

B.E. III Semester

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs per Week	CIE	SEE	SEE Duration in hours	
Theory Courses										
1	5PC301EC	Electronic Devices	3	0	0	3	40	60		3
2	5PC302EC	Signals and Systems	3	0	0	3	40	60		3
3	5PC303EC	Network Theory	3	0	0	3	40	60		3
4	5PC304EC	Switching Theory and Logic Design	3	0	0	3	40	60		3
5	5ES303EC	Probability Theory and Stochastic Processes	3	0	0	3	40	60		3
6	5HS302HS	Managerial Economics and Financial Accountancy	3	0	0	3	40	60		3
7	5MC303HS	Indian Constitution	2	0	0	2	40	60		0
8	5ES304EC	Python Programming	2	0	0	2	40	60		2
Practical/Laboratory Course										
9	5PC351EC	Electronic Devices and Logic Design Lab	0	0	2	2	40	60		1
10	5PC352EC	Network Theorem Lab	0	0	2	2	40	60		1
11	5ES353EC	Python Programming Lab	0	0	2	2	40	60		1
Total			22	0	6	28	440	660		23

III - Semester Detailed Syllabus

Course Code	Course Title						Core/Elective
5PC301EC	Electronic Devices						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

This course aims to familiarize :

1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes.
3. To familiarize the students with various two terminal and three terminal electronic devices working and use in the design of real time electronic products.
4. Design DC biasing techniques and evaluate A.C parameters for BJT in Amplifier Applications.
5. Explore V-I characteristics of FETs, MOSFETs and study IC fabrication techniques

COURSE OUTCOMES :

1. Demonstrate understanding of the characteristic behavior of various electronic devices such as Diodes, Transistors etc, and applying them for understanding various circuits.
2. Evaluate the performance parameters of various diode circuits (rectifiers, clippers and clampers). Identify the merits and demerits of various filters, formulate and design rectifier circuits with filters. Calculate ripple factor, efficiency and percentage regulation of rectifier circuits.
3. Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability.
4. Analyze and design various circuits for different applications in Engineering Field.

UNIT-I

Semiconductor Diode Characteristics: The p-n junction Diode, Energy band diagram, Current equations, V-I characteristics, Temperature dependence, Diode resistance-Static and Dynamic, Transition capacitance, Diffusion capacitance, Zener

diode, Avalanche breakdown, Zener breakdown mechanisms – Zener diode as voltage Regulator, Hall effect.

UNIT-II

Diode Applications: Diode as a circuit element, Clipping and clamping circuits, clamping circuit theorem. Half wave, Full wave and Bridge Rectifiers - their operation, performance characteristics- ripple factor calculations, and analysis; Filters (L, C, LC and CLC filters).

Special Purpose Semi-Conductor Devices: Elementary treatment of Silicon Controlled Rectifier (SCR), UJT, Tunnel diode. Schottky diode, LED, Photodiode, Solar cell.

UNIT-III

Bipolar Junction Transistor : Construction and Operation of Bipolar Junction Transistor, current components, Modes of transistor operation, BJT input and output characteristics of CB, CE, CC configuration, early effect

Biasing and Stabilization: Biasing techniques, Stabilization factors, Compensation techniques, Thermal run away, Thermal Stability

UNIT-IV

Small Signal Transistors equivalent circuits: Small signal low frequency h-parameter model of BJT, Approximate model, Analysis of BJT amplifiers using approximate model for CB, CE and CC configurations.

UNIT-V

Field Effect Transistor: Junction Field Effect Transistor: Principle of Operation - the Pinch-off Voltage, V-I Characteristics of JFET.

MOSFETs : Enhancement & Depletion mode MOSFETs, V-I characteristics, CMOS inverter. Small signal model analysis of FET

TEXT BOOKS :

1. Millman and Halkias , -“Electronic Devices and Circuits”, 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, -“Electronic Devices and Circuit Theory”, 10th Edition, PHI, 2009.
3. S.K. Gandhi, -“VLSI Fabrication Principles: Silicon and Gallium Arsenide”, Wiley India Pvt. Ltd., New Delhi, 2nd Edition. 1994.

REFERENCE BOOKS :

1. Jacob Millman, Christos Halkias, Chetan Parikh, -“Integrated Electronics”, McGraw Hill Publication, 2nd Edition, 2009.
2. David Bell, -“Fundamentals of Electronic Devices and Circuits”, Oxford University Press, 5th Edition, 2008.
3. Christian Piguet, -“Low Power CMOS Circuits Technology, Logic Design and CAD Tools”, 1st Indian Reprint, CRC Press, 2010.

Course Code	Course Title					Core/Elective	
5PC302EC	Signals and Systems					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. Analyze basic concepts related to continuous time signals and systems, mathematical representation of periodic signals.
2. Familiarize with basic operations on signals and mathematical representation of aperiodic signals using Fourier and Laplace transform.
3. Analyze basic concepts related to discrete time signals and systems, mathematical representation of discrete time signals.
4. Describe the concept of Z- Transform and its properties and illustrate their applications to analyze systems.
5. Define convolution, correlation operations on continuous and discrete time signals.

COURSE OUTCOMES :

1. Define and differentiate types of signals and systems in continuous and discrete time.
2. Apply the properties of Fourier transform to continuous time signals.
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs.
4. Apply Z-transforms to discrete time signals to solve Difference equations.
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation.

UNIT-I

Definitions and classifications: Classification of signals. Elementary continuous time signals, Basic operations on continuous-time signals. Classification of continuous-time systems: continuous time & discrete time systems, lumped-parameter & distributed –parameter systems, static & dynamic systems, causal &

non-causal systems, Time-invariant & time-variant systems, stable & unstable systems.

UNIT-II

Representation of Continuous-time signals: Analogy between vectors and signals, orthogonality and completeness.

Fourier series analysis of Continuous-time signals: Fourier series – Existence of Fourier series, Trigonometric and Exponential Fourier series, Computational formulae, Symmetry conditions, Complex Fourier spectrum.

UNIT-III

Continuous-time Fourier Transform (FT): The direct and inverse FT, existence of FT, Properties of FT, FT of standard signals, properties of FT, The Frequency Spectrum.

Linear convolution of continuous time signals: Graphical interpretation, properties of convolution, Correlation between continuous-time signals: Auto and Cross correlation, graphical interpretation, properties of correlation.

Laplace Transform (LT) Analysis of signals and systems: The direct LT, Region of convergence, existence of LT, properties of LT. The inverse LT, Solution of differential equations, System transfer function.

UNIT-IV

Discrete-time signals and systems: Sampling, Classification of discrete-time signals, Basic operations on discrete time signals, Classification of discrete time systems, properties of systems.

Linear Convolution of discrete time signals: Graphical interpretation, Properties of discrete convolution.

Fourier analysis of discrete-time signals: Discrete-time Fourier transform (DTFT), properties of DTFT, Transfer function, Discrete Fourier transform properties of DFT.

UNIT -V

Z-Transform analysis of signals & systems: The direct Z-transform, Region of convergence, Z-plane and S-plane correspondence. Inverse Z-transform, Properties of Z-transforms. Solution to linear difference equations, linear constant coefficient systems, System transfer function.

TEXT BOOKS:

1. B. P. Lathi, "Linear Systems and Signals", 2nd Edition, Oxford University Press, 2009.
2. Alan V Oppenheim, A. S. Wlisky, "Signals and System", 2nd Edition, Prentice Hall.

REFERENCE BOOKS:

1. Douglas K. Linder, "Introduction to Signals and Systems", McGraw Hill, 1999.
2. P. Ramesh Babu, R Ananada Natarajan, "Signals and Systems", SCITECH, 3rd edition, 2009.
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, "Signals and Systems", Pearson , 4th Edition, 1998.

Course Code	Course Title					Core/Elective	
5PC303EC	Network Theory					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. Concepts of Two Port networks, study of different two port parameter representations.
2. Concepts of the image impedance a different network, Design of attenuators.
3. Design concepts of equalizers.
4. Design concepts of different filters.
5. Design concepts of network synthesis.

COURSE OUTCOMES :

1. Able to Express given Electrical Circuit in terms of A, B, C, D and Z, Y Parameter Model and Solve the circuits and how they are used in real time applications.
2. Able to learn how to calculate properties of networks and design of attenuators.
3. Able to design of equalizers.
4. Able to design different types of filters using passive elements.
5. Able to synthesize the RL & RC networks in Foster and Cauer Forms.

UNIT-I

Two Port networks: Z, Y, h, g and ABCD parameters, equivalence of two ports networks, T-PI transforms, Reciprocity theorem, Interconnection of two port networks and Brune's test of inter connections.

UNIT-II

Symmetrical and Asymmetrical Networks: Characteristic impedance and propagation constant of symmetrical T and pi networks, Image and iterative impedances, Image transfer constant and iterative transfer constant of asymmetrical L, T and pi networks.

UNIT-III

Constant k- Filters - Low pass, high pass, band pass and band elimination filter design, m-derived low pass and high pass filter design, Composite filter design and notch filter.

UNIT-IV

Attenuators and Equalizers - Design of symmetrical T, pi, Bridge-T and Lattice attenuators, impedance matching networks, Inverse networks, Equalizers, Constant resistance equalizer, full series and full shunt equalizer.

UNIT-V

Network Synthesis : Hurwitz polynomials, positive real functions, Basic Philosophy of Synthesis, L-C Immittance functions, RC impedance functions and RL admittance functions. RL impedance functions and RC admittance functions. Cauer And Foster's forms of RL impedance and RC admittance. Properties of RC, RL Networks.

TEXT BOOKS

1. Ryder J.D, "Network Lines Fields", Prentice Hall of India, 2nd edition, 1991.
2. P.K. Jain and Gurbir Kau, "Networks, Filters and Transmission Lines", Tata McGraw- Hill Publishing Company Limited, 1st edition, 1994.

REFERENCE BOOKS:

1. A. Sudhakar and Shyam mohan, "Circuits Networks: Analysis Synthesis", Tata McGraw Hill, 4th edition, 2010.
2. Van Valkenburg M.E, "Introduction to Modern Network Synthesis", Wiley Eastern, 1st edition, 1994.
3. S.P. Ghosh and A.K. Chakraborty, "Network Analysis and Synthesis", McGraw Hill, 1st edition, 2009.

Course Code	Course Title					Core/Elective	
5PC304EC	Switching Theory and Logic Design					Core	
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. To understand basic number systems, codes and logical gates.
2. To understand the concepts of Boolean algebra.
3. To understand the use of minimization logic to solve the Boolean logic expressions.
4. To understand the design of combinational and sequential circuits.
5. To understand the state reduction methods for Sequential circuits.
6. To understand the various types of memories.

COURSE OUTCOMES :

Students will be able to: -

1. To apply the basic concepts of Boolean algebra for the simplification and implementation of logic functions using suitable gates namely NAND, NOR etc.
2. Make use of the concepts to solve the problems related to the logic circuits.
3. Design simple Combinational Circuits such as Adders, Subtractors, Code Convertors, Decoders, Multiplexers, and Magnitude Comparators etc.
4. Identification of gates – application. Understand and Design – concept of FSM, Mealy and Moore machines.
5. Design Sequential Circuits such as different types of Counters, Shift Registers, Serial Adders, and Sequence Generators. Compare various Programmable logic devices.

UNIT-I

Number System: Binary, decimal, octal, hexa decimal, weighted and un-weighted codes.

Boolean Algebra: Axiomatic definition of Boolean algebra, Binary operators, postulates of and theorems. Boolean addition, subtraction, 1's complement, 2's complement. Switching functions, Canonical forms and Standard forms, Simplification of switching functions using theorems.

Character coding schemes - ASCII. Arithmetic operations on binary octal,

hexadecimal and BCD numbers. Error Detection and Correction – Parity and Hamming code.

UNIT – II

Logic gates: Basic gates and universal gates.

Minimization of Switching Functions: simplification rules, Karnaugh map method, Prime implicants, don't care combinations, Minimal SOP and POS forms, Quine-McCluskey Tabular Method, Prime Implicant chart.

UNIT – III

Single output and multiple output combinational logic circuit design, AND-OR, OR-AND, and NAND/NOR realizations, Exclusive-OR and Equivalence functions, Binary adders/subtractors, carry look ahead adder, BCD adder, code converter, magnitude comparator, Encoder, Decoder, Multiplexer, Demultiplexer, MUX realization of switching functions, Parity bit generator, Code-converters, Concepts of threshold logic and threshold gates.

UNIT – IV

Sequential Circuits-1: Classification of sequential circuits (Synchronous, Asynchronous Pulse mode, and Level mode with examples). Basic flip-flops- Triggering and excitation tables. Conversion of flip-flops.

Sequential Circuits-2: The sequential circuit model, Asynchronous counters, Design of simple synchronous sequential circuits such as counters (Design of modulo-N counter, Ring counter, twisted ring counter) and Shift registers

UNIT - V

Programmable Logic Devices: Basic PLD's-ROM, PROM, PLA, and PLD Realization of Switching functions using PLDs.

Algorithmic State Machines: State machines and state diagrams. Design of weighing machine and binary multiplier.

TEXTBOOKS:

1. Morris Mano, -“Digital design” PHI, 2nd Edition.
2. Zvi Kohavi and Niraj K Jha -“Switching & Finite Automata theory”– Cambridge, 3rd Edition.

REFERENCE BOOKS:

1. Fletcher -“An Engineering Approach to Digital Design” – PHI. -2nd edition.
2. Roth, Kenny, -“Fundamentals of Logic Design”, Cengage Learning, Seventh Edition.
3. John M. Yarbrough -“Digital Logic Applications and Design”– Thomson Publications, 2006.
4. CVS Rao, -“Switching Theory and Logic Design” Pearson Education, 2005.

Course Code	Course Title				Core/Elective		
5ES303EC	PROBABILITY THEORY AND STOCHASTIC PROCESSES				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. To understand fundamentals of probability and random variables as applicable to Electronics Engineering.
2. To learn one Random variable characteristic function of different variables using their density functions.
3. To learn Two Random variable characteristic functions of different variables using their density functions.
4. To understand elementary concepts of the stochastic processes and their temporal characteristics.
5. To understand elementary concepts of the stochastic process and their spectral characteristics.

COURSE OUTCOMES :

Upon completing this course, the student will be able to

1. To understand different types of Random variables their density and distribution functions.
2. To learn one Random variable characteristics of different variables their density and distribution functions.
3. To extend bi-variate distributions and the operations on.
4. To understand elementary concepts of the stochastic process in to Temporal characteristics.
5. To understand elementary concepts of the stochastic process in to spectral characteristics.

UNIT-I:

Probability & Random Variable: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Baye's Theorem, Independent Events, Random Variable- Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable.

UNIT -II:

Distribution & Density Functions and Operations on One Random Variable :

Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Rayleigh, Methods of defining Conditional Event, Conditional Density, Properties. Expected Value of a Random Variable, Function of a Random Variable $g(x)$ and its distribution, Moments about the Origin, Central Moments, Variance and Skew, Chebyshev's Inequality (no proof), Characteristic Function, Moment Generating Function; Transformations of Random Variables.

UNIT -III:

Two Random Variables and operations : Joint Distribution and Density Functions and their properties, Joint Moments, Joint Characteristic Functions, Conditional Distributions (Point & Interval), Conditional Expected Values. Marginal distribution functions, Statistical independence, Sum of two random variables, Central Limit Theorem (no proof); Engineering application (theoretical discussion) – Mutual information, Channel Capacity and Channel Coding.

UNIT -IV

Stochastic Processes – Temporal Characteristics : Introduction to stationary (First and Second order; WSS; SSS), Statistical independence, Time averages and ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Auto correlation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties. Linear System Response of Mean and Mean-squared Value.

UNIT -V

Stochastic Processes - Spectral Characteristics :Power Density Spectrum and its properties; Relationship between Power Density Spectrum and Autocorrelation Function; Relationship between Cross-Power Density Spectrum and Cross-Correlation Function; White and colored noise, response to linear systems and stochastic inputs, concept of Markov Processes.

TEXT BOOKS :

1. Henry Stark and John W. Woods, “Probability and Random Processes with Application to Signal Processing”, Pearson Education, 3rd edition, 2014.
2. Athanasius Papoulis and S. Unni krishna Pillai, “Probability, Random Variables and Stochastic Processes”, McGraw Hill, 4th edition, 2006.

REFERENCE BOOKS:

1. Peyton Z. Peebles, “Probability Random Variables & Random Signal Principles”, Tata McGraw Hill, 4th edition, 2001.
2. k. Murugesan and P.Guruswamy, “Probability statistics and Random processes”, Anuradha Agencies, 3rd edition, 2003.
3. Bruce Hajek, “Random processes for Engineers”, Cambridge unipress, 2nd edition, 2015.

Course Code	Course Title					Core/Elective	
5HS302HS	Managerial Economics & Financial Accounting					HS	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand responsibilities of a manager of a business undertaking.
2. To analyze various determinants influencing demand and price.
3. To understand the principles of accounting and prepare Journal, Ledger, Trial Balance & Final accounts.
4. To understand Financial statement Analysis.
5. To evaluate & analyze the long term investments.

COURSE OUTCOMES :

1. Determine the responsibilities & decision making in the Organization.
2. Understand the various factors influencing demand & market structure.
3. Understand the principles of Accounting & solve the problems.
4. Analyze the Financial performance.
5. Understand the capital structure & to take decision on selection of projects.

UNIT-I

Introduction to Managerial Economics, its Scope, Importance and relation to other sciences, its usefulness to Engineers-Basic concepts of Managerial Economics.

UNIT-II

Demand Analysis: Introduction to demand, determinants, law of demand, its assumptions, Elasticity of demand-price, income and cross elasticity, demand forecasting, Market, competitive structure, price & output determination under perfect competition and Monopoly.

UNIT-III

Basics of Accounting: Financial Accounting - Definition - Accounting Cycle- Journal - Ledger - Cash book - Trial Balance.

UNIT-IV

Financial statement Analysis: Preparation of Final accounts with simple adjustments (including problems). Ratio Analysis – Importance – Liquidity and profitability ratios.

UNIT-V

Capital management : Significance determinates and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, Time Value of money - Methods: Non-Discounted cash flow methods (pay back, ARR), Discounted (NPV, PI, IRR) with problems.

TEXT BOOKS :

1. Mehta P.L., "Managerial Economics", Sultan Chand & Sons Publishers.
2. Luke M Froeb, "Managerial Economics - A Problem Solving Approach".
3. I.M.Panday, "Financial Management", Vikas Publishing House.
4. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House.

REFERENCE BOOKS :

1. R.L.Varshney, K.L.Maheshwari, Managerial Economics, Sultan Publishers.
2. D.M.Mithani, Managerial Economics, Himalaya Publishing House.
3. Mukherjee, Hanif, Financial Accounting, Tata McGraw Hill.
4. Ramachandran, Kakani, Financial Accounting for Management, Tata McGraw Hill.

Course Code	Course Title						Core/Elective
5MC303HS	Indian Constitution						MC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	0	-	0	40	60	0

COURSE OBJECTIVES :

1. To create awareness and relevance of the Indian Constitution, its directive principles.
2. To impart understanding of the role, powers and functions of administration at the Central, State and local levels.
3. To expose students to the relations between Central/Federal, State and Provincial units, divisions of executive, legislative and judiciary in them.
4. To impart knowledge about the statutory institutions and their role.

COURSE OUTCOMES:

1. Have a general knowledge and back ground of the Constitution of India and its importance.
2. Will distinguish and understand the working of the Central, state and provincial levels of administration.
3. Will be conscious about the fundamental duties, responsibilities and rights as an ideal citizen of India
4. Will be able to perceive and interpret the functioning and distribution of resources between centre and state.
5. Have an awareness and relate to the existing hierarchy of the social structure, election process and grievance redressal in a democracy.

UNIT-I

Introduction to Constitution- Meaning, reasons for having a constitution. Evolution of the Indian Constitution: History, 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Preamble- its importance and key words; Fundamental features of the Indian Constitution. Emergency powers

UNIT-II

Style of Governance adopted, Structure of the Indian Union, Relationship between bodies in hierarchy.

Union Government: Executive-President, Prime Minister, Council of Minister-role, position and powers.

State Government: Executive: Governor, Chief Minister, and Council of Minister - role, position and powers.

Local Government: Panchayat Raj Institutions, Rural and Urban local bodies-composition, role, position and powers.

UNIT-III

Rights and Duties: Fundamental Rights- importance and salient features,

Directive principles of State Policy-meaning and purpose, classification, importance and implementation

Fundamental duties of a good citizen.

UNIT-IV

Relation between Federal and Provincial units:

Union-State relations: Administrative, legislative and Financial, Inter-State council, NITI Ayog, Finance Commission of India.

Judiciary: Meaning and Functions, Conditions of independence of judiciary, Composition and powers of Supreme court, judicial activism and judicial restraint.

UNIT- V

Constitutional bodies: Finance Commission, UPSC, Election Commission, the CAG, National Commissions for SCs and STs, etc.

Statutory Institutions: Securities & Exchange Board of India, National Human Rights Commission, National Commission for Women, National Commission for Minorities, National Green Tribunal, National Commission for Protection of Child Rights etc.

TEXT BOOKS :

1. Durga Das Basu, "Introduction to the Constitution of India", 25th Edition, English- Hardcover – 1 January 2021, Dr. Durga das Basu (Author), ASIN:B091Q92R7R Publisher:Lexis Nexis, New Delhi, 2021.
2. PM Bhakshi, "The Constitution of India", 1 January 2017, English, Paperback, Publisher Universal Law Publishing - An imprint of Lexis Nexis.

REFERENCE BOOKS:

1. Subhash Kashyap, "National Book Trust Our Parliament", English Medium, ISBN 19788123701479, Publication National Book Trust-New Delhi.
2. Peu Ghosh, "Indian Government and Politics Paperback", (Author) Publisher: Prentice Hall India Learning Private Limited (1 January 2012), English, Paperback, ISBN-10: 8120346491; ISBN-13 : 978-8120346499.
3. Dr. B.L. Fadia, Dr. Kuldeep Fadia, "Indian Government and Politics", Authors: ISBN: 978-93 84885-62-5, Sahithya Bhavan Publications, Agra.

Course Code	Course Title						Core/Elective
5ES304EC	Python programming						Mandatory
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basic Mathematics	2	0	-	0	40	60	2

COURSE OBJECTIVES :

1. To learn how to use lists, tuples, and dictionaries in Python programs.
2. To learn how to write loops and decision statements in Python.
3. To learn how to read and write files in Python.
4. To learn how to use exception handling in Python applications for error handling.

COURSE OUTCOMES :

1. Explain basic principles of Python programming language.
2. Create, run, and manipulate Python Programs using core data structures like Lists, Tuple, Set and Dictionaries.
3. Understand and summarize different File handling operations.
4. Handle exceptions in programming.

UNIT-I

Basics of Python: Algorithms, building blocks of algorithms (statements, state, control flow), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms. Python Basics, Features of Python, Python Applications, Installing and running Python with Different IDEs, Comments in Python, Memory Management in Python, Garbage Collection in Python, Python I/O : Printing to the Screen, Reading Keyboard Input.

UNIT-II

Python Operators: Arithmetic, Relational and Comparison Operators, Python Assignment Operators, Logical Operators and Bitwise Operators, Membership Operators, Identity Operators, Operator Precedence and Associativity, Evaluating Expressions. Control Statements: A Word on Indentation, the if Statement, The if ... else Statement, The if ... elif ... else Statement, The while Loop, the for Loop, Infinite

Loops, Nested Loops, Loop manipulation using pass, continue, break and else Statement.

UNIT-III

Variables and Data Types in Python : How Python Sees Variables, Constants, Identifiers and Reserved words in Python, Naming Conventions in Python. Declaring and using Numeric data types: int, float, complex and Boolean, Sequences: Using String data type, Lists and Tuples, Methods and Useful Built-in Functions, Dictionaries and Set Types.

UNIT-IV

Python Programming using functions, modules, and packages: Organizing python codes using functions, Formal and Actual Arguments, Positional Arguments, Keyword Arguments, Default Arguments, Variable Length Arguments, Pass by Object Reference, Local and Global Variables, Scope and Lifetime of variables, Nested Functions, Recursive Functions, Powerful Lambda function.

UNIT-V

Python File Input-Output : Opening and closing file, Various types of file modes, reading and writing to files. Python Exception Handling: Avoiding code break using exception handling, Various keywords to handle exception, try .. exception else ... finally, Raising Exceptions, Assertions, Python Custom Exceptions. Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

TEXT BOOKS :

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "Learning with Python: How to Think Like a Computer Scientist", 3rd Edition.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Shroff O'Reilly Publishers.

REFERENCE BOOKS :

1. Hans Fangohr, "Introduction to Python for Computational Science and Engineering (A beginner's guide)", Edition, top, Publisher.
2. Timothy A. Budd, "Exploring Python", Mc Graw Hill Education.
3. John V Guttag, - "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press.

Course Code	Course Title					Core/Elective	
5PC351EC	Electronic Devices and Logic Design Lab					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

COURSE OBJECTIVES :

1. The V-I characteristics of diodes and determination of static and dynamic resistances of semiconductor diode.
2. To design the rectifiers and performance of parameters.
3. To understand the characteristics of transistor in various configurations

COURSE OUTCOMES :

1. To demonstrate the characteristic behavior of PN junction diode and Zener diode.
2. To design various non-linear wave shaping circuits using diodes for given specifications.
3. Analyze the behavior of non-linear wave shaping circuits using diodes.
4. Examine the characteristics of BJT and FET in various configurations.
5. Evaluate and compare the significant parameters obtained from the characteristics of BJT and FET.

List of Experiments:

PART-A

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode characteristics and its application as voltage regulator.
3. Clipping and Clamping Circuits.
4. Design, realization and performance evaluation of half wave rectifiers without filters and with filters (capacitor filter and π - section filter).
5. Plotting the characteristics of BJT in Common Base configuration and Common Emitter configuration.
6. V-I Characteristics of JFET in CS configuration.
7. Frequency response of Common Source FET amplifier.
8. V-I characteristics of UJT.

PART - B

1. Verification of truth tables of Logic gates and realization of Binary to Gray and Gray to Binary code converters.
2. Realization of Half adder/ and full adder/using universal logic gates.
3. Realization of Full adder/using MUX and Decoder.
4. Design 2's complement Adder/subtractor using IC 74283 and verify experimentally.
5. Verification of truth tables of Flip Flops and Flip flop conversions from one form to the other.

Note :

1. Wherever possible, Analysis and design of circuits shall be carried out using simulation tools.
2. A minimum of 10 experiments should be performed.

Objective

- To get acquainted with the Analog/Digital Training System.
- To get acquainted with different standard integrated circuits (ICs).
- To study the basic logic gates: AND, OR, INVERT, NAND, NOR, and XOR.
- To understand formulation of Boolean function and truth table of logic circuits.

Components

Analog/Digital Training System - IC Type 7400 Quadruple 2-input NAND gates
- IC Type 7402 Quadruple 2-input NOR gates
- IC Type 7404 Hex Inverters
- IC Type 7408 Quadruple 2-input AND gates
- IC Type 7432 Quadruple 2-input OR gates
- IC Type 7486 Quadruple 2-input XOR gate

Experiment No.	Title of the Experiment	Objective of the Experiment
1	To study and verify the truth table of logic gates	Identify various ICs and their specification a. OR gate b. AND gate c. NAND gate d. NOR gate
2	Realization of a Boolean function	To simplify the given expression and to realize it using Basic gates and Universal gate
3	Design and implementation using NAND gate	To realize why NAND gate is known as the universal gate by implementation of: a. NOT using NAND b. AND using NAND c. OR using NAND d. XOR using NAND
4	Adders and Subtractors	To realize a. Half Adder and Full Adder b. Half Subtractor and Full Subtractor by using Basic gates and NAND gates
5	Binary to grey generator	To learn the importance of weighted and non weighted code To learn to generate gray code.
6	Multiplexer and Demultiplexer	a. To design and set up a 4:1 Multiplexer (MUX) using only NAND gates. b. To design and set up a 1:4 Demultiplexer(DE-MUX) using only NAND gates.

7	Realization of a Boolean function using Logisim	To learn the use of Logisim software to design digital electronics circuits.
8	FlipFlop	a. Truth Table verification of 1) RS Flip Flop 2) T type Flip Flop. 3) D type Flip Flop. 4) JK Flip Flop. b. Conversion of one type of Flip flop to another

TEXT BOOKS :

1. R P Jain, - Modern Digital Electronics.
2. William Gothmann H, - Digital Electronics: An Introduction To Theory And Practice.
3. John Morris, - Digital Electronics.
4. Anand Kumar, - Fundamentals of Digital Circuits.

Course Code	Course Title					Core/Elective	
5PC352EC	Network Theorem Laboratory					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. To learn the usage of basic electronic components, equipments and meters, used in electronic laboratories.
2. To learn practical electric AC & DC circuits.
3. To learn about PCB making
4. To learn various filters.

COURSE OUTCOMES:

1. Use the basic electronic components and design circuits.
2. Verify various parameters of the circuits by applying theorems.
3. Understand the making of PCB.
4. Design various filters.

List of Experiments :

1. Study of all types of discrete Active & passive devices, display devices, integrated components, electro-mechanical components (switches, sockets, connectors etc.,) electromagnetic components (relays). Study and use of different meters (volt/ammeter, AVO/Multi meter) for the measurement of electrical parameters. Measurement of RLC components using LCR Meter.
2. Study of CRO and its applications.
3. Verification of Superposition and Tellegan's theorem.
4. Verification of Thevenin's and Maximum Power Transfer Theorem.
5. Measurement of two-port network parameters.
6. Measurement of Image impedance and Characteristics impedance.
7. Design of T-section constant K Low Pass Filter.
8. Design of m-derive High Pass Filter.
9. Verification of Reciprocity theorem.
10. Verification of Norton's theorem.
11. Soldering and De-soldering.
12. PCB Making.

Note : A minimum of 10 experiments should be performed. The students may use any commercial / open-source SPICE programs available such as MULTISIM, PSPICE, TINA, and LABVIEW for simulation.

Course Code	Course Title					Core/Elective	
5ES353EC	Python Programming Laboratory					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

COURSE OBJECTIVES :

1. To learn how to design and program using lists, Sets, tuples, and dictionaries.
2. To learn how to use indexing and slicing to access data in Python programs.
3. To learn structure and components of Python and to read and write files.
4. To learn how to design object oriented programs with Python classes and Exception handling techniques.
5. To learn how to do report preparation to access data.

COURSE OUTCOMES :

1. Develop solutions to simple computational problems using Python programs.
2. Solve problems using Control statements.
3. Develop Python programs by defining functions and parameters.
4. Use Python data structures for problem solving.
5. Apply file handling and report preparation to access data.
6. Develop Python programs for exception handling.

List of Programs :

1. Installing and running python programs with different environments.
2. Write a program to demonstrate python Input /Output functions and data types.
3. Write a program to use python Operators.
4. Write a program to apply control structures.
5. Write a program to implement List, Tuple, Set, dictionary Data structures in python.
6. Write a program to apply String handling functions.
7. Write a program to demonstrate Functions and parameters passing techniques.

8. Write a program to apply recursion and Lambda functions.
9. Write a program to demonstrate python modules and packages.
10. Write a program to apply python File handling.
11. Write a program to demonstrate python Exception Handling.
12. A case study on Creation of Dynamic OTP generator for Financial Transactions.

TEXT BOOKS :

1. Kenneth A. Lambert, “The Fundamentals of Python: First Programs”, 2nd Edition, 2017, Cengage Learning.
2. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India.

REFERENCE BOOKS:

1. Mark Summerfield. ?Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Allen B. Downey, ``Think Python: How to think like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/ O’Reilly Publishers, 2016.

B.E. (ECE) - IV SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits	
			L	T	P	Total Hours	CIE	SEE		
Theory										
1	5PC405EC	Analog Electronic Circuits	3	0	0	3	40	60	3	
2	5PC406EC	Automatic Control Systems	3	1	0	3	40	60	4	
3	5PC407EC	Computer Organization and Architecture	3	0	0	3	40	60	3	
4	5PC408EC	Electro Magnetic Theory and Transmission Lines	3	0	0	3	40	60	3	
5	5PC409EC	IC Applications	3	0	0	3	40	60	3	
6	5MC402HS	Essence of Indian Traditional Knowledge	2	0	0	2	40	60	0	
7	5HS403HS	Human Values and Professional Ethics	3	0	0	3	40	60	3	
Laboratories										
8	5PC453EC	AEC Laboratory	0	0	2	2	40	60	1	
9	5PC454EC	IC Applications Laboratory	0	0	2	2	40	60	1	
Total Credits									21	

IV - Semester Detailed Syllabus

Course Code	Course Title						Core/Elective
5PC405EC	Analog Electronic Circuits						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. The Understand the applications of BJT & FET as a switch and as an amplifier.
2. Analysis of BJT & FET in various configurations using small signal equivalent models and their frequency response.
3. Familiarize with concept and effect of negative feedback.
4. Study of positive feedback and Design different types of oscillators.
5. Design Power Amplifiers and calculate their efficiencies.

COURSE OUTCOMES :

1. Recall and relate the knowledge of BJT and FET behavior in the design of various biasing and amplifier circuits.
2. Apply low and high frequency models of transistor in the analysis of single stage and multistage amplifiers.
3. Design and analyze amplifier and oscillator circuits.
4. Compare and Contrast different types of biasing, Multistage, Feedback and Power amplifiers.
5. Interpret a given analog circuit and evaluate its performance parameters by applying acquired knowledge.

UNIT-I

Transistor at high frequencies : Hybrid π CE transistor model, Hybrid p Conductance's and Capacitances, CE short circuit current gain, Current gain with resistive load, Miller's Theorem.

BJT Amplifiers - Frequency Response: Frequency response of BJT Amplifier, Analysis at Low and High frequencies, Effect of coupling and bypass Capacitors - Single Stage CE Transistor Amplifier Response, Gain-Bandwidth Product, Emitter follower at higher frequencies.

UNIT - II

Multi Stage Amplifiers-Analysis of Cascaded RC Coupled BJT amplifiers, Cascode Amplifier, Darlington Pair, Different Coupling Schemes used in Amplifiers - RC Coupled Amplifier, Transformer Coupled Amplifier, Direct Coupled Amplifier.

UNIT -III

Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances. Method of analysis of feedback amplifiers, Analysis of Voltage series, voltage shunt, current series and current shunt feedback amplifiers.

UNIT -IV

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillator, LC oscillator, Crystal oscillator, Amplitude and frequency stability of oscillator.

Voltage Regulators: Transistor series and shunt voltage regulators.

UNIT - V

Large Signal Amplifies: Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, Class A resistive coupled and transformer coupled amplifiers, Class-B Push-pull and complementary symmetry amplifiers, Class AB operation.

TEXT BOOKS :

1. Millman and Halkias, -“Electronic Devices and Circuits”, 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, -“Electronic Devices and Circuit Theory”, 10th Edition, PHI, 2009.

REFERENCE BOOKS :

1. Jacob Millman, Christos Halkias, Chetan Parikh, -“Integrated Electronics”, 2nd Edition, McGraw Hill Publication, 2009.
2. David Bell, -“Fundamentals of Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2008.
3. Christian Piguet, -“Low Power CMOS Circuits Technology, Logic Design and CAD Tools” 1st Indian Reprint, CRC Press, 2010.
4. S.K. Gandhi, - “VLSI Fabrication Principles: Silicon and Gallium Arsenide”, Wiley India Pvt. Ltd., New Delhi, 2nd Edition. 1994.

Course Code	Course Title					Core/Elective	
5PC406EC	AUTOMATIC CONTROL SYSTEMS					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	0	40	60	4

COURSE OBJECTIVES :

1. To Analyze the stability and performance of dynamic systems in both time and frequency domain.
2. To design feedback controllers, such as PID, lead and lag compensators, to meet desired system performance specifications.
3. To provide knowledge of state variable models and fundamental notions of state model design.
4. To understand the classical methods of control engineering and physical system modeling by linear differential equations.
5. To understand state space representation of control systems.

COURSE OUTCOMES :

1. Convert a given control system into equivalent block diagram and transfer function.
2. Analyze system stability using time domain techniques.
3. Analyze system stability using frequency domain techniques.
4. Design a digital control system in the discrete time domain.
5. Analyze a control system in the state space representation.

UNIT-I

Control System Fundamentals and Components: Classification of control systems including Open and Closed loop systems, Transfer function representation, Mathematical modeling of Mechanical systems and their conversion into electrical systems, Block diagram representation, Block diagram algebra and reduction and Signal flow graphs and Mason's gain formula.

UNIT-II

Time Response: Transfer function and types of input. Transient response of second order system for step input. Time domain specifications Characteristic Equation of Feedback control systems Types of systems, static error coefficients, error series.

Stability: Concept of Stability, Routh-Hurwitz criterion for stability, Root locus technique and its construction.

UNIT-III

Frequency Response Plots: Bode plots, frequency domain specifications Gain and Phase margin. Principle of argument Nyquist plot and Nyquist criterion for stability

Compensation Techniques: Cascade and feedback compensation. Phase lag, lead and lag-lead compensators PID controller.

UNIT-IV

State Space Representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and Observability

UNIT-V

Discrete Control Systems : Digital control, advantages and disadvantages, Digital control system architecture. The discrete transfer function sampled data system Transfer function of sample data systems. Analysis of Discrete data systems

TEXT BOOKS :

1. Nagrath, I.J, and Gopal. M, "Control System Engineering", 5th Edition, New Age Publishers, 2009.
2. Nagoor Kani. "Control systems", Second Edition, RBA Publications,

REFERENCE BOOKS :

1. Ogata, K., "Modern Control Engineering", 5th Edition, PHI.
2. Ramesh Babu, -"Digital Signal Processing", 2nd Edition.
3. K. Deergha Rao, Swamy MNS, -"Digital Signal Processing, Theory and Applications", 1st Edition, Springer Publications, 2018.

Course Code	Course Title					Core/Elective	
5PC407EC	Computer Organization and Architecture					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. Implement the Fixed point and Floating point addition, Subtraction, multiplication and Division.
2. Describe the basic structure and operation of a Digital computer.
3. Discuss the different ways of communicating with I/O devices and standard I/O interfaces.
4. Analyze the hierarchical memory system including cache memories and virtual memory.
5. Understand issues affecting modern processors.

COURSE OUTCOMES :

1. Apply digital engineering fundamentals to acquire knowledge of arithmetic algorithms for different processors.
2. Interpret the concept of Basic processor system and analyze the performance of Micro programmed Control unit organization.
3. Implementing the techniques of pipelining and parallelism to analyze the performance of a Processor.
4. Apply the conceptual knowledge of system development with appropriate I/O Interface.
5. Interpret various techniques for efficient memory utilization to develop a system application.

UNIT -I:

DATA REPRESENTATION AND COMPUTER ARITHMETIC :

Introduction to Computer Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, ripple carry adder, carry look-ahead adder, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

UNIT-II

BASIC PROCESSOR ORGANIZATION AND DESIGN :

Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and micro program sequencer.

UNIT - III

CENTRAL PROCESSING UNIT:

General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

UNIT-IV

INPUT-OUTPUT ORGANIZATION :

I/O Bus and interface modules, I/O versus Memory Bus, Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor, CPU-IOP communication.

UNIT-V

MEMORY ORGANIZATION:

Memory hierarchy, Mapping of memory with CPU, Primary memory, Concept of memory interleaving, Associative memory, Cache memory organization and performance measures, cache mapping functions, Virtual memory organization, paging mechanism, address mapping using pages, Memory management hardware

TEXT BOOKS :

1. Morris Mano, M., -"Computer System Architecture," 3/e, Pearson Education, 2005.
2. Hamacher, Vranesic, Zaky, -"Computer Organization," 5/e, McGraw Hill, 2007.

REFERENCE BOOKS :

1. William Stallings, "Computer Organization and Architecture: Designing for performance," 7/e, Pearson Education, 2006.
2. Govindarajulu, B., "Computer Architecture and Organization" , 2/e, TMH, 2010.
3. John Hennessy and David Patterson, "Computer Architecture: A Quantitative Approach", 5th Edition, Elsevier.

Course Code	Course Title					Core/Elective	
5PC408EC	Electro Magnetic Theory and Transmission Lines					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. Analyze fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications to describe the relationship between Electromagnetic Theory and circuit theory.
2. Formulate the basic laws of static electricity, magnetism and extend them to time varying fields to define the Maxwell's equations in differential and integral form.
3. Derive the wave equations for conducting and di-electric mediums to analyze the wave propagation characteristics of Uniform Plane Waves (UPW) in normal and oblique incidences.
4. Analyze fundamental concepts of Transmission lines and to formulate the basic relationship between distortion less transmission lines & applications.
5. To understand the concepts of RF Lines and their characteristics, Smith Chart, and its applications, acquires knowledge to configure circuit elements, QWTs and HWTs and to apply the same for practical problems.

COURSE OUTCOMES :

1. Understand the different coordinate systems, vector calculus, coulombs law and gauss law for finding electric fields due to different charges and to formulate the capacitance for different capacitors.
2. Learn basic magneto-statics concepts and laws such as Biot –Savart's law and Amperes law, their application in finding magnetic field intensity, inductance, and magnetic boundary conditions.
3. Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems.

4. Determine the Transmission Line parameters for different lines, characterize the distortions and estimate the characteristics for different lines.
5. Analyze the RF Line features and configure them as SC, OC Lines, $\lambda/2$, $\lambda/4$ and $\lambda/8$ Lines and design the same for effective impedance transformation.
6. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems.

UNIT - I

Electrostatics: Review of coordinate systems. Coulomb's Law, Electric field due to various Charge distributions and Electric flux density. Gauss's Law and its applications. Work, Potential and Energy, The dipole. Current and Current density, Laplace and Poisson's equations. Calculation of capacitance for simple configurations.

UNIT - II

Magnetostatics: Steady magnetic - Biot-Savart's law, Ampere's law. Stoke's theorem, Magnetic flux and magnetic flux density. Scalar and vector magnetic potentials. Electric and Magnetic fields boundary conditions. Maxwell's equations for static and time varying fields.

UNIT - III

Electromagnetic Waves :

Uniform plane waves in free space and in conducting medium, Polarization. Instantaneous, average and complex Power, Poynting theorem, Surface Impedance.

Reflection and Refraction: Normal and Oblique incidence on dielectric and conducting medium.

UNIT - IV

Transmission Lines 1:

Overview of T and p networks. Two wire Transmission lines, Primary and secondary constants. Transmission Line equations. Infinite line and characteristic impedance- Open and short circuit lines and their significance. Distortion less transmission line, Concept of loading of a transmission line, Campbell's formula.

UNIT - V

Transmission Lines 2 :

Impedance of a transmission line, RF and UHF lines, transmission lines as circuit elements. Properties of $\lambda/2$, $\lambda/4$ and $\lambda/8$ Lines. Reflection coefficient and VSWR. Matching: Stub matching. Smith chart and its applications.

TEXT BOOKS :

1. Matthew N.O. Sadiku, -“Principles of Electro-magnetics”, Oxford University Press, 6th edition 2016.
2. William H. Hayt Jr. and John A. Buck, -“Engineering Electromagnetics”, Tata McGraw Hill, 7th edition, 2006.

REFERENCE BOOKS :

1. E.C. Jordan and K.G. Balmain, -“Electromagnetic Waves and Radiating Systems”, Pearson, 2nd edition, 2015.
2. K.D. Prasad, - “Antennas and Wave Propagation”, Khanna Publications.
3. Nannapaneni Narayana Rao, -“Elements of Engineering Electromagnetics”, Pearson, 6th edition, 2004.

Course Code	Course Title						Core/Elective
5PC409EC	IC APPLICATIONS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. To learn the concept of Op-Amp and its characteristics.
2. To impart the linear and non-linear applications of operational amplifier.
3. To impart the theory and applications of 555 IC Timer, PLL & IC Regulator.
4. To learn the characteristics of different logic families.
5. Discuss the operation of the most commonly used D/A and A/D converters.
6. To analyze combinational and sequential circuits with ICs.

COURSE OUTCOMES :

Student will be able to:

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and non-linear applications of Op-Amp.
3. Understand the concepts of IC555 timer, IC723 regulator and PLL.
4. Classify and describe the characteristics of different logic families.
5. Design and analyze ADC & DAC converters.
6. Design the Combinational and Sequential circuits with ICs.

UNIT - I

Differential Amplifiers: Classification, DC and AC analysis of single, dual input Balanced and unbalanced Output Configurations of Differential amplifiers using BJTs, Level Translator.

Introduction to ICs: Integrated circuits classification, Integrated circuit package & types, pin identification and temperature ranges.

Operational Amplifier (IC741): Op-Amp block diagram, ideal Op-Amp Characteristics, Op-Amp parameters: Input offset voltage; Output offset voltage, input offset and bias currents, Slew rate, CMRR and PSRR.

UNIT - II

Op-Amp Applications : Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Difference Amplifier, Summing Amplifier, ideal and practical Integrator and differentiator, Voltage to Current and Current to Voltage converters, Log and antilog amplifiers, Comparator, Schmitt Trigger with and without reference voltage, Triangular waveform generator.

Active Filters : Introduction – First order, Second order Active filters - LP, HP, BP, BR and All pass filter.

UNIT-III

555 Timer: Functional diagram. Modes of operation: Monostable, Astable multivibrators, applications of 555 Timer.

Voltage Regulators : Basic of voltage Regulators, Linear regulators using op-amp, IC Regulators 78XX and 723.

PLL : Operation, lock range, Capture range, PLL applications: Frequency multiplier and frequency translator.

UNIT-IV

Logic families: Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs. Comparison of TTL and CMOS logic families

Data Converters : Introduction, Digital to Analog Converters: Weighted Resistor DAC & Inverted R-2R Ladder DAC. Analog to digital Converters: Parallel Comparator ADC, Successive Approximation ADC and Dual Slope ADC. DAC and ADC specifications.

UNIT - V

Combinational Circuits: Design using TTL-74XX or CMOS 40XX series: Decoders, drivers for LED, Encoder, priority encoder, Multiplexer and their applications, Demultiplexer, Digital comparator, Parallel and serial binary adder, Subtractor circuits using 2's complement. Carry look-ahead adder, BCD adder.

Sequential Circuits: Design using TTL-74XX or CMOS 40XX series: Synchronous and Asynchronous counters, Cascading of BCD counters, applications of counters, Shift register and applications.

TEXT BOOKS:

1. David A Bell, -“Operational Amplifiers and Linear ICs”, 3/e, Oxford Publications, 2011.
2. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits,” 4/e, PHI, 2010.

REFERENCE BOOKS:

1. D.Roy Chowdhury, Shail B. Jain, “Linear Integrated Circuits”, 4/e, New / Age International (P) Ltd., 2008.
2. Ronald J. Tocci, Neal S. Widmer & Gregory L.Moss, “Digital Systems: Principles and Applications”, 10/e, PHI, 2011.
3. Jain R.P, “Modern Digital Electornics”, 4/e, TMH, 2011.

Course Code	Course Title				Core/Elective		
5MC402HS	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE				MC		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	0	-	0	40	60	0

COURSE OBJECTIVES :

1. To reinforce the students understanding with the pan-Indian heritage in terms of culture, traditions and knowledge.
2. To impart understanding of the importance of the roots of the traditional knowledge and types.
3. To impart basic knowledge on the evolution of the multiple languages that highlight India's diversity.
4. To know Indian Languages, Philosophies, Religion, Literature, Fine arts and Technology.
5. To explore the Ancient Science, Scientists, in Medieval and Modern India; the education system.

COURSE OUTCOMES :

1. Understand the concepts of Indian culture and Traditions and their importance.
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras, interpret the concepts and the importance to protect Intellectual property of the nation.

UNIT - I

- Dawn of human civilization and evolution of various cultures.
- Introduction to Culture: Civilization, Culture and heritage.
- General characteristics of culture, importance of culture in human literature.
- Indian Culture, Ancient India, Medieval India, Modern India.

UNIT -II

Indian Languages, Culture and Literature:

- Indian Languages and Literature-I:
- The evolution and role of Sanskrit, significance of scriptures to current society.
- Indian philosophies, other Sanskrit literature, literature of south India.
- Indian Languages and Literature - II :
- Northern Indian languages & literature.

UNIT-III

- Religion and Philosophy.
- Religion and Philosophy in ancient India.
- Religion and Philosophy in medieval India.
- Religious reform movements in modern India (selected movements only).

UNIT-IV

Fine Arts in India (Art, Technology& Engineering):

- Indian Painting, Indian handicrafts.
- Music: Divisions of Indian classic music, modern Indian music.
- Dance and Drama-Indian Architecture (ancient, medieval and modern) Science and Technology in India.
- development of science in ancient, medieval and modern India. Their relation in terms of modern scientific perspective.
- Protection of traditional knowledge, significance, value to economy.
- role of government in protection of indigenous knowledge and technology; protection of traditional knowledge bill, 2016.

UNIT- V

- Education System in India.
- Education in ancient, medieval and modern India.
- Aims of education, subjects, languages.
- Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

TEXT BOOKS :

1. Kapil Kapoor and Avadhesh Kumar Singh, "Indian Knowledge Systems" (2 Vols-Set), ISBN 10: 8124603367 / ISBN 13: 9788124603369, Published by D K Print world, Publication Date: 2007.
2. Samskrita Bharati, "Science in Samskrit, Samskrita Bharati", Published, New Delhi, India, 2007; ISBN 10: 8187276339 / ISBN 13: 9788187276333.
3. Basanta Kumar Mohanta and Vipin K. Singh, "Traditional Knowledge System and Technology in India", Book, Originally published: 2012 Publication Date: 2012; ISBN 10: 8177023101 ISBN 13: 9788177023107.

REFERENCE BOOKS :

1. 1.7-Position paper, "National Focus Group on Arts, Music, Dance and Theatre NCERT", March 2006, ISBN 81-7450-494-X, NCERT, New Delhi, 2010.
2. Nitin Singhania, "Indian Art and Culture", 4th Edition, ISBN: 9354601804 • 9789354601804, © 2022 | Published: December 20, 2021.
3. S. Narain, "Education and Examination Systems in Ancient India", written/ authored/edited, published 2017, English-Hardcover, ISBN 9789351282518 publisher: Kalpaz Publications.
4. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, New Delhi, 1989.
5. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, New Delhi, 2005.

Course Code	Course Title						Core/Elective
5HS403HS	Human Values and Professional Ethics						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Adaptive	3	0	-	0	40	60	3

COURSE OBJECTIVES :

1. To create an awareness on Human Values and Engineering Ethics.
2. To move from discrimination to commitment.
3. To understand social responsibility of an engineer.
4. To appreciate ethical dilemma while discharging duties in professional life.
5. To encourage students to discover what they consider valuable in life.

COURSE OUTCOMES :

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the role of a human being in ensuring harmony in society and nature.
4. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

UNIT -I

Introduction to Value Education: Value Education, Definition, Concept and Need for Value Education. The Content and Process of Value Education. Basic Guidelines for Value Education. Self-exploration as a means of Value Education. Happiness and Prosperity as parts of Value Education.

UNIT-II

Harmony in the Human Being: Human Being is more than just the Body. Harmony of the Self ('I') with the Body. Understanding Myself as Co-existence of the Self and the Body. Understanding Needs of the Self and the needs of the Body. Understanding the activities in the Self and the activities in the Body.

UNIT -III

Harmony in the Family and Society and Harmony in the Nature

Family as a basic unit of Human Interaction and Values in Relationships. The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour. Harmony in Nature : The Four Orders in Nature. The Holistic Perception of Harmony in Existence.

UNIT - IV

Social Ethics : The Basics for Ethical Human Conduct. Defects in Ethical Human Conduct. Holistic Alternative and Universal Order. Universal Human Order and Ethical Conduct. Human Rights violation and Social Disparities.

UNIT - V

Professional Ethics : Value based Life and Profession. Professional Ethics and Right Understanding. Competence in Professional Ethics. Issues in Professional Ethics – The Current Scenario. Vision for Holistic Technologies, Production System and Management Models.

TEXT BOOKS :

1. R. R. Gaur, R Sangal, G P Bagaria, -A Foundation Course in Human Values and Professional Ethics, 2009.
2. Prof. K. V. Subba Raju, -Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition, 2013, Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.

REFERENCE BOOKS :

1. E. F. Schumacher, 1973, "Small is Beautiful: a study of economics as if people mattered". Blond & Briggs, Britain.
2. A Nagraj, 1998, "Jeevan Vidya ek Parichay", Divya Path Sansthan, Amarkantak. Susan George, 1976, How the Other Half Dies, Penguin Press, Reprinted 1986.
3. Smriti Shrivastava, "Human Values and Professional Ethics", Katson Publications, 2007
4. Bertrand Russell, "Human Society in Ethics & Politics".
5. Corliss Lamont, "Philosophy of Humanism".

Course Code	Course Title					Core/Elective	
5PC453EC	AEC Laboratory					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	0	-	0	40	60	1

COURSE OBJECTIVES :

1. To design and simulate various BJT and FET Voltage and Power amplifiers.
2. To design and simulate various BJT Feedback amplifiers.
3. Analyse Oscillator circuits.
4. Analyse Series and Shunt Voltage Regulators.
5. Design and simulate tuned voltage amplifier.

COURSE OUTCOMES :

1. Apply the concepts of amplifiers in the design of Public Addressing System.
2. To be able to Generate Sinusoidal wave forms of given specifications.
3. Design stable system using feedback concepts.
4. Design of Tuned amplifier.
5. Design Series and Shunt Voltage Regulators.

List of Experiments

1. Two Stage RC Coupled CE BJT amplifier.
2. Two Stage RC Coupled CS FET amplifier.
3. Voltage Series Feedback Amplifier.
4. Voltage Shunt Feedback Amplifier.
5. Current series feedback Amplifier.
6. RC Phase Shift Oscillator.
7. Hartly & Colpitt Oscillators.
8. Design of Class A and Class B Power amplifiers.
9. Constant-k low pass & high pass filters.
10. Series and Shunt Voltage Regulators.
11. RF Tuned Amplifier.

SPICE :

12. Two Stage RC Coupled CS FET amplifiers.
13. Voltage Series Feedback Amplifier.
14. Current Shunt Feedback Amplifier.

Note: A minimum of 10 experiments should be performed. It is mandatory to simulate any three experiments using SPICE.

Course Code	Course Title					Core/Elective	
5PC454EC	IC APPLICATIONS LABORATORY					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

COURSE OBJECTIVES :

1. To learn the configurations and parameters of the 741 Op-Amp.
2. To explain the circuits of linear and nonlinear applications of Op-Amp.
3. Design and analyze the active filters circuit using Op-amp.
4. To know the concepts of IC555 timer & IC723.
5. To know the various characteristics of TTL and CMOS gates.
6. To learn combinational and Sequential circuits using digital ICS.

COURSE OUTCOMES :

1. Analyze the configurations, parameters of Op-Amp (IC741).
2. Demonstrate the circuits of Op-Amp for various applications.
3. Implement Active filters using Op-amps.
4. Analyze and design the circuits using IC555 timer, IC723 and data converters.
5. Analyze the characteristics of TTL and CMOS gates.
6. Analyze and design various combinational & sequential circuits using digital ICs.

List of Experiments

Part - A : Linear IC

1. Measurement of Op-Amp parameters.
2. Voltage Follower, Inverting and Non-Inverting Amplifiers using Op-Amp.
3. Arithmetic Circuits using Op-Amp.
4. Active filters : LP, HP and BP using Op-Amp.
5. Triangle and Square wave Generators. Schmitt Trigger using Op-Amp.
6. Monostable and Astable multivibrator using Op-Amp.

7. Astable, Monostable multi vibrators using IC555Timer.
8. IC voltage regulator.
9. Voltage controlled oscillator – NE 565.

Part - B : Digital IC

1. Measurement of various characteristic parameters of TTL and CMOS gates.
2. Flip Flop conversions and latches using gates and ICs.
3. Designing Synchronous, Asynchronous up/ down counters.
4. Shift Registers and Ring counters using IC Flip-Flop & Standards IC counters.
5. Interfacing counters with 7-segment LED /LCD display units.
6. Mux – Demux applications.
7. Code Converters and Parity Generator & Checker
8. Binary adder and subtractor, BCD adders using ICs.

Note: At least ten experiments should be conducted in the sem, of which three should be from PART - B.

V & VI - Semester Detailed Syllabus

B.E V- SEM ECE

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P	Total Hours	CIE	SEE	
1	5PC510EC	Microcontrollers	3	0	0	3	40	60	3
2	5PC511EC	Digital Signal Processing	3	0	0	3	40	60	3
3	5PC512EC	Analog Communication	3	0	0	3	40	60	3
4	5PE51XEC	Professional Elective - I	3	0	0	3	40	60	3
5	XOE5XXXX	Open Elective – I	3	0	0	3	40	60	3
6	5HS352HS	Effective Technical Communication	2	0	0	2	40	60	2
7	5PC551EC	Microcontrollers Lab	0	0	2	2	40	60	1
8	5PC552EC	Signals and Systems Lab	0	0	2	2	40	60	1
9	5PW571EC	Mini Project	0	0	2	2	40	60	1
Total Credits									20

5PE51XEC	Professional Elective-I
1	Electronics Measurement and Instrumentation
2	Scripting Languages
3	Real Time Operating Systems
4	Neural Networks

XOE5XXXX	Open Elective - I	Offered by
1	Disaster Mitigation	CIVIL
2	Oops using JAVA	CSE
3	Artificial Intelligence	AI&DS
4	Renewable Energy Systems	EEE
5	Basics of Electronic Communication	ECE
6	Start up & Entrepreneurship	MECH

V - Semester Detailed Syllabus

Course Code	Course Title						Core/Elective
5PC510EC	Microcontrollers						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Organization and Architecture	3	-	-	-	40	60	3

COURSE OBJECTIVES :

This course aims to familiarize

1. To understand architecture & programming of 8051 microcontroller.
2. To design Interfacing & Programming of I/O ports, timers and UART using 8051.
3. To design Interfacing of real time devices like ADC, DAC and stepper motor with 8051.
4. To understand architecture of ARM microcontrollers.
5. To design Interfacing of real time devices like RTC and WDT.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to

1. Explain the architecture of 8051
2. Write Assembly programming using 8051 microcontroller.
3. Interface different peripherals to 8051 microcontroller.
4. Explain the architecture of ARM controller.
5. Interface different peripherals to ARM controller.

UNIT-I

8051 Microcontroller : Internal architecture and pin configuration, 8051 addressing modes, instruction set, Bit addressable features. I/O Port structures, assembly language programming using data transfer, arithmetic, logical and branch instructions.

UNIT-II

8051 Timers and Interrupts : 8051 Timers/Counters, Serial data communication and its programming, 8051 interrupts, Interrupt vector table, interrupt programming.

UNIT-III

8051 Interfacing: Interfacing of 8051 with LCD, ADC, DAC, external memory, Stepper Motor interfacing

UNIT-IV

ARM Embedded Systems : The RISC design philosophy, The ARM design philosophy, ARM Processor fundamentals, registers, current program status register, pipeline exceptions, interrupts and vector table, core extensions, architecture revisions.

UNIT-V

LPC 21xx microcontroller : Internal memory, GPIOs, Timers, ADC, UART and other serial Interfaces, PWM, RTC, WDT.

TEXT BOOKS :

1. Mazidi M.A, Mazidi J.G & Rolin D. Mckinlay, “The 8051 Microcontroller & Embedded Systems using Assembly and C”, 2/e, Pearson Education, 2007
2. Sloss Andrew N, symes dominic, wright Chris “ARM System Developers Guide: Designing and optimizing”, Morgan kaufman.
3. Joseph Yiu, “The definitive guide to ARM Cortex-M3”, Elsevier, 2nd edition

REFERENCE BOOKS:

1. Ayala K.J, “The 8051 Micro Controller Architecture, programming and Application,” Penram International, 2007.
2. Steve Furber, “ARM System-on-Chip Architecture”, Second Edition, Pearson 2012.
3. Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM SYSTEM Developer’s Guide Designing and Optimizing System Software” Elsevier 2015.

Course Code	Course Title						Core/Elective
5PC511EC	Digital Signal Processing						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Signals and Systems	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To describe the necessity and of digital signal processing.
2. To discuss various design methods of FIR & IIR filters.
3. To describe the concepts of multirate signal processing and identify important features of TMS320C67XX DSP processors.

COURSE OUTCOMES :

1. Apply the knowledge of FFT Algorithms for computation of DFT.
2. Design of FIR filters using various methods.
3. Design of IIR filters using various methods.
4. Apply decimation and interpolation concepts for the design of sampling rate converters.

UNIT-I

Discrete Fourier Transform and Fast Fourier Transform : Discrete Fourier Transform (DFT), Computation of DFT, Linear and Circular Convolution, FFT algorithms: Radix- 2 case, Decimation in Time and Decimation in Frequency algorithms, in place computation, bit Reversal.

UNIT-II

Finite Impulse - Response Filters (FIR) : Linear phase filters, Windowing techniques for design of Linear phase FIR filters, Rectangular, Triangular, Bartlett, Hamming, Hanning , Kaiser Windows, Realization of filters, Finite word length effects.

UNIT-III

Infinite Impulse - Response Filters (IIR) : Introduction to filters, comparison between practical and theoretical filters, Butterworth and Chebyshev approximation, IIR digital filter design Techniques, Impulse Invariant technique, Bilinear transformation

technique, Digital Butter worth & Chebyshev filter implementation, Digital filters structures, Comparison between FIR and IIR.

UNIT - IV

Multirate Digital Signal Processing : Introduction, Decimation by factor D and 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, Sampling conversion by an arbitrary factor, Application of Multirate Signal Processing.

UNIT - V

Introduction to DSP Processors : Difference between DSP and other microprocessors architectures, Importance of DSP Processors- General purpose DSP processors, TMS320C67XX processor, architecture, registers, pipelining, addressing modes and introduction to instruction set.

TEXT BOOKS :

1. Nagoor Kani,, Digital Signal Processing,, McGraw-Hill Education, 2nd Edition, 2012
2. Alan V. Oppenheim & Ronald W. Schafer, Digital Signal Processing, PHI, 2nd edition, 2014.
3. B.Venkataramani & M. Bhaskar, ?Digital Signal Processor Architecture, Programming and Application, TMH, 2e 2013.

REFERENCE BOOKS:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Application", PHI, 4th edition, 2012.
2. Alan V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing", PHI, 2nd edition, 2014.

Course Code	Course Title						Core/Elective
5PC512EC	Analog Communication						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Signals & Systems	3	-	-	-	40	60	3

COURSE OBJECTIVES :

This course aims to familiarize

1. To analyze the analog communication system requirements.
2. To understand the generation of various analog modulation techniques.
3. To analyze the noise performance of analog modulation techniques.
4. To understand AM and FM receivers.
5. To understand the pulse modulation techniques.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to

1. Understand analog communication system.
2. Compare and analyze analog modulation techniques.
3. Calculate noise performance of analog modulation techniques.
4. Design AM and FM receivers.
5. Differentiate between pulse modulation & continuous modulation techniques.

UNIT - I

Amplitude Modulation: Need for modulation, Amplitude Modulation (AM), Double Side Band Suppressed Carrier (DSB - SC) modulation, Hilbert transform, properties of Hilbert transform, Single side band (SSB) modulation and Vestigial-sideband (VSB) modulation, Modulation and demodulation of all the modulation schemes, COSTAS Receiver.

UNIT - II

Angle modulation: Frequency Modulation (FM) and Phase modulation (PM), Concept of instantaneous phase and frequency. Types of FM modulation: Narrow band FM and wide band FM, FM spectrum in terms of Bessel functions, Direct and

Indirect (Armstrong's) methods of FM Generation Balanced discriminator, Foster–Seeley Discriminator, Zero crossing detector and Ratio detector for FM demodulation Amplitude Limiter in FM.

UNIT-III

Transmitters and Receivers : Classification of transmitters. High level and low level AM transmitters, FM transmitters, Principle of operation of Tuned radio frequency (TRF) and super heterodyne receivers Selection of RF amplifier, Choice of Intermediate frequency Image frequency and its rejection ratio Receiver characteristics, Sensitivity, Selectivity, Fidelity, Double spotting, Automatic Gain Control.

UNIT-IV

Analog pulse modulation : Sampling of continuous time signals. Sampling of low pass and band pass signals Types of sampling, Pulse Amplitude Modulation (PAM) generation and demodulation. Pulse time modulation schemes: PWM and PPM generation and detection, Time Division Multiplexing.

UNIT-V

Noise : Atmospheric noise, Shot noise and thermal noise. Noise temperature, Noise in two- Port network: noise figure, equivalent noise temperature and noise bandwidth. Noise figure and equivalent noise temperature of cascade stages. Narrow band noise representation S/N ratio and Figure of merit calculations in AM, DSB-SC, SSB and FM systems, Pre-Emphasis and De - Emphasis.

TEXT BOOKS :

1. Simon Haykin, “Communication Systems,” 2/e, Wiley India, 2011.
2. B.P. Lathi, Zhi Ding, “Modern Digital and Analog Communication Systems”, 4/e

REFERENCE BOOKS:

1. “P. Ramakrishna Rao, “Analog Communication,” 1/e, TMH, 2011.
2. T G Thomas and S Chandra Shekar, Communication theory, 2/e, McGraw-Hill Education
3. 3. R.P.Singh, S.D.Sapre, Communication Systems, 2/e McGraw-Hill Education, 2008.
4. H. Taub, D.L. Schilling, "Principles of communication systems", Tata McGraw Hill, 2001.

PROFESSIONAL ELECTIVE - I

(5PE51XEC)

Course Code	Course Title					Core/Elective	
5PE511EC	Electronics Measurement and Instrumentation					Core	
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
NT,EDC	3	0	-	0	40	60	3

COURSE OBJECTIVES

This course aims to familiarize

1. Performance characteristics and various errors present in measuring instruments.
2. Describe the various transducers and their working principles.
3. Understand construction, working principle of display devices, printers, oscilloscopes.
4. Comprehend different types of signal generators, their construction and operation.
5. To address the underlying concepts and methods behind digital instruments.

COURSE OUTCOMES :

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

1. Understand the performance characteristics and various errors of an instrument.
2. Apply the complete knowledge of transducers to measure the physical quantities in the field of science, engineering and technology.
3. Understand construction and working principle of transducers, display devices, printers, Oscilloscopes, signal generators and digital instruments.
4. Illustrate different types of signal generators.
5. Understand the operation of different digital instruments.

UNIT - I

Qualities of Measurements : Introduction, Performance Characteristics, Static Characteristics, Error in Measurements, Types of Static Error, Sources of Error, Dynamic Characteristics of

UNIT - II

Transducers : Introduction, Electrical Transducer, Selecting a Transducer, Resistive Transducers, Strain Gauges, Inductive Transducer, LVDT, Capacitive Transducer (Pressure), Load Cell (Pressure Cell), Piezo-Electrical Transducer, Photo Electric Transducer, Photo-Voltaic Cell, Temperature Transducers.

UNIT-III

Display Devices, Printers and Oscilloscope : Introduction, Display Devices, LED, LCD, Other Display Devices, Printers, Classification of Printers, Dot-Matrix Printers, Character at a Time Dot-Matrix Impact Printer, Non-Impact Dot-Matrix (NIDM) Printers.

Introduction to Basic Principle, CRT Features, Block Diagram of Oscilloscope, Simple CRO, Dual Beam CRO, Sync Selector for Continuous Sweep CRO, Dual Trace Oscilloscope, (VHF) Sampling Oscilloscope, Storage Oscilloscope (for VLF Signal), DSO.

UNIT-IV

Signal Generators : Introduction, Fixed Frequency AF Oscillator, Variable Frequency AF Oscillator, Basic Standard Signal Generator (Sine Wave), Modern Laboratory Signal Generator, AF Sine and Square Wave Generator, Function Generator, Square and Pulse Generator (Laboratory Type), Random Noise Generator, Sweep Generator, Wobbluscope, Video Pattern Generator.

UNIT-V

Digital Instruments: Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Decade Counter, Electronic Counter, Digital Measurement of Frequency (Mains), Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

TEXT BOOKS :

1. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill Education (India) Private Limited, 3rd Edition 2016.
2. Anand, "Electronics Instruments and Instrumentation Technology", PHI.

REFERENCE BOOKS :

1. David A. Bell, "Electronic Instrumentation and Measurements", 3e, Oxford Univ. Press, 2013.
2. A.D. Helbins. W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 5th Edition, PHI, 2003.
3. B.M. Oliver, "Electronic Measurements and Instrumentation", J.M. CAGE TMH Reprint 2009.
4. K. Lai Kishore, "Electronic Measurements and Instrumentation", Pearson Education 2010.
5. Albert D. Helstrick and William D. Cooper, "Modern Electronics Instrumentation & Measurement Techniques", Pearson Education.
6. Joshph J. Carr, "Elements of Electronics Instrumentation and Measurement", 3rd Edition, Pearson Education.
7. Doebelin, E.O., "Measurement systems", McGraw Hill, Fourth edition, Singapore, 1990.

Course Code	Course Title						Core/Elective
5PE512EC	Scripting Languages						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming Language skills	3	-	-	-	40	60	3

COURSE OBJECTIVES :

This course aims to familiarize

1. To understand the UNIX and Shell environments.
2. To study the Linux kernel and commands.
3. To understand the ability of PERL scripting language.
4. To study the Python scripting language.

COURSE OUTCOMES :

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

1. Able to use UNIX and Linux based systems to perform various tasks.
2. Able to use shell scripting to run programs of any scripting language.
3. Able to compile large programming sets in the Perl and Python environment.
4. Able to effectively apply knowledge of Perl and Python to new situations and learn from the experience.
5. Able to Use Python scripting language for Web application development.

UNIT-I

Linux : Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts, Overview of scripting languages.

UNIT-II

Shell : The Shell as a Process, Creating a Command File, VI Editor, UNIX Power Tools, Redirection and Pipelines, Variables, Conditional Constructs, Looping Constructs, Shell Functions, Parameters, Pattern Matching. Exporting, Signals and Traps, Built-In Commands, Bourne-Again Shell, Error Debugging, Advanced Shell Scripting Commands.

UNIT - III

Java Script : Overview, Object Orientation and JavaScript, Syntactic Characteristics, Primitives, Operators, Expressions, Input and Output, Control Statements, Objects Creation and modification, Arrays, Functions, Constructors, Pattern Matching. Manipulating DOM, HTML DOM Events, Basics of AJAX with example.

UNIT - IV

Ruby : Rails, The structure and Execution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, Cookies, Choice of Web servers, SOAP and web services. Rubik – Simple Tk Application, widgets, Binding events, Canvas, Scrolling.

Extending Ruby : Ruby Objects in C, Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter.

UNIT - V

Python : Introduction to Python language, Python-Syntax, Statements, Functions, Built-in- functions and Methods, Modules in python, Exception Handling, Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

TEXT BOOKS :

1. David Barron, “The World of Scripting Languages”, Wiley Publications.
2. Larry Wall, Tom Christiansen, John Orwant, “Programming PERL”, 3rd Ed, Oreilly publications.

REFERENCE BOOKS :

1. Steve Holden and David Beazley, “Python Web Programming”, New Riders Publications.
2. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly.

Course Code	Course Title						Core/Elective
5PE513EC	Real Time Operating Systems						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Operating Systems	3	-	-	-	40	60	3

COURSE OBJECTIVES :

This course aims to familiarize

1. To illustrate the functions of operating systems.
2. To explain various real time systems and study the scheduling algorithms.
3. To comprehend the concepts of process synchronization.
4. To describe elementary concepts of Vx Works.
5. To introduce the fundamental concepts of UNIX operating system.

COURSE OUTCOMES :

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

1. Classify various types of kernels and operating systems
2. Analyse various scheduling algorithms related to RTOS.
3. Summarize the Inter process communication tools.
4. Understand the elementary concepts of VxWorks.
5. Enumerate the fundamental concepts of UNIX operating system.

UNIT - I

Operating System Introduction: Structures of Operating System (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of OS and Hardware architecture, Evolution of operating systems- Batch, multi programming, Multitasking, Multiuser, parallel, distributed and real-time OS.

UNIT-II

Hard versus Soft Real-Time System: Jobs and Processors, Release time, Deadlines, and timing constraints, Hard and soft timing constraints, Hard real time systems, Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread scheduling, Multiprocessor scheduling concept, Real Time scheduling concept.

UNIT - III

Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, Software approaches, Semaphores and Mutex, Message passing, Monitors, Classical problems of Synchronization. Readers - Writers problem, Producer Consumer problem, Dining Philosopher problem. Deadlock. Principles of deadlock, Deadlock prevention, Deadlock Avoidance, Deadlock detection, An Integrated Deadlock Strategies.

UNIT - IV

Elementary Concepts of VxWorks: Multitasking, Task State Transition, Task Control – Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Deletion Safety. Comparison of RTOS – VxWorks, μ C/OS-II, RT Linux and Xenomai for Embedded RTOS Applications. Case Studies in VxWorks.

UNIT - V

UNIX Kernel : File System (open, create, close, lseek, read, write), Concepts of – Process, Concurrent Execution & Interrupts. Process Management – forks & execution (fork, vfork, exit, wait, exec). Basic level Programming with System calls, Shell programming and filters, UNIX Signals, POSIX Standards.

TEXT BOOKS :

1. Andrew S. Tanenbaum, “Modern Operating Systems,” 4/e, Pearson Edition, 2014.
2. Jane W.S. Liu, “Real Time Systems,” 1/e, Pearson Education, Asia, 2002.
3. Jean J Labrose, “Embedded Systems Building Blocks Complete and Ready-to-use Modules in C”, 2/e, CRC Press 1999.

REFERENCE BOOKS :

1. Karim Yaghmour, Jon Masters, Gilad Ben-Yesset, Philippe Gerum, “Building Embedded Linux Systems”, 2/e, O’ Reilly Media, 2008.
2. Wind River Systems, “VxWorks Programmers Guide 5.5”, Wind River Systems Inc.2002.
3. P. Raghavan, Amol Lad, Sriram Neelakandan “Embedded Linux System Design and Development”, 2005 CRC Press.

Course Code	Course Title					Core/Elective	
5PE514EC	Neural Networks					Elective	
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
PTSP	3	-	-	-	40	60	3

COURSE OBJECTIVES :

This course aims to familiarize

1. To provide an introduction to neural networks and their classification, enabling students to understand the fundamental concepts and principles.
2. To develop a strong foundation to the mathematical models of artificial neural networks, including the McCulloch-Pitts and perceptron neuron models.
3. To explore the activation and synaptic dynamics of neural networks, and understand different activation models such as additive, shunting, and stochastic models.
4. To familiarize students with the basic learning laws of neural networks, enabling them to understand the principles behind learning and adaptation in neural networks.
5. To provide an overview of pattern recognition tasks and their applications, including pattern association, pattern storage, and neural network memory systems.
6. To introduce feed-forward and feedback neural networks, such as the backpropagation neural network and the Hopfield network, and their respective features, limitations, and applications.

COURSE OUTCOMES :

After completing this course, the student will be able to

1. Understand the fundamental concepts and classification of neural networks, and apply this knowledge to solve real-world problems related to pattern recognition and memory systems.
2. Analyze and interpret the mathematical models of artificial neural networks, including the McCulloch-Pitts and perception neuron models, and apply them to various learning scenarios.
3. Evaluate and compare different activation models in neural networks, such as additive, shunting, and stochastic models, and select the appropriate model for specific applications.

4. Apply the basic learning laws of neural networks, such as Hebbian and delta rules, to train and adapt neural networks for pattern recognition and recall tasks.
5. Design and implement neural network memory systems, including auto, hetero, and bidirectional associative memory, for storing and retrieving patterns.
6. Develop an understanding of feed-forward and feedback neural networks, including back propagation and Hopfield networks, and apply them to solve complex problems in classification, approximation, and optimization.

UNIT - I

Introduction to Neural Networks, Classification, Mathematical Model of Artificial Neural Network, McCulloch-Pitts Neuron Model, Perceptron Neuron Model, ADALINE Neuron model.

UNIT - II

Activation and Synaptic Dynamics of Neural Networks, Additive, Shunting, and Stochastic Activation Models, Basic Learning Laws, Recall in Neural Networks.

UNIT - III

Pattern Recognition Tasks, Pattern Association, Pattern Storage (LTM & STM), Neural Network Memory: Auto, Hetero and Bidirectional Associative Memory.

UNIT - IV

Feed Forward Neural Networks, Single Layer & Multi-Layer Neural Networks, Perception Neural Networks and Solution of XoR Problem, Back Propagation Neural Networks: Features, Limitations, and Extensions.

UNIT - V

Feedback Neural Networks, Hopfield Network: Capacity and Energy Analysis, Applications.

Radial Basis Function Networks : Training Algorithm, Applications.

TEXT BOOKS :

1. B.Yegnanarayanan, "Artificial Neural Networks", Prentice Hall, New Delhi, 2007.
2. J.A.Freeman and D. M.Skapura, "Neural Networks Algorithms, Applications and Programming Techniques", Addison Wesley, NewYork, 1999.

REFERENCE BOOKS :

1. Simon Haykin, "Neural Networks (A Comprehensive Foundation)", McMillan College Publishing Company, NewYork, 1994.
2. S.N.Sivanandam & M.Paul Raj, "Introduction to Artificial Neural Networks", Vikas Publishing House Pvt Limited, 2009.
3. Richard O. Duda, Peter E Heart, David G. Stork, "Pattern Classification", John Wiley & Sons 2002.

OPEN ELECTIVE-I

(XOE5XXXX)

Course Code	Course Title					Core/Elective	
2OE501CE	Disaster Mitigation					Open Elective -I	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES :

This course aims to familiarize

1. Define disaster and explain the different types of disasters.
2. Describe the disaster management cycle and the role of NDMA in disaster management.
3. Analyze the legal aspects of disaster management.
4. Develop disaster mitigation plans.
5. Participate in disaster response and recovery activities.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Demonstrate the concepts of disaster management.
2. Identify different types of disasters.
3. Explain the disaster management cycle.
4. Illustrate the role of NDMA in disaster management.
5. Explain the development of disaster mitigation plan.

UNIT -I

Introduction to Disaster Management: Definition of disaster, Types of disasters, History of disaster management in India, National Disaster Management Authority (NDMA) and its role in disaster management, Disaster management cycle. Case studies of disasters in India and the world.

UNIT - II

Disaster Mitigation: Mitigation measures for different types of disasters, Use of technology in disaster mitigation, Disaster risk assessment, Disaster preparedness, Exercises and simulations on disaster mitigation.

UNIT - III :

Disaster Response: Search and rescue operations, Medical relief, Food and shelter, Restoration of essential services, Rehabilitation and reconstruction.

UNIT -IV

Disaster Law and Policy: Disaster management acts of India, Disaster management policies of India, Legal aspects of disaster management.

UNIT- V

Disaster Communication and Public Awareness: Importance of communication in disaster management, Methods of disaster communication, Public awareness programs, Case studies of disaster communication and public awareness in India and the world.

TEXT BOOKS :

1. R.Subramanian, "Disaster Management", Vikas Publishing House, 2018.
2. M. M. Sulphey, "Disaster Management", PHI Learning, 2016.

REFERENCE BOOKS :

1. S. C. Sharma, "Disaster Management: Concepts, Approaches and Techniques", Khanna Book Publishing House, 2017.
2. G. K. Ghosh, "Disaster Management : Theory and Practice", APH Publishing Corporation, 2018.

Course Code	Course Title					Core/Elective	
3OE501CS	OOPS USING JAVA					Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. The Java programming language: its syntax, idioms, patterns and styles.
2. Object oriented concepts in Java and apply for solving the problems.
3. How exception handling and multithreading makes Java robust.
4. Explore java Standard API library such as io, util, applet, awt.
5. Building of applications using Applets and Swings..

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Understand the concept of OOP and analyze relationships among classes, objects.
2. Develop programs using concepts like inheritance, packages, interfaces, Java I/O streams and strings.
3. Utilize exception handling and Multithreading concepts to develop Java programs.
4. Interpret the Java Collection API, Java utility classes, concept of files and serialization.
5. Design GUI applications using concepts like AWT controls and Swings and client server programs using networking concepts.

UNIT - I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming. Introduction to Java: Java buzzwords, bytecode. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access

control, static, final, nested and inner classes, exploring string class, using command-linear arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final.

Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT -II

Interfaces: Defining an interface, implementing interfaces, extending interface.

Packages: Defining, Creating and Accessing a Package, importing packages.

Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, built in exceptions, creating own exception sub classes.

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using isAlive() and join(), thread priorities, synchronization, inter thread communication, deadlock.

UNIT-III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map. Legacy classes and interfaces – Vector, Hashtable, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner Java.

Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT-IV

GUI Programming with java: The AWT class hierarchy, MVC architecture.

Applet Revisited: Basics, architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT - V

Exploring Swing: JLabel, ImageIcon, JTextField, the Swing buttons, JTabbedPane, JScrollPane, JList, JComboBox.

Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet.http package, handling HTTP requests and responses

TEXTBOOKS

1. Java: The Complete Reference, X Edition, Herbert Schildt, McgrawHill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3. Java for Programming, P.J.Dietel X Edition, PearsonEducation

REFERENCE BOOKS

1. The Java Programming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, III Edition, Pearson 2008
2. An Introduction to OOP, T. Budd, IIIEdition, Pearson Education.
3. Introduction to Java Programming, Y. Daniel Liang, X Edition, Pearson Education.

Course Code	Course Title					Core/Elective	
1OE501AD	ARTIFICIAL INTELLIGENCE					Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to make the student to

1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.
2. To introduces different knowledge representation methods in AI Programs.
3. To introduce different design techniques for Game Playing Programs.
4. To introduce the AI Agents their design, planning and learning techniques.
5. To introduce the natural language processing and expert systems.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand fundamental AI concepts and identify a range of symbolic and non symbolic AI techniques.
2. Demonstrate an understanding of various searching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software.
3. Use different knowledge representation techniques used in AI Applications.
4. Demonstrate an understanding of agent based AI architectures, Planning and logic based agents.
5. Exploring Expert systems options.

UNIT-I

Introduction : Artificial Intelligence and its applications, Artificial Intelligence Techniques Problem solving techniques: State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, AO* search, Constraint satisfaction problem, Agenda Driven Search, Mean-end analysis, Min- Max Search, Alpha-Beta Pruning, Iterative Deepening.

UNIT -II

Knowledge representation: Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Weak and Strong filler structures.

UNIT-III

Non Monotonic and Statistical Reasoning: on monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification.

UNIT -IV

Planning and Learning Agents : Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

UNIT -V

Introduction to Learning and Expert system: Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

TEXTBOOKS

1. AI: A Modern Approach Stuart J. Russel, Peter Norvig Pearson Education Latest Edition, 2012
2. Artificial Intelligence Elaine Rich, Knight McGraw Hill Third Edition 2010.
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition 2011.

REFERENCES

1. Artificial Intelligence, Partick Henry Winston Addison Wesley Latest Edition 2012.
2. Artificial Intelligence George Luger Pearson Education Latest Edition 2010.

Course Code	Course Title	Core/Elective					
4OE501EE	RENEWABLE ENERGY SYSTEMS (OPEN ELECTIVE–I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES:

1. To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, geo and tidal power.
2. To make the students understand the advantages and disadvantages of different renewable energy sources.

COURSE OUTCOMES :

At the end of the course students will be able to

1. Explain the advantages, disadvantages and applications of different non-conventional sources
2. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non- conventional sources

UNIT-I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H₂ /O₂ Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells- Applications of Fuel Cells.

UNIT- II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy, V-I and P-V curves.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energy collectors - Applications of Wind energy.

UNIT - IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

UNIT - V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifiers.

TEXTBOOKS :

1. Rai G.D, "Non-Conventional Sources of Energy", Khandala Publishers, New Delhi, 2011.
2. David M Buchla and Thomas E Kissell, "Renewable Energy Systems", 1st Edition by, Pearson India.

REFERENCES/SUGGESTED READING :

1. M.M.El-Wakil, "Power Plant Technology", McGraw Hill, 1984.
2. John Twidell, Tony Weir, "Renewable Energy Resources", 3rd Edition, Taylor and Francis.

Course Code	Course Title						Core/Elective
5OE501EC	Basics of Electronic Communication						Open Elective -I
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematics, Basic Electronics	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To provide an introduction to fundamental concepts in the understanding of communications systems.
2. To describe the network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
3. To discuss the evolution of wireless systems and current wireless technologies.

Course Outcomes :

At the end of the course, the students will be able to

1. Understand the working of analog and digital communication systems.
2. Explain the OSI network model and the working of data transmission.
3. describe the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.
4. Differentiate between analog and digital modulation techniques.
5. Understand the optical fibre communication link, structure, propagation and transmission properties.

UNIT-I

Introduction to Communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission, **Communication Parameters:** Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiation and Propagation:** Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT-II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes -ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT-III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT-IV

Telecommunication Systems: Telephones, Telephone system, Optical Communications : Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT-V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

TEXT BOOKS :

1. Louis E. Frenzel, “Principles of Electronic Communication Systems”, 3rd edition, McGraw Hill, 2008.
2. George Kennedy, Bernard Davis, “Electronic Communication systems”, 4th edition, McGraw Hill, 1999.

REFERENCE BOOKS :

1. Behrouz A. Forouzan, “Data Communications and Networking”, 5th edition, TMH, 2012.
2. Rappaport T.S., “Wireless communications”, 2nd edition, Pearson Education, 2010.
3. Wayne Tomasi, “Advanced Electronic Communications Systems”, 6th edition, Pearson Education.

Course Code	Course Title					Core/Elective	
6OE501ME	START- UP AND ENTREPRENEURSHIP					Open Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES :

Students should be able to understand

- To motivate students to take up entrepreneurship in future.
- To learn nuances of starting an enterprise & project management.
- To understand project formulation and choice Technology in Enterprise.
- To understand Intellectual properties, patents, Start-ups.

COURSE OUTCOMES :

After the completion of course students will be able to

1. Understand Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.
4. Understand the concept of Intellectual Property Rights and Patents
5. Comprehend the aspects of Start-Ups.

UNIT -1

Entrepreneurship: Definition, functions of Entrepreneurship, Characteristics and qualities of entrepreneurs, Entrepreneur vs. intrapreneur, need of innovation, Economic growth. Small Scale Industry in India, Linkage among small, medium and heavy industries.

UNIT –II

Indian Industrial Environment: Competence, Opportunities and Challenges, Emergence of First generation entrepreneurs, women entrepreneurs. Conception and evaluation of ideas and their sources. Types of enterprises. - Collaborative interaction for Technology development. Corporate Social Responsibility

UNIT –III

Project formulation: Introduction, Elements of Business Plan and its salient features, Analysis of market demand, Financial and profitability analysis and Technical analysis.

UNIT-IV

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, the main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of a patent, Licensing, Transfer of technology.

UNIT- V

Aspects of Start-Up: What is Start-Up, Start-up Policy, start-up strategy, Progress of startups in India, Principles of future organizations, start-up sectors and action plan for start-ups by Govt. of India.

TEXT BOOKS :

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House,
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata McGraw-Hill Publishing Company Ltd. 1995.
3. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster", Publication, 1994.

REFERENCE BOOKS :

1. G.S. Sudha, “Organizational Behaviour”, 1996.
2. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, Tata Me Graw Hill Publishing Company Ltd., 5th Ed., 2005.
3. G.B. Reddy, "Intellectual Property Rights and the Law", 5th Ed. 2005 Gogia Law Agency.
4. Ajit Parulekar and Sarita D’Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India Ltd, 2006.

HS 502HS & HS602HS	Effective Technical Communication (Common to ECE,ME,CE&EEE –V SEM & CSE&AI&DS – VI SEM)					Core	
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
	2	-	-	-	40	60	2

Course Objectives :	Course Outcomes :
The following are the Objectives of the Course : <ol style="list-style-type: none"> 1. To Understand the process, features and barriers of Communication. 2. To learn the aspects of communication and Presentation. 3. To comprehend the types of official and business correspondence. 4. To analyze the techniques of Report Writing 5. Aspects of data transfer and presentation. 	After completion of the course, the student will be able to : <ol style="list-style-type: none"> 1. Handle Technical Communication effectively by over coming barriers of communication. 2. Use different types of Professional correspondence to communicate effectively. 3. Use different types of Business and Inter Office Correspondence. 4. Acquire adequate skills to draft reports efficiently. 5. Enhance their skills of information transfer.

UNIT-I

Introduction to Communication.

Definition, process and Channels of Communication.

ABC of Technical communication.

Barriers to communication.

Differences between general and Technical writing.

UNIT-II

Aspects of Communication.

Importance of listening and types of Listening.

Types of Technical communication (Oral and Written).

Features of technical communication (Precision, relevance, format, style & Use of visual aids).

Persuasive Techniques.

UNIT - III

Technical Writing-I

Emails

IOM

Business Letters - enquiry and response; compliant and Adjustment; placement of order; Cover letters/Job Application & Resume Writing.

Business Proposals.

UNIT - IV

Technical Writing –II

Types of technical Reports (Informative, analytical, periodic, special, formal and Informal).

Formal Elements of a Report.

Feasibility, Project, Progress and Evaluation reports.

UNIT - V

Information Transfer and Presentations

Non-verbal to verbal

Verbal to Non – Verbal

Important aspects of Oral and Visual Presentations.

SUGGESTED READING:

1. Raman, Meenakshi & Sharma, Sangeeta.(2015). "Technical Communication: Principles and Practice", 3rd ed., New Delhi. OUP.
2. Rizvi, Ashraf, M (2017). "Effective Technical Communication", 2nd ed., New Delhi, Tata McGraw Hill Education.
3. Sharma, R. C & Mohan , Krishna.(2017). "Business Correspondence and Report Writing: A Practical approach to business & technical communication", 4th ed., New Delhi, Tata McGraw Hill Education.
4. Tyagi, Kavita & Misra, Padma.(2011). "Advanced Technical Communication". New Delhi, PHI Learning.
5. Jungk, Dale.(2004). "Applied Writing for Technicians", Newyork, McGraw Hill Higher Education.

Course Code	Course Title						Core/Elective
5PC551EC	Microcontrollers Lab						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Organization and Architecture	0	-	-	2	40	60	1

COURSE OBJECTIVES :

This course aims to familiarize

1. To develop and execute the assembly programming concepts of 8051.
2. To Design and develop 8051 based programs for various interface modules.
3. To develop and execute the embedded C programming concepts of ARM.
4. To Design and develop ARM based programs for various interface modules.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

1. To write assembly language programs using 8051 controller.
2. To develop interfacing applications using 8051 controller.
3. To develop embedded C programming concepts of ARM.
4. To develop ARM based programs for various interface modules.

List of Experiments

PART-A

[Experiments for 8051 Microcontroller kit]

1. Familiarity and use of 8051 microcontroller trainers, and execution of programs.
2. Instruction set for simple programs (using 4 to 5 lines of instruction code).
3. Timer and counter operations and programming using 8051.
4. Serial communications using UART.
5. Programming using interrupts.
6. Interfacing 8051 with DAC to generate waveforms.
7. Interfacing traffic signal control using 8051.
8. Program to control stepper motor using 8051.

9. ADC interfacing with 8051.
10. Serial RTC interfacing with 8051.
11. LCD interfacing with 8051.

PART-B

Interfacing Programs using embedded C on ARM Microcontroller Kit

1. Program to interface 8-bit LED and switch interface
2. Program to implement Buzzer interface on IDE environment
3. Program to display message in a 2 line x 16 characters LCD display and verify the result in debug terminal Stepper motor interface.
4. ADC & Temperature sensor LM35 interface
5. Transmission from kit and reception from PC using serial port.

NOTE:

1. At least ten experiments to be conducted in the semester.
2. Minimum of 5 from Part A and 5 from Part B is compulsory.
3. In Part-B, perform the experiments using assembler simulator like Keil software.

TEXT BOOKS :

1. Mazidi M.A, Mazidi J.G & Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C," 2/e, Pearson Education, 2007
2. Joseph yiu, "The definitive guide to ARM Cortex-M3", Elsevier, 2nd edition.

Course Code	Course Title						Core/Elective
5PC552EC	Signals and Systems Lab						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Signals & Systems	-	-	-	2	40	60	1

COURSE OBJECTIVES :

1. To develop C & MATLAB programs for operation of sequences.
2. To implement the algorithms of DFT, IDFT, FFT and IFFT on discrete time signals.
3. To design and obtain the frequency response of various digital filters.

COURSE OUTCOMES :

1. Develop MATLAB files for the verification of system response.
2. Design and analyze the digital filters using MATLAB.
3. Verify the functionality of FFT algorithms.
4. Experiment with multirate techniques using MATLAB & CCS.
5. Design and implement the digital filters on DSP processor.

PART-A

List of Signal Processing Experiments

Perform the following programs using MATLAB Simulator.

1. Introduction to MATLAB and signal generation.
2. Perform Linear Convolution.
3. Perform Circular Convolutions.
4. Perform DFT and FFT algorithm.
5. Perform FIR filters design using different window functions.
6. Perform IIR filters design: Butterworth and Chebyshev, LPF, HPF, BPF & BSF filter.
7. Perform Interpolation and Decimation.
8. Implementation of multi-rate systems.

PART-B

List of DSP Processor Experiments

Implement the following experiments using DSK (TMS320C67XX)

1. Introduction to DSP processors and Study of procedure to work in real-time.
2. Implement Solution of difference equations.
3. Implement Impulse Response.
4. Implement Linear Convolution.
5. Implement Circular Convolution.
6. Implement Fast Fourier Transform Algorithms.
7. Design of FIR (LP/HP) USING windows: (a) Rectangular (b) Triangular (c) Hamming windows.
8. Design of IIR (HP/LP) filters.

NOTE :

1. Atleast ten experiments to be conducted in the semester.
2. Minimum of 5 from Part A and Part B is compulsory.

TEXT BOOKS :

1. A. Nagoor Kani, "Digital Signal Processing", McGraw-Hill Education , 2nd Edition, 2012
2. John Leis, "Digital Signal Processing - A MATLAB - Based Tutorial Approach", Overseas Press, 1st Edition, 2008.

Course Code	Course Title						Core/Elective
5PW571EC	MINI PROJECT						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EDC, Microcontroller, H/W Skills	-	-	-	2	40	60	1

COURSE OBJECTIVES :

1. To conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. To provide training in soft skills and also train them in presenting seminars and technical report writing.
3. To design, implement and test the prototype/algorithm in order to solve the conceived problem.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to

1. Get practical experience of software design and development, and coding practices within Industrial/R&D Environments.
2. Gain working practices within Industrial/R&D Environments
3. Prepare reports and deliver effective presentation.
4. Demonstrate effective written and oral communication skills.
5. Innovate in various engineering disciplines and nurture their entrepreneurial ideas.

Guidelines for Mini Project

1. The mini-project is a team activity having maximum of 3 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.

4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

B.E VI - SEM ECE

S. No.	Course Category	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P	Total Hours	CIE	SEE	
Theory									
1	5PC613EC	Digital Communication	3	0	0	3	40	60	3
2	5PC614EC	VLSI Design	3	0	0	3	40	60	3
3	5PC615EC	Antenna and Wave Propagation	3	0	0	3	40	60	3
4	5PE62XEC	Professional Elective – II	3	0	0	3	40	60	3
5	5PE63XEC	Professional Elective – III	3	0	0	3	40	60	3
6	XOE6XXXX	Open Elective - II	3	0	0	3	40	60	3
Laboratories									
7	5PC651EC	Analog & Digital Communication Laboratory	0	0	2	2	40	60	1
8	5PC652EC	VLSI Design Lab	0	0	2	2	40	60	1
9	5HS653HS	Soft Skills Laboratory	0	0	2	2	40	60	1
10	5PW672EC	Technical seminar	0	0	2	2	50	-	1
11	5PW774EC	Summer Internship (during summer break)	-	-	-	-	-	-	*
Total Credits									22

***Note: Summer Internship** to be conducted during summer break and evaluation will be in VII Sem.

5PE62XEC	Professional Elective - II
1	Embedded System Design
2	Data analytics using R-Programming
3	Digital Image processing
4	CPLD/FPGA Architectures

5PE63XEC	Professional Elective-III
1	Internet of Things
2	Cyber Security
3	Multirate Signal Processing
4	Fundamentals of Electronics Packaging

XOE6XXXX	Open Elective - II	Offered by
1	Green Building Technologies	CIVIL
2	Software Engineering	CSE
3	Deep Learning	AI&DS
4	Electric Vehicle Technology	EEE
5	Fundamentals of IOT	ECE
6	3D Printing Technologies	MECH

VI - Semester Detailed Syllabus

Course Code	Course Title						Core/Elective
5PC613EC	DIGITAL COMMUNICATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PTSP, AC	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. Familiarize the students with elements of digital communication system and waveform coding techniques like PCM, DPCM, DM and ADM.
2. Introduce the concepts of information theory and source coding.
3. Familiarize the students with channel coding techniques such as LBC, BCC and convolution codes.
4. Introduce the concepts of baseband digital data transmission and analyze the error performance of different digital carrier modulation schemes like ASK, FSK, PSK etc.
5. Familiarize the students with the concepts of spread spectrum communication with emphasis on DSSS and FHSS.

COURSE OUTCOMES :

1. Classify the different types of digital modulation techniques PCM, DPCM, DM and ADM and compare their performance by SNR.
2. Illustrate the classification of channels and Source coding methods.
3. Distinguish different types of Error control codes along with their encoding/decoding algorithms.
4. Examine the Performance of different Digital Carrier Modulation schemes of Coherent and Non-coherent type based on Probability of error.
5. Generation of PN sequence using Spread Spectrum and characterize the Acquisition Schemes for Receivers to track the signals.

UNIT-I

Elements of Digital Communication System: Comparison of Digital and Analog Communication Systems,

Pulse Digital Modulation Schemes: Quantization and Encoding techniques, PCM. Companding in PCM systems - μ law and a law, Applications of PCM. Modulation and demodulation of DPCM, DM and ADM. Comparison of PCM, DPCM, DM and ADM. SNRQ of PCM and DM.

UNIT-II

Information Theory and Source Coding: Uncertainty, Information and entropy. Source-coding, Shannon – Fano and Huffman coding Discrete memory less channel – Probability relations in a channel, mutual information, Channel capacity - Binary Symmetric Channel, Binary Erasure Channel, , cascaded channels, information rate. Shannon-Hartley Theorem.

UNIT-III

Channel Coding: Types of transmission errors, need for error control coding, Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, Minimum distance of Linear block code, error correction and error detection capabilities, Standard array and syndrome decoding, Hamming codes.

Binary cyclic codes (BCC): Description of cyclic codes, encoding, decoding and error correction using shift registers.

Convolution codes: description, encoding – code tree, state diagram.

UNIT-IV

Base band digital data transmission – Block diagram, Inter Symbol Interference, Nyquist criterion for Zero ISI, Eye pattern

Digital Carrier Modulation Schemes - Description and generation of ASK, FSK, PSK optimum receiver – matched filter, correlation receiver. Gaussian error probability -Coherent detection of Binary ASK, FSK, PSK DPSK Comparison of digital carrier modulation schemes M-ary signaling schemes – Introduction, QPSK.

UNIT-V

Spread Spectrum Communication: Advantages of Spread Spectrum, generation and characteristics of PN sequences. Direct sequence spread spectrum and Frequency hopping spread spectrum systems and their applications. Acquisition and Tracking of DSSS and FHSS signals.

TEXT BOOKS :

1. Simon Haykin, “Communication systems” 4/e, Wiley India 2011
2. Sam Shanmugam K, “Digital and Analog Communication systems”, Wiley 1979.
3. B. P. Lathi, “Modern digital and analog communication systems” 3/e, Oxford University Press. 1998

REFERENCE BOOKS:

1. Leon W. Couch II., "Digital and Analog Communication Systems", 6th Edition, Pearson Education inc., New Delhi, 2001.
2. R.E. Zimer & R. L. Peterson: "Introduction to Digital Communication", PHI, 2001.

Course Code	Course Title						Core/Elective
5PC614EC	VLSI DESIGN						Core
Prerequisite L	Contact Hours per Week				CIE	SEE	Credits
	T	D	P				
STLD, ED	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To describe verilog hdl and develop digital circuits using various modeling styles.
2. To explain electrical properties of MOS devices to analyze the behaviour of inverters designed with various loads.
3. To give exposure to the design rules to be followed to draw the layout of any logic circuit and provide concept to design different types of combinational and sequential circuits.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to

1. Familiarize with the constructs and conventions of the verilog HDL programming in gate level and data flow modeling.
2. Generalize combinational and sequential logic circuits in behavioural modeling and concepts of switch level modelling.
3. Analyze modes of operation of MOS transistor and its basic electrical properties.
4. Draw stick diagrams and layouts for any MOS transistors.
5. Analyse the operation of various arithmetic and sequential logic circuits using CMOS transistors.

UNIT -1

Introduction to HDLs: Basic Concepts of Verilog, Data types, system tasks and compiler directives. Gate Level Modeling: Gate types and Gate Delays, Dataflow Modeling: Continuous assignments and Delays. Design of stimulus blocks. Design of Arithmetic Circuits using Gate level, Data flow modeling for Adders, Subtractors, 4- bit Binary Adder and 1-digit BCD adder.

UNIT-II

Modeling of Sequential Logic Modules: Latches, Flip Flops, Counters and Shift registers applications Tasks, Functions, Procedural Continuous Assignments, Design of Mealy and Moore FSM models for sequence detector using Verilog. Switch Level Modelling of basic gates.

UNIT-III

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS Fabrication Process. Basic Electrical Properties: Basic Electrical Properties of MOS: Ids- Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design.

UNIT- IV

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates. Basic circuit concepts. Design basic gates using Pass Transistor Logic, Transmission Gates and Multiplexers.

UNIT- V

Sub-system Design : Shifters, carry skip adder, carry select adder, Memory Elements: 6T SRAM cell, 1T DRAM cell. Sequential Logic Design: Behaviour of Bi-stable elements, CMOS D latch and Edge triggered Flip flops.

TEXT BOOKS :

1. Samir Palnitkar, “Verilog HDL A Guide to Digital Design and Synthesis,” 2nd Edition, Pearson Education, 2006.
2. Kamran Eshraghian Douglas and A. Pucknell, Essentials of VLSI circuits and systems", PHI, 2005 Edition
3. Weste and Eshraghian Principles of CMOS VLSI Design ‘, Pearson Education, 2nd edition, 1999.

REFERENCE BOOKS:

1. John. P. Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley, 2003
2. John M. Rabaey, "Digital Integrated Circuits", PHI, 1997.

Course Code	Course Title						Core/Elective
5PC615EC	ANTENNA AND WAVE PROPAGATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EMTL	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To familiarize the students with the basic principles of antennas and introduce the antenna terminology.
2. To introduce different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
3. To familiarize with the design of different types of antennas for various frequency ranges and latest developments in the practical antennas.
4. To introduce need for antenna arrays and the concepts of measurements of antennas.
5. To introduce the various modes of Radio Wave propagation used.

COURSE OUTCOMES :

1. To illustrate the basic principles of antennas and learn the antenna terminology.
2. To design different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
3. To design different types of antennas for various frequency ranges and get updated with latest developments in the practical antennas.
4. To apply the principles of antennas, to design antenna arrays and measure various parameters of antennas.
5. To Identify and understand the suitable modes of Radio Wave propagation used in current practice.

UNIT-I

Antenna Fundamentals: Introduction, Radiation Mechanism, Retarded potential, Isotropic Radiator, Radiation pattern, Radian and Steradian, Radiation Intensity, Gain, Directivity, Antenna Efficiency, Effective Aperture, Effective Length, Reciprocity Theorem, Friis transmission equation, Front-to-back ratio, Antenna Beamwidth, Beam Efficiency, Beam Area, Antenna Impedance, Polarization, Antenna temperature, Antenna Field Regions.

UNIT–II

Thin Linear wire Antennas: Radiation from Infinitesimal Dipole, Radiation Resistance of Short Dipole, Halfwave Dipole and Monopole, Loop Antennas, Helical Antennas.

UNIT–III

Antenna Arrays: Array of point sources, two element arrays with equal and unequal amplitudes, different phases, linear n- element array with uniform distribution, Principle of Pattern Multiplication, Binomial array, V- Antenna, Rhombic Antenna, Yagi - Uda Antenna, Log- periodic Antenna.

UNIT–IV

VHF and UHF Antennas: Babinet's principle, Slot Antennas, Horn antenna, Parabolic Reflector and Cassegrain Antennas, Lens Antennas, Microstrip Antennas, Smart Antennas

Antennas for Special Applications: Vehicle mounted antennas, VSAT and DBS TV antennas, RFID antenna, Plasma antenna, Terahertz antenna.

UNIT–V

Radio Wave Propagation: Modes of propagation - Ground wave propagation, Sky Wave Propagation and Space Wave Propagation, Structure of Atmosphere, Characteristics of Different Ionized Regions, Sky wave propagation, Ray Path, Virtual Height, MUF, Skip Distance, LOS.

TEXT BOOKS :

1. K. D. Prasad, Antennas and wave Propagation, Tech India Publication, New Delhi, 4e, 2019-20
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems," 2/e, PHI, 2001.

REFERENCE BOOKS :

1. J. D. Kraus, R. J. Marhefka; Ahmad S. Khan, Antennas and wave Propagation, McGraw-Hill, 4th Edition, 2010.
2. Constantine A. Balanis, Antenna Theory: Analysis and Design, Wiley, 3rd edition, 2005.
3. R. E. Collins, Antennas and Radio Propagation, Singapore: McGraw Hill, 1985.
4. R Harish and M. Sachidananda, Antennas and Wave Propagation, Oxford University Press, 2011.

PROFESSIONAL ELECTIVE-II

(5PE62XEC)

Course Code	Course Title					Core/Elective	
5PE621EC	Embedded System Design					Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Microcontrollers	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. Detailed overview of important concepts of Embedded system.
2. Analyze PIC microcontroller, its features and programming.
3. Describe ARM Microcontroller architectural details and instruction set.
4. Understand ARM Memory management.
5. Learn the techniques to develop an embedded system and case studies.

COURSE OUTCOMES :

1. After completing this course, the student will be able to:
2. Understand the fundamentals of the embedded system design.
3. Enumerate the instruction set of ARM Processor by studying the architecture of ARM core.
4. Acquire knowledge on the serial, parallel and network communication protocols.
5. Learn the embedded system design life cycle and co-design issues.
6. List the various embedded software development tools used in the design of embedded system for various applications.

UNIT-I

Introduction to Embedded Systems: Overview of Embedded System Architecture, Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture. Application areas of Embedded Systems and Categories of Embedded Systems. Embedded System Design and Co-Design issues and Design Cycle Process.

UNIT-II

PIC 18: Family Overview, Architecture, Instruction Set, Addressing modes. Timers, interrupts of PIC 18, Capture/Compare and PWM modules of PIC 18.

UNIT -III

ARM Architecture: ARM Processor Families. Instruction Set: Data Processing

Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

UNIT -IV

ARM Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instruction Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions. Exception and interrupt handling.

ARM Memory Management: Cache Architecture, Policies, Flushing and Caches, MMU, Page Tables, Translation Access Permissions, Context Switch.

UNIT -V

Embedded Software Development Tools, Host and Target Machines, Linkers/ Locators for Embedded Software, Getting Embedded Software into the Target System. Debugging Techniques.

Case Studies: Design of Embedded Systems using Microcontrollers – for applications in the area of communications and automotives. (GSM/GPRS, CAN, Zigbee).

TEXT BOOKS :

1. Raj Kamal, "Embedded Systems - Architecture, Programming and Design", 2nd Edition, TMH, 2008.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides – Designing & Optimizing System Software," Elsevier, 2008.

REFERENCE BOOKS :

1. Mazidi, MCKinlay and Danny Causey, "PIC Microcontrollers and Embedded Systems", Pearson Education, 2007.
2. David.E. Simon, "An Embedded Software Primer", 1st Edition, Pearson Education, 1999.
3. Jonathan W. Valvano, "Embedded Microcomputer Systems", Real Time Interfacing, Thomas Learning, 1999.

Course Code	Course Title						Core/Elective
5PE622EC	Data analytics using R-Programming						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering. Mathematics	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To learn basics of R Programming environment: R language, R- studio and R packages.
2. To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting.
3. To learn Decision tree induction, association rule mining and text mining.

COURSE OUTCOMES :

At the end of the course, the students will be able to

1. Use various data structures and packages in R for data visualization and summarization.
2. Use linear, non-linear regression models, and classification techniques for data analysis.
3. Use clustering methods including K-means and CURE algorithm.

UNIT-I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT-II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT-III

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression.

UNIT-IV

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists,

Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

UNIT - V

Classification : performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbour's implementation in R, Clustering: K-Means Algorithm, K-Means implementation in R.

TEXT BOOKS :

1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly, 2017.

REFERENCE BOOKS :

1. Roger D Peng, R Programming for Data science, Lean Publishing, 2016.
2. Rafael A Irizarry, Introduction to Data Science, Lean Publishing, 2016.

Course Code	Course Title						Core/Elective
5PE623EC	DIGITAL IMAGE PROCESSING						Elective
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
S&S, DSP	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To provide an introduction to the basic concepts and methodologies for Digital Image processing.
2. To familiar with spatial and transform domain techniques used in Image Enhancement, Restoration and Segmentation of Images.
3. To gain knowledge about various Image transforms used in Image processing and Image compression problems.
4. To understand various methods employed for edge, line and isolated points detection in an image.

COURSE OUTCOMES :

After completing this course, the student will be able to

1. Develop a foundation that can be used as the basis for higher study and research in the Image processing area.
2. Design various filters for processing and deblurring of images without destroying fine details like edges and lines.
3. Apply image processing techniques for processing and analysis of remotely sensed, Microscope, Radar and Medical images.
4. Understand the need for Digital Image processing techniques for Machine vision.
5. Applications and concept of image compression.

UNIT – I

Digital Image Fundamentals: Image sensing, acquisition, Image formation model, sampling and Quantization, Basic relationships between pixels; neighbours of a pixel, adjacency, connectivity, regions and boundaries. Image formation, brightness, adaptation and discrimination. Categorization of images according to their source of EM radiation.

UNIT–II

Image Transforms : 2D Fourier transform, Properties of 2D Fourier transform, Walsh, Hadamard, Slant, Haar, Discrete cosine transform and Hotelling transform.

UNIT–III

Image Enhancement: Spatial domain techniques: Contrast stretching, histogram equalization and histogram specification method, Neighborhood averaging and adaptive Median filter. Frequency domain methods: Ideal Low pass, Butterworth and Gaussian Lowpass filters. Ideal Highpass, Butterworth and Gaussian Highpass filters. Homomorphic filtering.

UNIT–IV

Image Restoration: Mathematical expression for degraded image, estimation of degradation functions: image observation, experimentation and by modeling, Inverse filter, Wiener filter, Geometric transformation, periodic noise reduction method.

UNIT–V

Image segmentation and Compression: Detection of discontinuities, point line And Edge detection methods: Gradient operation, Laplacian, Prewitt, Sobel, Laplacian of a Gaussian and Canny edge detectors. Image compression: Functional block diagram of a general image compression system various types of redundancies, Huffman coding, Arithmetic coding.

TEXT BOOKS :

1. Rafeal C. Gonzalez, Richards E. Woods, Digital Image Processing ?, Pearsons Education, 2009, 3rd Edition.
2. Anil K Jain, Fundamentals of Digital Image Processing, Prentice-Hall of India Private Limited, New Delhi, 1995.
3. Milan Sonka, Vaclav Havel and Roger Boyle, Digital Image Processing and Computer vision, Cengage Learning India Pvt. Limited, 2008.

REFERENCE BOOKS:

1. S.Jayaraman, S. Esakkirajan, T. Veerakumar, -Digital Image Processing- TataMcGrawHill 2014.
2. A K. Jain, -Fundamentals of Digital Image Processing- Pearson 2004.
3. Vipul Singh, -Digital Image Processing with MATLAB and Lab view', Elsevier 2013.

Course Code	Course Title						Core/Elective
5PE624EC	CPLD/FPGA Architectures						Elective
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
STLD, VLSI	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. Understand the ASIC design flow and Programming Technologies.
2. Study different Architecture of FPGAs.
3. Understand the FPGA physical Design Flow of FPGA.
4. Learn the placement and routing algorithms.
5. Enlist the verification and testing methods of digital circuits.

COURSE OUTCOMES :

1. After completing this course, the student will be able to.
2. Design of ASICs using implementation tools for simulation and synthesis.
3. Describe the architecture of FPGAs.
4. Discuss physical design using FPGAs and CAD tools.
5. Describe placement & routing algorithms.
6. Analyze verification and testing of Digital circuits.

UNIT-I

Introduction to ASICs : Types of ASIC's, ASIC design flow, Economies of ASICs, Programmable ASICs: CPLD and FPGA. Commercially available CPLDs and FPGAs: XILINX, ALTERA, ACTEL. FPGA Design cycle, Implementation tools: Simulation and synthesis, Programming technologies. Applications of FPGAs.

UNIT-II

FPGA logic cell for XILINX, ALTERA and ACTEL ACT, Technology trends, Programmable I/O blocks, FPGA interconnect: Routing resources, Elmore's constant, RC delay and parasitic capacitance, FPGA design flow, Dedicated Specialized components of FPGAs.

UNIT-III

FPGA physical design, CAD tools, Power dissipation, FPGA Partitioning, Partitioning methods.

Floor planning: Goals and objectives, I/O, Power and clock planning, Low-level design entry.

UNIT -IV

Placement: Goals and objectives, Placement algorithms: Min-cut based placement, Iterative Improvement and simulated annealing.

Routing, introduction, Global routing: Goals and objectives, Global routing methods, Back-annotation. **Detailed Routing:** Goals and objectives, Channel density, Segmented channel routing, Maze routing, Clock and power routing, Circuit extraction and DRC.

UNIT - V

Verification and Testing: Verification: Logic simulation, Design validation, Timing verification. Testing concepts: Failures, Mechanism and faults, Fault coverage.

Testing concepts: failures, mechanisms and faults, fault coverage, ATPG methods, and programmability failures.

TEXT BOOKS :

1. Pak and Chan, Samiha Mourad, “Digital Design using Field Programmable Gate Arrays”, Pearson Education, 1/e, 2009.
2. Michael John Sebastian Smith, “Application Specific Integrated Circuits”, Pearson Education Asia, 3/e, 2001.

REFERENCE BOOKS:

1. S. Trimberger, Edr, “Field Programmable Gate Array Technology”, Kluwer Academic Publications, 1994.
2. John V. Oldfield, Richard C Dore, “Field Programmable Gate Arrays”, Wiley Publications.
3. Clive Maxfield, “The Design Warrior’s Guide to FPGAs”, Elsevier, 2004.

PROFESSIONAL ELECTIVE-III

(5PE63XEC)

Course Code	Course Title						Core/Elective
5PE631EC	INTERNET OF THINGS						Elective
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
Controllers, Communication protocols, web services	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To discuss about the fundamentals of IoT and its applications and requisite infrastructure.
2. To describe Internet principles and communication technologies relevant to IoT.
3. To illustrate hardware and software aspects of designing an IoT system.
4. To describe concepts of cloud computing and data analytics.
5. To demonstrate business models and manufacturing strategies of IoT products.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to

1. Understand the various applications of IoT and other enabling technologies.
2. Comprehend various protocols and communication technologies used in IoT.
3. Design simple IoT systems with requisite hardware and Python programming software.
4. Understand the relevance of cloud computing and data analytics to IoT.
5. Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT-I

Introduction to Internet of Things: Physical Design of IoT: Things in IoT, IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and logistics, Smart Agriculture and Industry, Smart Industry and smart Health.

UNIT-II

Internet Principles and Communication Technology: Internet Communications: An Overview –IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS.

UNIT-III

Prototyping and Programming: Cost Vs Ease of Production, Prototypes and Production, Open-Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

Introduction to Python: Python packages for IoT, IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT - IV

Cloud Computing and Data analytics: Introduction to Cloud storage models -SAAS, PAAS, IAAS. Communication APIs, Amazon web services for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT - Apache Hadoop- Map reduce job execution workflow.

UNIT-V

IoT Case Studies: Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation, Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

TEXT BOOKS :

1. Internet of Things - Converging Technologies for smart environments and integrated ecosystems, River Publishers.
2. Adrian McEwen (Author), Hakim Cassimally, “Designing the Internet of Things”, Wiley India Publishers.

REFERENCE BOOKS :

1. Kenneth A Lambert and B.L. Juneja, “Fundamentals of Python”, Cengage Learning.
2. Vijay Madiseti, Arshdeep Bahga, “Internet of Things (A Hands-on-Approach),” VPT Publisher, 1st Ed., 2014.

Course Code	Course Title						Core/Elective
5PE632EC	CYBERSECURITY						Elective
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
Programming skills, web services	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To understand various types of cyber-attacks and cyber-crimes.
2. To learn threats and risks within context of the cyber security.
3. To have an overview of the cyber laws & concepts of cyber forensics.
4. To study the defensive techniques against these attacks.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to

1. Analyze and evaluate the cyber security needs of an organization.
2. Understand Cyber Security Regulations and Roles of International Law.
3. Design and develop security architecture for an organization.
4. Understand fundamental concepts of data privacy attacks.

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT-II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, 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.

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, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

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.

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime : Examples and Mini - Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS :

1. Nina Godbole and Sunit Belpure, 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,
3. Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCE BOOKS :

1. James Graham, Richard Howard and Ryan Otson, -Cyber Security Essentials, CRC Press.
2. Chwan-Hwa(john) Wu,J. David Irwin, -Introduction to Cyber Security, CRC Press T&F Group.

Course Code	Course Title						Core/Elective
5PE633EC	MULTIRATE SIGNAL PROCESSING						Elective
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
S&S, DSP	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To review the fundamentals of multirate systems.
2. To describe the techniques for multirate filter banks.
3. To explain the quadrature-mirror filter banks.
4. To demonstrate the concept of adaptive digital filters.
5. To illustrate the concept and application of wavelets.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to

1. Solve problems in sampling rate conversion and filter banks.
2. Build digital filter bank systems.
3. Implement quadrature-mirror filter banks for multirate signal processing.
4. Analyze the various adaptive processing algorithms.
5. Implement wavelets in signal processing applications.

UNIT-I

Review of fundamentals of Multirate systems: Decimation by an integer factor D , Interpolation by an integer factor L , Time- and frequency-domain representation and analysis of decimated and interpolated signals, Efficient structures for decimation and interpolation filters, Sampling rate conversion by a rational factor L/D , Inter connection of building blocks, polyphase representation, Multi stage implementation of sampling-rate conversion, Applications of Multirate systems.

UNIT-II

Multirate Filter banks: Digital filter banks, Uniform DFT filter banks, Polyphase implementation of Uniform filter banks.

Nyquist filters : L th -band filters, half band filters, Half-band High pass filter, Window Design of Half-Band Filter, Interpolation and decimation with Low Pass Half-Band

Filters, Design of Linear phase Lth- band FIR filters, Relation between Lth-Band filters and power complementary filters.

UNIT -III

Quadrature- Mirror Filter banks: The filter bank structure, Analysis of Two channel QMF bank, Errors in the QMF bank, Alias free filter banks, Alias-free realization, Alias-free FIR QMF bank, Alias-free IIR QMF bank, perfect reconstruction(PR) two-channel FIR filter bank, Alias-free L-channel filter bank and Multilevel filter banks-filter with equal and unequal pass band widths.

UNIT -IV

Adaptive Algorithms to adjust coefficients of digital filters: Least Mean Square (LMS), Recursive Least Square (RLS) and Kalman Filter Algorithms.

UNIT -V

Wavelets and its applications: Introduction to wavelet Theory, wavelet transform, Definition and properties, Continuous Wavelet Transform and Discrete Wavelet Transform, Application of Wavelets in signal processing.

TEXT BOOKS:

1. J.G Proakis. D.G Manolakis. "Digital Signal Processing: Principles. Algorithms and Applications", 3rd Edn. Prentice Hall India, 1999.
2. P.P. Vidyathanan, "Multi-rate Systems and Filter Banks," Pearson Education, 2008.
3. Bruce W Suter, "Multi-rate and Wavelet Signal Processing." Volume 8, Academic Press, 1998.

REFERENCE BOOKS:

1. B. Widrow & S Stearns, "Adaptive Signal Processing", PHI, 1985.
2. K. P. Soman, K. I. Ramachandran, N. G. Resmi, "Insight into wavelets from theory to practice", PHI.

Course Code	Course Title						Core/Elective
5PE634EC	Fundamentals of Electronics Packaging						Elective
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
Electrical and Electronics; Mechanical, Chemical, Instrumentation, Chemistry, Physics, Materials Engineering	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. The course will sensitize the participants to the fundamentals of electronics systems packaging.
2. The course is multidisciplinary in nature.
3. Today products in electronics industry need to be packaged to current state-of-art if it has to be in the leading edge market. Hence systems packaging is essential.

COURSE OUTCOMES :

1. Discuss the various packaging types.
2. Design of packages which can withstand higher temperature, vibrations and shock.
3. Design of PCBs which minimize the EMI and operate at higher frequency.
4. Analyze the concepts of testing methods.
5. Discuss the various packaging types.

UNIT-I

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

UNIT-II

Electrical Issues in Packaging: Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines,

Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitics.

UNIT -III

Chip Level Packaging : IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test.

Single chip packaging: functions, types, materials processes, properties, characteristics, trends.

Multi chip packaging: types, design, comparison, trends. System – in – package (SIP); Passives: discrete, integrated, and embedded.

UNIT -IV

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

UNIT -V

Testing: Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue –failures – thermo mechanically induced –electrically induced – chemically induced.

Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

TEXT BOOK :

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

REFERENCE BOOK:

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

OPEN ELECTIVE-II

(XOE6XXXX)

Course Code	Course Title					Core/Elective	
2OE602CE	Green Building Technologies					Elective	
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to impart knowledge of

1. To impart knowledge of the principles behind the green building technologies
2. To know the importance of sustainable use of natural resources and energy.
3. To understand the principles of effective energy and resources management in buildings
4. To bring awareness of the basic criteria in the green building rating systems
5. To understand the methodologies to reduce, recycle and reuse towards sustainability.

COURSE OUTCOMES :

After completion of the course, the student will be able to

- CO 1. Define a green building, along with its features, benefits and rating systems.
- CO 2. Describe the criteria used for site selection and water efficiency methods.
- CO 3. Explain the energy efficiency terms and methods used in green building practices.
- CO 4. Select materials for sustainable built environment & adopt waste management methods.
- CO 5. Describe the methods used to maintain indoor environmental quality.

UNIT-I

Introduction to Green Buildings : Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems - GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

UNIT-II

Site selection and planning: Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc.

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

UNIT-III

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy.

Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT-IV

Building materials: Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolona cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off- site organic waste management

UNIT-V

Indoor Environmental Quality for Occupant Comfort and Wellbeing: Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics.

Codes related to green buildings : NBC, ECBC, ASHRAE, UPC etc.

TEXT BOOKS :

1. Michael Bauer, Peter Möhle and Michael Schwarz “Green Building – Guidebook for Sustainable Architecture” Springer, 2010.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.

REFERENCE BOOKS :

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao ‘Alternative building materials and technologies’.

Course Code	Course Title					Core/Elective	
3OE602CS	SOFTWARE ENGINEERING					Elective	
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to impart knowledge of

1. Describe and compare various software development methods and understand the context in which each approach might be applicable
2. To impart knowledge on various phases, methodologies and practices of software development
3. To apply the project management and analysis principles to software project development.
4. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metric
5. To apply the design & testing principles to software project development.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Acquired working knowledge of alternative approaches and techniques for each phase of SDLC.
2. Judge an appropriate process model(s) for software project attributes and analyze requirements for project development.
3. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting
4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system
5. Apply the software engineering principles in real time project development.

UNIT - I

Introduction to Software : What is software? Types of software, Characteristics of software Attributes of good software.

Software Engineering: What is software engineering, Software engineering costs? What are the key challenges facing software engineering, Systems engineering & software Engineering, SDLC.

Software Development Process Models: prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

UNIT-II

Software Engineering Principles : SE Principles, Communication Principles, Planning Principles, Modelling Principles, Construction Principles, Deployment.

Software Requirement Analysis and Specification: System and software requirements, Types of software requirements, Elicitation and analysis of requirements, Requirement validation, Requirements specification, Feasibility.

UNIT-III

Building the Analysis Model : Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling.

Design Engineering: Design Process and Quality, Design Concepts, the Design Model.

Performing User Interface Design : The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design.

Coding: Programming languages and development tools, Selecting languages and tools Good programming practices, Coding Standards

UNIT -V

Software Testing and Quality Assurance: Verification and validation Techniques of testing Black-box and White-box testing Inspections Levels of testing Unit testing, Integration Testing, Interface testing, System testing, Alpha and beta testing, Regression testing Design of test cases, Quality management activities: Product and process quality Standards, ISO900, Capability Maturity Model (CMM), Risk management.

Debugging: Debugging Techniques, The Art of Debugging.

Current trends in Software Engineering Software Engineering for projects and products.

TEXTBOOKS:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, VII Edition, McGraw Hill, 2009.
2. Ian Sommerville, Software Engineering, VII edition, Addison-Wesley.
3. RajibMall, -Fundamentals of Software Engineering.

REFERENCE BOOKS:

1. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, Oxford University Press, 1996
2. Pankaj Jalote, An Integrated Approach to Software Engineering, III Edition, Narosa Publishing House, 2000.

Course Code	Course Title					Core/Elective	
1OE602AD	DEEP LEARNING					Elective	
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to impart knowledge of

1. Develop and Train Deep Neural Networks.
2. Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition.
3. Build and train RNNs, work with NLP and Word Embeddings.
4. The internal structure of LSTM and GRU and the differences between them.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Feature Extraction from Image and Video Data.
2. Implement Image Segmentation and Instance Segmentation in Images.
3. Implement image recognition and image classification using a pretrained network (Transfer Learning).
4. Traffic Information analysis using Twitter Data.
5. Autoencoder for Classification & Feature Extraction.

UNIT -I

Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.

UNIT-II

About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Underfitting. Hyperparameters.

UNIT -III

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Back propagation Through the Convolutional Layer. Filters and Feature Maps. Back propagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, Alex Net, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. RCNN, Fast R-CNN, Faster R- CNN, Mask-RCNN, YOLO

UNIT-IV

About NLP & its Toolkits. Language Modeling. Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Cooccurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Back propagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to- Sequence Models (Seq2Seq). Gated recurrent unit GRU.

UNIT-V

About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational.

TEXT BOOKS

1. Deep Learning A Practitioner’s Approach Josh Patterson and Adam Gibson O’Reilly Media, Inc. 2017.
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020.

REFERENCE BOOKS

1. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.
2. Pro Deep Learning with Tensor Flow, Santanu Pattanayak, Apress, 2017.

Course Code	Course Title					Core/Elective	
4OE602EE	ELECTRIC VEHICLE TECHNOLOGY					Elective	
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES :

The objective of this course is to impart knowledge of

1. Know the history of electric hybrid electric vehicles (EV & HEV) and emphasize the need and importance of EV-HEV for sustainable future.
2. Introduce the fundamental concepts and principles of electric and hybrid electric vehicles drive train topologies.
3. Develop a thorough understanding of the key elements of EV/HEV: Electric Machines for Propulsion Applications and Energy Sources.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. To identify and describe the history and evolution of electric & hybrid electric vehicles to emphasize on the need and importance of EV/HEV for sustainable future.
2. To identify and describe the principles of various EV/HEVs drive train topologies along with their power flow control and fuel efficiency estimation.
3. To design and select electric propulsion system components for EV/HEV drives suitability for the desirable performance and control.
4. To compare and evaluate various energy sources and energy storage components for EV and HEV applications.

UNIT-I

Introduction : History of electric vehicles (EV) and hybrid electric vehicles (HEV), need and importance of EV and HEV, Power/Energy supplies requirements for EV/HEV applications, vehicle power source characterization, and transmission characteristics. Vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion.

UNIT-II

Drive-Train Topologies: Series, Parallel, Series -Parallel and Complex configurations of HEV, basics of hybrid traction system, various hybrid drive-train topologies, power flow control in drive-train topologies, fuel efficiency analysis.

UNIT-III

Electrical Machines and Power Converters for Hybrid and Electric Vehicles: Electric system components for EV/HEV, suitability of DC and AC machines for EV/HEV applications, AC and DC Motor drives. Permanent magnet and switch reluctance machines, configuration and control of drives. Power Converters- Converters for EV and HEV applications.

UNIT-IV

Energy Sources for EV/HEV : Requirements of energy supplies and storage in EV/HEV, Review of batteries, fuel cells, flywheels and ultra-capacitors as energy sources for EV/HEV, characteristics and comparison of energy sources for EV/HEV, hybridization of different energy sources.

UNIT-V

Electric Vehicles Charging Station : Type of Charging station, Selection and Sizing of charging station, Components of charging Station and Single line diagram of charging station. Contactless inductive charging- Stationary Inductive charging, resonant and compensation circuit topologies.

TEXT BOOKS :

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, USA, 2012.
2. Iqbal Hussain, Electric & Hybrid Vehicles – Design Fundamentals, 2nd Edition, CRC Press, 2011.

REFERENCES BOOKS :

1. Chris Mi, M. Abdul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspective, Wiley, 2011
2. Simora Onori, Hybrid Electric Vehicles Energy Management Strategies, Springer.

Course Code	Course Title						Core/Elective
5OE602EC	Fundamentals of IOT						Open Elective -II
Prerequisite	Contact Hours per Week						
Controllers, Communication protocols, web services	L	T	D	P	CIE	SIE	Credits
	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To introduce the fundamentals, applications and requisite infrastructure of IoT.
2. To describe Internet principles and communication technologies relevant to IoT.
3. To discuss hardware and software aspects of designing an IoT system.
4. To explain the concepts of cloud computing and data analytics.
5. To illustrate the business models and manufacturing strategies of IoT products.

COURSE OUTCOMES :

1. Understand the various applications of IoT and other enabling technologies.
2. Comprehend various protocols and communication technologies used in IoT.
3. Construct simple IoT systems with requisite hardware and python programming.
4. Understand the relevance of cloud computing and data analytics to IoT.
5. Apply the business model of IoT from developing a prototype to launching a product.

UNIT-I

Introduction to Internet of Things: Introduction to Internet of Things: Physical Design of IoT : Things in IoT, IoT protocols, Logical Design of IoT : IoT functional Blocks, Communication Models, APIs, IoT enabling technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and logistics, Smart Agriculture and Industry, Smart Industry and smart Health.

UNIT-II

Internet Principles and communication technology : Internet Communications: An Overview - IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses TCP and UDP Ports, Application Layer Protocols - HTTP, HTTPS.

UNIT-III

Prototyping and Programming : Cost Vs Ease of Production, Prototypes and Production, Open-Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms - Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, Python packages for IoT, IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT-IV

Cloud computing and Data analytics: Introduction to Cloud storage models -SAAS, PAAS, IAAS. Communication APIs, Amazon web services for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT - Apache Hadoop- Map reduce job execution workflow.

UNIT-V

IoT Case Studies: Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation, Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

TEXT BOOKS:

1. Internet of Things - Converging Technologies for smart environments and integrated ecosystems, River Publishers.
2. Adrian McEwen (Author), Hakim Cassimally, “Designing the Internet of Things”, Wiley India Publishers.

REFERENCE BOOKS :

1. Fundamentals of Python, Kenneth A Lambert and B.L. Juneja, Cenage Learning.
2. Internet of Things (A Hands-on-Approach), Vijay Madiseti , Arshdeep Bahga, VPT Publisher, 1st Ed., 2014.

Course Code	Course Title					Core/Elective	
6OE602ME	3D PRINTING TECHNOLOGIES					Open Elective-II	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	40	60	3

COURSE OBJECTIVES :

1. To understand the fundamental concepts of 3D Printing, its advantages & limitations.
2. To know the various types of STL file errors and other data formats used in additive manufacturing Technology.
3. To know the working principle, advantages, disadvantages & applications of liquid, solid and powder based 3D Printing technologies.
4. To know the diversified applications of 3D Printing technologies and explore them in different industrial sectors.

COURSE OUTCOMES :

After the completion of course the students will be able to:

1. Describe the fundamentals of 3D printing, classify and explain advantages and disadvantages of 3D Printing technologies.
2. Select the suitable CAD data formats and software used in 3D Printing technology.
3. Describe the operating principles, capabilities and limitations of liquid, solid & powder based 3D Printing Technologies.
4. Compare different 3D printing technologies based on their process capabilities and applications.
5. Apply the capabilities and knowledge of 3D printing in different industrial sectors.

UNIT-I

Prototyping Fundamentals: Historical Development, Fundamentals of 3D Printing, Advantages and Limitations of 3D Printing, commonly used terms, 3D Printing Process Chain, 3D Modelling, Data conversion and transmission, Checking & Preparing, Building, Post processing, Classification of 3D Printing processes,

Fundamental Automated Processes, Distinction between 3D Printing and Conventional Machining Processes.

Data Formats & Software : Data formats; conversion and transmission, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs, Newly Proposed Formats. Software's Features: Magics, Mimics, Solid View, Cura, ITK Snap.

UNIT-II

Liquid based Systems : Stereo Lithography Apparatus (SLA): Models and Specifications, Process, working principle, photopolymers, photo polymerization, Layering Technology, laser and laser scanning, Applications, Advantages and Disadvantages. Poly jet: Models and

Specifications, Process, working principle, Applications, Advantages and Disadvantages. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

UNIT-III

Solid-based Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages. Fused Deposition Modelling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages. Multi Jet Modelling (MJM): Models and specifications, Process, Working principle, Applications, Advantages and Disadvantages.

UNIT-IV

Powder Based Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages. **Three Dimensional Printing (3DP):** Models and Specifications, Process, working principle, Applications, Advantages and Disadvantages. **Laser Engineered Net Shaping (LENS):** Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

UNIT-V

Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Electronic Industry, Jewellery Industry, Coin Industry, GIS application, Construction field, Arts and Architecture, Pattern for investment and vacuum casting, Medical Models

and **Bioengineering Applications:** Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production Medical Devices, Forensic Science and Anthropology and Web Based Rapid Prototyping Systems.

TEXT BOOKS :

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” Fifth Edition, World scientific
2. 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing” Springer, Second Edition.

REFERENCE BOOKS :

1. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies:
2. Frank W. Liou, “Rapid Prototyping & Engineering Applications”- CRC Press, Taylor & Francis Group.
3. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley & Sons.

Course Code	Course Title						Core/Elective
5PC651EC	ANALOG/DIGITAL COMMUNICATION LAB						Core
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
	AC, DC	-	-	-	2	40	60
COURSE OBJECTIVES : 1. Demonstrate AM, FM, Mixer, PAM, PWM and PPM techniques. 2. Understand multiplexing techniques. 3. Understand and simulate digital modulation (i.e., ASK, FSK, BPSK, QPSK) generation and detection. 4. Model analog, pulse modulation, PCM, Delta and Digital modulation techniques using CAD tools 5. Obtain data formats.							
COURSE OUTCOMES : 1. Understand and simulate modulation and demodulation of AM and FM. 2. Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively. 3. Understand and simulate the PAM, PWM & PPM circuits 4. Understand baseband transmission (i.e., PCM, DPCM, DM, and ADM) generation and detection. 5. Understand error detection and correction.							

PART-A

Analog Communication Experiments list:

1. AM generation and detection
2. FM generation and detection
3. Pre emphasis and De-emphasis circuits
4. Multiplexing Techniques (FDM and TDM)
5. Mixer Characteristics
6. Sampling , PAM, PWM, and PPM generation and detection
7. Generation and Detection of Analog and Pulse modulation techniques by using MATLAB/Simulink/Labview

PART-B

Digital Communication Experiments list:

1. PCM generation and detection
2. Data formats / channel encoding and decoding.
3. Linear and Adaptive Delta Modulation and Demodulation
4. Modem characteristics.
5. ASK generation and Detection.
6. FSK and Minimum Shift Keying generation and Detection.
7. Phase shift keying methods (BPSK, QPSK) generation and Detection.
8. Generation and Detection of PCM, Delta modulation and Digital modulation Schemes (ASK, FSK, BPSK, QPSK) by using MATLAB/Simulink/Lab-view.

Note: At least ten experiments should be conducted in the semester, of which five should be from PART - B.

Course Code	Course Title						Core/Elective
5PC652EC	VLSI DESIGN LAB						Core
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
STLD, VLSI	-	-	-	2	40	60	1

COURSE OBJECTIVES :

1. To develop Verilog HDL code for digital circuits using gate level, data flow and behavioural, Modelling and Verify the design block using stimulus.
2. To study the VLSI CAD tools.
3. To implement transistor level circuits.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to:

1. Write the Verilog HDL programs in Gate level and Data flow Modelling.
2. Implement combinational and sequential circuits using Verilog.
3. Analyse digital circuits using VLSI CAD tools like DSCH, Microwind.
4. Design CMOS circuits like basic gates, adders at the transistor level.
5. Implement the layout of simple CMOS circuits like inverter and basic gates.

List of Experiments

PART-A

1. Write structural Verilog HDL model for
 - a. 4-bit ripple carry adder.
 - b. 4-bit binary Adder cum Subtractor
 - c. 1-digit BCD adder
2. Write a Verilog HDL program in behavioural model for
 - a. 8:1 multiplexer
 - b. 8:3 encoder
 - c. 3:8 decoder
3. Write a Verilog HDL program in Hierarchical structural model for
 - a. 16:1 multiplexer realization using 4:1 multiplexer
 - b. 3:8 decoder realization through 2:4 decoder

4. Write a Verilog HDL program in behavioural model for
 - a. SR-FF, b. D-FF, c. JK-FF and d. T-FF
5. Write a Verilog HDL program in behavioural model for
 - a. 8 bit asynchronous up-down counter
 - b. 8 bit synchronous up-down counter
6. Write a Verilog HDL program for 4-bit sequence detector through Mealy state machines
7. Write a Verilog HDL program for 3-bit sequence detector through Moore state machines

PART-B

Transistor Level implementation of CMOS circuits using VLSI CAD tool

1. Basic Logic Gates:
 - a. Inverter,
 - b. NAND and
 - c. NOR
2. Half Adder and Full Adder
3. Half Subtractor and Full Subtractor
4. Implement the Layout of CMOS Inverter.
5. Implement the Layout of CMOS NAND.
6. Implement the Layout of CMOS NOR
7. Implement the Layout of CMOS Half Adder and Full Adder.
8. Implement the Layout of CMOS Half Subtractor and Full Subtractor

Note:

1. A total of 10 experiments must be completed in the semester.
2. Minimum of 5 experiments from Part-A and 5 from Part-B is compulsory.

Course Code	Course Title					Core/Elective	
HS 553HS & HS653HS	SOFT SKILLS LAB (Common to CSE&AI&DS – V SEM & ECE, ME, CE&EEE –VI SEM)					Core	
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES :

The following are the Objectives of the Course :

1. To enable the students to listen to different speakers in different contexts for various purposes and learn target language expressions.
2. To enable the students to develop confidence and interactive skills to speak professionally in different situations.
3. To enable students to learn and develop various reading skills and strategies.
4. To enable the students to develop written expression of thought and provide opportunities to explore ideas by utilizing various techniques.
5. To equip the students to develop needed confidence and interactive skills to speak professionally and acquire skills to face any Interview.

COURSE OUTCOMES :

After completion of the course, the student will be able to

- CO 1.** Listen to a variety of speakers and texts and will be able to comprehend and perform the required tasks.
- CO 2.** Interact in a group professionally and communicate confidently in terms of both the spoken and written communication.
- CO 3.** Develop the skills and strategies of reading and writing.
- CO 4.** Face any Interview confidently by managing time, making decisions by speaking appropriately according to the context.
- CO 5.** Demonstrate right attitude and right skills to cope with team and communicate professionally.

LIST OF EXPERIMENTS

I. Listening Skills

- Listening to different situations by Native Speakers.
- Listening to Conversations.
- Listening to Motivational Speeches.

II. Speaking Skills

- Describing a person or a place or a thing using relevant adjectives.
- Picture Perception
- Oral Presentations.
- Etiquette in different situations.

III. Reading Skills

- Reading different Texts
- Reading Comprehension Passages.
- Skimming and Scanning
- Paraphrasing.

IV. Writing Skills

- Writing Slogans related to the image.
- Communicating on Social Media.

V. Interview Skills

- Skills required to attend an Interview
- Soft Skills to be demonstrated in a Job Interview.
- Debates and Group discussions.

SUGGESTED READINGS:

1. Andrea J. Rutherford. Basic Communication Skills for Technology. Pearson Education. Inc. New Delhi.
2. Antony Jay and Ros Jay. Effective Presentation. How to be a Top Class Presenter. Universities Press.(India) Limited.1999.
3. Robert M Sherfield and etal. “Developing Soft Skills” 4th edition, New Delhi: Pearson Education,2009.
4. M.Ashraf Rizvi Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited. New Delhi.

Course Code	Course Title					Core/Elective	
5PW672EC	TECHNICAL SEMINAR					Core	
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
Professional skills, communication skills	L	T	D	P	50	-	1
	-	-	-	2			

Seminar based on core contents related to parent discipline/department/branch of Engineering.

Course Code	Course Title						Core/Elective
5PW774EC	SUMMER INTERNSHIP						Core
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
	L	T	D	P			
professional skills, soft skills, communication skills	-	-	-	-	40	60	1

COURSE OBJECTIVES :

1. To enhance practical and professional skills.
2. To provide training in soft skills and also train them in presenting seminars and technical report writing.
3. To expose the students to industry practices and team work.

COURSE OUTCOMES :

On successful completion of the course, the students will be able to:

1. Acquire practical experience of software design and development, and coding practices within Industrial / R&D Environments.
2. understand working practices within Industrial/R&D Environments
3. Prepare reports and deliver effective presentation.
4. demonstrate effective written and oral communication skills
5. Innovate in various engineering disciplines and nurture their entrepreneurial ideas.

Summer Internship is introduced as part of the curriculum for encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organizations/Computer Industry/Software Companies/R&D Organization for a period of 4 to 6 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co-ordinate (person from industry). The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship.

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of internal marks are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (xx Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Industry Attachment Program.

Note : Students have to undergo summer internship of 4 to 6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.