Name of the Module: Advanced Numerical Methods  
Module Code: MA 501  
Semester: I  
Credit Value: 3 [P=0, T=0, L=3]  

A. Course of Objectives:  
The course is designed to meet the objectives of:  

a) Introducing the basic concepts of round off error, truncation error, numerical stability and condition, Taylor polynomial approximations; to derive and apply some fundamental algorithms for solving scientific and engineering problems: roots of nonlinear equations, systems of linear equations, polynomial and spline interpolation, numerical differentiation and integration, numerical solution of ordinary differential equations.  
b) Application of computer oriented numerical methods which has become an integral part of the life of all the modern engineers and scientists. The advent of powerful small computers and workstation tremendously increased the speed, power and flexibility of numerical computing.  
c) Injecting future scope and the research directions in the field of numerical methods.  

B. Course Content :  

Algebraic and Transcendental Equations: Definition and sources of errors, solutions of nonlinear equations, Bisection method, Newton's method, fixed point iterations, Regula-Falsi method, convergence analysis, Newton's method for two variables.  

Solution of the system of Linear equations: Gauss elimination method, Gauss Jordan method, Matrix Inversion, Operations Count, LU Factorization method, Gauss-Jacobi and Gauss-Seidel method, Successive Over Relaxation method  


Finite difference schemes for partial differential equations: Discretization, Explicit and Implicit schemes, Consistency, Stability and Convergence, Stability analysis by matrix and Von Neumann methods, Lax's equivalence theorem, Finite difference schemes for initial and boundary value problems - FTCS, backward Euler and Crank-Nicolson schemes, ADI methods for Parabolic and Hyperbolic PDEs, Central difference schemes Elliptic PDEs  

C. Text Books:  
D. Reference Books:


E. Course outcomes:

Upon Completion of the subject:

a) Students will be skilled to do Numerical Analysis, which is the study of algorithms for solving problems of continuous mathematics.

b) Students will know numerical methods, algorithms and their implementation in C++ for solving scientific problems.

c) Students will be substantially prepared to take up prospective research assignments.
Name of the Module: Probability and Random Processes
Module Code: MA 502
Semester: I
Credit Value: 3 [P=0, T=0, L=3]

A. Objectives: The course is designed to meet the objectives of:
   a) imparting theoretical knowledge and practical application to the students in the area of probability and random processes,
   b) introducing the basic notions of probability theory and develops them to the stage where one can begin to use probabilistic ideas in statistical inference and modeling, and the study of random processes,
   c) providing confidence to students in manipulating and drawing conclusions from data and provide them with a critical framework for evaluating study designs and results,
   d) injecting future scope and the research directions in the field of random processes.

B. Course Content:

**Probability-Introduction:** Axiomatic definition of probability; conditional probability, independence and Baye’s theorem, continuity property of probabilities.


**Two and Higher Dimensional Random variable:** Jointly distributed random variables: joint distribution (discrete and continuous), marginal distribution, conditional distributions, expectations, joint moments, transformation of random variables.

**Convergences of random variable:** Convergence in probability and distribution, laws of large numbers, central limit theorem.

**Random process:** Random process; mean auto-correlation and auto-covariance functions; stationary process: wide-sense stationary (WSS) processes and strong – sense stationary process, ergodicity; spectral representation of a real WSS process-power spectral density, cross-power spectral density, Poisson and Markov processes.

C. Textbooks:

D. Reference books


E. Course outcomes:
Upon Completion of the subjects:
  a) students will add new interactive activities to fill gaps that we have identified by analyzing student log data and by gathering input from other college professors on where students typically have difficulties,
  b) students will add new simulation-style activities to the course in Inference and Probability,
  c) students will be substantially prepared to take up prospective research assignments.
Name of the Module: Advanced Discrete Mathematics
Module Code: MA 503
Semester: I
Credit Value: 3 [P=0, T=0, L=3]

A. Course Objectives:
The course is designed to meet with the objectives of:
   a) to extend student’s Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems,
   b) apply logical reasoning to solve a variety of problems.

B. Course Content:


   Basic concepts of set theory, Representations of Discrete Structures, Set operations, Relations and ordering, types of relations, Equivalence classes, Partition of a set, Matrix representation of a relation, Representation of relations by graphs, Functions, Types of functions, Composition and inverse of function and their properties, Characteristic function, Hashing function, Recursive function, Recursion in mechanical theorem proving.

   Algebraic Structures: Introduction, Algebraic systems: Examples and general properties, Semi groups and monoids, Groups, Normal subgroup, Homomorphism, Isomorphism.

   Lattices and Boolean Algebra: Introduction, Lattices as Partially order sets, Properties of lattices, Sub-lattices, lattice Homomorphism, Boolean algebra and its Properties, Boolean Expressions and Boolean Functions, Representation and minimization of circuits, Design examples using Booleanfunction/ Algebra

   Graph Theory: Graph isomorphism, Sub graph, Degree, Walk, Path, Cycle, Connectivity, Cut vertices and cut edges, Trees, Spanning trees, Graph algorithms, Shortest path, Minimal spanning tree, Fundamental circuit.


C. Text Books

D. Reference Books

7. N. Deo, Graph Theory, Prentice Hall of India, 1974.

E. Course outcomes:

Upon completion of the subject:

a) Students will have acquired greater precision in logical argument and have gained a core mathematical understanding of discrete mathematics.

b) Students will have learned and practised basic concepts of mathematical proof (direct proof, proof by contradiction, mathematical induction). Students will be able to handle the standard logical symbols with some confidence.

c) Students will have learned elementary combinatorial and counting techniques and how to apply them to simple problems.

d) Students will be able to simplify complex mathematical expressions and apply general formulae to specific contexts.

e) Students will have learned how to state precisely and prove elementary mathematical statements and solve problems.

f) Students will have a basic understanding of information technology and its use in mathematical contexts.
Name of the Module: Computing Lab  
Module Code: MA 504  
Semester: I  
Credit Value: 1 [P=2, T=0, L=0]

A. Course of Objectives:
The course is designed to meet the objectives of:

a) To increase the Numerical programming skill to solve the various engineering problems,
b) To injecting future scope and the research directions in the field of numerical methods.

B. List of Experiments:

C. Books:

D. Course outcomes:
Upon Completion of the subject:
a) Students will be skilled to do Numerical Analysis, which is the study of algorithms for solving problems of continuous mathematics.
b) Students will know numerical methods, algorithms and their implementation in C++ for solving scientific problems.
c) Students will be substantially prepared to take up prospective research assignments.