B.Tech ECE Syllabus

Semester I – Common for ECE and CSE

MA-1001	Mathematics-I (Calculus and Differential Equations)	L-T-P-C:3-1-0-4

Course objective: In this course the students are introduced to some basic tools in Mathematics which are useful in modelling and analyzing physical phenomena involving continuous changes of variables or parameters. The differential and integral calculus of functions of one or more variables and of vector functions taught in this course have applications across all branches of engineering. This course will also help in understanding application of Laplace and Fourier Transformation in Communication theory.

Module I

Infinite series & Mean Value theorem: Sequence and series, convergence, Comparison test, Integral test, D'Alembert ratio test, Rabbe's test, Lograthmic test, Cauchy root test, Leibnitz's rule, Rolle's Theorem, Lagrange and Cauchy Mean Value theorems. Function of Several Variables: Limit, Continuity and Differentiability, Partial Differentiation, Homogeneous function – Euler's theorem, change of variables, Jacobian, Taylor's theorem for function of several variables, Extrema of function of multi-variables, saddle points, Lagrange method for undetermined multipliers.

Module II

Integral Calculus: Multi Integral (Double & Triple Integral) , Change of order of integration, Area of bounded region, Arc length of curve, volume and surface area of solid of revolution, multiple integral by change of variables, Dirichlet integrals, moment of inertia, center of gravity. Beta and Gamma Functions: Improper integrals, Beta function, Gamma functions, Improper integrals involving a parameter

Module III

Vector Calculus: Gradient, Directional derivatives, Divergence and Curl, line integral and Green's theorem, surface and volume integral, Green's, Gauss, Stoke's theorems and their application.

Module IV

Ordinary Differential Equations: Existence and uniqueness of solutions of first order ODE, Exact differential equation, solution of linear differential equation, higher order linear differential equation, Solution of homogeneous and nonhomogeneous ODE, variation of parameters, Undetermined coefficients, power series method, System of simultaneous ODE.

Module V

Partial Differential Equation: First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non- linear First Order PDE, Some Standard form-

I, II, III, IV. Charpit's Method, Higher Order Homogeneous linear PDE with constant coefficients, C.F. & P.I., Non- homogeneous P.D.E with constant coefficients, C.F. & P.I. Application of Partial Differential Equation

Module VI

Laplace Transform: Laplace Transform and its properties, Unit-step, Impulse and Periodic functions, Error Function, Inverse Laplace Transform, Convolution Theorem, Evaluation of Integral by Laplace transform, Application of Laplace transform to solution of ODE & PDE. Fourier Series and Fourier Transform: Fourier series, Convergence of Fourier series, Half range series. Fourier Integral, Fourier Sine and Cosine Integral, Complex form of Fourier integral. Fourier Transform, Fourier Sine and Cosine transform, Finite sine and Cosine transform, Convolution Theorem, Application of Fourier Transform to boundary value problems.

Course outcome:

- Learn the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point
- Compare and contrast the ideas of continuity and differentiability
- To able to evaluate integrals of rational functions by partial fractions.
- To distinguish between linear, nonlinear, partial and ordinary differential equations.
- To solve basic application problems described by second order linear differential equations with constant coefficients.
- Understand the fundamental concepts of functions with several variables, its derivatives in partial forms with other important related concepts, their applications in maxima - minima problems.
- Apply the principles of integral to solve a variety of practical problems in sciences and engineering.
- Apply Laplace and Fourier transform in engineering applications.

Text Book:

1. Simmons, G. F. "Differential Equations, TATA McGraw-Hill Publishing Company LTD. New Delhi, 1995."
2. Das, B. C., and B. N. Mukherjee. "Integral calculus—differential equations." UN Dhur & Sons Pvt. Ltd, Kolkata (1996).

Reference Book:

3. Jain, Rajinder Kumar, and Satteluri RK Iyengar. Advanced engineering mathematics. Alpha Science Int'l Ltd., 2007.
4. Grewal, B. S. "Higher engineering mathematics." 2002, Khanna Publishers, New Delhi (1996).
5. Kreyszig, Erwin. "Advanced Engineering Mathematics, 10th Edition." , Wiley India edition (2009).

EC-1001	Electronic Devices & Circuits	L-T-P-C:3-0-0-3

Course objective:

- Use of basic electronic devices in building circuits.

- Apply P-N junction diodes for different applications.
- Apply BJT, FET and MOSFET circuits for different applications.

Module I

Physics of Semiconductor Device: Insulators, semiconductors, and metals classification using energy band diagrams, mobility and conductivity, electrons and holes in intrinsic and extrinsic semiconductors, drift and diffusion, charge densities in semiconductors, Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic semiconductors, Effect of Excess Carrier in Semiconductor Device.

Module II

Diode Characteristics and Applications: P-N junction diode and its characteristics, Mathematical analysis of built-in potential, depletion width, peak electric field and diffusion current density, Diode applications (half-wave and full-wave rectifiers, clippers, clampers), Non-ideal diode models, Zener diodes and its applications, Diode capacitance and switching times, Types of diodes (LED, Varactor diode, Schottky diode, Photodiode).

Module III

BJT: Bipolar Junction Transistor (BJT types, operation, configurations, characteristics), Cutoff and saturation operations, Q point, BJT switching times, Applications of BJT.

FET: Field Effect Transistor (FET types, operation, configurations, characteristics), MOS structure, CV characteristics, Metal-Oxide Semiconductor FET, Complimentary MOSFET (CMOS).

Module IV

BJT biasing and small-signal analysis of BJT amplifiers, FET biasing and small-signal analysis of FET amplifiers, Frequency response (low-frequency and high-frequency responses of amplifiers), and Gain bandwidth product.

Course outcome:

Upon Completion of the course, the students will be able to:

- Explain the structure and working operation of basic semiconductor devices.
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct various electronic circuit.

Text Book:

1. Adel S. Sedra, Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press, 7th Edition, 2017.
2. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall, 11th Edition, 2015.

Reference Book:

1. Jacob Millman, Christos C. Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", Tata McGraw Hill, 2nd Edition, 2017.

2. Donald A. Neamen, "Microelectronics: Circuit Analysis and Design", McGraw Hill, 4th Edition, 2010.

EC-1101	Electronic Devices & Circuits lab	L-T-P-C:0-0-3-2

Familiarization with Cathode Ray Oscilloscope, Function generator and various electronic components and Experiments related to Volt-Ampere Characteristics of PN junction diode, Zener Diode and Light Emitting Diode, Zener Voltage regulator characteristics, clipping circuits, clamper circuits, Half-Wave rectifier with and without filter, Full-Wave rectifier with and without filter, Bipolar Junction Transistor, Frequency response of CE amplifier, Characteristics of n-channel/p-channel MOSFETs and CMOS inverter.

Project:

Familiarization with PCB design

EC-1003	Electrical Technology	L-T-P-C:3-0-0-3

Course objective:

- Understand the basic ideas and principles of Electrical and Electronic Circuits.
- Recognize basic elements for electrical and electronic circuits
- Realize the details of electrical power systems, generators, motors etc.

Module I

Electrical Circuit: Circuit Elements Resistance, Inductance & Capacitance, Kirchhoff's Laws, Voltage Source (Definition, Characteristics of Practical Source, and Equivalent Current Source). Magnetic Circuit, Flux, MMF, Reluctance, Analogy with Electric Circuits. Simple Calculations for Composite Magnetic Circuits. Three phase system: Its necessity and advantages, meaning of phase sequence, star and delta connections, balanced supply and balanced load, line and phase voltage/current relation, three phase power measurements.

Module II

Parameters of AC Circuits: Periodic Function, Average & R.M.S., Values, Steady State Behavior With Sinusoidal Excitation, Phasor Representation, Reactance & Impedance, Series & Parallel Circuit, Power Factor, Principle of Generation of Single Phase & Three Phase Voltages, Power in Balanced Three Phase AC System

Module III

Transformers: Necessity of transformer, Principle of operation, Types and construction of transformers. emf equation. Losses, variation of losses with respect to load, efficiency, Condition for maximum efficiency. Domestic Wiring: Service mains, meter board and distribution board. Brief discussion on concealed conduit wiring. Two-way and three-way control Elementary discussion on circuit protective devices: Fuse and

Miniature Circuit Breaker (MCB's), electric shock, precautions against shock. Earthing: Pipe and Plate earthing.

Course Outcome:

Upon Completion of the course, the students will be able to:

- Design basic components of Electrical and Electronic Circuits.
- Explain the working principle of Electrical measurements
- Design Transformer and related circuits

Text Book:

1. John Hiley, Keith Brown and Ian Mckenzie Smith, Electrical And Electronic Technology, 10th Edition, 2018, Pearson Publishers.
2. Mittle and Mittal, Basic Electrical Engineering, 2nd Edition, 2019, TMH.

Reference Book:

1. D. P Kothari. and I. J. Nagrath, Theory and Problems 0f Basic Electrical Engineering, 6th Edition, 2018. Prentice. Hall India.
2. D. C Kulshresta, Basic Electrical Engineering, 1st Edition, 2019, TMH India.

CS-1001	Computer Programming: Concepts and Practices	L-T-P-C:3-0-0-3

Course objective:

- To understand the basic concept of writing a program.
- To understand role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language
- To apply the use of conditional expressions and looping statements to solve problems associated with conditions, repetitions and function.
- To analyze the concept of array and pointers dealing with memory management.
- To Evaluate the File handling concepts for permanent storage of data or record.
  To create dynamic data structure applications as self-referential structure.

Module I

Computer fundamentals, Evolution of programming languages, Syntax and semantics, Concurrency, Number systems, Functional Programming and Logic programming languages, Computational complexity

Module II

Programming in C, Pseudo-code, Character set, Identifiers, Keywords, Data Types, Constant and Variables, Operators, expressions and statements, conditional and looping statements.

Module III

Data types, Type Checking and Scopes, Storage Classes, Arrays, Sequential and Linked linear lists, Trees, Trees representations, binary tree traversals, Graphs, Graphs representations.

Module IV

Functions, Structures, Union, Storage Classes, Pointers, Dynamic memory allocations, file handling in C, Pre-processor directives and macros, I/O handling, Header files.

Module V

Sorting and searching algorithms, String algorithms, Pattern search and text editing, Hashing.

Course outcome:

- Understand fundamental principles of problem solving.
- Familiarize the design and analysis of algorithms.
- Understand and practice the C programming language for solving mathematical and scientific problems.

Text Book:

1. K. L.P. Mishra and N. Chandrasekaran; Theory of Computer Science (Automata, Languages and Computation), 2nd Edition, Prentice-Hall Punb.India, 2016.
2. G. Shanker Rao; Mathematical Foundations of Computer Science, I.K. International Publishing House Private Limited, 2006.

Reference Books:

1. A.M. Tenenbaum, Y. langsum and M.J. Augenstein; Data Structures using C, Prentice Hall of India private. Limited, 2015.
2. Robert Sedgewick; Algorithms in C, Addition-Wesley, 2010.

CS-1101	Computer Programming Lab	L-T-P-C:0-0-3-2

Familiarization of a computer and the environment for execution of sample programs involving expression evaluation, Conditionals and branching, Iteration, Functions. Applications of Arrays, Sequential and Linked linear lists, structure, pointer and dynamic memory allocation, String manipulation. Sorting and Searching algorithms and File- handling.

PH-1001	Engineering Physics	L-T-P-C:3-0-0-3

Course objective:

- To apply basic principles of physics to engineering applications.
- To introduce advances in technology for engineering applications.
- To apply the concepts of special theory of relativity in various field of engineering.
- Explain Quantum Mechanics to understand wave particle dualism
- Explain the principles of laser and optical fibers.

Module I

Mathematical Preliminaries: Physical meaning of Gradient, Divergence and Curl. The fundamental theorem of divergences (Gauss's divergence theorem) and curls (Stokes' curl theorem). Curvilinear Coordinates: Polar coordinates, Spherical polar coordinates and Cylindrical polar coordinates. Gradient, divergence and curl in curvilinear coordinates.

Module II

Electrodynamics: Maxwell's equations: differential and integral forms, significance of Maxwell's equations, displacement current and correction in Ampere's law, Electromagnetic waves, EM wave equation, plane electromagnetic waves, Polarization of EM waves, Poynting's theorem.

Module III

Special Relativity: Basics of Special Relativity, Galilean and Lorentz transformations, Michelson- Morley experiment. Postulates of Einstein's special theory of relativity. Time dilation and length contraction, relativistic kinematics and mass-energy equivalence.

Module IV

Quantum Physics: Dual nature of matter, de-Broglie Hypothesis, Heisenberg uncertainty principle and its applications, postulates of quantum mechanics, wave function & its physical significance, probability density, Schrodinger's wave equation, Eigen values & Eigen functions, Application of Schrodinger equation.

Module V

Laser and Fiber Optics: Principles of lasers, Einstein Coefficients and their relations, Types of Lasers and their applications. Concept of optical fibers and types of optical fibers, modes of propagation, fiber optic communication, optical fiber sensors, connector and couplers.

Course outcome: Student will be able to:

- Determine gradient, divergence and curl of scalar and vector fields.
- To formulate and solve the engineering problems on electromagnetism.
- To explain special theory of relativity and apply its concepts in various fields of engineering.
- To explain fundamentals of quantum mechanics and apply it to problems on bound states.
- Describe the basics of laser physics and working of optical fibers.

Text Book:

1. Panofsky & Phillips, Classical Electricity & Magnetism, 2nd ed., Dover Publications, 2005. (Text Book).
2. Optical Fiber communication- G Keiser (McGraw Hill) (Text Book)
3. Neeraj Mehta, Applied Physics for Engineers, PHI Learning Pvt. Ltd., 2011. (Text Book)
4. Perspectives of Modern Physics, A. Beiser (Text Book).

Reference Book:

1. 1.Antennas and Wave Propagation, G.S.N. Raju, Pearson Education (Ref)
2. David J Griffith, Introduction to Electrodynamics, 4th ed. , PHI, 2014. (Ref.).
3. Paul Dirac, Principles of Quantum Mechanics, 4th ed., Oxford Uni. Press, 2004. (Ref.)

HS-1001	Professional Communication	L-T-P-C:2-0-0-2

Course objective: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

Module I

Communication Fundamentals: Introduction to Verbal and Nonverbal Communication, received pronunciation; how to activate passive vocabulary; technical/non-technical and business presentations; questioning and answer skills; soft skills for professionals; role of body postures, movements, gestures, facial expressions, dress in effective communication; Information/ Desk/ Front Office/ Telephone conversation; how to face an interview/press conference; Group discussions, debates, elocution.

Module II

Interviewing Principles and Skills: Fundamental principles of interviewing, Interview etiquette: dress code, body language, attending job interviews, telephone/skype interview, one to one interview &panel interview, Success in an interview, Types of Interviews, Improving self-expression Important Non-verbal aspects.

Module III

Group Discussions: Methodology of GD, Improving Group performance, Developing persuasive speaking skills, Listener oriented speaking, Group discussion practice

Module IV

Professional Writing: Kinds of business letters, Job Applications and Resume Writing, Report Writing, Proposal layout and design, E-mail etiquette, Notices, Agenda and Minutes, Technical writing, business writing.

Module V

Delivering Professional Presentations: Elements of effective English, Effective paragraphs, The power of reading, Punctuation and Capitalization

Course outcome:

At the end of the course Learners will be able to

- Make effective verbal and nonverbal communication.
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Text Book:

1. Barun K. Mitra, Effective Technical Communication, Oxford University Press, Delhi.2006.

Reference Book:

1. Business Correspondence and Report Writing - R. C. Sharma
2. Business Communication - M. Balasubramanyam
3. Essentials of Business Communication - R. Pal and Kolahalli
4. Business Communication and Report Writing - Sharma, Mohan
5. Lesikar's Basic Business Communication – Lesikar

Semester II – Common for ECE and CSE

MA-1002	Mathematics II (Probability and Statistics)	L-T-P-C:3-1-0-4

Course objective:
The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modeling, prediction, computer networks, communication engineering etc.

Module I

Probability Theory: Joint, marginal and conditional distributions, moments and conditional moments, correlation and regression, transformation of variables, bivariate normal and Dirichlet distribution.

Module II

Multivariate distribution: χ^2, t and F distributions. Correlation and regression; Multinomial, uniform distribution on bounded subsets of R^p, multivariate normal and Dirichlet distributions, Cauchy distributions. Order statistics

Module III

Chebyshev's Inequality, Convergence in probability, Bernoulli's theorem, Convergence almost surely, weak law of large numbers, Central and De-Moivre Laplace limit theorems.

Module IV

Statistics: Sampling distribution: χ^2, t and F distributions. Estimation: Method of moments, maximum likelihood estimation, unbiasedness, consistency, comparing two estimators, confidence interval estimation for mean, difference of means, variance, proportions, sample size problems. Test of Hypothesis: Neyman-Pearson Lemma, composite hypothesis, comparison of normal populations, large-sample test, test on multinomial distributions, goodness of fit.

Module IV

Curve fitting and Correlation: Principle of least squares and curve fitting, correlation and regression, scatter diagram, regression lines, bivariate frequency distribution. Theory of errors: Gauss Postulate of arithmetic mean, normal law, error function. Principle of least squares, confidence interval.

Course outcome:

- Develop problem-solving techniques needed to accurately calculate probabilities.
- Apply problem-solving techniques to solving real-world events.
- Apply selected probability distributions to solve problems.
- Present the analysis of derived statistics to all audiences

Text Book:

1. Elements of Probability and Statistics – A.P. Baisnab and M. Jas
2. Probability and Statistics – M. H. Degroof

Reference Book:

1. Mathematics of Statistics Vol I & II – J. F. Kenney & E. S. Keeping
2. Introduction to Statistics – R. G. D. Steel

EC-1002	Digital Logic & Design	L-T-P-C:3-0-0-3

Course objective:

- To prepare students to understand the basic ideas and principles of digital logic levels.
- To prepare students to perform the analysis and designing of various digital electronic circuits.

Module I

Number System, Binary Codes and Boolean Algebra: Conversion of bases, Representation of negative numbers, 1's complement, 2's complement, arithmetic using 2's complement, Hexadecimal code, weighted codes - BCD, Excess-3 code, Gray Code. Logic gates, Boolean Algebra, Standard and canonical representation and minimization of Boolean expressions using Karnaugh map.

Module II

Combinational Logic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Full adder using half adder, BDC Adder. Carry Look ahead, Multipliers. Multiplexer/de- multiplexers, Encoders and Decoders, Application of universal logic gates.

Module III

Sequential Logic Circuits: Latches, Edge Triggered Flip Flops: SR, D, JK, Master slave JK. Excitation tables, conversion of Flip Flops. State Diagrams.

Module IV

Counters and Registers: Synchronous and Asynchronous counters, Up/Down Counters, Design of Synchronous counters, Cascaded Counters, Counter Decoding, Counter applications. Shift register functions, Serial in/serial out shift registers, serial in parallel out/shift registers, Parallel In/Parallel out shift registers, bidirectional Shift registers, Shift register counters, Shift register Applications.

Module V

Converters, Logic Families and Wave shaping using IC-555: Design of various Analog to Digital & Digital to Analog Converters. Parameters of Logic Families. Introduction to logic Families: DTL, RTL, TTL, CMOS.555 Timer, astable and monostable multivibrator and bistable multivibrator.

Course outcome:

After studying this course, the students would gain enough knowledge

- Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.
- To understand and examine the structure of various number systems and its application in digital design.
- The ability to understand, analyze and design various combinational and sequential circuits.
- Ability to identify basic requirements for a design application and propose a cost effective solution.
- The ability to identify and prevent various hazards and timing problems in a digital design.
- To develop skill to build and troubleshoot digital circuits.

Text Book:

1. Digital Design 5e, Mano / Ciletti, Pearson
2. Digital Circuits and Design 5e, Salivahanan, Oxford
3. Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6e, Mano, Pearson.

Reference Book:

1. Digital Electronics: Principles and Integrated Circuits, Maini, Wiley
2. Digital Electronics, Kharate, Oxford
3. Digital Design: Principles and Practices, 4e, Wakerly, Pearson

EC-1102	Digital Logic & Design Lab	L-T-P-C:0-0-3-2

Digital Logic and Design Lab includes both software and hardware portion for designing, realization, analysis and implementation of various Digital Logic circuits, such as Half adder, Half subtractor, Full adder, Full subtractor, Code-converter, Universal Gates based circuit implementation, Digital-Comparator, Multiplexer, De-Multiplexer, Encoder, Decoder, +ve edge triggered Master slave JK-FF, -ve edge triggered Master slave JK-FF, Shift-register - SISO (serial in serial out) - SIPO (serial in parallel out) - PISO (parallel

in serial out) - PIPO (parallel in parallel out), ripple UP-counter, ripple DOWN-counter, and various synchronous as well as asynchronous counters.

CS-1002	Data Structure and Programming Languages	L-T-P-C:3-0-0-3

Course objective:

- Understand and remember algorithms and its analysis procedure.
- Introduce the concept of data structures through ADT including List, Stack, and Queues.
- To design and implement various data structure algorithms.
- To introduce various techniques for representation of the data in the real world.
- To develop application using data structure algorithms.
- Compute the complexity of various algorithms.

Module I

Data structures fundamentals, Abstract data types, Arrays, Sequential and linked structures, Stacks, Queues, Dynamic memory allocation, Compaction and Garbage collector, Python fundamentals, Data types, Variables, Boolean values, Operators, Functions, Tuples.

Module II

I/O Operations, Conditional execution, Loops, Logical and bit wise operations, Lists and list processing, Dictionaries and Data processing, Modules, Packages.

Module III

String and List methods, Exceptions, Trees, binary trees, binary tree traversals, Threaded trees, Applications of trees.

Module IV

Graphs, Graphs representations, Depth first and Breadth first search algorithms, minimum spanning trees, Shortest path algorithms, Application of Graphs.

Module V

Sorting and Searching, Merge-sort, Quick-sort, Heap-sort, Binary search, External search, Hashing, String algorithms.

Course outcome:

- Select appropriate data structures as applied to specified problem definition.
- Implement operations like searching, insertion, and deletion, traversing mechanism etc. On various data structures.
- Students will be able to implement linear and Non-Linear data structures.
- Implement appropriate sorting/searching technique for given problem.
- Design advance data structure using Non-linear data structure.
- Determine and analyse the complexity of given Algorithms.

Text Book:

1. Jon Kleinberg and Eva Tardos; Algorithm Design, Pearson education Inc. 2006.
2. John Jelly; Python Programming : An Introduction to Computer Science , 3rd Edition , 2016

Reference Books:

1. G. Shanker Rao; Mathematical Foundations of Computer Science, I.K. International Publishing House Private Limited, 2006.
2. A.M. Tenenbaum, Y. langsum and M.J. Augenstein; Data Structures using C, Prentice Hall of India private. Limited, 2015.
   Robert Sedgewick; Algorithms in C, Addition-Wesley, 1998.

CS-1102	Data Structures Lab	L-T-P-C:0-0-3-2

Demonstration of simple programs execution on Computer in Python. Python application in solving problems on System of n algebraic equations, Matrix manipulations, Prime numbers, Fibonacci sequences, N-Queens problems, Tower of Hanoi, Sudoku puzzles, Magic squares, Sorting and Searching, Sequential and random access files manipulations, Lists, trees and graphs.

CS-1004	Discrete Mathematics	L-T-P-C: 3-1-0-4

Course objective:

- To develop logical thinking and its application to computer. The subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument.
- To learn the idea behind development of automaton and finite state machines
- To understand about limit of computability.

Course content:

Unit-I

Mathematical Logic: Statements and Connectives, Elementary operations of logic, Well-formed statement formulas, Equivalence of formulas, Principle of duality, Tautologies and Implications, Functional completeness of sets of connectives, Exclusive OR: NAND and NOR, Disjunctive and Conjunctive Normal forms, Propositional Logic; Inference theory, Predicates, Variables and Quantifiers, Predicate formulas, Free and Bound Variables, Universe of Discourse, Valid formulas and Equivalences, Theory of Inference for Predicate Calculus

Unit-II

Sets: Concept of Infinity. Cardinals and Ordinals. Countable and Uncountable Numbers. Cantor's Theorems; Relations, Properties of Relations, Equivalence relations and Partitions, Relation matrices, Counting: Principle of Inclusion and Exclusion, Functions: Characteristic Functions, Permutation Functions, Cycle decomposition of permutations, Even and Odd permutations, Growth of Functions.

Unit-III

Lattices and Boolean Algebra: Partially Ordered sets, Lattices properties of Lattices,
Finite Boolean Algebras.

Unit-IV

Algebraic Structures, Set with one operation: Semi-group, Monoid, Group, Permutation Group; Set with two operations: Ring and Fields. Isomorphism, Automorphism and Homomorphism. Polynomial Rings and Cyclic Codes.

Unit-V

Graphs: Definitions and Representation; Directed Graphs: Matrix representation of Digraphs, Path and Reachability, Transitive Closures and Warshall's Algorithm. Eulerian and Hamiltonian paths and cycles, Graph Traversal algorithms. Trees: Rooted Trees, Undirected Trees, Spanning Trees of Graphs, Algorithms for Minimal Spanning Trees.

Unit-VI

Modeling of Computation: Language and Grammar. Finite State Machine &Monoid. Russel's Paradox and In computability. Tractable and Intractable problems.

Course outcome:

- Expressing a logic sentence in terms of predicates, quantifiers, and logical connectives.
- Distinguishing between different infinite sets and limit of computation
- Understanding the set of naturals, reals, complex numbers and integers and the operations applicable over them to make them Group, Ring or Field
- Using tree and graph algorithms to solve problems.
- Evaluating Boolean functions and simplify expressions using the properties of Boolean algebra.

Text Book:

1. C Liu, D. Mohapatra. Elements of Discrete Mathematics: A Computer Oriented Approach.
2. Narsingh Deo. Graph Theory With Applications To Engineering And Computer Science
3. Kenneth H Rosen. Discrete Mathematics and Its Applications. TMH Publishing.

Reference Book:

1. Tremblay & Manoher: Discrete Mathematical Structures with Applications to Computer Science (Tata McGraw Hill)
2. Kolman, Busby & Ross: Discrete Mathematical Structures (Prentice Hall of India)
3. Mott, Kandel & Baker: Discrete Mathematics for Computer Scientists and Mathematicians (Prentice Hall of India).

HS-1002	Ethics & Human Values	L-T-P-C:2-0-0-2

Course objective:

- To develop a critical ability to distinguish between essence and form, or between what is of value and what is superficial, to life.
- To move from discrimination to commitment. It is to create an ability to act on any discrimination in a given situation.

- It encourages students to discover what they consider valuable. After learning the course, they should be able to discriminate between valuable and the superficial in real situations in their life.

Course content:

Module I

Human Values: Morals, Values and Ethics Integrity- Work ethic- Service learning – Civic virtue – Respect for others - Living peacefully- Caring- Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy- Self-confidence- Character- Spirituality – Introduction to Yoga and meditation for professional excellence and Stress management.

Module II

Engineering Ethics: Senses of Engineering ethics – Variety of moral issues, types of inquiry- Moral dilemmas- Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories of right action – Self-interest – Customs and Religion – Uses of Ethical theories.

Module III

Engineering as Social Experimentation: Engineering as Experimentation – Engineers as responsible experimenters – Code of ethics – A Balanced Outlook on Law

Module IV

Safety, Responsibilities And Ethics: Safety and Risk – Assessment of Safety and risk, Risk Benefit Analysis and Reducing Risk – Respect for authority – Collective Bargaining – Confidentiality – Conflict of interest –Occupational crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

Module V

Global Issues: Multinational Corporations – Environmental Ethics – Computer ethics – Weapons Development – Engineers as managers – Consulting engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of conduct – Corporate Social Responsibility

Course outcome:

- It ensures students sustained happiness through identifying the essentials of human values and skills.
- It facilitates a correct understanding between profession and happiness.
- It helps students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature.
- Ability to develop appropriate technologies and management patterns to create harmony in professional and personal life.

Text Book:

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003
2. Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004

Reference Book:

1. Charles B Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics-Concepts and Cases", Cengage learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for scientists and engineers", Oxford university press, 2001
5. Laura P Hartman and Joe Desjardins, "Business Ethics: Decision making for personal integrity and social responsibility", McGraw Hill education, India Pvt, New Delhi, 2013

Semester III

MA-2001	Mathematics-III (Complex variable, Real analysis & Linear Algebra)	L-T-P-C:3-1-0-4

Course objective:

- To equip the students with methods of solving a general system of linear equations.
- To familiarize them with the concept of Eigen values and diagonalization of a matrix which have many applications in Engineering.
- To understand the basic theory of functions of a complex variable and conformal Transformations.

Module I

COMPLEX VARIABLES: Algebra of complex numbers, elementary analytic functions, complex integration, series representations for analytic functions, residue theory and conformal mapping and its applications.

Module II

Elementary set theory, finite, countable and uncountable sets. Real number system as a complete ordered field. Archimedean property, supremum, infimum. Riemann-Stieltjes integral, properties, integration and differentiation, fundamental theorem of calculus. Sequence and Series, convergence, limsup, liminf.

Module III

Bolzano-Weierstrass Theorem. Heine-Borel Theorem. Sequence and Series of Function, pointwise and uniform convergence, Cauchy Criterion for uniform convergence. Weierstrass's M-Test, Abel's and Dirichlet's Test for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation Theorem. Power Series, uniqueness theorem.

Module IV

Abel's and Tauber's Theorem. Function of Several Variables. Directional derivative, derivative as a linear transformation. Taylor's Theorem, Inverse function and implicit function theorem, Jacobians, extremum

problems with constraints. Monotonefunctins, types of discontinuity, functions of bounded variation, Lebesgue measure and Lebesgue integral.

Module V

Linear Algebra: Matrices over a field. Matrix, characteristic and minimal polynomials, eigen values and eigen vectors. Caylay-Hamilton Theorem. Linear transformation (L.T), rank and nullity, dual space and basis, representation of L.T by matrices. Change of basis. Normal form of matrices. Invariant factors and elementary divisors. Unitary similarity, unitary and normal operators on inner product spaces. Triangular, Jordan and rational form of matrices.

Course outcome:

- Solve any given system of linear equations
- Find the Eigen values of a matrix and how to diagonalize a matrix
- Identify analytic functions and Harmonic functions.
- Evaluate real definite Integrals as application of Residue Theorem.
- Identify conformal mappings
- Find regions that are mapped under certain Transformations.

Text Book:

1. Complex Variables and Applications- J. W. Brown and R. V. Churchill.
2. Mathematical Analysis- T. M. Apostol
3. Linear Algebra-G. E. Shiby

Reference Book:

1. Real Analysis- R. R. Goldberg
2. Linear Algebra-J. H. Kwak & S. Hong

CS-2001	Python Programming	L-T-P-C:3-0-0-3

Course content:

Module I

Introduction, Data Types and Operators: Installation and working with Python, Variables and data types in python, Perform computations and create logical statements using Python's operators: Arithmetic, Assignment, Comparison, Logical, Membership, Identity, Bitwise operators, list, tuple and string operations.

Module II

Python Decision making and Loops: Write conditional statements using If statement, if ...else statement, elif statement and Boolean expressions, While loop, For loop, Nested Loop, Infinite loop, Break statement, Continue statement, Pass statement, Use for and while loops along with useful built-in functions to iterate over and manipulate lists, sets, and dictionaries. Plotting data, Programs using decision making and loops.

Module III

Python Functions and Modules: Defining custom functions, Organizing Python codes using functions, Create and reference variables using the appropriate scope, Basic skills for working with lists, tuples, work

with dates and times, get started with dictionaries, Importing own module as well as external modules, Programming using functions, modules and external packages

Module IV

Python File Operations: An introduction to file I/O, use text files, use CSV files, use binary files, Handle a single exception, handle multiple exceptions, Illustrative programs, Exercises.

Module V

MicroPython: Introduction, main difference between MicroPython and Python, Installation of MicroPython on Hardware, MicroPython libraries, GPIO programming on MicroPython Hardware, Sensor Programming using MicroPython.

Course outcome:
The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.

Text Book:
1. Introduction to Computation and Programming Using Python, John V Guttag, PHI.
2. Fundamentals of Python – First Programs, Kenneth A. Lambert.

Reference Book:
1. Python Programming Fundamentals- A Beginner's Handbook, Nischay kumar Hegde.
2.

CS-2101	Python Programming Lab	L-T-P-C:0-0-3-2

Control structures, list and tuples, conditional statements and loops, functions, Import a module, plot data, MicroPython and NodeMCU. Configure NodeMCU for MicroPython. MicroPython to send digital data on GPIO pins of NodeMCU and glow LED connected with NodeMCU or any other MicroPython supported board. Connect Digital/Analog I/O module with NodeMCU, Display temperature in MicroPython, Connect NodeMCU with with WiFi Access Point and transmit data from NodeMCU to Cloud. Connect Digital/Analog I/O module with NodeMCU and send temperature and light data on cloud (Thingspeak, Firebase or any other cloud service).

CS-2003	Computer Organization and Architecture	L-T-P-C:3-0-0-3

Module I

Introduction: Organization and Architecture, Block diagram of digital computer, Structure and function, Register Transfer language, Register transfer Bus and Memory transfer.

Module II

Computer Arithmetic: Arithmetic micro operations, Logic micro operations, Shift micro operations and Arithmetic logic shift unit, Addition and Subtraction, Multiplication Algorithms and Division Algorithms, Floating Point representation and its Operations

Module III

Computer Organization and Design: Instruction codes, Computer Registers, Computer instructions, Instruction cycle, Memory-reference Instructions, Register reference instructions, Input-output and Interrupt, Stack organization, Instruction formats, Addressing modes, Data Transfer and manipulation, Program control, Reduced Instruction set computer.

Module IV

Pipeline Processing and Memory Organization: Pipeline Processing- Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, memory organization – Memory Hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, and Virtual memory.

Module V

Input – Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt Direct memory Access, Input-Output Processor, Serial Communication.

Course outcome: At the end of the course the students will be able to:

- Identify functional units, bus structure and addressing modes
- Design the hardwired and micro-programmed control units
- Identify memory hierarchy and performance.
- Design Arithmetic Logic Unit
- Interface I/O devices
- Understand pipelined execution and instruction scheduling

Text Book:

1. M .Morris Mano, Computer System Architecture, Pearson Edu.

Reference Book:

1. William Stallings, Computer Organization and Architecture Designing for Performance, Pearson Education.
2. Carl Hamacher, Computer Organization, McGraw Hill Publishers.

CS-2103	Computer Organization and Architecture Lab	L-T-P-C:0-0-3-2

List of Experiments:

1. Study and design of various adder, subtractor, multiplexer.
2. Design of ALU with at least 8 operations.
3. Design of simple memory with m number of address lines and n number of data lines.
4. Design of Associative/Direct mapped cache memory design

5. Using Xilinx timing analysis tools finding cycle time and pipelining gain. Using Xilinx or ModelSim (Simulator) design a pipelined processor.
6. Write or modify programs to test all the different hazard cases.

EC-2001	Analog & Linear Integrated Circuit	L-T-P-C:3-0-0-3

Course objective:

- Elucidate and design of Analog amplifier and Feedback circuits
- Acquaint with the theoretical & practical aspects of Op-amp with different linear and non-linear applications.
- Illustrates the function of application specific ICs such as Voltage regulators, PLL for different electronic applications.

Module I

Basics of Analog Amplifier: Differential amplifier, configurations, AC analysis, constant current bias, Darlington pair, current mirror, cascaded differential amplifier stages, effect of coupling, level translator.

Power Amplifiers Classification: A, B, AB, C Classes, Efficiency, Push Pull Configuration, Complimentary Symmetry, Second Harmonic & Cross Over Distortion.

Module II

Feedback Amplifier and Oscillator: Concept of feedback, types of feedback – their advantages and disadvantages, effect of feedback on frequency response & impedances, Analysis of different feedback amplifiers. Voltage-series and Current shunt Feedback amplifiers using FET.

Oscillators Stability, Barkhausen Criteria, RC, LC & Crystal Oscillators

Module III

Basics of Operational Amplifier: Op-amp (symbol, equivalent circuit and its analysis, open loop transfer characteristics), Ideal op-amp based basic configurations (inverting amplifier, non-inverting amplifier, voltage follower, summing amplifier using inverting and non-inverting configurations, differential input-differential output amplifier, difference amplifier, instrumentation amplifier, I to V converter, V to I converter, integrator, differentiator, Practical op-amp IC741 characteristics Input/output Impedance, Slew Rate, CMRR etc.

Module IV

Applications of Operational Amplifier: Design and analysis of first and higher order low pass, high pass, band pass (wide and narrow band) and band elimination (wide and narrow band) and all pass active filters;Log and anti-log amplifiers, analog multipliers, precision circuits (half-wave and full wave rectifiers, positive and negative clipper circuits, positive and negative clamper circuits, peak detector circuits), comparator and Schmitt trigger circuits, sample-and-hold circuits.

Sinusoidal oscillators (oscillators based on phase-shift, Wien bridge, Hartley, Colpitt, crystal), Non-sinusoidal oscillators (square and triangular waveform generators), Data converters: Binary weighted, R-2R digital to analog converters, flash type, successive approximation type, counter type, dual slope analog to digital converters.

Module V

Special Function ICs: Timer IC-555, Multivibrators, Voltage controlled oscillator, Phase-locked loop, Voltage regulators, Voltage to Frequency converters, OTA, Opto-couplers and fibre optic IC.

Course outcome:

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

- Design Analog amplifier and feedback circuits
- Infer different characteristics of operational amplifiers and its effect on output and their compensation techniques.
- Demonstrate linear and non-linear applications of an Op-amp and special application ICs.
- Design linear and non-linear applications of operational amplifiers.

Text Book:

1. S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw-Hill Education, 4th Edition, 2016.
2. D. R. Choudhry and S. B Jain, "Linear Integrated Circuits", New Age International, 5th Edition, 2018.
3. Jacob Millman and Christos C. Halkias,"Integrated Electronics: Analog and Digital Circuits and Systems", Tata McGraw Hill Education, 2nd Edition, 2011.

Reference Book:

1. L.K. Maheshwari, M.M.S. Anand, "Analog Electronics", Prentice Hall India, 2nd Edition.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2nd Edition, 2017.

EC-2101	Analog & Linear Integrated Circuit Lab	L-T-P-C:0-0-3-2

Experiments related to Differential amplifier, Oscillator, Power amplifier, Inverting and non-inverting amplifier, Integrator and differentiator, Zero-crossing detector, Summing amplifier, Logarithmic and antilogarithmic amplifier, Schmitt trigger, Second and third order low and high pass filter, Band pass filter, square wave and triangular wave generators, Astable and monostable multivibrator, RC phase shift oscillator, D/A and A/D converter and PLL.

Project:

Mini project based on operational amplifier applications.

EC-2003	Circuit Analysis & Synthesis	L-T-P-C:3-0-0-3

Course objective:

- Familiarization with laws and methods of network analysis and synthesis.
- Realize the AC steady-state responses and transient response of resistance, inductance and capacitance in terms of impedance.
- Acquaint with Two port networks, Feedback circuit and Amplifier

Module I

Node and Mesh Analysis: Node and mesh equation, matrix approach of complicated networkcontaining voltage and current sources, and reactance, source transformation and duality.

Network Theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, Millar's theorem, compensation and Tallegen's theorem as applied to AC. circuits.

Module II

First order circuits: RC, RL, and RLC networks with and without initial conditions, with Laplace transforms evaluation of initial conditions, Q factor.

Module III

AC Circuit Analysis: Instantaneous and average power, RMS value, apparent power and power factor, Behavior of series and parallel resonant circuits, Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero integral solutions, locations, Behavior of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Module IV

Two Port Network Analysis:

Z, Y, h, ABCD parameters and circuit analysis, Analysis of a transistor amplifier using h parameters.

Feedback and Amplifiers

Different types of feedback, Amplifiers

Course Outcome:

Upon Completion of the course, the students will be able to:

- Understand the concept of circuit elements, lumped circuits, circuit laws and reduction.
- Analyze AC circuits parameters
- Synthesize networks and model the electronic circuits

Text Book:

1. Charles Alexander and Mathew Sadiku, "Fundamentals of Electric Circuits", 5th Edition, 2014, TMH.
2. Van Valkenburg; Network analysis, 3rd Edition, 2019, Pearson

Reference Book:

1. A. Sudhakar, S.P. Shyammohan, Circuits and Network, 5th Edition, 2017, Tata Mcgraw-Hill New Delhi.
2. Jhon Bird, Electrical Circuit Theory and Technology; 3rd Edition, 2016, PHI.

HS-2001	Management Concepts and Organizational Behavior	L-T-P-C:2-0-0-2

Course objective:

- To expose the students to basic concepts of management.
- To equip the students with requisite knowledge, skills & right attitude necessary to understand behavioral processes at individual, team and organizational level.
- To provide effective leadership in a global environment.

Module I

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management.

Module II

Introduction of organization: - Meaning and process of Organization, Management v/s Organization; **Fundamentals of Organizational Behavior:** Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. **Individual Processes and Behaviour**- **Personality**- Concept, determinants and applications; **Perception**- Concept, process and applications, **Learning**- Concept (Brief Introduction); **Motivation-** Concept, techniques and importance

Module III

Interpersonal Processes- **Teams and Groups**- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict**- Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership. **Communication –** Meaning, process, channels of communication, importance and barriers of communication.

Module IV

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; **Organizational culture -** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

Course outcome: At the end of the course, student will able to

1. apply the managerial concepts in problem-solving for effectively managing the organizational processes.
2. apply interpersonal skills within and outside of organization effectively.
3. understand the individuals and groups inside organizations.

4. understand the organizational culture and change

Text Book:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson.
2. Stoner, J et. al, Management, Prentice Hall of India
3. Moorhead, Griffin, Introduction to Organizational Behaviour, Cengage.
4. Hitt, Miller, Colella, Organizational Behaviour, Wiley
5. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India

Reference Book:

1. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill.
2. Satya Raju, Management – Text & Cases, PHI.
3. Pareek, Udai, Understanding Organizational Behavior, Oxford
4. K. Awathappa, Organizational Behavior, HPH.
5. Kavita Singh, Organizational Behavior: Text and cases, Pearson.

Semester IV

EC-2002	Electromagnetic Theory	L-T-P-C:3-1-0-4

Course objective:

- To understand the fundamental principles and laws of electromagnetic propagation and radiation effects.
- To understand operation of transmission line and waveguide.

Module I

Introduction to co-ordinate systems:-Cartesian coordinate, Cylindrical Coordinates, Spherical Coordinates, Inter Coordinate Transformation; Differential length, Area and Volume, Line, Surface and Volume Integrals; Divergence Theorem, Stokes's Theorem; Electric Field Intensity:-field of line charge, sheet charge, continuous volume charge distribution; Electric flux density, Gauss Law, Applications of Gauss Law; Definition of Electric potential, work, Energy potential difference, Potential field of different types of charges, Potential gradient, dipole and field due to a dipole, Energy density in the electric field.

Module II

Time Varying Fields and Maxwell's Equation: Gauss's law, Poisson's and Laplace's Equations, Ampere's Circuit Law, Magnetic Flux Density, Faraday's Law, Introduction of Maxwell's equations, displacement current, equations of continuity for time varying field.

Module III

Wave equation in an isotropic homogeneous medium and its solution, phasor notation, polarization of waves, reflection and refraction of plane waves at plane boundaries, Poynting vector.

Module IV

Waveguides and Planar Transmission Lines: Electromagnetic fields in parallel-plate, rectangular, and circular waveguides, TE and TM modes, wave impedance, wave velocities, attenuation in waveguides, Electromagnetic fields in microstrip lines, and co-planar waveguides.

Module V

Transmission Lines: Time-domain analysis of transmission lines; Bounce diagrams; Frequency-domain analysis of transmission lines; Standing waves; Smith chart; Transmission line matching: Single and double-stub matching, Types of antenna and their applications.

Course outcome:

- It will get you ready for advanced courses in antenna, microwave, radar, and wireless Communication.
- Ability to understand and compute Electromagnetic fields and apply them for design and Analysis of electrical equipment and systems.

Text Book:

1. Sadiku Matthew N.O. "Elements of Electromagnetic", Oxford University Press.
2. Hayt, W. H. and Buck J. A., "Engineering Electromagnetics", Tata Mc Graw Hill.

Reference Book:

1. Pozar D.M. "Microwave Engineering", Fourth Edition, John Wiley & Sons Inc.
2. Joseph Edminister, Vishnu Priye," ELECTROMAGNETICS", Schaum's Outline Series.

EC-2004	Microprocessors and Microcontrollers	L-T-P-C:3-0-0-3

Course objective:

- To introduce basics of microcontrollers and microprocessor, their architecture, internal organization and their functions, interfacing an external device with the controllers/processor.
- To provide strong foundation for designing real world applications using microprocessors and microcontroller.

Module I

Introduction to 8085: Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

Module II

System Bus Structure: Basic configurations – System bus timing –System design using 8085 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors

Module III

Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Interrupt controller – DMA controller – Programming and applications

Module VII

Microcontroller: Architecture of 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming and interfacing-system design using 8051.

Course outcome: At the end of the course the students will be able to:

- Identify a detailed s/w & h/w structure of the Microprocessor.
- Interface different external peripheral devices with microprocessors and microcontrollers.

Text Book:

1. Ramesh Gaonkar, "Microprocessor architecture, programming, and application with the 8085", Penram International, 2002.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
3. Doughlas V. Hall, Microprocessors and Interfacing, TMH, 2nd edition, 2006.

Reference Book:

4. Ashok Kumar Mukhopadhyay, "Microprocessor, Microcomputer and Their Applications", 3rd Edition, Alpha Science International Limited, 2007.
5. K.Uma Rao, Andhe Pallavi, "The 8051 microcontrollers, architecture and programming and applications", Pearson, 2009.
6. Liu & Gibson, "Microcomputer Systems - The 8086/8088 Family Architecture, Programming and Design", Prentice Hall of India, 2nd Ed, 2006.

EC-2104	Microprocessors and Microcontrollers Lab	L-T-P-C:0-0-3-2

Programming using 8085 kit: Simple programs based on the arithmetic and logical operation; Design of a variable time delay counter (mod 8); Measuring pulse width of a square wave.

Interfacing: stepper motor, matrix keyboard (4×4), traffic light controller; Implementing ADC, Generating triangular saw tooth and square wave; Communication between microprocessors using 8255 PPI chip; Generate various waveforms using DAC.

Simple project using Raspberry Pi and Arduino.

Programming using 8051 kit: Simple programs based on the arithmetic and logical operation; delay generation; Interfacing; waveform generation using DAC.

EC-2006	**Signals and Systems**	**L-T-P-C:3-0-0-3**

Course objective:

- Analyze signals and systems to represent real world system in terms of both the time and transform domains.
- Develop the mathematical skills to design solutions to real world problems using convolution, filtering, modulation and sampling.

Module I

Introduction to Signals and Systems: Signal basics, classification of signals, Elementary signals, Transformations of the independent variables, Exponential and Sinusoidal signals, signal operations, signal properties, Sampling and Reconstruction of signals, System basics, classification of systems, Continuous-Time Systems, Discrete-Time Systems, system properties, linearity, time/shift-invariance, causality, stability.

Module II

Linear Time-invariant Systems: Continuous-time Linear Time-invariant (LTI) system, Discrete-time LTI system, Properties of LTI systems, Impulse response and step response, response to an arbitrary input, Convolution, Correlation, System representation through linear constant coefficient differential equations.

Module III

Frequency Analysis of Signal and Systems: Fourier series representation of continuous-time periodic signals, Properties of continuous-time Fourier series, Fourier series and LTI systems, Representation of aperiodic signals, The Fourier transform for periodic signals, Properties of the Continuous-time Fourier transform (CTFT), Convolution and multiplication properties and their effect in the frequency domain. Frequency Analysis of Continuous-Time Signals, Frequency Analysis of Discrete-Time Signals, Properties of Discrete-Time Fourier Transformation (DTFT), Frequency-domain characteristics of Liner-Invariant Systems

Module IV

Laplace Transform and Z -Transform: The Laplace transforms for continuous-time signals and systems, Properties of the Laplace transform, Analysis and characterization of LTI systems using the Laplace transform, z-transformation, Properties of the Z-Transformations, Inversion of the z-transform, The One-Sided Z-transformation, Analysis of Linear-Time-Invariant Systems in the Z-Domain.

Course outcome: At the end of the course, students will be able to

- Classify signals and systems based on their properties and determine the response of LTI system using convolution.
- Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
- Analyze system properties based on impulse response and Fourier analysis.
- Apply the Laplace transform and Z- transform to analyze continuous-time and discrete-time signals and systems.

Text Book:

1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, "Signals and Systems", Prentice Hall, 2nd Edition, 2003.
2. B.P. Lathi, "Principles of Linear Systems and Signals", Oxford University Press, 2nd Edition, 2009.

Reference Book:

1. M. J. Roberts, "Fundamentals of Signals & Systems", Tata McGrawHill, 2007.
2. R. E. Zeimer, W. H. Tranter and R. D. Fannin, "Signals & Systems - Continuous and Discrete", Pearson Education, 2007.
3. S. Haykin and B. V. Veen, "Signals and Systems‖ 2nd Edition", Wiley, 2007.

EC-2008	Analog Communication	L-T-P-C:3-0-0-3

Course objective:

- To analyzed nature of transmission and reception of baseband signals.
- To introduce the students to various modulation and demodulation techniques of analog communication i.e. amplitude, angle and pulse modulation.
- To analyze the noise performance of the communication system.

Module I

Introduction to Fourier Series and Fourier Transform; Energy and Power Spectral Densities; Introduction of communication, Elements of Communication System-Transmitters, transmission channels and receivers; Concepts of modulation and need for modulation.

Module II

Amplitude modulation (AM): Time domain expression of baseband signal; modulation index, frequency domain (spectral) representations, phasor diagram, AM transmission bandwidth; AM for a single tone

message- carrier and side band components; Transmission requirements for AM, normalized power and side band power. Double side band suppressed carrier modulation (DSB-SC) - time and frequency domain expressions; Transmission requirements for DSB, bandwidth and transmission power for DSB-SC; Generation of DSB-SC, square law modulators, balanced modulators, ring modulators, switching modulators. Single side band modulation (SSB):Basic concept, SSB with suppressed/reduced carrier, advantages and generation of SSB; transmit band width and power, side band filter examples; Vestigial side band modulation (VSB)- Basic concept and application

Module III

Demodulation of AM signals- square law and envelope detectors; The super heterodyne receiver for standard AM radio; Synchronous demodulation of AM, DSB and SSB using synchronous detection, Effects of frequency and phase errors in the local oscillator in DSB and SSB Demodulation of SSB with pilot carrier, use of SSB in telephony. Phase-Locked Loop (PLL): Carrier recovery circuits, Basic operation of PLL, mathematical analysis, applications.

Module IV

Angle Modulation (FM/PM): Instantaneous frequency instantaneous phase, time domain representation for FM and PM; Narrow band angle modulation with frequency and phase, modulation index, Phasor diagram; FM and PM signals for a single tone message, spectral representation, power and effective bandwidth; Generation of wide band FM using Armstrong method, commercial FM requirements. Detection of FM and PM signals, limiter discriminator; Demodulation of PM using PLL; FM broadcasting and stereo FM radio.

Module V

Noise Performance of Analog Communication Systems: Signal-to-noise ratio (SNR) in linear modulation, synchronous detection of DSB; SNR for AM, DSB and SSB; comparison of DSB, SSB and AM; Effect of noise in envelope and square law detection of AM, threshold effects in nonlinear detectors; SNR for FM, SNR improvement using pre-emphasis and de-emphasis. FM threshold effects; Comparison of linear and exponential modulation system for additive white band-limited noise channels.

Module VI

Pulse Modulation, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM.

Course outcome:

This course is designed to cover the fundamentals, principles, concepts, and techniques of analog communication systems like i.e. amplitude, angle and pulse modulation. The outcome of course are:

- Student will understand the various modulation technique and its practical implementation.
- Analyze the communication system in presence of noise in communication the channel.

Text Book:

1. J. G. Proakis and M. Salehi, “Communication Systems Engineering”, Pearson Education India; 2nd edition (2015).
2. S. Haykin, “Introduction to Analog & Digital Communication Systems”, Wiley, 2nd edition (2012).

Reference Book:

1. T. Schilling, "Principles of Communication system", McGraw Hill Education, 4th edition (2017).
2. G. Kennedy, B. Davis, S. Prasanna, "Electronic Communication Systems", McGraw Hill, 5th edition (2011).
3. B. P Lathi, "Modern Analog & Digital Communication Systems", Oxford; 4th edition (2011)

EC-2108	Analog Communication Lab	L-T-P-C:0-0-3-2

To design, verification and analyses the concepts of Sampling Theorem, Amplitude, DCB-SC, Frequency, Pulse Amplitude, Pulse Width, Pulse Position Modulation and Demodulation through software and hardware equipment. Also, analyses the white noise and limit the wide band & narrow band frequency range of the noise, Analog Multiplexing and Demultiplexing.

EC-2010	Control System	L-T-P-C:3-0-0-3

Course objective:

- To be able to analyze a working mathematical model of control systems.
- To be perform time-domain and frequency-domain analyses of the mathematical model to predict the transient and steady state system performance.
- Design a stable control system satisfying requirements of stability and reduced steady state error.

Module I

Introduction: Motivation, Examples and case studies of control systems, Control system Components: Sensors, Actuators, Computational blocks, And feedback control systems: open loop and closed loop control system.

Mathematical modelling: Mathematical modelling of: electrical systems, mechanical systems, electro-mechanical systems. Laplace transforms, transfer functions, electrical analogues of other dynamical systems. State-space modelling of dynamical systems. Block diagrams, block diagram reductions. Signal flow graph, Mason's gain formula.

Module II

Time-domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, e. g. rise time, peak time, settling time, peak overshoot for the second and higher order system. Effects of a Pole and Zero on the Second-Order System, Steady state error and error constants for type 0, type 1 and type 2 system.

Feedback control actions: Proportional, derivative, integral control and PID control.

Module III

Solution of state equation: Eigen values & eigenvectors digitalization state transitive matrix, stability Routh-Hurwitz stability analysis.Characteristics equation of closed loop system root loci, construction of loci, Effect of adding, poles and Zeros on the loci, Stability by root loci

Module IV

Frequency Domain analysis: Bode and Nyquist plots, Effect of adding, poles and Zeros, Polar plot, Nyquist stability analysis, Relative stability: Gain and phase margins.

Module V

Frequency-Domain compensation: lead lag, Lag-lead compensation, Design of compensating networks. State Space Analysis: Transfer Matrix, Controllability and Observability.

Course outcome:

Students will develop the understanding of working control system via mathematical modelling. They can analyze the behavior of the control system in both time and frequency domain. The student will be able to:

- understands the mechanisms of various control systems and analyze their operation,
- develops own mathematical model of feedback control systems,
- Examines the control system model and verify with the concept and its applicability.

Text Book:

1. Nise Norman S., Control Systems Engineering, Wiley India, 7th edition (2018)
2. I. J. Nagrath and M. Gopal, Control system Engineering, New Age International, 5th edition (2009).

Reference Book:

1. Ogata K., Modern Control Engineering, Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, (2000).
2. 2. Kuo B.C., Automatic Control Systems, Prentice-Hall of India Pvt Ltd., New Delhi, 6th edition, (1991).

ES-2002	Environmental Sciences & Green Technology	L-T-P-C:2-0-0-2

Course objective:

- To develop an understanding of the environment, resources and climate change issues.
- To enable the students to assess the environmental impact.
- To understand the linkage between biology, physics, chemistry, earth and atmospheric sciences.

Course content:

Module I

Introduction to Environmental Pollution: Introduction to Environmental Pollution: Environmental Awareness, Concept of an ecosystem, structure and function of an ecosystem, energy and nutrient flow, biogeochemical cycles, sources, pathways and fate of environmental pollutants.

Module II

Atmosphere & Air Pollution: Air pollution- Introduction, Segments of environment, Layers of atmosphere and their significance; Mechanism, Causative factors, Consequences and Preventive measures – Ozone depletion, Greenhouse effect and Global warming; Earth's radiation budget, Classification of air pollutants, Indoor air pollution, Smog-photochemical and sulphurous, Acid rain, Air Quality Standards, Human health effects-Bhopal gas tragedy.

Module III

Air Pollution Monitoring & Control: Pollution Sources: Stationary & Mobile Emission Sources, Monitoring & Control of air pollutants using high volume sampler, cyclone separators, wet scrubbers, electrostatic precipitators, etc. automobile emission control,

Module IV

Water Pollution: Water Resource; Water Pollution: Definition, Classification, Sources of Contamination, Pollutants & their Detrimental Effects; Water Quality: Portability limit – WHO and PHED Specification; Water Quality Monitoring, Municipal Water Treatment: Slow and Rapid Sand Filter, Disinfection – Methods, Advantages & Disadvantages, and Sterilization.

Module V

Industrial &Waste Water Treatment: Industrial Water: Specification of boiler feed water, internal and external treatment, ion exchange process, electro-dialysis, and reverse osmosis. Sewage Treatment: composition, aerobic and anaerobic treatment, chemical and biological oxygen demand

Module VI

Soil and Noise pollution: Lithosphere and Soil profile, Soil contamination, sources of soil contamination, Important environmental properties of soil contaminants, Ecological & Health effects, Exposure & Risk Assessment. Noise pollution: Brief introduction to noise pollution, source, measurement and prevention of noise pollution

Module VII

Radioactive Pollution & Solid Waste Management: Radioactive pollutant: units of radiation and instruments for their measurements, types of radioactive pollutants and risk factor associated with these radiations Radioactive waste and their disposal, accidental leakage of radiation from nuclear reactors (discuss Chernobyl and Fukushima) Solid waste management different types of solid waste, composting, biological methods of detoxification of hazardous waste Onsite handling and composting, integrated solid waste management.

Course outcome: At the end of the course the students will be able to:

- Identify formula and solve environmental problems
- Apply engineering equipment to solve environmental problem.
- Develop equipment for Green Technology in the society.

Text Book:

1. De. A. K., Environmental Chemistry: New Age International (P) Ltd. Publishers.
2. Masters, G.M, Introduction to Environmental Engineering.

Reference Book:

1. Miller, T. G. Jr., Environmental Science, Wadsworth Publishing House, USA
2. Connell, D. W., Basic Concepts of Environmental Chemistry

Semester V

CS-3001	Database Management Systems	L-T-P-C:3-0-0-3

Course objective:

- The focus of this course is on database design, architecture, and relational models.
- Normal forms, Internal schema and Database design would also be explored
- Also Focus on DBMS Transactions and Introduction to distributed Databases.

Module I

Introduction: Basic concepts, Advantages of a DBMS over file-processing systems, Data abstraction, Data Models and data independence, Components of DBMS and overall structure of DBMS, Data Modeling, entity, attributes, relationships, constraints, keys E-R diagrams, Components of E-R Model.

Module II

Relational Mode: Relational Model: Basic concepts. Attributes and domains, concept of integrity and referential constraints, schema diagram. Relational Query Languages: Relational Algebra and Relational Calculus: Tuple relational and domain relational calculus.

Module III

SQL: Introduction to SQL, Characteristics and advantages of SQL, SQL Data Types and Literals, DDL, Tables: Creating, modifying, deleting, Views: Creating, dropping, Updating using Views, DML, SQL Operators, SQL DML queries, SELECT query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple variables, set comparison, ordering of tuples, aggregate functions, nested queries, Database modification using SQL Insert, Update and Delete queries, Dynamic and Embedded SQL and concept of stored procedures, Query-by-example.

Module IV

Relational Database Design: Notion of normalized relations, functional dependency, decomposition and properties of decomposition, Normalization using functional dependency, Multi-valued dependency and Join dependency. Storage and File Systems: Secondary Storage, RAID, File Organization, Indices, Static and Dynamic Hashing, B-trees and B+ Trees

Module V

Query Management and Transaction Processing: Measures of query cost, Selection operation, sorting and join operation, Transaction Concept, Components of transaction management, Concurrency and recovery system, Different concurrency control protocols such as timestamps and locking, validation, Multiple granularity, Deadlock handling, Different crash recovery methods such as log-based recovery, shadow paging, Buffer management and Remote backup system.

Module VI

Object-Based Databases: Nested Relations, Complex Types and Object Orientation, Querying with Complex Types, Creation of Complex Values and Objects, Comparison of Object-Oriented and Object-Relational Databases. Database Architectures: Database system Architecture: Centralized, Client Server, Parallel and Distributed Systems. Web enabled System.

Course outcome:

- Learner would appreciate the systematic design and principals involved in any database development.
- The importance of canonical normal forms and its design in large scale database systems would be a secondary outcome of this course

Text Book:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database system concepts", 5th Edition, McGraw Hill International Edition.
2. 2. Raghu Ramkrishnan, Johannes Gehrke, "Database Management Systems", Second Edition, McGraw Hill International Editions.

Reference Book:

1. Rob Coronel, "Database systems: Design implementation and management", 4th Edition, Thomson Learning Press.
2. 2. Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Third Edition, Pearson Education, 2003.

CS-3101	Database Management Systems Lab	L-T-P-C:0-0-3-2

List of experiments:

1. ER diagrams exercise and SQL, PL-SQL: Modeling exercises for ER Diagrams, Identification of Attributes & Keys. Design Discussions. SQL Commands and Queries (20-25 Queries to be written and data retrieved)
2. Writing SQL Triggers & Assertions.
3. Mini Project implementation (Details of following are given to the students with functional components with project tasks:
4. Draw ER Diagram, Schema of each table required in Project, Normalize all table up to 3NF, Implementation Task: User Interface creation and Report generation.
5. Each student is assigned with a problem. The student is to develop a logical and physical database design for the problem.
6. The logical design performs the following tasks: Map the ER/EER diagrams to a relational schema. Be sure to underline all primary keys, include all necessary foreign keys and indicate referential integrity constraints.
7. Perform physical design based above logical design using Oracle/MSSQL on Windows platform and MySQL/PostgreSQL on Linux platform
8. Perform DML and DDL using all possible SQL commands and with the help anyone host languages like C, C++, VB etc. (i.e. embedded SQL)
9. Perform DML and DLL using PL/SQL and PL/pgSQL for the above problems.
10. Assignment based on object based database.
11. Assignment based on Indexing.
12. Design a mini project for any live problem as per SE constraints and implement using the techniques studied for above assignments.

EC-3001	Digital Communication	L-T-P-C:3-0-0-3

Course objective:

- To present the basic principles that underline the analysis and design of digital communication systems.
- Transmission of information in digital form from a generating source to one or more destinations.
- Analysis and design of communication systems affected by the characteristics of physical channels through which the information is transmitted.

Module I

Representation and processing of signals, Comparison of analog and digital communication, Conversion of analog signal to digital form, Baseband signal, Band pass signal, Block diagram of digital communications, Signal processing operations in digital communications, Quantitative analysis of modulation schemes

Module II

Baseband and Bandpass transmission through AWGN channel, PAM, Pulse code modulation, Delta modulation, Multiplexing, Correlation receiver, Matched filter, Digital modulation schemes- M-ary PSK, M-ary QAM, and M-ary FSK, Coherent and noncoherent modulation techniques

Module III

Receiver structure and error performance, Comparison of modulation schemes. Digital transmission through band-limited (BL) channel, Design of BL signals with zero ISI; Design of BL signals for controlled ISI-partial response signals; Design of transmitter and receiver for known channel, Synchronization.

Module IV

Channel capacity and coding, channel models, channel capacity and bounds on communication, Source coding and channel coding for reliable communication, Multiple Access Communication: TDMA, FDMA, DS SS, FHSS, OFDM and their applications.

Course outcome:

- Model a digital communication system.
- Understanding of the fundamental concepts and techniques, used in the design, performance analysis, and implementation of current communication systems and useful in the development of the communication systems of the future.

Text Book:

1. J. G. Proakis and M. Salehi, Communication Systems Engineering, Pearson.
2. B. Sklar, Digital Communication: Fundamentals and Applications, Pearson, 2001.

Reference Book:

1. B.P. Lathi, Zhi Ding,"Modern Digital And Analog Communication Systems"4th Edition, Oxford press.
2. J. G. Proakis, Digital Communications, McGraw-Hill, 5th Ed.
3. S. Benedetto and E. Biglieri, Principle of Digital Transmissions, Kluwer.
4. Simon Haykin, "Communication System" 5th Edition, John Wiley and sons.
5. A. B. Carlson, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, McGraw-Hill.
6. M. K. Simon, S. M. Hinedi and W. C. Lindsey, Digital Communication Techniques: Signal Design and Detection, PHI.

EC-3101	**Digital Communication Lab**	**L-T-P-C:0-0-3-2**

Random binary signals, Unipolar NRZ, Polar NRZ line codes, Unipolar RZ and Polar RZ line codes, Conversion of analog signal into PCM format, Delta Modulator**,** ASK Modulator and demodulator, PSK Modulator and demodulator, FSK Modulator and demodulator, BER calculation using Monte Carlo simulation, Impairments of signals generated for different modulation formats, Multiplexer and de-multiplexer of digital signals.

Project:

Familiarization with digital communication system design

EC-3003	**Microelectronics Circuits**	**L-T-P-C:3-0-0-3**

Course objective:

- Be familiar with the MOSFET physical structure and operation, electrical characteristics, circuit models and basic circuit applications.
- To develop the ability to analyze and design microelectronic circuits for both analog and digital applications.

Module I

Introduction: Physics of MOS Transistors: Structure, Operation, I-V Characteristics, Second-Order Effects - MOS Capacitance- MOS scaling techniques-MOS Device Models- PMOS Transistor,-CMOS Technology

Module II

CMOS Amplifiers: MOS Amplifier Topologies, Biasing, Realization of Current Sources, Common-Source Stage, Common-Gate Stage, CG Stage with Biasing, Source Follower, Source Follower with Biasing

Module III

Cascode Stages and Current Mirrors: Cascode Stage, Cascode as a Current Source, Cascode as an Amplifier, Current Mirrors, Bipolar Current Mirror, MOS Current Mirror

Module IV

Differential Amplifiers: Differential Signals, Differential Pair, Bipolar Differential Pair, Qualitative Analysis, Large-Signal Analysis, Small-Signal Analysis, MOS Differential Pair, Cascode Differential Amplifiers, Common-Mode Rejection, Differential Pair with Active Load

Module V

Digital CMOS circuit: Static Characterization of Gates, Dynamic Characterization of Gates, Power-Speed Trade-Off, CMOS Inverter: Voltage Transfer Characteristic, Dynamic Characteristics, Power Dissipation, CMOS NOR and NAND gates.

Course outcome:

After studying this course, students will be able to:

- Understand the underlying physics and principles of operation of MOS field effect transistors (MOSFETs).
- Analyze and design microelectronic circuits for linear amplifier & digital applications.
- Design, simulate and optimize analog and digital CMOS circuits with the aid of CAD tools.

Text Book:

1. B. Razavi, "Fundamentals of Microelectronics", 2nd edition, Wiley, 2013.
2. S.M. Kang & Y. Leblebici, "CMOS Digital Integrated Circuits-Analysis & Design", McGraw-Hill, 4th edition, 2016.

Reference Book:

- B. Razavi, "Design of Analog CMOS Integrated Circuits", TMH, 2002
- B.G. Streetman & S. Banerjee, "Solid State Electronic Devices", PHI, 6th edition, 2009.
- Sedra and Smith, Microlectronics Circuits, Oxford University Press, 7th edition, 2017.

EC-3103	Microelectronics Circuits Lab	L-T-P-C:0-0-3-2

Introduction to SPICE Simulation, AC/DC operation, DC sweep transfer function, frequency response, transient response, device models, simulation and analysis of electronic circuits and systems.

Study of PMOS & NMOS Characteristics using SPICE; Static behavior of CMOS inverter; Dynamic behavior of CMOS inverter; Simulation of CMOS gates –NAND, NOR, NAND etc., various MOS amplifier topologies, MOS differential amplifier- various current-mirror circuits.

EC-3005	Microwave Engineering	L-T-P-C:3-0-0-3

Course objective:

- Analyze transmission-line circuits at RF and microwave frequencies
- Use the Smith chart for solving transmission-line problems
- Design impedance matching in transmission-line networks
- Perform transient analysis of transmission-line networks
- Analyze EM transmission characteristics of planar-lines and waveguides
- Design planar-line sections for RF and Microwave circuits
- Perform Scattering parameter analysis of RF networks.

Module I

Introduction: Introduction to Microwave Engineering, Microwave System, Microwave Frequencies, Millimetre waves, Lumped and Distributed Elements, Applications of Microwave Engineering, Maxwell's Equation.

Module II

Microwave Waveguides: General Solutions for TE, TM, TEM waves, Parallel Plate Waveguide, Rectangular Waveguide, and Circular Waveguide, Coaxial line, Strip line, Microstrip line.

Module III

Microwave Components: Hybrid microwave circuits – Waveguide Tees, Magic Tees, Hybrid rings. Microwave Cavities – Circular cavity and Rectangular Cavity Resonator. Circulators, Isolators, Directional Couplers, Power Dividers.

Module IV

Microwave Devices: Schottky diode, PIN diode, Varactor diodes, IMPATT diode, TRAPATT diode, BARITT diode, Tunnel diode, Gunn diode, MBT, HBT

Module V

Microwave Tubes: Klystrons, Multicavity Klystron, Reflex Klystrons, TWTs, Magnetron.

Course outcome:

- This course will provide students with a strong background in microwave and RF engineering enabling them to contribute to research and development for the emerging high speed and wireless information infrastructure.
- Students focused on the communication field or wanting to get involved in the design and applications of RF and microwave circuits and devices will need to take this course.
- Analysis and design techniques at these high frequencies are different from those followed at the lower frequencies as they involve the use of scattering parameters as well as distributed (rather than lumped) analysis approaches.

Text Book:

1. Pozar D.M. "Microwave Engineering", Fourth Edition, John Wiley & Sons Inc., 2012, ISBN: 978-0-470-63155-3.
2. Liao S.Y. "Microwave Devices and Circuits", Third Edition, Prentice Hall (Pearson Education), 2003, ISBN: 978-81-7758-353-3

Reference Book:

1. K. C. Gupta, R. Garg, and I. J. Bahl, "Microstrip Lines and Slot lines",Artech House, Dedham, Mass., 1979.

HS-3001	Entrepreneurship Development	L-T-P-C:2-0-0-2

Course objective:

- To develop entrepreneurial quality and motivation in students for entrepreneurship.
- To enable students to identify and create business opportunities that may be commercialized.
- To make the student understand the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Module I

Introduction to Entrepreneurship: Meaning of Entrepreneur, Types of Entrepreneur, Entrepreneurial Traits and skills, Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs, Entrepreneurship - its Barriers.

Business Opportunity Identification: Business ideas, methods of generating ideas, and opportunity recognition.

Module II

Enterprises and Ownership Structure: MSME industries, Forms of Business Ownership, Advantages and the disadvantages of the three major forms of ownership: the sole proprietorship, the partnership, and the corporation. Registration of company in India.

Module III

Business: Components of macro and micro business environment. Creating and Starting the Venture Sources of new Ideas. **Business Plan:** The Business Plan Nature and scope of Business plan, Elements of

Business Plan: Marketing plan, financial plan and the organizational plan, Writing Business Plan, Evaluating Business plans.

Financing and Managing the new venture Sources of capital: Understanding capital requirements, identifying the sources of finance, angel investing and venture finance, managing cash flow. Break-even analysis, Project analysis.

Marketing and sales controls: Marketing concept and evolution, marketing process, E-commerce, Internet advertising.

Module V

Institutional support to Entrepreneurship: Institutional support towards the development of entrepreneurship in India, DICs, IDC, SFCs, SSIDCs, KVIC, NSIC, SIDBI.

Course outcome:

- The students will be able to understand the systematic process to select and screen a business idea.
- The students will be able to write a business plan.
- The student will aware about industry structure and how to start up a company

Text Book:

1. Khanka. S.S., **Entrepreneurial Development,** S.Chand
2. Nandan, H., **Fundamentals of Entrepreneurship**, PHI

Reference Book:

1. Donald F Kuratko, **Entreprenuership – Theory, Process and Practice**, Cengage
2. Hisrich R D, Peters M P, **Entrepreneurship**, TMH
3. Rajeev Roy, **Entrepreneurship**, Oxford

Semester VI

EC-3002	Measurement & Instrumentation	L-T-P-C:3-0-0-3

Course objective:

- Overview of basic measurement characteristics and system
- Analyze the working principle of electronic instruments.
- Demonstrate ability to select suitable instrument for measurement of physical quantity.

Module I

Basics Measurement Systems: Schematics of Measuring Systems, Performance Characteristics, Order of Instruments, Static/Dynamic Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Loading Effect, Sensitivity, Repeatability, Reproducibility, Fidelity.

Module II

Oscilloscopes: Digital storage oscilloscope internal block diagram, horizontal and vertical deflection systems, Ramp Generator, Measurement of amplitude, frequency and phase (Lissajous method), Overview of Mixed Signal Oscilloscope (MSO).

Module III

Electronic Instruments: Fundamentals of Ammeter, Voltmeter and Ohmmeter, Range Changing, Rectifier Based Voltmeter, Digital Voltmeter, True- RMS responding Voltmeter, Low and High Resistance Measurement, DC Bridges, AC Bridge and their Applications, Resistivity measurement using two probe and four probe technique, Digital Frequency Meter, Function Generators, Frequency Synthesizer, Introduction to Noise Measurement techniques.

Module IV

Technology of Sensors and its Signal Conditioning: Active and passive transducers, Measurement of displacement (Resistance, capacitance, inductance; LVDT), Force (strain gauges), Pressure (piezoelectric transducers), Temperature (resistance thermometers, thermocouples, and thermistors), Velocity, pH measurement, Liquid level Measurement, Measurement of Humidity and Moisture, Signal Conditioning Circuits and Data Acquisition System, Digital Processing of Sensing Result.

Module V

Introduction to Modern Sensors: Bio Sensors, Gas Sensor, Optical Sensors, Surface Acoustic Wave Sensors

Course Outcome:

Upon Completion of the course, the students will be able to:

- Understand philosophy of Measurement system
- Recognize internal building blocks of Electronic test and indicating instruments
- Design an instrument as per the requirements of measurand.

Text Book:

1. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 3rd Edition 2016, PHI.
2. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Edition, 2013, Oxford.

Reference Book:

1. J. Prasad, M.N Jayaswal, and V. Priye, "Instrumentation and Process Control", 2nd Edition, 2016, Willey
2. A. K. Ghosh, "Introduction to Measurements and Instrumentation", 4th Edition, 2019, PHI

EC-3102	Measurement & Instrumentation Lab	L-T-P-C:0-0-3-2

List of Experiments:

1. Design Digital Oscilloscope & Function generator.
2. Design Multimeter & Frequency counter.

3. Design System to measure Strain, Displacement, and Temperature etc.
4. Design System to measure Pressure and Level.
5. Develop Interfacing module between Sensing unit and Mobile or PC.
6. Study of data acquisition system using software and test all signal points.

Project:

Determination of characteristics of a solid-state sensor/fibre-optic sensor.

EC-3004	VLSI & MEMS Technology	L-T-P-C:3-0-0-3

Course objective:

- To teach the fundamentals of micromachining and micro fabrication techniques
- Understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon, computer aided simulation and synthesis tool for hardware design.

Module I

Introduction: Moore's Law, VLSI Design flow, Design hierarchy, VLSI Design style: Full custom, Gate array, standard-cell, Macro cell based design, Field programmable devices, design quality

Module II

Process in VLSI: Wafer preparation, Oxidation, Diffusion, Ion implantation, Deposition, Metallization, Etching and Lithography. IC fabrication: nMOS fabrication, n-well and p-well process, Stick diagram. Layout and Layout design rules

Module III

Basic bipolar process technologies: NMOS technology and its limitations, CMOS Technology, advanced CMOS processes. Design rules for NMOS and CMOS technologies for Layouts.

Module IV

Fundamentals of MEMS/NEMS Design & Fabrication: Needs of MEMS, MEMS material, MEMS Features, design limits and safety factors, processing techniques: Lithography, GalvanikAbforming (LIGA), Lift-off, Chemical Mechanical Polishing, Surface micromachining, Bulk micromachining, Deep Reactive Ion Etching, Application of MEMS, Recent trends in MEMS/NEMS. Challenges and opportunities associated with bringing MEMS to market, Basic MEMS operating principles

Course outcome:

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

- Know the basic concepts of micro systems and advantages of miniaturization.
- Design digital systems using MOS circuits (Static and Switching characteristics of inverters).

- Able to learn Layout, Stick diagrams, Fabrication steps.
- Understand the fundamentals of micromachining and micro fabrication techniques.

Text Book:

1. S.M. Sze, "VLSI Technology", TMH, 2nd edition, 2003.
2. S.K. Gandhi, "VLSI Fabrication Principles", John Willey & Sons, 2nd edition, 2008.
3. S.D Senturia, "Microsystems design". Kluwer Academic Publishers, 2001.
4. N.P. Mahalik, "MEMS", Tata McGraw Hills Publishers, 2007.

Reference Book:

1. G.T.A. Kovacs, "Micromachined transducer", McGraw Hill, 1998.
2. Pucknell, Douglas A. and Eshraghian, Kamran, "Basic VLSI Design", Prentice – Hall (India), 3rd edition, 2004.
3. S.M. Kang & Y. Leblebici, "CMOS Digital Integrated Circuits-Analysis & Design"**,** McGraw-Hill, 4th edition, 2016.

EC-3104	**VLSI & MEMS Lab**	**L-T-P-C:0-0-3-2**

Device simulation using TCAD tool: NMOS, PMOS, CMOS

Layout extraction & simulation using L-edit: PMOS, NMOS, CMOS inverter, various CMOS gates, CMOS half adder, CMOS full adder.

Simulation and fabrication of MEMS devices.

Fabrication and electrical characterization of various microelectronic devices.

EC-3006	**Digital Signal Processing**	**L-T-P-C:3-0-0-3**

Course objective:

- To provide detailed principles and algorithms of digital signal processing.
- Able to have basic knowledge of digital signal processing.

Module I

Introduction: Overview of Discrete time signals and systems Z-Transform: Generalized complex exponentials as eigen signals of LTI systems, z-transform definition, region of convergence (RoC), properties of RoC, properties of the z-transform, inverse z-transform methods-pole-zero plots, time-domain responses of simple pole-zero plots, RoC implications of causality and stability.

Module II

Properties and applications of DFT, implementing linear time invariant systems using DFT, circular convolution, linear convolution using DFT; Fast Fourier Transform, FFT algorithms: Decimation in time, decimation in frequency; Goertzel algorithm; Application of transform in speech, audio, image and video coding, Karhunen-Loeve Transform, JPEG and MPEG coding standards

Module III

IIR and FIR filters, filter design specifications; Design of digital IIR filters: Impulse invariant, and bilinear transformation techniques for Butterworth and Chebyshev filters; Design of FIR filters: Windowing, frequency sampling filter design, optimum approximations of FIR filters.

Module IV

Adaptive systems: Definitions, characteristics, applications, properties, and examples. Adaptive filtering, adaptive equalization, noise cancellation and beam forming.

Module V

Fundamentals of multirate systems, Decimation and interpolation, application of Multirate DSP in sampling rate conversion; Filter banks; Polyphase structures; Quadrature-mirror filter bank; Wavelet transform and its relation to multi-rate filter banks; applications to speech and audio coding.

Course Outcome: At the end of the course the students will be able to:

- Understand the discrete time systems and visualize the operation of filters.
- Able to analyze digital systems in time and frequency domain.

Text Book:

1. Proakis, J.G. and Manolakis, D.G., "Digital Signal Processing: Principles, Algorithm and Applications".
2. Alan V. Oppenheim,"Discrite-time signal processing", pearson.

Reference Book:

1. S. K. Mitra, "Digital Signal Processing: A Computer Based Approach", TMH.
2. B. Widrow and S. D. Stearns, "Adaptive Signal Processing", Prentice Hall.

EC-3106	Digital Signal Processing lab	L-T-P-C:0-0-3-2

1. Write a program to generate different signals waveform.
2. Write a program to perform discrete convolution (linear and circular) for a given two sequence and also prove my manual calculation.
3. Write a program to find the Z-Transform of any given sequence.
4. Write a program to compute discrete Fourier transform and inverse discrete Fourier transform of a given sequence using FFT algorithm (DIT-FFT and DIF-FFT).
5. Write a program to design an analog Butterworth filter and Chebyshev filter for a given specification.
6. Write a program to find time and frequency domain response (impulse response and step response) for a given FIR and IIR systems.
7. Record a signal using Raspberry Pi and Perform signal processing on recorded sample of signal.
8. Develop and test the Inverse Discrete Fourier Transform (IDFT), Finite Impulse Response (FIR) filters using Arduino.

Semester VII

EC-4001	Optical Communication	L-T-P-C:3-0-0-3

Course objective:

- To provide in-depth knowledge of modern optical communication systems
- To understand the characteristics and limitations of system components
- To analyse the performance of optical fiber systems

Module I

Optical communication system evolution, Generic optical system, wireless optical systems, Applications and design challenges, Mode theory for circular waveguides,Optical fibers, Wave propagation in optical fiber, Ray and wave theory

Module II

Physical and electrical characteristics of fiber, Fiber nonlinearities, Polarization, Interference, Fiber materials, Fiber fabrication, Attenuation in fibers, Absorption and scattering losses, Bending losses, Dispersion

Module III

Basic concepts of optical sources, semiconductor lasers, distributed feedback lasers, Frequency chirping, LED, Source to fiber power launching, Lensing schemes, Fiber to fiber joints, Fiber splicing, Fiber connectors, Optical modulators

Module IV

Optical detectors, Principles of photo detector, PIN and avalanche photo diode, Phototransistor, Responsivity, Bandwidth, Noise, Optical amplifiers and filters

Module V

Optical transceivers, Direct detection and coherent receivers, Noise in detection process, WDM, Modulation techniques, BER, System design, Power budgeting, Rise time budgeting, OTDR principles, Maximum transmission distance due to attenuation and dispersion, Attenuation and dispersion limits

Course outcome:

- Identify and characterize different components of an optical fiber communication link.
- Compute optical fiber link design parameters
- Design considerations and assess the performance of optical devices and systems

Text Book:

1. G. Keiser, Optical Fiber Communications, McGraw-Hill, 2008.
2. M. Senior, Optical Fiber Communications. Principle and Practice, Prentice Hall.
3. G. P. Agrawal, Fiber-Optic Communication Systems, 3rd Edition, John Wiley & Sons, Inc., 2002.

Reference Book:

1. R.Papannareddy, "Lightwave Communication Systems: A Practical Perspective", Penram International.
2. B. Razavi, "Design of Integrated Circuits for Optical Communications", McGraw-Hill.
3. A. Yariv, "Optical Electronics in Modern Communications", Oxford University Press.
4. Joseph C. Palais , Fiber Optic Communications, 4th Edition, Prentice Hall.

EC-4101	Optical Communication Lab	L-T-P-C:0-0-3-2

Refractive index profile of optical fibers, b-V curve, Dispersion in silica fiber, Modal analysis for a step index and graded index fiber, Modal analysis for a single mode and multimode fiber, Attenuation and fiber loss, Optical fiber communication system design, BER and Q factor, BPSK and QPSK modulated system, Maximum bit rate for RZ/NRZ encoding with different modulation format.

Project:
Familiarization with optical fiber based communication system.