Department of Electronics & Communication Engineering

and

Department of Computer Science and Engineering

Course Structure and Syllabi

For

4 Yrs. B.Tech Programme

Effective from 2020 Batch Onwards

भारतीय सूचना प्रौद्योगिकी संस्थान राँची

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, RANCHI

(An Institution of National importance under act of Parliament)

(Ranchi - 834010), Jharkhand

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:

- To give a multi-dimensional approach to calculus, with concepts, results, and problems being expressed geometrically, numerically, analytically, and verbally.
- To study behavior of functions, different approach of derivatives for the function
- To understand the applications of definite Integral, Improper integrals, Beta functions, Gamma Functions, Error functions in real world
- To understand Application of Laplace and Fourier Transformation in Communication theory.

Course content:

Unit 1

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.

Unit 2

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

Unit 3

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.

Unit 4

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.

Unit 5

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

Unit 6

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. Differential Equations, G. F. Simmons, Tata Mcgraw-Hill.
2. Differential Calculus by Das and Mukherjee, U. N. Dhur
3. Integral Calculus by Das and Mukherjee, U. N. Dhur
4. Advanced Engineering Mathematics by E. Kreyszig. (Wiley)

Reference Book:

1. Calculus by Thomas and Finney, Addition Wesley
2. Advanced Engineering Mathematics by Jain and Iyenger, Narosa Pub. House
3. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers
4. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons.
5. Principles of Mathematical Analysis, Walter Rudin

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.

Course content:

Unit 1

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.

Unit 2

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).

Unit 3

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).

Unit 4

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.

Unit 1

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.

Unit 2

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

Unit 3

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:3-0-2-5

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 a programming 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.

Course content:

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Course outcome:

- Understand fundamental principles of problem solving.
- Familiarize the design and analysis of algorithms.
- Understand and practice the computer 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.

Computer Programming Lab:

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.

Course content:

Unit 1

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.

Unit 2

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.

Unit 3

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.

Unit 4

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.

Unit 5

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.

Course content:

Unit 1

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.

Unit 2

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.

Unit 3

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

Unit 4

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.

Unit 5

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, climate prediction and computer networks etc.

Course content:

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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.

Unit 5

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.

Course content:

Unit 1

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.

Unit 2

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.

Unit 3

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

Unit 4

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.

Unit 5

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, 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.

Course content:

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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 NonLinear data structure.
- Determine and analyze the complexity of given Algorithms.

Text Book:

1. Jon Kleinberg and Eva Tardos; Algorithm Design, Pearson education Inc. 2006.
2. A.M. Tenenbaum, Y. langsum and M.J. Augenstein; Data Structures using C, Prentice Hall of India private. Limited, 2015.

Reference Books:

1. G. Shanker Rao; Mathematical Foundations of Computer Science, I.K. International Publishing House Private Limited, 2006.
2. Robert Sedgewick; Algorithms in C, Addition-Wesley, 1998.

Data Structure Lab:

Demonstration of simple programs execution on Computer. 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: 3-0-0-3

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 1

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 2

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 3

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

Unit 4

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 5

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, Grarph Traversal algorithms. Trees: Rooted Trees, Undirected Trees, Spanning Trees of Graphs, Algorithms for Minimal Spanning Trees.

Unit 6

Modeling of Computation: Language and Grammar. Finite State Machine & Monoid. Russel's Paradox and Incomputability. 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)
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:

Unit 1

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.

Unit 2

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.

Unit 3

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as Experimentation – Engineers as responsible experimenters – Code of ethics – A Balanced Outlook on Law

Unit 4

SAFETY, RERSPONSIBILITIES 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

Unit 5

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 pres, 2001
5. Laura P Hartman and Joe Desjardins, "Business Ethics: Decision making for personal integrity and social responsibility", Mc Graw Hill education, India Pvt, New Delhi, 2013

B.Tech CSE Syllabus

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.

Course Content:

Unit 1

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

Unit 2

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.

Unit 3

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.

Unit 4

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.

Unit 5

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:

Unit 1

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.

Unit 2

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.

Unit 3

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

Unit 4

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.

Unit 5

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.

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

Course content:

Unit 1

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

Unit 2

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

Unit 3

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.

Unit 4

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

Unit 5

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:

- 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, Mc Graw Hill Publishers

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

List of Lab Assignments / Experiments:

Study and design of various adder, subtractor, multiplexer. Design of ALU, simple memory, Associative/Direct mapped cache memory, pipelined processor, Cycle time and pipelining gain. Testing of different hazard cases.

CS-2005	**Theory of Computation**	L-T-P-C:3-0-0-3

Course content:

Unit 1

Introduction of subject with basics and fundamental concepts, Finite Automata: Introduction, Block diagram and representation. Construction of finite automata, Construction of minimal finite automata(for finite and infinite language), Compound Automata, Non-deterministic finite automata(NFA), Conversion of NFA to DFA, Є-NFA, Є-closure of state, Conversion of Є-NFA to NFA, Conversion of Є-NFA to DFA. Decision property of FA, Comparison algorithm, Optimization and minimization of FA.

Unit 2

Regular language: Prefix, Reverse, Regular expression and its type. Properties of regular expression, Construction of regular expression, Conversion of FA to regular expression (Arden's lemma, State elimination method), Conversion of regular expression to FA (Method of synthesis, Method of Decomposition), Algebraic properties of regular expression, Closure properties of regular expression, Pumping lemma, Weak form of Pumping lemma, Myhill-Nerode theorem.

Unit 3

Finite Automata with output: Moore machine, Mealy machine, Its representation, Construction and Conversion among each other.

Unit 4

Grammar: Introduction, Definition, Types, Construction of grammar, Chomsky hierarchy, Conversion of regular grammar into finite automata, Conversion of FA to RG, Context free grammar and language, Unit production, Є-production, Simplification, Normal form (CNF, GNF), Decision property of CFG, Push Down Automata(PDA): Introduction, block diagram, Deterministic PDA, Non-deterministic PDA, Closure property of CFL, Conversion of CFG to PDA, Pumping lemma for CFL, Turing machine, REG, REL, Block diagram, Turing machine as a transducer, Recursive set and Recursive enumerable set, LBA and CSL.

Unit 5

Undecidability: Introduction, Satisfiability, P vs NP, Cook's Theorem, Reducibility and Undecidable Problem, Rice's theorem, NP- Hard, NP-Complete

Course outcome:	• Understand formal machines, languages and computations • Design finite state machines for acceptance of strings • Design context free grammars for formal languages • Develop pushdown automata accepting strings • Design Turing machine • Distinguish between decidability and undecidability
Text Book:	1. Peter Linz, An Introduction to Formal Languages and Automata, Jones & Bartlett 2. Vivek Kulkarni, Theory of Computation, Oxford University Press
Reference Book:	1. John E. Hopcroft, Rajeev Motwani, Jeffrey D Ullman, Introduction to Automata Theory, Languages and Computation, Pearson 2. Michael Sipser, Introduction to Theory of Computation, 3rd Edition, Course Technology

CS-2007	**Fundamentals of Algorithms**	L-T-P-C:3-0-0-3
Course objective:	• Understand concept of computer algorithms and learn techniques of problem solving • Design algorithms for solving practical problems • Learn analysis of algorithms in terms of complexity theory	

Course content:

Unit 1
Preliminaries: Problem vs. Solutions. Algorithms vs. Programs. Properties of Algorithm. Complexity Measures. Model of Computation – RAM model (Architecture, instruction set, usage). Examples.

Unit 2
Asymptotic Notation: Growth of function over input size – Big-Oh, Big-Omega, Big-Theta, Small-Oh, Small-Omega Notations and their relationship. Master's theorem. Recursion tree.

Unit 3
Basic Algorithm Techniques: Searching techniques – Linear search vs Binary search. Different sorting techniques – sort by insertion, sort by exchange, sort by selection, sort by merging, special purpose sorting. Role of randomness in computing and average case analysis – Case study: Quick sort. Lower Bound Theory. Hashing.

Unit 4
Other Algorithm techniques: Divide and conquer, Dynamic Programming and Greedy Strategy – when to use what. Examples - Matrix chain multiplication, Knapsack problem (Classical and Fractional), n-Queen problem, Huffman Coding.

Unit 5
Graph Algorithms: Graph Traversal, Minimum Spanning Tree, Single Source Shortest Path, All Pair Shortest Path, Hamiltonian Cycle and Travelling Salesman Problem. Applications of these algorithms.

Unit 6
Limit of Computation: Reducibility. Classes of Problems: P, NP, NP completeness, NP hard problems. Examples. Incomputability.

Course outcome:	• Learn when to use which algorithm techniques and for which kind of problems • Understand lower bound of problems • Design efficient computer algorithm for solving practical problems
Text Book:	1. Introduction to Algorithms – Cormen, Leiserson, Rivest and Stein 2. Fundamentals of Computer Algorithms – Horowitz and Sahni
Reference Books:	1. The Design and Analysis of Computer Algorithms -- Aho, Hopcroft and Ullman 2. The Art of Computer Programming (Vol 1 & 3) – Donald E Knuth

CS-2107	**Algorithms Lab**	**L-T-P-C:0-0-3-2**

Study of time requirements of searching and sorting algorithms; Tally the experimental time requirement with the theoretical time complexity; Understanding of problem size and growth of functions; Understanding best case, worst case and average case analysis.

Text file compression using Huffman coding, Implementation of graph algorithms; Study of data structures' roles in developing efficient algorithms (in connection with graph algorithms), Role of randomness in computing.

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.

Unit 1

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.

Unit 2

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

Unit 3

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.

Unit 4

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

MA-2002	Mathematics-IV: Combinatorics and Graph Theory	L-T-P-C:3-0-0-3

Course objective:

- Students will learn core ideas in combinatorial mathematics.
- Define how graphs serve as models for many standard problems
- Discuss the concept of graph, tree, cut set, flow and networks
- See the applications of graphs in science, business and industry

Course content:

I. Combinatorics:

Unit 1

Mathematical Induction, Fundamental Principles of Counting: The Rules of Sum and Product, The Principle of Inclusion and Exclusion, The pigeonhole principle, Permutations, Combinations – The Binomial Theorem, Binomial coefficients, Combinations with and without Repetition, The Catalan Numbers

Unit 2

Generating Functions: Definition and Examples – Calculation Techniques, Partitions of Integers, the Exponential Generating Function, The Summation Operator

Unit 3

Recurrence Relations: The Method of Generating Functions, Solving Recurrence Relations using Substitution and Generating Functions, Method of Characteristic Roots, Solutions of homogeneous and non-homogeneous recurrence relations

II. **Graph Theory:**

Unit 4

Fundamental Concepts: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, Hamilton Paths and Cycles. Trees, Rooted Trees, Trees and Sorting, Weighted Trees and Prefix Codes

Unit 5

Planar Graph Theory: Vertex coloring and upper bounds, Structure of k- chromatic Graphs, Chromatic Polynomials, Line Graphs and edge-coloring, Euler's formula and beyond, The five color map theorem, Kuratowski's Theorem, Characterization of Planar graphs, Planar duality, Spanning trees in planar graphs, Planarity-coloring and cycles.

Unit 6

Optimization on Graphs: Transport Networks – Max-flow, Min-cut Theorem, Matching Theory, Optimization of flows, transportation problems, Optimization of spanning trees. Applications: de Bruijn garph and sequences, Random walks on graphs.

Course outcome:	• Learning how to apply combinatorial ideas to practical problems. • Understanding the use of graphs as models. • Understanding of various types of trees and methods for traversing trees. • Solving some real time problems using concepts of graph theory • Analyzing combinatorial objects satisfying certain properties and answer questions related to existence, construction, enumeration and optimization
Text Book:	1. Kenneth H Rosen. Discrete Mathematics and Its Applications. TMH Publishing. 2. C Liu, D. Mohapatra. Elements of Discrete Mathematics: A Computer Oriented Approach. 3. Narsingh Deo. Graph Theory With Applications To Engineering And Computer Science
Reference Book:	1. Lovasz, Pelikan, and Vesztergombi. Discrete Mathematics: elementary and beyond. 2. D. West. Introduction to graph theory, Prentice Hall, 1996 3. Harris, Hirst, & Mossinghoff. Combinatorics and Graph Theory, 2008 4. Michel Townsend. Discrete Mathematics: Applied Combinatorics and graph theory.

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.

Course content:

Unit 1

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.

Unit 2

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

Unit 3

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

Unit 4

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.

Unit 1

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.

Unit 2

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.

Unit 3

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

Unit 4

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.

CS-2002	Compiler Design	L-T-P-C:3-0-0-3

Course content:

Unit 1

Introduction to Compilation: Compilers, Analysis of the source program, Phases of a compiler, Cousins of the Compiler, Grouping of Phases, Compiler construction tools, Lexical Analysis, Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Data structures in compilation, LEX, Lexical analyzer generator

Unit 2

Syntax Analysis: Role of Parser, Writing Grammars, Context-Free Grammars: Top-Down parsing-Recursive Descent Parsing, Predictive Parsing, Bottom-Up parsing-Shift Reduce Parsing, Operator Precedent Parsing; LR Parsers–SLR Parser, Canonical LR Parser, LALR Parser, YACC –Automatic Parser Generator

Unit 3

Semantic Analysis: Intermediate forms of source Programs, Abstract syntax tree, Polish notation & 3-Address codes, Attributed Grammars, Syntax Directed Translation, Conversion of popular programming languages, Constructs into Intermediate code forms, Declarations, Assignments, Statements, Boolean Expressions.

Unit 4

Code Optimization & Run Time Environment: Introduction, Principal sources of optimization, Optimization of basic blocks, Introduction to global data flow analysis, Basic blocks, Flow graphs, Data flow equation, Global optimization, Data flow analysis for structured programs.

Unit 5

Code Generation: Issues in the design of code generator, The target machine, Next-use Information,

A simple Code generator, DAG representation of Basic Blocks, Peephole Optimization.	
Course outcome:	• Understand phases in the design of compiler • Design top-down and bottom-up parsers • Identify synthesized and inherited attributes • Develop syntax directed translation schemes • Develop algorithms to generate code for a target machine
Text Book:	1. O.G. Kakde, Compiler design, Laxmi Publications
Reference Book:	1. Aho, Ravi Sethi, Monica S Lam, Ullman, Compilers -Principles, Techniques and Tools, Pearson 2. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures, Morgan Kauffmann, 2001. 3. John R Levine, Tony Mason, Doug Brown, Lex and Yacc, Orielly

CS-2102	Compiler Lab	L-T-P-C:0-0-3-2

Generate assembly language code for a block of assignment and arithmetic statements.
Elimination of left recursion and left factoring algorithms and generate predictive parsing table.
Generation of parser program, SLR Parsing table, derivation sequence, Intermediate Code, three address code, Grammar- Construction of Predictive Parsing Table -LR Parsing Tables -Parsing Actions.

CS-2004	Numerical Methods and Scientific Computing	L-T-P-C:3-0-0-3

Course content:

Unit 1

Errors in Numerical Methods: Approximate numbers and Significant figures; Rouding-off numbers; Errors: Absolute, Relative and Percentage; Error in Arithmetical operations; A General Error Formula; Errors in Numerical Computations; Inverse Problems.

Unit 2

Solution of equations in one variable: Bisection method; Iteration method; Regula-Falsi method; Convergence of Regula-Falsi method; Secant method; Newton-Raphson method; Generalised Method for multiple roots; Rate of Convergence of Newton‘s square root formula; Newton‘s Inverse formula; Graffe‘s Root-Squaring method; Ramanujan‘s method; Rate of Convergence and. Computer Programmes for the above methods.

Unit 3

Numerical solution of system of equations: Gauss elimination method; Gauss-Jordan method; Jacobi‘s iteration method; Gauss Sidel method; Ill conditioned problems; Error analysis; Computer programs based for the above methods.

Operators and Difference Equations: Forward difference operator, Backward difference operator, Shift operator, Average operator, Central difference operator and their relations; Factorial Notation; Synthetic division; Missing Term Technique; Basic ideas of Difference Equations.

Unit 4

Interpolation: Newton‘s forward interpolation formula; Newton‘s backward interpolation formula; Stirling‘s Formula; Bessel formula; Lagrange‘s interpolation formula; Divided differences; Newton‘s divided difference formula; Numerical differentiation and applications; Central Difference Interpolation Formulae; Gauss‘ Forward central Difference Formula; Gauss‘ Backward central Difference Formula; Computer Programs for the above formulas.

Unit 5

Numerical integration: A general quadrature formula for equidistant nodes; Trapezoidal rule;

Simpson‘s one-third rule, Simpson‘s three-eight rule; Wedddle‘s rule; Inherent errors in numerical integrations; Newton-Cotes quadrature formula; Euler-Maclaurin formula; Gaussian quadrature formula; Flow charts, Algorithms and Computer Programs to implement the above techniques.

Unit 6

Numerical Methods of Solution of ordinary differential equations: Picard‘s Method of Successive Approximations ; Picard‘s Method for Simultaneous First Order Differential Equations; Euler‘s Method;; Modified Euler‘s Method; Runge-Kutta method; Flow-charts, algorithms and computer programs for the above methods.

Course outcome:	It is not always possible to find exact solutions of algebraic and differential equations. Therefore it is numerical techniques that are an alternative way to find solutions to most of the physical engineering problems. The course aims to provide engineering students with adequate knowledge of numerical techniques
Text Book:	1. Numerical Methods For Scientific And Engineering Computation M. K. Jain, S. R. K. Iyengar And R. K. Jain
Reference Book:	1. An Introduction to Numerical Analysis, Kendall Atkinson

HS-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:

Unit 1

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.

Unit 2

Atmosphere & Air Pollution

Air pollution- Introduction, Segments of environment, Layers of atmosphere and their significance; Mechanism, Causative factors, Consequences and Preventive measures – Ozone depletion, Green house 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.

Unit 3

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,

Unit 4

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, Sterilization

Unit 5

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

Unit 6

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

Unit 7

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:

- Identify formula and solve environmental problems
- Apply engineering equipments to solve environmental problem.
- Develop equipments 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 System (DBMS)	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.

Course content:

Unit 1

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.

Unit 2

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.

Unit 3

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.

Unit 4

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

Unit 5

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.

Unit 6

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. RamezElmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third

Edition, Pearson Education, 2003.

CS-3101	DBMS Lab	L-T-P-C:0-0-3-2

ER diagrams exercise and SQL, PL-SQL: Modeling exercises for ER Diagrams, Identification of Attributes & Keys. Design Discussions. SQL Commands and Queries , SQL Triggers & Assertions. Perform physical design based above logical design using Oracle/MSSQL on Windows platform and MySQL/PostgreSQL on Linux platform, DML and DDL using all possible SQL commands. Implement a small database application for the above system using suitable front end and back end tool. Create a transaction by embedding SQL into an application program. Generate different useful reports. Implementation of a small databse using NoSQL and/or New SQL database system.

CS-3003	**Operating Systems**	L-T-P-C:3-0-0-3

Course objective:

- To study the design and services provided for managing processes, their synchronization and scheduling.
- To design and use the services provided for memory management and the file system.
- To apply UNIX and WINDOW-2000 as case studies.

Course content:

Unit 1
Introduction, History of OS, Computer H/W, Design of OS, Evolution of OS, Priority-handler, Interrupt-handler and System-call handler.

Unit 2
Serial and concurrent computation, Functional systems, Processes and thread management, Inter-process Communication and Synchronization, Process Scheduling, Deadlocks, Protection and Security.

Unit 3
Memory management, Contiguous and Noncontiguous schemes, Paging and virtual memory and Memory related system calls.

Unit 4
File management system, Contiguous and noncontiguous organization, Chaining and indexing, Address translation, Directories and File related system calls.

Unit 5
Unix and Windows 2000 as case studies.

Course outcome:

1. Able to understand the basic components of an operating system and the interactions among its various components.
2. Able to implement the theory of processes, memory, I/O and files.

Text Book:

1. Silverschatz, Galvin and Gagne; Operating System Concepts, 9th Edition, John Wiley and Sons Inc. 2015.
2. A.S. Tanenbaum; Modern Operating Systems, 2nd Edition, Prentice-Hall, New-Jersey, 2001.

Reference Book:

1. Milan Milenkovich; Operating Systems: Concepts and Design,

	McGraw-Hill international edition, Computer Science Series, 2001. 2. Per Brinch Hansen; Operating System Principles, Prentice-Hall Publication, New Delhi,2015.	
CS-3103	**Operating Systems Lab**	**L-T-P-C:0-0-3-2**
Familiarization with UNIX system calls for process management and inter-process communication. process management (creation, synchronization, and communication); processor scheduling; deadlock prevention, avoidance, and recovery; main-memory management; virtual memory management (swapping, paging, segmentation and page replacement algorithms); control of disks and other input/output devices; file-system structure and implementation; and protection and security.		

CS-3005	**Computer Graphics and Multimedia**	**L-T-P-C:3-0-0-3**
Course objective:	● To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them. ● To learn the basic principles of 3- dimensional computer graphics. ● Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition. ● Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections. ● To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications. ● To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles, and applications.	

Course content:

Unit 1

Basics, applications and scope, Graphics standards, Interaction (sample- and event-driven) and Graphics user Interface (GUI) features. Graphics display devices, Input devices, Rendering pipeline.

Mathematical concepts, Lines and line representations, Polygons and polygon interiors, Dot and cross products, Planes and plane representations, Line-line and line-plane intersections.

Unit 2

Scan Conversion: Line, Circle and Ellipse drawing algorithms-DDA, Bresenham. Polygon scan

conversion, Antialiasing.

Viewing pipeline, Window to viewport co-ordinate transformation , clipping operations , point clipping , line clipping- Cohen and Sutherland line clipping, clipping circles , polygons & ellipse.

Unit 3

2D and 3D Geometrical Transformations – scaling, translation, rotation, shear, Viewing Transformations: parallel and perspective projection, Affine transformation Viewing. Orthographic viewing, Mathematics of perspective, Curve representation, surfaces , designs , Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry. Illumination and Shading Models. Introduction to Ray-tracing, Human vision and color, Lighting, Reflection and transmission models.

Unit 4

Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia. Image, video and audio standards.

Introduction to Digital Image: Image formats-JPEG, BMP, TIFF, GIFF. Image evaluation, Layers, Filters, Image manipulation-scaling, cropping, rotation.

Audio: digital audio, MIDI, processing sound, sampling, compression.

Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression.

Unit 5

Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.

Course outcome:	● To list the basic concepts used in computer graphics. ● To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping. ● To describe the importance of viewing and projections. ● To define the fundamentals of animation, virtual reality and its related technologies. ● To understand different types of Multimedia File Format ● To design an application with the principles of virtual reality

Text Book:	1. Computer Graphics (Principles and Practice) by Foley, van Dam, Feiner and Hughes, Addisen Wesley (Indian Edition) 2. Computer Graphics by D Hearn and P M Baker, Printice Hall of India 3. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI	
Reference Book:	1. Mathematical Elements for Computer Graphics by D F Rogers, McGraw Hill 2. Sanhker, Multimedia –A Practical Approach, Jaico	
CS-3105	**Computer Graphics & Multimedia Lab**	L-T-P-C:0-0-3-2

Study of Fundamental Graphics Functions, Line drawing algorithms: DDA Algorithm, Bresenham's Algorithm, Circle drawing algorithms: Bresenham's Algorithm, Mid-Point Algorithm, Ellipse drawing algorithm.

2D and 3D transformations, Cohen Sutherland and Lian Barsky line clipping algorithm, Bezier curve.

Key frame animation and Path animation, animation of solar system.

CS-3007	**Advanced Computer Architecture**	L-T-P-C:3-0-0-3

Course objective:

- Understand the micro-architectural design of processors.
- Learn about the various techniques used to obtain performance improvement and power savings in current processors.

Course content:

Unit 1

FUNDAMENTALS OF COMPUTER DESIGN

Review of Fundamentals of CPU, Memory and IO – Trends in technology, power, energy and cost, Dependability - Performance Evaluation

Pipelining: Basic concepts of pipelining, data hazards, control hazards, and structural hazards; Techniques for overcoming or reducing the effects of various hazards.

Unit 2

INSTRUCTION LEVEL PARALLELISM

ILP concepts – Compiler Techniques for Exposing ILP – Dynamic Branch Prediction – Dynamic Scheduling – Multiple instruction Issue – Hardware Based Speculation – Static scheduling - Multi-threading - Limitations of ILP – Case Studies.

Unit 3

DATA-LEVEL PARALLELISM

Vector architecture – SIMD extensions – Graphics Processing units – Loop level parallelism.

Unit 4

THREAD LEVEL PARALLELISM

Symmetric and Distributed Shared Memory Architectures – Performance Issues –Synchronization – Models of Memory Consistency – Case studies: Intel i7 Processor, SMT & CMP Processors

Unit 5

MEMORY AND I/O

Cache Performance – Reducing Cache Miss Penalty and Miss Rate – Reducing Hit Time – Main Memory and Performance – Memory Technology. Types of Storage Devices – Buses – RAID – Reliability, Availability and Dependability – I/O Performance Measures.

Course outcome:

- Evaluate performance of different architectures with respect to various parameters
- Analyze performance of different ILP techniques
- Identify cache and memory related issues in multi-processors

Text Book:

1. John L Hennessey and David A Patterson, "Computer Architecture A Quantitative Approach", Morgan Kaufmann/ Elsevier, Fifth Edition, 2012.

Reference Book:

1. Kai Hwang and Faye Briggs, "Computer Architecture and Parallel Processing", Mc Graw-Hill International Edition, 2000.

2. Sima D, Fountain T and Kacsuk P, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.

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.

Unit 1

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.

Unit 2

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.

Unit 3

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.

Unit 4

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

CS-3002	Artificial Intelligence	L-T-P-C:3-0-0-3
Course objective:	1. To introduce the basic principles, techniques and applications of AI. 2. To study knowledge representation, logic, inference, problem solving, search algorithms, game theory, perception, learning, planning, and agent design.	

Course content:

Unit 1

Introduction, history, foundations and applications of AI. Design and analysis of intelligent Agents and environment, Toy problems. Propositional Logic, First Order Logic (FOL), Forward and Backward chaining.

Unit 2

Uninformed Search, Sensor less problems, Contingency problems, Heuristic Search, local search and optimization, online search.

Unit 3

Constraint Satisfaction Problems, Game Theory, Probability basics, Bayesian Networks, Fuzzy logics, Beliefs, Desires and Uncertainty.

Unit 4

The planning problem, partial order planning, planning graphs and algorithms, Basics of ANN and Prolog Programming.

Unit 5

Expert Systems, Logic and knowledge based systems, Semantic Nets.

Course outcome:	1. Able to demonstrate fundamental understanding of the history and foundations of artificial intelligence. 2. Able to apply basic AI principles in problem solving, inference, perception, knowledge representation and learning. 3. Able to demonstrate fundamental understanding of various applications in intelligent agents, expert systems, artificial neural networks and other machine learning models.
Text Book:	1. S. Russell and P. Norvig, Artificial Intelligence, a modern approach, 2nd Edition, Pearson, 2011. 2. Nils J. Nilson; Principles of Artificial Intelligence, Narosa Publishing House, 2012.
Reference Book:	1. M. Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, Addison Wesley. 2. Elaine Rich, Artificial Intelligence, McGraw-Hill International Edition, Computer Science Series, 1983.

CS-3102	**Artificial Intelligence Lab**	**L-T-P-C:0-0-3-2**

Breadth First Search, Depth First Search and Backtracking algorithms, Uniform Cost Search, A* and AO* Algorithms, Constraint Satisfaction Problem, Minimum Remaining Values, Most Constrained Variable and Least Constraining Values Heuristics.

Simple reflex agent for solving a financial problem, Bridge configuration problem. Expert system for solving an industrial problem.

CS-3004	**Software Engineering**	**L-T-P-C:3-0-0-3**
Course objective:	• To discuss the software engineering discipline, its evolution, impact and emergence of software engineering and explain the development and use of different software life cycle models for real-life industrial applications. • To discuss different aspects of software project management, risk management and configuration management and explain various requirement elicitation, analysis and specification techniques. • To discuss various software design methodologies, the impact of cohesion and coupling measures on the goodness of the software design. • To discuss the importance of practicing different coding standards, guidelines and different testing strategies along with software reliability metrics and software quality management techniques &	

	standards.

Course content:

Unit 1

Software development life cycle and Project Management Software development life cycle (SDLC) models, software project management, project planning, project estimation, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management

Unit 2

Requirements analysis and specification Requirements gathering and analysis, software requirements specification, formal systems specification, axiomatic specification, algebraic specification.

Unit 3

Software Design Outcome of a design process, cohesion and coupling, layered arrangement of modules, approaches to software design, function-oriented software design overview of SA/SD methodology, structured analysis, DFDs, structured design, detailed design, design review, object-oriented software design UML diagrams, use case modelling, unified process, OOD goodness criteria, user interface design, types of user interfaces, component-based GUI development.

Unit 4

Coding and Testing Coding standards and guidelines, code review, software documentation, unit testing, black-box testing, white-box testing, debugging, integration testing, system testing.

Unit 5

Change Requirements, Version control, Change management, scheduling, estimating, etc. Manual and Automatic Test Data Generation for Software Systems/Embedded Systems. Software reliability and Quality management.

Course outcome:	After reading this subject, students will be able to: • Choose a proper life cycle model for different real-life industrial projects, prepare the SRS document, design the software using function-oriented approach (DFDs) and object-oriented approach

	(UML diagrams), code it, and test the developed software using different software testing strategies. • Understand the concepts of computer aided software engineering (CASE) and use different CASE tools in the development, maintenance and reuse of software systems.
Text Book:	1. R. S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill Publications , 2006 2. R. Mall, Fundamentals of Software Engineering, PHI Learning , 2014
Reference Book:	1. I. Sommerville, Software Engineering, Pearson Education , 2006 2. A. Behferooz and F. J. Hudson, Software Engineering Fundamentals, Oxford University Press , 2000

Software Engineering Lab:

SRS document, Use Case diagrams, Domain Models, Class Diagrams, Sequence Diagrams, Collaboration Diagrams, State Chart Diagrams and Activity Diagrams, Z and Petrinet, cyclomatic complexity, error seeding methodology.

Load testing, mutation testing. mutation score, functional testing.

CS-3006	**Computer Networks**	**L-T-P-C:3-0-0-3**

Course content:

Unit 1

Introduction: Use of computer networks, Network hardware, Network software, Reference models, Example networks.

Unit 2

Physical Layer: Guided transmission media, FDM, TDM, Switching. Data Link Layer: Design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols. MAC Sublayer: The channel allocation problem, Multiple access protocol, Token ring, Ethernet, Wireless LANs, Data link layer switching.

Unit 3

Network Layer: Design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internet working principles, The network layer in the internet-IPv4, IP addresses, IPv6, ICMP, Mobile IP.

Unit 4

Transport Layer: The transport layer services, Elements of transport layer protocols, The internet transport protocols-UDP and TCP.

Unit 5

Application Layer: DNS-Domain name system, E-mail, The World Wide Web, Streaming audio and video, Content delivery networks.

Course outcome:	• Understand OSI and TCP/IP models • Analyse MAC layer protocols and LAN technologies • Design applications using internet protocols • Implement routing and congestion control algorithms • Develop application layer protocols

Text Book:	2. Behrouz A Forouzan, Firouz Mosharraf, Computer Networks: A Top - Down Approach	
Reference Book:	2. Andrew S. Tanenbaum, David J Wetherall, Computer Networks, Pearson Edu. 3. Larry L Peterson, Bruce S Davis, Computer Networks, Elsevier	
CS-3106	**Computer Networks Lab**	**L-T-P-C:0-0-3-2**
Study of different types of network cables and practically implement cross wired cable and straight through cable using clamping tool. Study of network devices and network IP in detail. Study of network IP and practically connect the computers in LAN, Study of basic network command and network configuration commands, Configure a network topology using packet tracer software. Configure a network using Distance vector/Link state routing protocol. Simulation of sliding window protocol, ARP and RARP. Implementation of File Transfer Protocol, Half Duplex Chat Using UDP, Full Duplex Chat Using TCP/IP. Simulate the packet transmission over Ethernet LAN and its CSMA/CD protocol.		

Semester VII

CS-4001	**Cryptography and Network Security**	**L-T-P-C: 3-0-0-3**
Course objective:	● Understand OSI security architecture and classical encryption techniques. ● Acquire fundamental knowledge on the concepts of finite fields and number theory. ● Understand various block cipher and stream cipher models. ● Describe the principles of public key cryptosystems, hash functions and digital signature	

Course content:

Unit 1

INTRODUCTION & NUMBER THEORY: System Security Concepts- Information Security, Data and Network Security, Integrity, and Availability, NIST FIPS 199 Standard, Assets and Threat Models. Control Hijacking– Attacks and defenses, Buffer overflow and control hijacking attacks. FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid‟s algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat‟s and Euler‟s theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

Unit 2

BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY: Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-

Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

Unit 3

HASH FUNCTIONS AND DIGITAL SIGNATURES: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

Unit 4

SECURITY PRACTICE & SYSTEM SECURITY: Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions.

Malicious Software and Software Security- Malicious Web, Internet Security Issues, Types of Internet Security Issues, Intrusion detection system, Computer viruses, Spyware, Key-Loggers, Secure Coding, Electronic and Information Warfare, Trusted systems, Practical implementation of cryptography and security.

Unit 5

E-MAIL, IP & WEB APPLICATION SECURITY: E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec – IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding).

Web Application Security- SQL injection, Cross-site request forgery, Cross-site scripting, Attacks and Defenses, Generating and storing session tokens, Authenticating users, The SSL protocol, The lock icon, User interface attacks, Pretty Good Privacy.

Course outcome:	● Compare various Cryptographic Techniques ● Design Secure applications ● Inject secure coding in the developed applications
Text Book:	1. Cryptography and Network Security- William Stallings, 6 th Edition, Pearson Education, March 2013. 2. William Stallings, Network Security Essentials: Applications and

	Standards, Prentice Hall, 4th edition, 2010.
Reference Book:	1. Behrouz A. Ferouzan, "Cryptography & Network Security" 2. Cryptography – Theory and practice, Douglas R Simson

CS-4103	**Cryptography and Network Security Lab**	**L-T-P-C:0-0-3-2**

Perform encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher. DES algorithm logic, BlowFish algorithm, Rijndael algorithm, RSA Algoithm, Diffie-Hellman Key Exchange mechanism. Calculate the message digest of a text using the SHA-1 algorithm.