNIT 1: PROPAGATION THROUGH WAVEGUIDES: Rectangular and circular waveguides, solution of wave equation for TE & TM modes, degenerate and dominant modes, power transmission& power loss, excitation of wave guides, non-existence of TEM mode in waveguide, introduction to stripline and microstrip-line.
MICROWAVE CAVITY RESONATORS: Rectangular and cylindrical cavities, quality factor and excitation of cavities.

UNIT 2: MICROWAVE COMPONENTS: Scattering matrix, E-plane, H-plane and hybrid tee, hybrid ring, waveguide discontinuities, waveguide couplings, bends and twists, transitions, directional couplers, matched load, attenuators and phase shifters, irises and tuning screws, detectors, wave meter, isolators and circulators.

UNIT 3: MICROWAVE MEASUREMENTS: Tunable detector, slotted line carriage, VSWR meter, measurement of frequency, wavelength, VSWR, impedance, attenuation, low and high power radiation patterns.

UNIT 4: MICROWAVE TUBES: Limitation of conventional active devices at microwave frequency, Klystron, Reflex klystron, magnetron, TWT, BWO; principle of operation and performance characteristics and applications.

UNIT 5: MICROWAVE SEMICONDUCTOR DEVICES: PIN diode, Tunnel diode, Gunn diode, IMPATT, TRAPATT and BARRIT, High electron mobility transistors; principle of operation, characteristics and applications.

BOOKS:

1. Liao, “Microwave Devices & Circuits”, PHI, 2003.

2. Das and Das, “Microwave Engineering”, TMH, 2009.
3. Collin, R.E. “Foundations for Microwave Engineering”, TMH,2007.
4. Gautam, A K, “Microwave Engineering”, Kataria & Sons

L:T:P:: 3:0:0 **Credits-3**

EEC-031 PROBABILITY THEORY AND STOCHASTIC PROCESSES

COURSE OBJECTIVE:

1. This gives basic understanding of random signals and processing
2. Utilization of Random signals and systems in Communications and Signal Processing areas.
3. To know the Spectral and temporal characteristics of Random Process.
4. To Learn the Basic concepts of Noise sources

COURSE OUTCOMES:

1. Students will demonstrate the ability to understand representation of random signals.
2. Students will be able to investigate characteristics of random processes.
3. Students will be able to make use of theorems related to random signals.
4. Students will be able to understand propagation of random signals in LTI systems.
5. Students will be able to solve engineering problems related to random signals.

COURSE CONTENTS:

UNIT 1: Sets and set operations, probability space, conditional probability and Bayes theorem, combinatorial probability and sampling models.

UNIT 2: Discrete random variables, probability mass function, probability distribution function, example random variables and distributions, continuous random variables, probability density function, probability distribution function, example distributions.

UNIT 3: Joint distributions, functions of one and two random variables, moments of random variables; conditional distribution, densities and moments; characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds.

UNIT 4: Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); limit theorems; strong and weak laws of large numbers, central limit theorem.

UNIT 5: Random process, stationary processes, mean and covariance functions, Ergodicity, transmission of random process through LTI, power spectral density.

BOOKS:

1. H. Stark and J. Woods, Probability and Random Processes with Applications to Signal Processing, Third Edition, Pearson Education
2. Papoulis and S. Unnikrishnan Pillai, Probability, Random Variables and Stochastic Processes, Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

L:T:P:: 3:0:0 **Credits-3**

EEC-032 INFORMATION THEORY AND CODING

COURSE OBJECTIVES: This course envisions to impart to students to

1. An understanding of the fundamental knowledge of information
2. An understanding of channel capacity to achieve efficient as well as reliable communication.
3. An understanding of various Source and Channel Coding Techniques
4. Fundamental understanding on block codes, cyclic codes and convolutional codes, also explore its practical challenges.
5. An ability to design and provide solutions for practical low cost, efficient, reliable and secure communication system.

COURSE OUTCOMES:

1. Students will be able to understand the concept of information and entropy
2. Students will be able to calculate of channel capacity.
3. Students will be able to apply coding techniques.
4. Students will be able to understand the error sources and error control coding.
5. Students will be able to solve engineering problems related to information theory and coding

COURSE CONTENTS:

UNIT 1: SOURCE CODING: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measures for Continuous Random Variables, Source Coding Theorem, Huffman Coding, The Lempel-Ziv Algorithm, Rate Distortion Function, Optimum Quantizer Design.

UNIT 2: CHANNEL CAPACITY AND CODING: Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem The Shannon Limit, Random Selection of Codes.

UNIT 3: LINEAR BLOCK CODES FOR ERROR CORRECTION: Introduction to Error Correcting Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes Hamming Codes, Optimal Linear Codes, Cyclic Codes, Polynomials, division Algorithm for Polynomials, Minimal Polynomials, BCH Codes, Primitive Elements.

UNIT 4: CONVOLUTIONAL CODES: Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolutional Codes (Analytical Representation), Notions for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Veterbi Decoding of Convolutional Codes.

UNIT 4: TRELLIS CODES MODULATION: Introduction to TCM, The concept of Coded Modulation, Mapping by Set Partitioning, Ungerboeck's TCM Design Rules, TCM Decoder, Performance Evaluation for AWGN Channel, Computation of dfree, TCM for Fading Channel.

BOOKS:

1. Bose, Ranjan “Information Theory, Coding & Cryptography” Tata McGraw Hill
2. Van Lint, J.H. “Introduction to Coding Theory” Springer
3. Proakis, John G. “Digital Communications” McGraw Hill
4. Sathyanarayana, P.S. “Probability Information and Coding Theory” Dynaram Publications Bangalore
5. Gallager “Information Theory and Reliable Communication”
6. Shulin & Costello “Error Correcting Codes” Prentice Hall (India).
7. Taub & Schilling “Principles of Communication Systems” Tata McGraw Hill

L:T:P:: 3:0:0 **Credits-3**

EEC-033 RADAR & NAVIGATION

COURSE OBJECTIVES: This course envisions to impart to students to

1. To understand the basic principles of radar communication .
2. Identification and detection of fixed and moving targets using different types of radars.
3. To understand different duplexer mechanisums and tracking systems of radar.
4. To understand various electronic warfare measures used in radars.
5. To understand the concepts of navigational aids.

COURSE OUTCOMES:

1. Students will be able to understand the principle and working of radar systems.
2. Students will be able to analyze and handle the signals and waveform of radar systems.
3. Students will have knowledge of detection and direction finding techniques.
4. Students will have knowledge of satellite navigation systems.
5. Students will be able to solve engineering problems related to radar and navigation systems.

COURSE CONTENTS:

UNIT 1: RADAR SIGNAL MODELS: Radar block diagram operation distributed target forms of range equation, radar cross section, Clutter, signal to clutter ratio, noise model and signal to noise ratio, frequency models, Doppler shift, simplifies approach to Doppler shift, pulse and CW radar, FMCW radar,

UNIT 2: RADAR WAVE FORMS: Waveform matched filter of moving targets, ambiguity function and ambiguity function of the simple matched pulse filter for the pulse burst.
ADVANCED RADAR: MTI radar, MST radar, Synthetic aperture radar (SAR)

UNIT 3: DETECTION FUNDAMENTALS: Radar detection as hypothesis testing, Neyman-Pearson detection rule, likelihood ratio test, threshold detection of radar signals, non-coherent integration of non-fluctuating targets, Albersheim and Shnidaman equations, Binary integration.

UNIT 4: RADIO DIRECTION FINDING: Loop direction finder, goniometerand errors in direction finding, Radio Ranges; LF /MF four course radio ranges, VOR, ground equipment & receiver, VOR errors.
HYBERBOLIC SYSTEM OF NAVIGATION: LORAN, Decca, DME & TECAN.

UNIT 5: AIDS TO APPROACH AND LANDING: ILS, GCA & MLS Doppler Navigation; Doppler frequency, Doppler radar equipment, CW & FMCW Doppler radar, frequency trackers, Doppler range equation.
SATALLITE NAVIGATION SYSTEM: Transit system, IRNSS, NAVSTAR and GPS, basic principles of operation, signal structure of NAVSTAR broadcasts, data message, velocity determination, accuracy of GPS & differential navigation, NAVSTAR receiver.

BOOKS:

1. Skolnik, Introduction to Radar Systems, McGraw Hill, 2002.
2. Richards, Fundamentals of Radar Signal Processing, TMH, 2014.
3. Nagraja, Elements of Electronics Navigation, TMH, 2001.
4. Peebles, Radar Principles, Wiley, NY, 1993.
5. Sen and Bhattacharya, Radar Systems and Radio Aids to Navigation, Khanna, 2001.

L:T:P:: 3:0:0 **Credits-3**

EEC-034 ANALOG FILTER DESIGN

COURSE OBJECTIVE: This course envisions to impart to students to

1. to understand the basics concept of analog filter design
2. to design and implements passive filters, RC active filters and switched-capacitor filters.
3. The mathematical problem solving ability of students to get improved design of filter's parameters.
4. motivated to design of resistor less active filter design

COURSE OUTCOMES:

1. The students will understand the basics of analog filter design
2. The mathematical problem solving ability of students get improved.
3. The students will be motivated to design of resistor less active filter design
4. The analog system analyzing and designing skills of students will be improved.

COURSE CONTENTS:

UNIT-1: Review of basic concepts: Review of Op-amp circuits, Ideal and Real operational amplifiers, Categorization of filters-Low-pass filter, High-pass filter, band-pass filter, band-reject filter, Gain equalizers, and Delay equalizers.

UNIT-2: Approximation Theory: Butterworth approximation, Chebyshev approximation, Inverse Chebyshev approximation, Pole locations, Filter specifications, Comparison of maximally flat and equal ripple response, Basic of sensitivity, Frequency Transformations: Low pass to High pass, Low pass to band pass, Low pass to band elimination.

UNIT-3: Biquad Filters: Three amplifier Biquad: Basic low pass and band pass circuit, realization of the general Biquadratic Functions, summing of four Amplifier biquad, feed forward three amplifier biquad, Passive Ladder structures, Inductor Substitution using Gyrator, Transformation of elements using the FDNR.

UNIT-4: Transconductance–C Filters: Basic Transconductance Cell, Basic transconductor building blocks- resistors, integrators, amplifiers, summers, gyrator, First and second order filters, higher order filters.

UNIT-5: Switched capacitor filters: The MOS switch, The switched capacitor, first order building blocks, second order sections, sampled data operation, Switched capacitor first and second order filters, Bilinear transformation.

BOOKS:

1. Gobind Daryanani, "Principles of active network synthesis and design", John Wiley and Sons.
2. R. Schaumann, M. E. Van Valkenburg, "Design of analog filters", Oxford University Press.
3. T. L. Deliyannis, Y. Sun and J. Kel Fiedler, "*Continuous-Time Active Filter Design",* Boca Raton: CRC Press LLC,1999

L:T:P:: 3:0:0 **Credits-3**

AHT 011: TOTAL QUALITY MANAGEMENT

COURSE OBJECTIVE :The course should enable the students to:

1. To understand the concept of Quality in Manufacturing and Service units.
2. To understand the Implication of Quality in Business.
3. To understand the Organization Structure in TQM.
4. To understand how to implement Quality Programs in an Organization.
5. To have exposure to challenges in Quality Improvement Programs.

COURSE OUTCOMES

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

1. Identify the significance of quality in an organization.
2.Describe how to manage quality improvement teams.
3. Describe how to organize management and quality policies in TQM.
4. Apply the tools of quality improvement programs in an organization.
5. Assess the benefits of implementing TQM Program in an organization.

COURSE CONTENTS:

UNIT-1: Introduction: Evolution of Quality, Historical Perspectives, Relationship among Quality, Vision, Mission and Objectives of an Organization, Role of Quality in a Corporate Structure of an Organization, Attributes of Product and Service Quality, Quality Characteristics: Quality of Design, Quality of Performance and Quality of Conformance, Zero Defect and Continuous Improvement.

UNIT-2: Conceptualization of TQM: Introduction to Total Quality Management (TQM), Barriers to TQM, Benefits of TQM implementation, Basic Approaches of TQM, TQM Models, Quality Information System and Planning. Importance of TQM in manufacturing and Service Industry.

UNIT-3: Organization Structure in TQM: Role of Top Management, Quality Council, Quality Circles, Organization Structure for Quality Circles, Quality Policies, Role of Middle and Lower Management, Problem Solving Techniques.

UNIT-4: Tools and Systems for Quality Management: Basic Tools: Cause & Effect Diagram, Flow Diagrams, Trend Charts, Histogram, Scatter Diagram, Control Chart, Advanced Tools: Affinity Diagram, Inter Relationship Diagram, Tree Diagram, Matrix Diagram, Process Decision Program Chart (PDPC) and Matrix Data Analysis, Fault Tree Analysis, Quality Function Deployment (QFD) Definition and Phases in QFD. Taguchi Approach To Quality System Design, Six - sigma Definition & Implementation Steps, Just In Time Production System, Quality Production through JIT and Kanban, Failure Mode and Effect Analysis (FMEA): Scope, Mode, Illustrative Example and Applications.

UNIT-5: Quality Assurance: Causes of Quality Failure, Quality Assurance: Need and Various Elements in Quality Assurance Programme, Quality Control- on Line and off Line, Statistical Concepts in Quality, Chance and Assignable Causes, Bench Making in Quality Management.

Implementation and Need of ISO 9000: ISO 9000 - 2000 Quality System: Elements, Registration, Documentation, Implemental Steps, Quality Audit, Product and Process Audit Scope, Steps and Benefits.

Books and References

1. Total Quality Management by Dale H Bersterfilled, PHI Publication.
2. Total Quality Management by N.V.R Naidu, G. Rajendra, New Age international Publication.
3. Total Quality Management by L. Sugandhi and Samuel Anand, PHI Publication.
4. Total Quality Management by R.S Naagarazan, New Age International Publication.

L:T:P:: 0:0:2 **Credits-1**

ECP-061 CONTROL SYSTEMS LAB

COURSE OBJECTIVES: This course envisions to impart to students to

1. To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors, stepper motor and potentiometer.
2. To understand time and frequency responses of control system with and without controllers and compensators.

COURSEOUTCOMES:

1. Students will be able to analyze the performance of various control systems under different operating conditions.
2. Students will be able to verify the responses of various control systems.
3. Students will be able to design the experiments, analyze and interpretation of data.
4. Students will acquire skills of teamwork, technical communication and effective report writing.
5. Students will be capable of solving practical engineering problems related to control systems.

COURSE CONTENTS:

1. To determine response of second order systems for step input for various values of constant 'k' using linear simulator unit and compare theoretical and practical results.
2. To verify and compare the performance of P, PI and PID temperature controller for an oven.
3. To determine the performance of a dc position control system.
4. To obtain transfer characteristics of a synchro-transmitter and receiver.
5. To determine speed–torque characteristics of a servo motor.
6. To determine the performance parameters of a dc servomotor.
7. To analyze the behavior of dc motor in open loop at various loads.
8. To design and test a lag, lead and lag-lead compensator using Bode plot.
9. To calculate the basic step angle of a stepper motor.
10. To verify the response of a digital controller over a second order simulated process.
11. To verify the frequency response analysis of the dc servomotor control system using PID controller.
12. To position the D.C Servomotor to required degree using DSP Controller

L:T:P:: 0:0:2 **Credits-1**

ECP-062 DIGITAL SIGNAL PROCESSING LAB

COURSE OBJECTIVES

1. To understand the basics of Signal Processing via MATLAB implementation
2. To understand the Digital Signal Processor Architecture and it's functioning.
3. To develop MATLAB code and its application in signal processing.

COURSE OUTCOMES:

1. Students will be able to implement various digital processing techniques using modern tools such asMATLAB and DSP processors.
2. Students will be able to design various digital filters using MATLAB.
3. Students will be able to design the experiments, analyze and interpretation of data to achieve validconclusions.
4. Students will acquire skills of teamwork, technical communication and effective report writing.
5. Students will be capable of solving practical engineering problems related to digital signal processing.

COURSE CONTENTS:

1. To determine the linear convolution of the given sequences.
2. To determine the circular convolution of the given sequences.
3. To determine the discrete Fourier transform of a given sequence.
4. To determine the fast Fourier transform of a given sequence.
5. To design a FIR low pass filter using Rectangular window.
6. To design a FIR low pass filter using Hamming window.
7. To design a FIR low pass filter using Triangular window.
8. To design a FIR high pass filter using Rectangular window.
9. To design a FIR high pass filter using Hamming window.
10. To design a FIR high pass filter using Triangular window.
11. To design an IIR low pass filter using impulse invariance method.
12. To design an IIR high pass filter using bilinear transformation method.
13. To determine the discrete cosine transform of a given sequence.
14. Digital signal processing using TMS320C6713 DSK and code composer studio.
15. Consider a LTI system with impulse response h(t) and input excitation x(t). Develop a generic program to obtain the output response in time-domain and in frequency-domain.
16. Develop a program to show that the sum of n number of Random variables (n tending to infinite) has the probability distribution function tending to Gaussian (central-limit theorem).
17. To develop program for computing inverse Z-transform.
18. To develop program for finding magnitude and phase response of LTI system described by system functionH(z).
19. To develop program for computing DFT and IDFT.
20. To develop program for computing circular convolution.
21. To develop program for conversion of direct form realization to cascade form realization.
22. To develop program for cascade realization of IIR and FIR filters.
23. To develop program to analyze the frequency content of the voice signal.
24. To write a program using FFT to obtain the frequency spectrum of AM, FM signal and to examine theeffect of modulation index on the frequency contents.
25. Let us consider a non-linear device governed by equation $y(t)=a_1 \times x(t)+a_2 \times x^2(t)+a_3 \times x^3(t)$. Let $x(t)=\sin(wt)$.Develop a program to obtain the output signal and plot its spectrum.

L:T:P:: 0:0:2 **Credits-1**

ECP-063 MICROWAVE LAB

COURSE OBJECTIVES: This course enables the students:

1. To develop an understanding about the measurements of the various microwave passive components.
2. To develop an understanding about the measurements of the performance parameters of Microwave Crystal Detector and Gunn Diode.
3. To develop an ability to understand a planar microwave filter.
4. To develop an ability to understand a planar microwave coupler.
5. To develop an ability to understand a microstrip planar power divider

COURSE OUTCOMES:

1. Students will be able to measure the different characteristics and parameters of various electromagnetic components using standard microwave bench.
2. Students will be able to characterize the performance parameters of wave guides and antennas.
3. Students will be able to design the electromagnetic experiments, analyze and interpretation of data.
4. Students will acquire skills of teamwork, technical communication and effective report writing.
5. Students will be capable of solving practical engineering problems related to electromagnetic waves.

COURSE CONTENTS:

1. Verification of characteristics of the reflex klystron tube and determine its electronic tuning range.
2. Measurement of frequency and wavelength for a rectangular waveguide working on TE_{10} mode.
3. To determine standing wave ratio and coefficient of rectangular wave-guide.
4. To verify the following characteristics of Gunn Diode:
   (a) V-I characteristics.
   (b) Output power and frequency as a function of voltage.
   (c) Square wave modulation through PIN diode.
5. To measure the polar pattern and the gain of wave guide horn antenna.
6. Verification of the function of multi-hole directional coupler using the following parameters:
   (a) Main line and auxiliary line VSWR.
   (b) Coupling factor &directivity of the coupler.
7. Determine S-parameters of magic Tee terminated by matched load.
8. Verify working principle of the Isolator.
9. Verify working principle of the Circulators.
10. Verify working principle of Attenuators (Fixed and variable type).
11. Verify working principle of the Phase shifter.
12. Experiments based on Microstrip antenna design, simulation and fabrication.

L:T:P:: 2:0:0 **Credits-0**

AHT-009: CONSTITUTION OF INDIA

COURSE OBJECTIVE:

1. To acquaint the students with legacies of constitutional development in India and help to understand the most diversified legal document of India and philosophy behind it.
2. To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.

COURSE OUTCOMES

The course should enable the students to:

1. Understand the basic knowledge and salient features of Indian Constitution.
2. Identify and explore the basic features and modalities about Indian constitution.
3. Discusses the essence of Union and its territories, Citizenship, Fundamental Rights, DPSP and Fundamental Duties.
4. Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
5. Differentiate different aspects of Indian Legal System and its related bodies.

Unit-1 Constitutional Framework

Meaning of Terms and Phrases frequently used in political system like constitution, constitutionalism, Rule of Law, Federal system, Government and so on. Historical Background of Indian Constitution, Making of Indian Constitution, Salient features of Indian Constitution, Preamble of Indian Constitution.

Unit-2 Different Parts, Articles, and their significance

Part I to IVA (Union and its territories w.r.t. Indian States, Citizenship, Fundamental Rights conferred to citizens and foreigners, Directive Principles of State Policy– Its importance and implementation and Fundamental Duties and its legal status), Article 1 to 51A and their significance.

Unit-3 System of Government

Parliamentary Form of Government in India – The constitution powers and status of the President of India, Federal structure and distribution of legislative and financial powers between the Union and the States, Emergency Provisions: National Emergency, President Rule, Financial Emergency and Amendment of the Constitutional Powers and Procedure and the significance of basic structure in Indian Judicial system

Unit-4 Working of Central, State & Local Self Government as per constitution

Framework for central government (President, Vice president, Prime Minister, Central council of ministers, Parliament, Supreme court and so on), Framework for state government (Governor, Chief Minister, state legislature, High court and so on) and Framework for local self government (Panchayatiraj, Municipalities) and Union Territories.

Unit-5 Constitutional, Non-Constitutional and other bodies

Discussion on Various constitutional bodies like Election Commission, UPSC, SPSC, Finance commission, NCSC, NCST, NCBC, CAG and AGI. Discussion on Various non-constitutional bodies like NITI Aayog, NHRC, CIC, CVC, CBI, Lokpal and Lokayukta. Discussion on Various other constitutional bodies like Co- operative societies, Official Language, Tribunals etc.

Text/Reference books-

1. M. Laxmikanth, "Indian Polity", McGraw- Hill, 6th edition, 2020
2. D.D. Basu, "Introduction to the Indian Constitution", LexisNexis, 21st edition, 2020
3. S.C. Kashyap, " Constitution of India", Vitasta publishing Pvt. Ltd., 2019

L:T:P:: 2:0:0 **Credits-0**

AHT-010: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

COURSE OBJECTIVES:

The course should enable the students to:

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day to day life.
3. To make the students know the need and importance of protecting traditional knowledge.
4. To make the students understand the concepts of Intellectual property to protect the traditional knowledge.
5. This course is also concentrating on various acts in protecting the environment and Knowledge management impact on various sectors in the economy development of the country.

COURSE OUTCOMES:

The course should enable the students to:

1. Understand the concept of Traditional knowledge and its importance.
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.
5. Know the contribution of scientists of different areas.

Unit – 1 Introduction to Traditional and Culture Knowledge

Define culture, traditional, civilization and heritage knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK). Indigenous traditional knowledge Vs western traditional knowledge vis-à-vis formal knowledge.

Unit-2 Protection of Traditional Knowledge

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of traditional knowledge Protection, value of traditional knowledge in global economy, Role of Government to harness traditional knowledge.

Unit – 3 Traditional Knowledge and Intellectual Property

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Global legal forums for increasing protection of Indian Traditional Knowledge.

Unit – 4 Traditional Knowledge in Different Sectors

Traditional knowledge in engineering, biotechnology and agriculture, traditional medicine system, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity,

Food security of the country and protection of traditional knowledge.

Unit – 5 Education System in India

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

Text/Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.
3. Traditional Knowledge System in India, by Amit Jha, 2009.
4. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
5. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh Pratibha Prakashan 2012.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005) Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)

SYLLABUS

For

B.TECH

(Electronics & Communication Engineering)

4TH Year

Effective From – Session 2025-26

EFFECTIVE FROM 2025-26

B.Tech. (ELECTRONICS & COMMUNICATION ENGINEERING) (w.e.f. 2025-26)													
SEMESTER-VII													
Sl. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-015/ AHT-016	HSC	HSMC -1 / HSMC-2	3	0	0	30	20	50	100		150	3
2	EEC-04X	DE	Departmental Elective-4	3	0	0	30	20	50	100		150	3
3	EEC-05X	DE	Departmental Elective-5	3	0	0	30	20	50	100		150	3
4	XXX-0XX	OE	Open Elective-2	3	0	0	30	20	50	100		150	3
5	ECP-071	DLC	Seminar	0	0	2			50			50	1
6	ECP-072	DLC	Design Project	0	0	4			100			100	2
7	ECP-073	DLC	Internship-III*	0	0	2			50			50	1
8	AHT-017	MC	Disaster Management	3	0	0	30	20	50	100		150	3
9	AHT-018	NC	Innovations and Problem Solving (Audit Course)	2	1	0	15	10	25	50		-	-
10	GP-07	NC	General Proficiency						50			-	-
			Total	**17**	**1**	**8**						**950**	**19**
11		**Minor Course (Optional)**		3	1	0	30	20	50	50		150	4
*The Internship-III (4-6 weeks) conducted during summer break after VI semester and will be assessed during VII semester													

	Departmental Elective - 4		**Departmental Elective - 5**
EEC-041	CMOS Design	EEC-051	Biomedical Signal Processing
EEC-042	Mixed Signal Design	EEC-052	Digital Image Processing and applications
EEC-043	Micro-elctromechanical System (MEMS)	EEC-053	Advance Digital Signal Processing
EEC-044	Nano-electronics	EEC-054	Nano Materials

HSMC-1	AHT-015	Rural Development, Administration and Planning
HSMC-2	AHT-016	Project Management & Entrepreneurship

Open Elective-2, 3, 4 (for 7th & 8th Semester): These courses may be taken only by the students of other department in 7th or 8th Semester. ECE students shall opt open elective offered by other departments:		
Open Elective - 2	EEC-065/ EEC-066	Electronics Product Design/ Advanced Mobile Technology
Open Elective - 3	EEC-067	Multirate Digital Signal Processing
Open Elective - 4	EEC-068	Nano Electronics

Abbreviations: L-No. of Lecture hours per week, T-No. of Tutorial hours per week, P-No. of Practical hours per week, CT- Class Test Marks, TA-Marks of teacher's assessment including student's class performance and attendance, PS-Practical Sessional Marks, ESE-End Semester Examination, TE-Theory Examination Marks, PE- Practical External Examination Marks

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

EFFECTIVE FROM 2025-26

B.Tech. (ELECTRONICS & COMMUNICATION ENGINEERING) (w.e.f. 2025-26)													
SEMESTER-VIII													
Sl. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-016/ AHT-015	HSC	HSMC -2 / HSMC-1	3	0	0	30	20	50	100		150	3
2	EEC-06X-030	DE	Departmental Elective-6	3	0	0	30	20	50	100		150	3
3	XXX-0XX	OE	Open Elective-3*	3	0	0	30	20	50	100		150	3
4	XXX-0XX	OE	Open Elective-4*	3	0	0	30	20	50	100		150	3
5	ECP-0081	DLC	Project	0	0	12			100		200	300	6
6	GP-08	NC	General Proficiency						50			-	-
			Total	**12**	**0**	**12**						**900**	**18**
7	**Minor Course (Optional)**			3	1	0	30	20	50	50	100	150	4
***Open Elective-3, 4: Select open elective subject from other departments**													

Subject code	Departmental Elective - 6
EEC-061	Wireless Communication
EEC-062	Audio Speech Processing
EEC-063	Public Broadcast Engineering
EEC-064	Electronic Switching Systems

Open Elective-2, 3, 4 (for 7th & 8th Semester): These courses may be taken only by the students of other departments in 7th or 8th Semester. ECE students shall opt open elective offered by other departments:		
Open Elective - 2	EEC-065/ EEC-066	Electronics Product Design/ Advanced Mobile Technology
Open Elective - 3	EEC-067	Multirate Digital Signal Processing
Open Elective - 4	EEC-068	Nano Electronics

Abbreviations: L-No. of Lecture hours per week, T-No. of Tutorial hours per week, P-No. of Practical hours per week, CT- Class Test Marks, TA-Marks of teacher's assessment including student's class performance and attendance, PS-Practical Sessional Marks, ESE-End Semester Examination, TE-Theory Examination Marks, PE- Practical External Examination Marks

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

L:T:P:: 3:1:0 **Credits-3**

HSMC-1
AHT-015: Rural Development: Administration and Planning

COURSE OBJECTIVES : This course enables the students to

1. Gain knowledge on the concepts related to administration, its importance and various approaches of Development Administration.
2. Gain skills on New Public Management, Public Grievances and Redressal Mechanisms, Accountability and Transparency in Administration and e-governance in the rural development sector.
3. Develop their competency on the role of Bureaucracy in Rural Development.

COURSE OUTCOMES : After completion of the course student will be able to:

1. Students can understand the definitions, concepts and components of Rural Development.
2. Students will know the importance, structure, significance, resources of Indian rural economy.
4. Students will have a clear idea about the area development programmes and its impact.
5. Students will be able to acquire knowledge about rural entrepreneurship.
6. Students will be able to understand about the using of different methods for human resource planning.

COURSE CONTENTS

UNIT-I:

Rural Planning & Development: Concepts of Rural Development, Basic elements of rural Development, and Importance of Rural Development for creation of Sustainable Livelihoods, An overview of Policies and Programmes for Rural Development- Programmes in the agricultural sector, Programmes in the Social Security, Programmes in area of Social Sector.

UNIT-II:

Rural Development Programmes: Sriniketan experiment, Gurgaon experiment, Marthandam experiment, Baroda experiment, Firkha development scheme, Etawapilot project, Nilokheri experiment, approaches to rural community development: Tagore, Gandhi etc.

UNIT-III:

Panchayati Raj & Rural Administration: Administrative Structure: bureaucracy, structure of administration; Panchayati Raj Institutions Emergence and Growth of Panchayati Raj Institutions in India; People and Panchayati Raj; Financial Organizations in Panchayati Raj Institutions, Structure of rural finance, Government & Non-Government Organizations / Community Based Organizations, Concept of Self help group.

UNIT-IV:

Human Resource Development in Rural Sector: Need for Human Resource Development, Elements of Human Resource Development in Rural Sector Dimensions of HRD for rural development-Health, Education, Energy, Skill Development, Training, Nutritional Status access to basic amenities – Population composition.

UNIT-V:

Rural Industrialization and Entrepreneurship: Concept of Rural Industrialization, Gandhian approach to Rural Industrialization, Appropriate Technology for Rural Industries, Entrepreneurship and Rural Industrialization- Problems and diagnosis of Rural Entrepreneurship in India, with special reference to Women Entrepreneurship; Development of Small Entrepreneurs in India, need for and scope of entrepreneurship in Rural area.

Text Books/References:

1. Corporate Social Responsibility: An Ethical Approach - Mark S. Schwartz.
2. Katar Singh: Rural Development in India – Theory History and Policy.
3. Todaro M.P. Economic Development in III World war.
4. Arora R.C – Integrated Rural Development in India.
5. Dhandekar V.M and Rath N poverty in India.
6. A.N.Agarwal and Kundana Lal: Rural Economy of India.
7. B.K.Prasad: Rural Development-Sarup& Son's Publications.

L:T:P:: 3:1:0 **Credits-3**

HSMC-2
AHT-016: PROJECT MANAGEMENT & ENTREPRENEURSHIP

COURSE OBJECTIVES:

The course should enable the students to:

1 Understand the concepts of Project Management for planning to execution of projects.
2 Understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3 Be capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.
4 Understand the concepts of Entrepreneurship, role of entrepreneur in economic development, steps for establishing an enterprise.

COURSE OUTCOMES:

After completion of the course student will be able to:

1 Understand project characteristics and various stages of a project.
2 Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic.
3 Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
4. Describe Entrepreneurship, Examine role of entrepreneur in economic development.
5. Describe the steps to establish an enterprise.

COURSE CONTENTS

UNIT-I:

Entrepreneurship: Entrepreneurship: need, scope , Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (Mc Clellend's Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes.

UNIT-II:

Entrepreneurial Idea and Innovation: Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness.

UNIT-III:

Project Management: Project management: meaning, scope & importance, role of project manager; project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal, Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.

UNIT-IV:

Project Financing: Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.

UNIT-V:

Social Entrepreneurship: Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.

Case study and presentations: Case study of successful and failed entrepreneurs. Power point presentation on current business opportunities..

Text Book:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harperand Row.
2. Business, Entrepreneurship and Management: Rao, V.S.P.;Vikas
3. Entrepreneurship: Roy Rajeev.
4. TextBookofProjectManagement:Gopalkrishnan,P.andRamamoorthy,V.E.;McMill.
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.;PHI.
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.;MGH.

L:T:P:: 3:0:0 **Credits-3**

EEC-041 CMOS DESIGN

COURSE OBJECTIVES: This course enables the students:

1. Understand the static and dynamic behavior of MOSFET and CMOS inverter.
2. Appraise and analyse the characteristics of combinational logic gates in CMOS.
3. Design and Evaluate the characteristics of sequential logic circuits
4. Design and Evaluate the Memory design.
5. to understand the Design For Testability of VLSI circuits

COURSE OUTCOMES:

1. Students will be able to understand the principles of MOS devices and their applications in designing ofvarious MOS inverter circuits.
2. Students will be able to implement efficient techniques at circuit level for improving power and speed ofcombinational and sequential circuits.
3. Students will be able understand the pass transistors logic, transmission gates logic, static and dynamicCMOS logic circuits.
4. Students will be able to design memories with efficient architectures to improve their performance.
5. Students will be able to solve electronic circuit problems.

COURSE CONTENTS

UNIT 1: REVIEW Basic MOSFET Characteristics, Threshold Voltage, Body Bias concept, Current Voltage Characteristics, Square Law Model, MOSFET Modeling, MOSFET Capacitances, Geometric Scaling Theory, Full Voltage Scaling and Constant Voltage Scaling.

UNIT 2: CMOS INVERTER: Static CMOS inverter, layout, switching threshold and noise margin concepts and their evaluation, dynamic behavior, power consumption. NMOS MOS pass transistor inverter.
COMBINATIONAL LOGIC: Static CMOS design, rationed logic, pass transistor logic, dynamic logic, cascading dynamic gates, CMOS transmission gate logic.

UNIT 3: SEQUENTIAL LOGIC: Static latches and registers, bi-stability principle, MUX based latches, static SR flip-flops, master-slave edge-triggered register, dynamic latches and registers, concept of pipelining, timing issues.

UNIT 4: MEMORY AND ARRAY STRUCTURE: ROM, RAM, peripheral circuitry, memory reliability and yield, SRAM and DRAM design, flash memory, PLA, PAL, FPGA.

UNIT 5: DESIGN FOR TESTABILITY: Logic testing, sequential logic testing, guidelines to be adopted in design for test, scan-designing techniques, and built-in self-test (BIST) techniques.

BOOKS:

1. Kang, Yusuf, CMOS Digital Integrated Circuits, TMH, 2002.
2. Rabaey, Chandrakasen, Digital Integrated Circuits: A Design Perspective, PHI, 2009.

3. Weste, Harris, CMOS VLSI Design: A Circuits and Systems Perspective, Pearson, 2005.
4. Pucknell, Eshraghian, Basic VLSI Design PHI, 2017.

L:T:P:: 3:0:0 **Credits-3**

EEC 042-MIXED SIGNAL DESIGN

COURSE OBJECTIVES: This course enables the students:

Understand design and operation of basic analog and digital circuits, understand layout and matching of analog components, design and analysis of switched capacitor circuits, analysis of data conversion algorithms, design of data converter circuits, understand performance limitation of converter topologies, Group projects involving a complete mixed-signal system design.

COURSE OUTCOMES:

1. Students will be able to understand the practical situations where mixed signal analysis is required.
2. Students will be able to analyze and handle the inter-conversions between signals.
3. Students will be able to design systems involving mixed signals.
4. Students will have knowledge of various ICs used in mixed signals.
5. Students will be able to solve engineering problems related to mixed signals.

COURSE CONTENTS

UNIT 1: Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous- time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

UNIT 2: Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

UNIT 3: Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

UNIT 4: Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

UNIT 5: Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

BOOKS:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi, Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, revised second edition, IEEE press, and 2008.
4. Rudy V. de Plassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill.
6. R. Schauman, Design of analog filters by, Prentice-Hall.
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford University press, first Indian edition, 2008.

L:T:P:: 3:0:0 **Credits-3**

EEC-043 MICRO ELECTRO-MECHANICAL SYSTEMS (MEMS)

COURSE OBJECTIVES: This course enables the students:

1. To understand the Fundamental concepts of MEMS technology
2. To classify different micro sensors and micro actuators
3. To acquire basic knowledge about application of MEMS in different areas and physical modeling used in MEMS Design.
4. To understand different Microfabrication techniques, MEMS materials and design issues
5. To understand the integration and packaging of MEMS devices.

COURSE OUTCOMES:

1. Students will be able to understand the MEMS structures and their applications.
2. Students will be able to understand the micro sensors and actuators.
3. Students will be able to understand the fabrication process of MEMS.
4. Students will have knowledge of manufacturing and design procedures of MEMS.
5. Student will be capable of solving engineering problems related to MEMS.

COURSE CONTENTS

UNIT-1: INTRODUCTION TO MICROSYSTEMS: Overview of microelectronics manufacture and Microsystems technology, Definition MEMS materials, Laws of scaling, multi-disciplinary nature of MEMS, Survey of materials central to micro engineering, Applications of MEMS in various industries.

UNIT-2: MICRO SENSORS AND ACTUATORS: Working principle of Microsystems, micro actuation techniques, micro sensors types, Micro-actuators types, micro-pump, micro-motors, micro-valves, micro-grippers, and micro-accelerometers.

UNIT-3: FABRICATION PROCESS: Substrates single crystal silicon wafer formation, Photolithography, Ion implantation, Diffusion, Oxidation, CVD, Physical vapour deposition, Deposition epitaxy, etching process.

UNIT-4: MICRO SYSTEM MANUFACTURING: Bulk Micro manufacturing, surface micro machining, LIGA, SLIGA, Micro system packaging materials, die level, device level, system level, packaging techniques, die preparation, surface bonding, wire bonding, sealing.

UNIT-5: MICROSYSTEMS DESIGN AND PACKAGING: Design considerations, Mechanical Design, Process design, Realization of MEMS components, Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS

BOOKS:

1. Mohamed Gad – el – Hak, “MEMS Handbook”, CRC Press, 2002.
2. Rai-Choudhury P. “MEMS and MOEMS Technology and Applications”, PHI Learning Private Limited, 2009.
3. Sabrie Solomon, “Sensors Handbook,” McGraw Hill, 1998.

4. Marc F. Madou, “Fundamentals of Micro Fabrication”, CRC Press, 2nd Edition, 2002.
5. Francis E.H. Tay and Chong .W.O, “Micro fluidics and Bio MEMS application”, IEEE Press New York, 1997.
6. Trimmer William S., Ed., “Micromechanics and MEMS”, IEEE Press New York, 1997.
7. Maluf, Nadim, “An introduction to Micro electro mechanical Systems Engineering”, AR Tech house, Boston 2000.
8. Julian W. Gardner, Vijay K. Varadan, Osama O. Awadel Karim, “Micro sensors MEMS and Smart Devices”, John Wiby & sons Ltd., 2001.

L:T:P:: 3:0:0 **Credits-3**

EEC 044 NANO-ELECTRONICS

COURSE OBJECTIVES: This course enables the students:

1. Understand the theory of Classical Particles, Classical Waves, Quantum Particles, Quantum Mechanics of Electrons, Free and Confined electrons.
2. Interpret the various aspects of Electrons Subject to a Periodic Potential – Band Theory of Solids and apply the perceived knowledge.
3. Appraise and analyse the characteristics of the theory of Coulomb Blockade and the Single-Electron Transistor.
4. Perceive models of Semiconductor Quantum Wells, Quantum Wires and Quantum Dots and evaluate their characteristics.
5. Apprehend Nanowires, Ballistic Transport and Spin Transport models and develop/integrate them for their applications.

COURSE OUTCOMES:

1. Students will be able to acquire knowledge about nano-electronics and shrink down approach.
2. Students will be able to understand concept behind nano-MOSFETs and nano-devices.
3. Students will be able to set up and solve the Schrodinger equation for different types of potentials in one dimension as well as in 2 or 3 dimensions for specific cases.
4. Students will be able to acquire knowledge about leakage in nano-devices.
5. Students will be able to understand applications of nano-electronics.

COURSE CONTENTS

UNIT I: SHRINK-DOWN APPROACHES: Introduction to Nano scale Systems, Length energy and time scales, Top down approach to Nanolithography, CMOS Scaling, Limits to Scaling, System Integration Limits - Interconnect issues, etc.

UNIT II: OVERVIEW OF NANOELECTRONICS AND DEVICES: The Nano-scale MOSFET, FinFETs, Vertical MOSFETs, Resonant Tunneling Transistors, Single Electron Transistors, New Storage devices, Optoelectronic and Spin electronics Devices.

UNIT III: BASICS OF QUANTUM MECHANICS: History of Quantum Mechanics, Schrödinger Equation, Quantum confinement of electrons in semiconductor nano structures, 2D confinement (Quantum Wells), Density of States, Ballistic Electron Transport, Coulomb Blockade, NEGF Formalism, Scattering.

UNIT IV: LEAKAGE IN NANOMETER CMOS TECHNOLOGIES: Taxonomy of Leakage: Introduction, Sources, Impact and Solutions. Leakage dependence on Input Vector: Introduction, Stack Effect, Leakage reduction using Natural Stacks, Leakage reduction using Forced Stacks. Power Gating and Dynamic Voltage Scaling: Introduction, Power Gating, Dynamic Voltage Scaling, Power Gating methodologies.

UNIT V: FUTURE ASPECTS OF NANOELECTRONICS: Molecular Electronics: Molecular Semiconductors and Metals, Electronic conduction in molecules, Molecular

Logic Gates, Quantum point contacts, Quantum dots and Bottom up approach, Carbon Nano-tube and its applications, Quantum Computation and DNA Computation.

BOOKS:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003
6. Lundstorm, M. and Guo, J., Nanoscale Transistors – Device Physics, Modeling and Simulation, Springer (2006).
7. Bhushan, B., Handbook of Nanotechnology, Springer (2007) 2nd ed.
8. Beenaker, C.W.J., and Houten, V., Quantum Transport in Semiconductor Nanostructures in Solid State Physics, Ehernreich and Turnbell, Academic Press (1991).

L:T:P:: 3:0:0 **Credits-3**

EEC-051 BIOMEDICAL SIGNAL PROCESSING

COURSE OBJECTIVES: This course enables the students:

1. Understand the fundamentals of Digital Signal Processing and Biomedical Signal Processing.
2. Grasp the concept of stochastic processes to develop advanced Biomedical signal processing concept.
3. Comprehend Digital Signal Processing and Biomedical Signal Processing.
4. Grasp how to integrate the concept of matrix algebra, probability models, random processes and linear algebra to Separate information Source using Spatial filters.
5. To develop and ability to evaluate the performance of BSS algorithm in diverse areas of application with the help of practical examples.

COURSE OUTCOMES:

1. Students will have knowledge of different biomedical signals.
2. Students will be able to understand the ECG and EEG signals and its analysis.
3. Students will have knowledge of data reduction algorithms and their applications.
4. Students will have knowledge of various filtering algorithms used in biomedical signal processing.
5. Students will be capable of solving engineering problems related to biomedical signals.

COURSE CONTENTS

UNIT 1: INTRODUCTION TO BIOMEDICAL SIGNALS: Classification, Acquisition and Difficulties during Acquisition Basics of Electrocardiography, Electroencephalography, Electromyography & electro-ethnography, Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in biomedical field.

UNIT 2: ECG: Measurement of Amplitude and Time Intervals, QRS Detection (Different Methods), ST Segment Analysis, Removal of Baseline Wander and Power Line Interferences, Arrhythmia Analysis, Portable Arrhythmia Monitors.

UNIT 3: DATA REDUCTION: Turning Point algorithm, AZTEC Algorithm, Fan Algorithm, Huffman and Modified Huffman Coding, Run Length Coding.

UNIT 4: EEG: Neurological Signal Processing, EEG characteristic, linear prediction theory, Sleep EEG, Dynamics of Sleep/Wake transition, study of pattern of brain waves, Epilepsy-Transition, detection and estimation.

UNIT 5: EP ESTIMATION: Signal Averaging, Adaptive Filtering; General Structures of Adaptive filters LMS Adaptive Filter, Adaptive Noise Canceling, Wavelet Detection; Introduction, Detection by Structural features, Matched Filtering, Adaptive Wavelet Detectionand Detection of Overlapping Wavelets.

BOOKS:

1. Tomkin, Biomedical Digital Signal Processing, PHI, 2000.
2. Reddy, Biomedical Signal Processing, McGraw Hill, 2005.
3. Crommwell, Biomedical Instrumentation and Measurement, PHI, 1990.

4. Cohen, Biomedical Signal Processing, I & Licrc Press, 1986.
5. Rangaraj, Biomedical Signal Analysis a Case Study Approach, John Wiley, 2017.
6. Webster, Medical instrumentation Application and Design, John Wiley, 2010.

L:T:P:: 3:0:0 **Credits-3**

EEC-052 DIGITAL IMAGE PROCESSING AND APPLICATIONS

COURSE OBJECTIVES: This course enables the students:

1. To gain understanding on digital image formation, characteristics and its processing steps.
2. To demonstrate the use of different spatial and frequency domain processing techniques to improve the image quality.
3. To apply various segmentation and compression techniques of an image.
4. To introduce various image description and representation methods for computer vision applications.

COURSE OUTCOMES:

1. Students will be able to understand various transforms used in digital image processing.
2. Students will be able to understand image enhancement techniques and its applications.
3. Students will have knowledge of image restoration and its applications.
4. Students will be able to understand image segmentation, compression, and their practical use.
5. Students will be able to solve engineering problems related to digital image processing.

Syllabus :

UNIT 1: DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS: Elements of visual perception, Image sampling and quantization, Basic relationship between pixels, Basic geometric transformations, Introduction to Fourier Transform and DFT, Properties of 2D Fourier Transform, FFT, Separable Image Transforms, Walsh, Hadamard, Discrete Cosine Transform, Haar, Slant, Karhunen, Loeve transforms and Wavelet Transform.

UNIT 2: IMAGE ENHANCEMENT TECHNIQUES: Spatial Domain methods; Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, spatial filtering; smoothing, sharpening filters, Laplacian filters, Frequency domain filters; smoothing, sharpening filters, Homomorphic filtering.

UNIT 3: IMAGE RESTORATION: Model of Image Degradation/restoration process, Noise models, Inverse filtering,least mean square filtering, Constrained least mean square filtering, Blind image restoration.

UNIT 4: IMAGE SEGMENTATION AND REPRESENTATION: Edge detection, threshold, Region Based segmentation, Boundary representation; chair codes, Polygonal approximation, Boundary segments, boundary descriptors; Simple descriptors, Fourier descriptors, Regional descriptors, simple descriptors and texture.

UNIT 5: IMAGE COMPRESSION: Pseudo inverse, Singular value decomposition Lossless compression; Variable length coding, LZW coding, Bit plane coding, predictive coding, DPCM, Lossy Compression; Transform coding, Wavelet coding, Basics of Image compression standards, JPEG, MPEG, Basics of Vector quantization.

BOOKS:

1. Gonzalez, Woods, Digital Image Processing, Pearson,2006.

2. Pratt, Digital Image Processing, John Willey,2010.
3. Sonka, hlavac, Boyle, Broos, Image Processing Analysis and Machine Vision, Thompson Learning, 2007.
4. Jain, Fundamentals of Digital Image Processing, PHI ,1995.
5. Magundar – Digital Image Processing and Applications, Prentice Hall of India.
6. Sriidhar, Digital Image Processing, Oxford University Press, 2011.

L:T:P:: 3:0:0 **Credits-3**

EEC-053 ADVANCE DIGITAL SIGNAL PROCESSING

COURSE OBJECTIVES: This course enables the students:

1. Understand Theory Of Multi Rate DSP, Solve Numerical Problems And Write Algorithms
2. Understand Theory Of Prediction And Solution Of Normal Equations.
3. To Get Knowledge Of Parametric Methods Of Power Spectrum Estimation
4. Understand DSP Algorithms

COURSE OUTCOMES:

1. Students will be able to understand theory of different filters and algorithms
2. Students will be able to understand theory of multi-rate DSP, solve numerical problems and writealgorithms
3. Students will be able to understand the power spectrum estimation techniques.
4. Students will have knowledge of parametric methods of power spectrum estimation.
5. Students will be able to solve engineering problems related to DSP.

UNIT 1: REVIEW OF DFT, FFT, IIR FILTERS AND FIR FILTERS: Introduction to Filter Structures (IIR & FIR), Frequency Sampling Structures of FIR, Lattice Structures, Forward Linear Prediction, Backward Linear Prediction, Reflection Coefficients for Lattice Predictors, Implementation of Lattice Structures for IIR filters, Advantages of Lattice Structures.

UNIT 2: MULTI RATE SIGNAL PROCESSING: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling Rate Conversion by a Rational Factor I/D, Implementation of Sampling Rate Conversion, Multistage Implementation of Sampling Rate Conversion.

UNIT 3: APPLICATIONS OF MULTI RATE SIGNAL PROCESSING: Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Sub-band Coding of Speech Signals, Digital Filter Banks, Trans-multiplexers, Quadrature Mirror Filter Bank.

UNIT 4: POWER SPECTRUM ESTIMATION: Estimation of Spectra from Finite Duration Observations of Signals, Nonparametric Methods: Bartlett, Welch & Blackman-Tukey Methods, Comparison of all Nonparametric Methods.

UNIT 5: PARAMETRIC METHODS OF POWER SPECTRUM ESTIMATION: Relationships between the Autocorrelation & the Model Parameters, AR Models; Yule-Walker & Burg Methods, MA & ARMA Models for Power Spectrum Estimation.

BOOKS:

1. Proakis & Manolakis, Digital Signal Processing: Principles, Algorithms & Applications, PHI, 2007.
2. Salivahanan, Vallavaraj, Gnanapriya, Digital Signal Processing, TMH, 2010.
3. Kay, Modern Spectral Estimation: Theory & Application, PHI, 2000.
4. Vaidyanathan, Multi Rate Systems and Filter Banks, Pearson Education, 2002.

L:T:P:: 3:0:0 **Credits-3**

EEC-054 NANO MATERIALS

COURSE OBJECTIVES: This course enables the students:

1. The influence of dimensionality of the object at nanoscale on their properties.
2. Size and shape controlled synthesis of nanomaterials and their future applications in industry.

COURSE OUTCOMES:

1. Students will able to understand the role of nanomaterial in communication
2. Students will get familiar with basics of synthesis mechanism of Nano Materials.
3. Students will be able to understand different characterization techniques.
4. Students will be able to do various analyses for understanding material behavior.
5. Students will be having options to choose a particular application based on possible frequency bands.

Syllabus :

Unit 1: Introduction: Description of various international standards, IEEE radar band , Significance of Absorbers, permittivity, permeability, loss angle, Electromagnetic Interference (EMI), Shielding, Need of Microwave absorbers, Significance of Absorbers, dielectric absorber, hard ferrite, soft ferrite, Microwave Absorbing Materials, Ferrite Materials, magnetic properties and crystal structure, Industrial need of Microwave Absorbers.

Unit 2: Basics of Synthesization: need of weighing, mixing & grinding, drying, pre-sintering, need of pestle mortar, sieving of powder, need of PVA, palletisation, Solid-state Reaction (standard ceramic method), preparation of M-type hexagonal Ferrite.

Unit 3: Role of Characterization: Need of characterization, Types of characterization, Bragg's Law, Lattice constants, miller indices, Bulk density, X-ray powder diffraction (XRD), Scanning Electron Microscopy (SEM), wave number, Fourier Transform Infrared Spectroscopy (FTIR), Vector network analyzer (VNA), Dielectric and magnetic loss, Nicholson-Ross-Weir (NRW).

Unit 4: Different Mechanisms of analysis: Reflection loss, input impedance, characteristic impedance, real and imaginary impedance, Quarter wavelength mechanism, Impedance matching mechanism, Eddy current effect, coercivity, anisotropy field, Hysteresis Properties.

Unit 5: Structural and Morphological Analysis: Dielectric and Magnetic Loss Tangent, Eddy Current Loss, Matching thickness, frequency band and absorption bandwidth for reflection loss, Matching Between Absorber Impedance and Characteristic Impedance, Curie Point Measurement, DC Electrical Resistivity, Ferromagnetic Resonance

BOOKS:

1. Hitchcock, R. Timothy, "Radio-frequency and microwave radiation", American Industrial Hygiene Assn. p. 1. ISBN 1931504555, 2004.
2. Kumar, Sanjay, Shukla, Saurabh, "Concepts and applications of microwave Engineering", PHI Learning Pvt. Ltd. p. 3. ISBN 8120349350, 2014.

3. Jones, Graham A., Layer, David H., Osenkowsky, Thomas G, "National Association of Broadcasters Engineering Handbook", 10th Ed. Taylor & Francis. p. 6. ISBN 1136034102, 2013.
4. Vincent G. Harris "Handbook of Magnetic Materials", Volume 20, 2012.
5. A.J. Moulson and J. M. Herbert, "Electro ceramics: materials, properties, applications", 2nd edition, 2016.

L:T:P:: 0:0:2 **Credits-1**

ECP-071 VLSI DESIGN LAB

COURSE OBJECTIVES: This course enables the students:

1. Understand the structural, behavioural, data-flow models for digital circuits simulation.
2. Apply their understanding to design digital circuits/universal gates and draw layout of the same.
3. Analyse the MOS device characteristics and its model parameters.
4. Integrate basic blocks to build a bigger module and evaluate the results.
5. Create/develop digital and analog subsystems keeping design goals in consideration.

COURSE OUTCOMES:

1. Students will be able to design and implement digital systems TCAD software like Xilinx.
2. Students will be able to design and realize the MOSEFT technology using Cadence modern tools.
3. Students will be able to design the experiments, analyze and interpretation of data.
4. Students will acquire skills of teamwork, technical communication and effective report writing.
5. Students will be capable of solving practical electronics circuits.

Syllabus

1. Draw resistive load inverter circuit schematic, also, perform transient and DC analysis of the inverter circuit.
2. Draw CMOS inverter circuit schematic; also, perform transient and DC analysis of the inverter circuit.
3. Create symbol and layout of CMOS inverter. Run DRC to check whether layout is following design rules and LVS to determine the parasitic resistances and capacitances used in design layout.
4. Design a common source amplifier, also draw schematic and perform transient and DC analysis.
5. Design a common drain amplifier (Source follower amplifier), also perform transient and DC analysis.
6. Design a differential amplifier using MOSFETs; also, perform transient and DC analysis.
7. Design a current mirror circuit; also, perform transient and DC analysis.
8. Design a NAND gate circuit; also, perform transient and DC analysis.
9. Create symbol and layout of NAND, run DRC to check whether layout is following design rules and LVS to determine the parasitic resistances and capacitances used in design layout.
10. Design a 2x1 MUX circuit using the NAND gate.

L:T:P:: 0:0:4 **Credits-2**

ECP-072 DESIGN PROJECT

COURSE OBJECTIVES:

The object of Project is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. It is expected to provide a good training for the student(s) in R&D work and technical leadership.

The project assignment normally includes:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminaryAnalysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Final development of product/process, testing, results, conclusions and future directions;
5. Preparing a paper for Conference presentation/Publication in Journals, if possible;
6. Preparing a dissertation in the standard format for evaluation by the Department.
7. Final Seminar Presentation before a Departmental Committee.

COURSE OUTCOMES:

1. Students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas for sustainable development of society.
2. Students will demonstrate the skills to solve complex engineering problems and to analyze and interpret the data.
3. Students will demonstrate a sound technical knowledge and skill of their selected project and attitude of an engineer with professional ethics and life-long learning in context of modern technology.
4. Students will acquire skills of team management to achieve common goals using modern engineering tools.
5. Students will be able to develop communication skills in written and oral forms.

L:T:P:: 0:0:2 **Credits-1**

ECP-073 Internship-III

COURSE OBJECTIVES:

An internship is on the job training for the professional and is often taken up by students during his undergraduate in their free time to supplement their formal education and expose them to the world of work. Internships offer various occasion to interns during internship programs to expand familiarity in their choose area of work, to find out what they have an importance in an exacting in specific line of business, develop professional network links, build interpersonal skill. An internship may be compensated, non-compensated or some time to some extent paid. The student has to undergo an internship of 4 to 6 weeks during the vacation period.

The objectives of internship are:

1. To have the intern's individual development through challenging occupational coursework
2. To a typical and worthy extra-curricular activity that helps develops credentials for their semester.
3. It is designed and planned through consultation with the institute so as to fit into the undergraduate practice.
4. The internship involves closed direction or mentoring by a specialized expert.
5. It includes work experiences that go together with classroom learning.
6. It builds upon the association of any academy institute or university with has employers.
7. It is mainly victorious when the intern, the institute, and the employer all share conscientiousness in making it a valuable practice.

COURSE OUTCOMES:

1. Students will be able to make links across different areas of engineering and technology.
2. Students will understand the application of technology, resources and modern engineering tools to solve complex practical problems.
3. Students will understand responsibilities of professional engineering practice.
4. Students will be able to understand the working of a team to manage the projects in industrial environment.
5. Students will be able to develop skills of technical communication and report writing.

L:T:P:: 3:0:0 **Credits-3**

EEC-061 WIRELESS COMMUNICATION

COURSE OBJECTIVES: This course enables the students:

1. An understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards and various multiple access techniques.
2. An understanding on cellular concept, cellular architecture and evolution of different generations and standards for mobile cellular communication.
3. An ability to analyze different channel parameters, causes of impairments in signal propagation and impairment removal techniques.
4. An ability to explain the architecture, functioning and protocols of various wireless communication networks.
5. An ability to explain the capabilities and application of various wireless communication networks

COURSE OUTCOMES:

1. Students will be able to analyze radio propagation mechanisms in wireless scommunication along with their applications.
2. Students will be able to understand concepts of cellular architecture and its application to traffic engineering problems.
3. Students will be able to understand various multiple access techniques used for proper utilization of bandwidth resource.
4. Studentswillbeabletounderstandvariousmodulationschemesusedinwirelesscommunicationandtoformulatethe problem related to spectrum efficiency.
5. Knowledge of this course is going to enhance the capability of students for solving engineering problems related to wireless communication.

Syllabus :

UNIT 1: SERVICES AND TECHNICAL CHALLENGES: Types of services, requirements for the services, multipath propagation, spectrum limitations, noise and interference limited systems, principles of cellular networks, multiple access schemes.

UNIT 2: WIRELESS PROPAGATION CHANNELS: Propagation mechanisms (qualitative treatment), propagation effects with mobile radio, channel classification, link calculations, narrowband and wideband models, propagation models, path loss components

UNIT 3: WIRELESS TRANSCEIVERS: Structure of a wireless communication link, modulation and demodulation, quadrature/4-differential quadrature phase shift keying, offset-quadrature phase shift keying, phase shift keying, binary frequency shift keying, minimum shift keying, Gaussian minimum shift keying, power spectrum and error performance in fading channels, 16-QAM, 64-QAM.

UNIT 4: SIGNAL PROCESSING IN WIRELESS SYSTEMS: Principle of diversity, macro-diversity, micro-diversity, signal combining techniques, transmit diversity, equalizers; linear and decision feedback equalizers, review of channel coding and speech coding techniques.

UNIT 5: ADVANCED TRANSCEIVER SCHEMES: Spread spectrum systems; cellular code division multiple access systems, principle, power control, effects of multipath propagation on code division multiple access, application of orthogonal frequency division multiplexing in GSM, IS-95, IS-2000 and III & IVgeneration wireless networks and standards.

BOOKS:

1. Molisch, “Wireless Communications”, John Wiley, 2012.
2. Rappaport, “Wireless communications”, Pearson Education, 2009.
3. Haykin&Moher, “Modern Wireless Communications”, Pearson Education, 2011.
4. Goldsmith, “Wireless Communications”, Cambridge University Press, 2014.

L:T:P:: 3:0:0 **Credits-3**

EEC-062 AUDIO AND SPEECH SIGNAL PROCESSING

COURSE OBJECTIVES: This course enables the students:

1. To understand speech production and human auditory model. To analyse structures of speech codecs and classification of speech coding techniques
2. To understand different speech signal processing techniques
3. To understand basics of scalar and vector quantization
4. To understand basic of LPC and its variants for various applications
5. To understand different coding techniques and speech coding standards

COURSE OUTCOMES

1. To study the basic concepts of speech and audio
2. To study the analysis of various M-band filter banks for audio coding
3. To learn various transform coders for audio coding.
4. To study the speech processing methods in time and frequency domain

Syllabus :

UNIT1: MECHANICS OF SPEECH AND AUDIO: Introduction-Review of Signal Processing Theory-Speech production mechanism–Nature of Speech signal–Discrete time modeling of Speech production–Classification of Speech sounds–Phones–Phonemes–Phonetic and Phonemic alphabets–Articulatory features. Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking-Non simultaneous Masking-Perceptual Entropy-Basic measuring philosophy -Subjective versus objective perceptual testing-The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

UNIT 2: TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS: Introduction-Analysis-Synthesis Framework for M-band Filter Banks-Filter Banks for Audio Coding: Design Considerations-Quadrature Mirror and Conjugate Quadrature Filters-Tree- Structured QMF and CQF M-band Banks-Cosine Modulated "Pseudo QMF" M-band Banks-Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT)-Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion-Preecho Control Strategies.

UNIT-3: AUDIO-CODING-AND-TRANSFORM-CODERS: Lossless Audio Coding-Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advanced, 4Audio Coding-Optimum Coding in the Frequency Domain- Perceptual Transform Coder -Brandenburg-Johnston Hybrid Coder- CNET Coders-Adaptive Spectral Entropy Coding-Differential Perceptual Audio Coder-DFT Noise Substitution-DCT with Vector Quantization -MDCT with Vector Quantization.

UNIT 4: TIME AND FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING:

Time domain parameters of Speech signal – Methods for extracting the parameters :Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods

HOMOMORPHIC-SPEECH-ANALYSIS: Cepstral analysis of Speech–Formant and Pitch Estimation–Homomorphic Vocoders.

UNIT 5: LINEAR-PREDICTIVE-ANALYSIS-OF-SPEECH: Formulation of Linear

Prediction problem in Time Domain–Basic Principle–Auto correlation method–Covariance method–Solution of LPC equations–Cholesky method–Durbin's Recursive algorithm–lattice formation and solutions-Comparison of different methods–Application of LPC parameters–Pitch detection using LPC parameters–Formant analysis–VELP–CELP.

BOOKS:

1. Digital Audio Signal Processing, Second Edition, UdoZölzer, A. John Wiley& sons Ltd Publications
2. Applications of Digital Signal Processing to Audio And Acoustics Mark Kahrs, Karlheinz Brandenburg, Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow.
3. Digital Processing of Speech signals – L. R. Rabiner and R.W. Schaffer - Prentice Hall – 1978

L:T:P:: 3:0:0 **Credits-3**

EEC-063 PUBLIC BROADCAST ENGINEERING

COURSE OBJECTIVES: This course enables the students:

1. To understand TV signal transmission and reception technologies.
2. To understand the various broadcasting techniques.
3. This course is going to enhance the understanding of students about microphones and recorders.
4. To understand the television receiver systems.
5. To solve engineering problems related to TV systems.

COURSE OUTCOMES:

1. Students will be able to understand TV signal transmission and reception technologies.
2. Students will be able to understand the various broadcasting techniques.
3. This course is going to enhance the understanding of students about microphones and recorders.
4. Students will be able to understand the television receiver systems.
5. Students will be able to solve engineering problems related to TV systems.

Syllabus:

UNIT 1: TRANSMISSION TECHNOLOGIES: Public vs. Private broadcasting systems, Terrestrial transmission; Satellite and Cable broadcasting; Up linking and Down linking, Conditional Access System, DTH, IPTV

UNIT 2: RADIO BROADCASTING SYSTEMS: MW, SW, FM; Internet Radio, Podcasting: Satellite Radio, Community Radio, Analogue and Digital Audio, sampling, optical sound track, Audio formats and Dolby digital sound.

UNIT 3: MICROPHONES AND RECORDERS: Types of microphones, characteristics of microphones, Audio mixers and controls, equalizers; graphic and parametric, noise gate, filters, compressor, expander, limiters, dynamic range and gain controls, types of recorder; open reel, cassette recorders and Digital, multi-track recording.

UNIT 4: FUNDAMENTALS OF TELEVISION: Geometry form and Aspect Ratio, Image Continuity, Number of scanning lines, scanning; interlaced, progressive, Picture resolution, vestigial sideband modulation, VSB transmission, Broadcast standards; NTSC, PAL, SECAM and HDTV, ATSC terrestrial transmission standard, DVB-T transmission standard, ISDB-T transmission standard, channel allocations, Video formats, MPEG-2.

UNIT 5: CAMERA AND PICTURE TUBES: Basic principle of camera tubes, Image orthicon, vidicon, plumbicon, silicon diode array vidicon, solid state image scanners, monochrome picture tubes, beam deflection, screen phosphor, face plate, picture tube characteristics, colour television display tubes, delta, gun-precision, in-lineand Trinitron color picture tubes, 3D TV, HDTV, LCD, LED Television.

BOOKS:

1. Gulati, Monochrome Television Practice, Principles, Technology and Servicing, New age InternationalPublishes, 2014.

2. Defleur / Dennis, “Understanding Mass Communications”, Goyalsaab Publishers, 2001.
3. Millerson, TV Production, Focal Press, 2012.
4. Zettl, Herbert, Television Production Handbook, Thomson Wadsworth, 2014.
5. Chattergee, “Broadcasting in India”, Sage Publication, 2005.

L:T:P:: 3:0:0 **Credits-3**

EEC-064 ELECTRONIC SWITCHING SYSTEMS

COURSE OBJECTIVES: This course enables the students:

1. To learn Switching, Signaling and traffic in the context of telecommunication network.
2. To expose through the evolution of switching systems from manual and electro mechanical systems to stored program-controlled digital systems.
3. To design and analyze multistage switching systems
4. To study signaling, packet switching and network
5. Capable of solving electronic switching system problems

COURSE OUTCOMES:

1. Students will be able to understand various principles and techniques of switching systems.
2. Students will be able to design and analyze multistage switching systems.
3. Students will be able to understand different aspects of telecom traffic engineering.
4. Students will understand network synchronization, subscriber access and carrier systems.
5. Students will be capable of solving electronic switching system problems.

UNIT 1: INTRODUCTION: Message switching, circuits switching, functions of a switching system, register translator senders, distribution frames, crossbar switch, a general trunking Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing; Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Bi-phase, Differential Encoding, Time Division Multiplexing (T1 carrier system CCIT and DS lines) TDM Loops and Rings.

UNIT 2: DIGITAL SWITCHING: Switching functions, space division switching, multiple stage switching, non-blocking switches, blocking Probabilities DCS hierarchy, integrated cross connect equipment, digital switching in environment, zero loss switching.

UNIT 3: TELECOM TRAFFIC ENGINEERING: Network traffic load and parameters, grade of service and blocking probability, Traffic Characterization; Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities; End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems; Exponential service Times, Constant Service Times, Finite Queues.

UNIT 4: NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT: Timing Recovery, Phase Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter, Timing Inaccuracies; Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

UNIT 5: DIGITAL SUBSCRIBER ACCESS: ISDN Basic Rate Access Architecture, ISDN U Interface and ISDN Channel Protocol, HD-Rate Digital Subscriber Loops; Asymmetric Digital Subscriber Line, VDSL.

DIGITAL LOOP CARRIER SYSTEMS: Universal Digital Loop Carrier Systems,

Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band Modems; PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

DSL TECHNOLOGY: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM &CMTS and DOCSIS. SONET; Devices, Frame, Frame Transmission, Synchronous Transport Signals, STSI, Virtual Tributaries and Higher rate of service.

BOOKS:

1. Thiagarajan, Tele communication switching system and networks, PHI, 2015.
2. Bellamy, Digital telephony, John Wiley, 2000.
3. Taub & Schilling, Principles of Communication Systems, TMH, 2008.
4. Flood, Telecommunication switching, Traffic and Networks, Pearson Education, 2001.

L:T:P:: 0:0:12 **Credits-6**

ECP-081 PROJECT

The object of Project is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. It is expected to provide a good training for the student(s) in R&D work and technical leadership.

The project assignment normally includes:

8. Survey and study of published literature on the assigned topic;
9. Working out a preliminary Approach to the Problem relating to the assigned topic;
10. Conducting preliminaryAnalysis/Modelling/Simulation/Experiment/Design/Feasibility;
11. Final development of product/process, testing, results, conclusions and future directions;
12. Preparing a paper for Conference presentation/Publication in Journals, if possible;
13. Preparing a dissertation in the standard format for evaluation by the Department.
14. Final Seminar Presentation before a Departmental Committee.

COURSE OUTCOMES:

6. Students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas for sustainable development of society.
7. Students will demonstrate the skills to solve complex engineering problems and to analyze and interpret the data.
8. Students will demonstrate a sound technical knowledge and skill of their selected project and attitude of an engineer with professional ethics and life-long learning in context of modern technology.
9. Students will acquire skills of team management to achieve common goals using modern engineering tools.
10. Students will be able to develop communication skills in written and oral forms.

Annexure - II

List of Minor Courses offered by Electronics and Communication Engineering Department to B. Tech. Programme

Sl. No.	Major B. Tech. Degree programmes (Discipline / Branch of Study as Prescribed by the University from time to time)	Eligible Minor (After successfully passing the subjects worth 20 Credits as available against each Minor)*	Offering Department	Award of Degree
1	Artificial Intelligence & Machine Learning Computer Science (Artificial Intelligence & Machine Learning) Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Computer Science and Engineering Electrical Engineering Electrical & Electronics Engineering Information Technology Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	**RF and Microwave Engineering** 1. Electromagnetics Field Theory 2. Antenna and wave propagation 3. Microwave Engineering 4. Radar and Navigation 5. Satellite Communication 6. Microwave semiconductor Devices 7. Microstrip Antenna Design 8. Smart Antenna	**ECE**	"B. Tech. in branch name with Minor in ***RF and Microwave Engineering***

2	Artificial Intelligence & Machine Learning Computer Science (Artificial Intelligence & Machine Learning) Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Computer Science and Engineering Electrical Engineering Electrical & Electronics Engineering Information Technology Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering	**VLSI Design** 1. Analog Electronics Circuits 2. Semiconductor Devices 3. Design of CMOS Integrated Circuits 4. CMOS Design 5. Analog Filter Design 6. Nano-electronics 7. Mixed Signal Design 8. Digital System Design	**ECE**	"B. Tech. in branch name with Minor in **VLSI Design** "

	Power Plant Engineering			
3	Artificial Intelligence & Machine Learning Computer Science (Artificial Intelligence & Machine Learning) Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Computer Science and Engineering Electrical Engineering Electrical & Electronics Engineering Information Technology Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	**Communication System** 1. Signal and Systems 2. Analog Communication 3. Digital Communication 4. Wireless Communication 5. Satellite Communication 6. Multi-media Communication 7. Information Theory and Coding 8. Antenna and wave Propagation	**ECE**	"B. Tech. in branch name with Minor in ***Communication System***"
4	Artificial Intelligence & Machine Learning Computer Science (Artificial Intelligence & Machine Learning) Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Computer Science and Engineering Electrical Engineering Electrical & Electronics Engineering Information Technology Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	**Signal Processing** 1. Signal and Systems 2. Digital Signal Processing 3. Advanced Digital Signal Processing 4. Biomedical Signal Processing 5. Multi-rate Signal Processing 6. Audio and Video Speech Signal Processing 7. Analog Signal Processing 8. Digital Image Processing	**ECE**	"B. Tech. in branch name with Minor in ***Signal Processing***"

***If required the student may opt requisite fundamental course/s for a minor specialization as audit course.**