SEMESTER 1

13SA11 REAL ANALYSIS

4 0 0 4

BASICS: Elementary set theory, finite, countable and uncountable sets, real number system as a complete ordered field, Archimedean property, supremum, infimum. (10)

METRIC SPACES: Definition and examples, open, closed, compact sets, perfect sets, connected sets. Heine-Borel theorem. Weirstrass theorem. (12)

SEQUENCES AND SERIES: Convergent sequences, subsequences, Cauchy sequences, upper and lower limits. Series – Series of nonnegative terms, the root test and ratio test, power series, summation of parts, absolute convergence, addition and multiplication of series, rearrangements. (12)

CONTINUITY AND DIFFERENTIATION: Continuous functions, continuity and compactness, continuity and connectedness, discontinuities, monotonic functions. Differentiation – mean value theorem, continuity of derivatives, derivatives of higher order, Taylor's theorem (12)

THE RIEMANN STIELTJES INTEGRAL: Riemann Integral - definition and existence of integral, properties of the integral. Riemann Stieltjes Integral– definition, properties, integration and differentiation. (14)

Total L : 60

REFERENCES:

1. Walter Rudin, "Principles of Mathematical Analysis", Mc Graw Hill, New Delhi, 1987.
2. Tom M Apostol, "Mathematical Analysis", Narosa Publishing House, New Delhi, 2002.
3. Murray H Portter," Basic elements of Real Analysis," Springer-Verlag, New York,1998.
4. Binmore K G, "Mathematical Analysis", Cambridge University Press, Cambridge,1999.
5. Sterling K Berberian "Fundamentals of Real Analysis", Springer-Verlag, New York,1999

13SA12 DISCRETE MATHEMATICS

4 0 0 4

MATHEMATICAL LOGIC: Propositional Logic, propositional equivalences, predicates and quantifiers, rules of inference, normal forms. (12)

SETS, FUNCTIONS AND RELATIONS: Set operations, functions, relations and their properties, representing relations using matrices, representing relations using digraphs, equivalence relations, partial orderings. (12)

COMBINATORICS: Basic counting principles, the pigeonhole principle, permutations and combinations, generalized permutations and combinations, generating permutations and combinations. (12)

ADVANCED COUNTING TECHNIQUES: Recurrence relations, solving linear recurrence relations, generating functions, counting problems and generating functions, solving recurrence relations using generating functions, inclusion and exclusion. (12)

GRAPHS: Graphs and graph models, graph terminology and special types of graphs, matrix representation of graphs, isomorphism, connectivity, Euler and Hamiltonian paths, shortest path algorithm. (12)

Total L: 60

REFERENCES:

1 Kenneth H Rosen and Kamala Krithivasan, "Discrete Mathematics and its Applications", Tata McGraw Hill, New Delhi,2011.
2. Doerr Alan and Levasseur Kenneth, "Applied Discrete Structures for Computer Science", Galgotia, New Delhi, 2001.
3. Jonathan L Gross and Jay Yellen, "Graph theory and its Applications," Chapman & Hall, Boca Raton, London, New York, 2006.
4. Alan Tucker, "Applied Combinatorics", John Wiley & Sons, New York, 2003.

13SA13 APPLIED LINEAR ALGEBRA

4 0 0 4

GENERAL VECTOR SPACES: Real vector spaces, Euclidean vector spaces, subspaces, linear independence and dependence, basis and dimension , row space, column space and null space. (14)

LINEAR TRANSFORMATIONS: General linear transformations, kernel and range , rank and nullity , inverse linear transformations, matrices of general linear transformations, similarity, isomorphism. (12)

INNER PRODUCT SAPCES: Inner products, angle and orthogonality in inner product spaces, orthonormal bases, Gram-Schmidt process , QR-decomposition, best approximation: least, squares, change of basis, orthogonal matrices. (12)

EIGENVALUES AND EIGEN VECTORS: Eigenvalues and eigenvectors, diagonalization, orthogonal diagonalization. (8)

APPLICATIONS: Application to differential equations, geometry of linear operators on R2 , least squares fitting to data, approximation problems- Fourier series, constructing curves and surfaces through specified points, electrical networks, geometric linear programming, the earliest applications of linear algebra, cubic spline interpolation. (14)

Total L: 60

REFERENCES:

1. Howard Anton and Chris Rorres, "Elementary Linear Algebra – Applications Version", Wiley India, New Delhi, 2011
2. David C Lay, "Linear Algebra And Its Applications", Pearson Education, New Delhi, 2009
3. Steven J Leon, "Linear Algebra with Applications", Prentice Hall, New Jersey,2006
4. Gareth Williams, "Linear Algebra with Applications", Narosa Publishing House, New Delhi, 2009
5. Gilbert Strang, "Linear Algebra And Its Applications", Thomson Learning, Singapore, 2007
6. Otto Bretscher, "Linear Algebra with Applications", Prentice Hall, New Jersey, 2005

13SA14 NUMERICAL ANALYSIS

4 0 0 4

ERRORS AND APPROXIMATIONS: Definition and sources of errors, propagation, and analysis, errors in summation, stability in Numerical Analysis. (5)

NONLINEAR EQUATIONS: Bisection method, Regula falsi method, Newton's method, Graeffe's method, and Bairstow's method. (8)

SYSTEMS OF LINEAR EQUATIONS: Gaussian Elimination, Pivoting and Scaling in Gaussian Elimination, Variants of Gaussian elimination, error analysis, Gauss Jacobi and Gauss Seidal iteration methods, convergence. (10)

EIGENVALUE PROBLEM: Eigenvalue location, error and stability results, power method and Jacobi method (7)

INTERPOLATION: Finite difference operators, Polynomial Interpolation, Newton's forward, backward and divided difference interpolation formulae, Lagrange interpolation – Interpolation error. (12)

DIFFERENTIATION AND INTEGRATION: Differentiation, Newton-cotes Integration formulas - Trapezoidal rule and Simpson's Rule– Gaussian quadrature. (8)

ORDINARY DIFFERENTIAL EQUATIONS: Taylor series method, Euler and Modified Euler methods, Runge Kutta methods, Milne's method, convergence criteria and error propagation- Boundary value problems. (10)

Total L: 60

REFERENCES:

1. Kendall E Atkinson, "An Introduction to Numerical Analysis", John Wiley & sons Inc., New York, 2001.
2. Curtis F Gerald, Patrick O Wheatley, "Applied Numerical Analysis", Pearson Education, New Delhi, 2003.
3. Richard L Burden and J Douglas Faires, "Numerical Analysis", Thomson Brooks Cole, USA, 2001.
4. Laurence V Fausett, "Applied Numerical Analysis using Matlab", Prentice Hall, New Jercy, 1999.

13SA15 PROGRAMMING IN C

3 0 0 3

INTRODUCTION: C character set, data types, constants, variables, arrays, declarations, storage classes, expressions, statements, symbolic constants, operators and expressions, various types of operators, library functions, data input and output functions. (10)

CONTROL STATEMENTS: conditional branches: if statement, types of if statements, switch case, go to, break and continue, while, do... while, for loop, nested for loops. (4)

ARRAYS: Defining an array, processing arrays, multi dimensional arrays, arrays and strings. (4)

POINTERS: Declaration, pointers to variables, pointers to functions, pointers and 1d array, pointers and multi dimensional array, operations on pointers, array of pointers, passing array of pointers to other functions, dynamic memory allocations. (7)

FUNCTIONS: Defining a function, accessing a function, passing arguments to a function, specifying arguments data types, function prototypes, passing arrays to a function. (6)

STRUCTURES AND UNIONS: Definitions, processing structure, user defined data types, structures and pointers, passing structure to functions, self referential structures and nested structures, Definitions and processing unions, comparison between structures and unions. (6)

FILES: open, close, process, types of files, operations on files. (5)

PRE PROCESSOR DIRECTIVES: command line arguments, I/O manipulators. (3)

Total L: 45

REFERENCES:

1. Kernighan B.W, Ritchie D.M, "C programming language", Pearson education, New Delhi, 2004
2. Herbert Schildt, "C- The complete reference", Tata McGraw Hill, New Delhi, 2002
3. Deitel H M & Deitel P J,"C- How to program", Pearson education, New Delhi, 2001
4. Gottfried, "Programming with C", Tata McGraw Hill, New Delhi, 2004

13SA16 PROFESSIONAL COMMUNICATION

2 0 0 2

READING COMPREHENSION : Reading for Critical purposes. (2)

SCIENTIFIC STYLE: Clarity - simplicity - exactness - brevity -unity - coherence - objectivity. Formal and informal writing (4)

Presentation skills (2)

Introduction to soft skills (2)

Interpersonal- Intrapersonal Communication (2)

Meetings (2)

Professional Report writing (4)

Professional Values and Ethics – Workshop (4)

PRATICALS: Short speeches, group discussions, meetings (8)

Total L: 30

REFERENCES:

1. Teaching Materials prepared by the Faculty, Department of English, PSG College of Technology, Coimbatore, 2013.
2. Rodney Huddleston and Geoffrey K Pullam , " A student's introduction to English Grammar", Cambridge University Press, Cambridge, 2005.
3. Bert Decker, "The Art of Communicating", Decker Communications, 2004.
4. Meenakshi Raman and Sangeetha Sharma, "Technical Communication Principles and Practice", Oxford University Press, USA, 2004.
5. Dr AjayRai, "Effective English for Engineers and Technologies: Reading , writing and Speaking", Crest Publishing House, Delhi, 2003.
6. Paul V Anderson," Technical Communication: A reader – Centered Approach", Asia Pvt Ltd., Boston, 2003
7. Albert Joseph, "Writing process 2000", Prentice Hall, New Delhi.

13SA17 C PROGRAMMING LAB

0 0 3 1.5

LIST OF EXPERIMENTS:

1. Programming concepts involving conditional, control and repetition statements.
2. Handling single dimensional and two dimensional arrays including string operations.
3. Defining and accessing function through call by value and call by reference including passing an array and structure to a function.
4. Recursive programs.
5. Defining and Handling Structures, array of structures and union.
6. Implementation of pointers, operations on pointers and dynamic storage allocation.
7. Programs on I/O Manipulators.
8. Creating and processing data files.
9. Simple programs on preprocessor directives.

Total P: 45

13SA18 NUMERICAL ANALYSIS LAB

0 0 2 1

1. Solution of Non-linear equations (Bisection method, Regula Falsi method, Graeffe's method, Bairstow's method)
2. Solution of system of linear equations (Gauss-Jordan elimination, Gauss Jacobi and Gauss Seidal methods)
3. Finding Eigenvalues and Eigenvectors (Power method and Jacobi method).
4. Interpolation (Newton forward, Newton Backward, Newton divided difference, Lagrange's interpolation)
5. Numerical Intergation (Newton-Cote's quadrature, Gaussian quadrature)
6. Solution of ordinary differential equations (Euler and Modified Euler methods, Runge-Kutta method and Milne's method)

(Coding shall be done using C programming)

Total P: 30

SEMESTER 2

13SA21 TOPOLOGY AND FUNCTIONAL ANALYSIS

4 0 0 4

TOPOLOGICAL SPACES AND CONTINUOUS FUNCTIONS: Topological spaces, basis for a topology, subspace topology, order topology, closed sets and limit points, Hausdroff spaces, product topology, metric topology- continuous functions. (12)

CONNECTEDNESS AND COMPACTNESS: Connected spaces, connected sub sets of the real line, components and local connectedness, compact spaces, compact sub sets of the real line, local compactness. (12)

COUNTABILITY AND SEPARATION AXIOMS: Countability axioms. separation axioms, normal spaces, Urysohn's Lemma, Tietze extension theorem, Uryshon's metrization theorem, Tychonoff theorem. (12)

BANACH SPACES: Definition and examples, continuous linear transformations. Hahn-Banach theorem, the natural imbedding of a normed space in bidual, the open mapping theorem, the closed graph theorem. The Conjugate of an operator. (12)

HILBERT SPACES: Definition and simple properties, orthogonal complements, orthonormal sets, conjugate space, adjoint of an operator, self - adjoint operators, normal and unitary operators, projections. (12)

Total L: 60

REFERENCES:

1. James R Munkres, "Topology - A First Course", Prentice Hall, New Delhi, 2005.
2. George F Simmons, "Introduction to Topology and Modern Analysis", Tata McGraw Hill, New Delhi, 2004
3. Erwin Kreyszig, "Introductory Function Analysis with Applications", John Wiley and Sons, New York, 2005
4. Limaye B V, "An Introduction to Functional Analysis", New Age International, New Delhi, 1996.

13SA22 APPLIED PROBABILITY

4 0 0 4

BASICS OF PROBABILITY: Introduction, conditional probability, random variables, distributions: Binomial, Poisson, geometric, uniform, exponential, normal, Weibull and Erlang (10)

BIVARIATE DISTRIBUTIONS: Joint distributions of two random variables, joint probability mass functions, joint probability density functions, independent random variables: independence of discrete and continuous random variables, conditional distributions: discrete case and continuous case. (10)

EXPECTATION AND VARIANCE: Expected values of sums of random variables, covariance, correlation, conditioning on random variables. (8)

STOCHASTIC PROCESSES: Introduction, Poisson process, Markov chains, classifications of states of Markov chains, absorption probability, period, steady state probabilities. (10)

CONTINUOUS TIME MARKOV CHAINS: Introduction, Kolmogorov forward equation, Kolmogorov backward equation, steady state probabilities, Birth - Death processes. (8)

QUEUEING MODELS: Introduction, characteristics, M/M/1, M/M/1/K, M/M/c, M/M/c/K, M/M/c/c, M/G/1, G/M/1 queueing models. (14)

Total L: 60

REFERENCES:

1. Saeed Ghahramani, "Fundamentals of Probability with Stochastic Processes",Prentice Hall, New Jersy, 2005.
2. Trivedi K.S, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. Sheldon M. Ross, "Stochastic Processes", Wiley India Pvt. Ltd, New Delhi, 2008.
4. Medhi J, "Stochastic Processes", New Age International Publishers, New Delhi, 2008.
5. Minh, D.L (Paul), "Applied Probability Models", Duxbury Thomson Learning, Singapore, 2002
6. Gross D, Harris C.M., "Fundamentals of Queueing Theory", Wiley India Pvt. Ltd, New Delhi, 2009.
7. Sheldon M. Ross, "Introduction to Probability Models", Academic Press, New Delhi, 2003.

13SA23 DIFFERENTIAL EQUATIONS

4 0 0 4

EXISTENCE-UNIQUENESS: Review of exact equations of first order, The method of successive approximations, Lipchitz condition, Convergence of successive approximations, Existence and Uniqueness of solutions for first order initial value problem, Non-local existence of solutions, Existence and uniqueness of solutions to systems, Existence and uniqueness for linear systems, Equations of order n. (10)

SECOND ORDER EQUATIONS: General solution of homogeneous equations, Non-homogeneous equations, Wronskian, Method of variation of parameters, Sturm comparison theorem, Sturm separation theorem, Boundary value problems, Green's functions, Sturm-Liouville problems. (12)

SERIES SOLUTION OF SECOND ORDER LINEAR EQUATIONS: ordinary points, regular singular points, Legendre polynomials and properties, Bessel functions and properties. (10)

SYSTEMS OF DIFFERENTIAL EQUATIONS: Algebraic properties of solutions of linear systems, the eigenvalue-eigenvector method of finding solutions, fundamental matrix solutions, matrix exponential, nonhomogeneous equations, variation of parameters. (10)

PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER: Introduction, Cauchy's problem of first order equations, linear equations of the first order, integral surfaces passing through a given curve, surfaces orthogonal to given system, nonlinear

partial differential equation for first order, compatible systems of first order equations, Charpit's method. Partial differential equations of second order- Linear partial differential equations with constant coefficients. (18)

Total L: 60

REFERENCES:

1. Earl A Coddington , "An Introduction to Ordinary Differential Equations" , Prentice Hall of India Ltd., New Delhi, 2002.
2. Simmons G.F., "Differential Equations with Applications and Historical Notes", Tata McGraw Hill, New Delhi, 2003.
3. Earl A Coddington and Normal Levinson, "Theory of Ordinary Differential Equations", Tata McGraw Hill, New Delhi 2008.
4. Ian Sneddon, "Elements of Partial Differential Equations", Tata McGraw Hill, New Delhi, 2006.
5. George F Simmons, Steven G "Differential Equations –Theory and Practice, Tata McGraw Hill, New Delhi, 2007.

13SA24 DATA STRUCTURES AND ALGORITHMS

3 0 0 3

INTRODUCTION: Data structures, abstract data types, primitive data structures, analysis of algorithms, algorithm design techniques: Divide and Conquer, Greedy method-Back Tracking, Master's theorem. (8)

ARRAYS: Operations, implementation of one, two, three and multi dimensioned arrays, different types of arrays, applications on sets and strings. (3)

STACKS: Primitive operations, sequential implementation, applications. Recursion: definition, process and implementation using stacks. parentheses matching. evaluation of expressions. (4)

QUEUES: Primitive operations, Sequential implementation, priority queues, de queues, applications. (4)

LISTS: Insertion and deletion of nodes , singly linked lists, doubly linked lists, circular lists, multiply linked lists, applications: addition of polynomials; sparse matrix representation. linked stacks. linked queues, linked priority queues. (7)

TREES AND GRAPHS: Terminologies, implementation, Binary tree**:** properties, sequential and linked representation, binary tree operations, traversals, expression trees: definitions and basic terminologies, representation of graphs, graph traversals. (8)

SORTING: Insertion sort, selection sort, shell sort, bubble sort, quick sort, heap sort, merge sort, radix sort, algorithms, analysis. (6)

HASH TABLE: Introduction, operations, implementation. hash table, hash function, internal hashing: open addressing, separate chaining. external hashing: probes for successful search, unsuccessful search. (5)

Total L: 45

REFERENCES:

1. Pai G A V, "Data Structures and Algorithms", Tata McGraw Hill, New Delhi, 2008.
2. Thomas H.Corman, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", PHI Learning Pvt.Ltd, New Delhi, 2009.
3. Aaron M Tanenbaum, Moshe J Augenstein and Yedidyah Langsam, "Data structures using C and C++", Pearson Education, New Delhi, 2004.
4. Sahni Sartaj, "Data Structures, Algorithms and Applications in C++", Mc Graw Hill, New Delhi, 2005.

13SA25 OBJECT ORIENTED PROGRAMMING IN C++

3 0 0 3

INTRODUCTION: Procedure oriented programming, object oriented paradigm, principles and concepts of object oriented programming: objects, classes, inheritance, polymorphism, message passing, abstraction, encapsulation, information hiding, object oriented language, applications of oop. (5)

C++: History of C++, structure and applications of C++, basic data types, tokens, expressions and control structures, operators in C++, manipulators. (3)

FUNCTIONS: Function prototyping, parameter passing mechanisms, returning value from function, returning address from function, return by reference, inline functions, default, constant arguments, function overloading. (3)

CLASSES AND OBJECTS: Class specifications, member function, scope resolution operator, access qualifiers, array of objects, pointers to objects- this pointer. (5)

NESTING MEMBER FUNCTIONS: Private member functions, memory allocation for objects, dynamic memory allocation and dynamic objects- static data members, static member functions, friend function, object as function arguments, returning objects, const member function, pointers to members. (10)

CONSTRUCTORS: Types of constructors, constructors with default arguments, multiple constructors in a class, dynamic initialization of objects, copy and dynamic constructors, destructors, destructors overloading. (4)

POLYMORPHISM: Overloading unary operator and binary operator using operator functions and friend functions, input/output operator overloading, function overloading, template functions and template classes, runtime polymorphism. (5)

INHERITANCE: Defining derived classes, types of inheritance, virtual base classes, virtual function, pure virtual functions, and constructors in derived and base classes, friend class. (7)

EXCEPTION HANDLING: Exception, error, try.. catch, i/o manipulators, file handling. (3)

Total L: 45

REFERENCES:

1. Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley, Newyork, 2004
2. Stanley B Lippman and Josee Lajoie, "The C++ Primer", Addison Wesley, Newyork, 2005
3. Ashok N Kamthane, "OOP with ANSI and Turbo C++", Pearson Education, New Delhi, 2006

13SA26 UNIX AND OOPS LAB

1 0 4 3

UNIX:

1. Shell Script for command line arguments
2. Shell script for string handling
3. Shell script using if.. else and switch case statements
4. Using Looping structures in shell script
5. Menu driven programming using shell script
6. Shell script for file handling

C++.

1. Programs on classes and objects
2. Array of objects
3. Programs using static members and member functions
4. Constructor and destructors
5. Programs with function having arguments and return type as objects.
6. Friend functions, friend class
7. Static and dynamic polymorphism
8. Types of inheritance
9. Virtual function, pure virtual functions, virtual base class
10. I/O Manipulators
11. Exception handling and File handling

Total L: 15 + P: 60= 75

13SA27 RDBMS LAB

2 0 3 3.5

1. Table designing with related queries.
2. Database designing with constraints
3. Functional dependency
4. Referential integrity
5. Multi-valued dependency
6. Creation of view for a table.
7. Definition and creation of procedures
8. Definition of triggers Locks, PL/SQL block, Cursor Management, to handle anomalies.
9. Imposing restrictions on queries for security reasons.
10. Creation of a package by effectively using all the facilities existing in RDBMS.

Total L: 30 + P: 45= 75

13SA28 DATA STRUCTURES LABORATORY

0 0 3 1.5

1. Implementation of one, two dimensioned arrays
2. Sparse Matrix operations using arrays.
3. Program on implementing stacks
4. Implementation on queues and different types of queues
5. Implementing singly ,doubly linked list
6. Singly, doubly linked as stack and queues
7. Binary Search Trees and its operations.
8. Implementation of B Trees.
9. Implementation of BFS and DFS in Graphs.
10. Programs for different types of sorting techniques

Total P: 45

SEMESTER 3

13SA31 COMPLEX VARIABLES AND INTEGRAL TRANSFORMS

4 0 0 4

ANALYTIC FUNCTIONS: Functions of a complex variable, limits and continuity, derivatives, analytic functions - CR equations, harmonic functions . (10)

INTEGRALS: Definite integrals of functions, contour integrals, Cauchy-Goursat theorem, simply and multiply connected domains, Cauchy integral formula, derivatives of analytic functions, Liouville's theorem and the fundamental theorem of Algebra, Maximum modulus principle. (13)

Convergence of series, Taylor series, Laurent series, zeros, Rouche's theorem, singularities and residues, Cauchy residue theorem, evaluation of improper integrals and definite integrals involving sines and cosines, mapping by elementary functions, linear transformation- linear fractional transformation. (13)

INTEGRAL TRANSFORMS: Laplace and Inverse Laplace transforms - properties, Heaviside's unit step function, impulse function, periodic functions, convolution, solution of ordinary differential equations, simultaneous differential equations. (12)

FOURIER TRANSFORMS: Basic properties, Fourier cosine and sine transform, Finite Fourier cosine and sine transform, solution of partial differential equations, Discrete Fourier transform, Fast Fourier transform – DIT algorithm. (12)

Total L: 60

REFERENCES:

1. James ward Brown and Ruel V.Churchill, "Complex Variables and Applications" McGraw-Hill Education, New Delhi, 2004.
2. L.Ahlfors: Complex Analysis, McGraw-Hill, New Delhi, 1979.
3. Dyke P.P.G, "An introduction to Laplace transforms and Fourier series", Springer (India) private Ltd, New Delhi, 2005.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley &Sons, New Delhi, 2011.
5. Ray Wylie C and Louis C Barret, "Advanced Engineering Mathematics", Tata Mc Graw- Hill Publishing Company Ltd, New Delhi, 2003.
6. Lonnie C. Ludeman, Fundamentals of Digital Signal Processing, Wiley-India pvt. Ltd., New Delhi, 2009.

13SA32 OPERATIONS RESEARCH

4 0 0 4

LINEAR PROGRAMMING: Formulation, graphical method, simplex method, two phase method, simplex multipliers, dual and primal, dual simplex method, revised simplex method, Karmarker's algorithm. (14)

NON LINEAR PROGRAMMING: Interval halving method, Fibonacci method, pattern search method – Hooke and Jeeves method, Gradient of a function – Steepest descent method,conjugate gradient method, Fletcher – Reeves method. (10)

DYNAMIC PROGRAMMING: Principle of optimality, backward and forward induction methods, calculus method of solution, tabular method of solution, shortest path network problems, applications in production. (10)

CPM AND PERT: Calculations on CPM networks, various floats for activities, critical path, updating a project, operation time cost trade off curve, project time cost trade off curve, selection of schedule based on cost analysis arrow networks, time estimates, earliest expected time, latest allowable occurrence time and slack of events, critical path, probability of meeting scheduled date of completion of project. (12)

DECISION MAKING : Decisions under uncertainty, under certainty and under risk, decision trees, expected value of perfect information and imperfect information. (8)

ANT COLONY OPTIMIZATION: Ant's foraging behavior and optimization, artificial ants and minimum cost paths, traveling sales man problem, ACO algorithm for traveling sales man problem . (6)

Total L: 60

REFERENCES:

1. Hamdy A Taha, "Operations Research – An Introduction", Pearson Education, New Delhi, 2002
2. Singiresu S Rao, "Engineering Optimization Theory and Practice", New Age International, New Delhi 2004
3. Hillier F and Lieberman G J, "Introduction to Operations Research", Tata Mc Graw Hill, New Delhi, 2012.
4. Kambo N S, "Mathematical Programming Techniques", East West Press, New Delhi, 2006.
5. Kalyanmoy Deb, "Optimization for Engineering Design, Algorithms and Examples", Prentice Hall, New Delhi, 2010.
6. Marco Dorigo and Thomas Stutzle, "Ant Colony Optimization" Prentice Hall , New Delhi, 2005.

13SA33 DATA MINING

3 0 0 3

INTRODUCTION: Data mining, kinds of data, kinds of patterns, major issues in data mining; Data objects and attribute types, measuring data similarity and dissimilarity. (6)

DATA PREPROCESSING: Data preprocessing, data cleaning, data integration, data reduction. (5)

MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic concepts, frequent item set mining methods, apriori algorithm, FP tree, pattern evaluation methods. (9)

CLASSIFICATION: Basic concepts, decision tree induction, Bayes classification methods, model evaluation and selection, metrics for evaluating classifier performance, Holdout methods and Random sub sampling, Cross-validation and ROC Curves, Techniques to improve classification accuracy, Bagging, Boosting and AdaBoost. (9)

CLUSTER ANALYSIS: Cluster analysis, partitioning methods, K-means, K-medoids, hierarchical methods, agglomerative versus divisive hierarchical clustering, density-based methods. (9)

TRENDS IN DATA MINING: Mining distributed, heterogeneous and legacy databases, Multimedia data mining, Data mining and the World Wide Web, Security and Privacy issues for data mining. (7)

Total L: 45

REFERENCES:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining – Concepts and Techniques", Reed Elsevier India, New Delhi, 2012.
2. Bhavani Thuraisingham, "Data Mining – Technologies, Techniques, Tools and Trends", CRC Press, Delhi, 2008.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education, New Delhi 2009.
4. Arun K Pujari, "Data Mining Techniques", University Press, Hyderabad, 2010.
5. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Reed Elsevier India, New Delhi, 2009.

13SA34 SOFT COMPUTING

3 0 0 3

INTRODUCTION: Soft computing constituents and conventional artificial intelligence, neuro fuzzy and soft computing characteristics. (4)

FUZZY SETS: Fuzzy sets, fuzzy rules and fuzzy reasoning, fuzzy inference systems, fuzzy C- means clustering. (15)

NEURAL NETWORKS: Architecture, backpropagation for feedforward networks, supervised learning neural networks, perceptrons, Adaline-, back propagation multilayer perceptrons. (9)

UNSUPERVISED LEARNING: Competitive learning networks, Kohonen self organization networks, learning vector quantization, Hebbain learning, principal component networks, Hopfield network. (9)

GENETIC ALGORITHMS: Fundamentals, encoding, fitness function, reproduction, inheritance operators, cross over, inversion and deletion, mutation operator, bit-wise operators, generational cycle. (8)

Total L: 45

REFERENCES:

1. Jang J.S.R, Sun C.T, Mizutani. E, "Neuro-Fuzzy and Soft Computing", PHI New Delhi, 2012
2. Rajasekaran.S, Vijayalakshmi Pai G.A, "Neural networks, Fuzzy logic, and Genetic algorithms synthesis and applications", PHI New Delhi, 2011.
3. Timothy J Ross, "Fuzzy logic with Engineering Applications-ED3", Wiley, India, New Delhi, 2011.
4. Laurence Fausett, "Fundamentals of Neural Networks: Architecture Algorithms and Applications", Pearson Education, New Delhi, 2004.

13SA36 SOFT COMPUTING LAB

0 0 2 1

Implementation of fuzzy membership function
Plot instances of fuzzy membership function with various values of parameter
Finding fuzzy crossover point and width
Designing and implementing fuzzy inference system
Categorizing data by Fuzzy C means clustering
Implementation of backpropagation networks
Implementation of Kohonen self organization networks
Implementation of Hopfield network
Solving a nonlinear optimization problem using genetic algorithms

Total P: 30

13SA37 JAVA LABORATORY

2 0 3 3.5

1. Implementing Object Oriented Concepts.
2. Implementing Control Statements
3. Implementation of Interface and Package program.

4. Program to handle Built-in and User-defined Exception
5. Multithreading
6. Implementation of Collection interfaces
7. Streams Handling.
8. Applet Implementation with AWT Controls.
9. Design Client/Server application using Socket Programming
10. Implementation of JDBC & Servlets.

Total L: 30 + P: 45= 75

13SA38 MINI – PROJECT & SEMINAR

Mini – project is to be done during the summer vacation at the end of the second semester and a seminar is to be conducted during the third semester.

13SA41 PROJECT WORK

Every candidate shall undertake a project work during the fourth semester. The project work shall be undertaken in an industrial / research organization or in the college in consultation with the faculty guide and the Head of the Department. In case of the project work at industrial / research organization , the same shall be jointly supervised by a faculty guide and an expert from the organization.

ELECTIVES

13SA51 ADVANCED DATA STRUCTURES AND ALGORITHMS

3 0 0 3

INTRODUCTION: Algorithm – analysis of algorithms – best case and worst case complexities, analysis of some algorithms using simple data structures. (4)

AVL TREES : Definition – Height – Searching – Insertion and deletion of elements, AVL rotations – Analysis. (4)

MULTIWAY SEARCH TREES : Indexed Sequential Access – m-way search trees – B-Tree – searching, insertion and deletion - B+ trees - Tries. (6)

GRAPHS : Definition – representations (Adjacency matrix, packed adjacency list and linked adjacency list) – network representation – Graph search methods (Breadth first and depth first traversals). (5)

DIVIDE AND CONQUER : Method – examples – Merge sort, Quick sort, Binary Search. (4)

GREEDY METHOD : Optimization problems – method – examples – Minimum cost spanning tree (Kruskal's and prim's algorithms), Topological sorting, optimal storage on tapes. (4)

DYNAMIC PROGRAMMING: Method – examples – All pairs shortest path problem – Traveling salesman problem. (5)

BACK TRACKING : Method – Examples – Eight queen's problem, Hamiltonian Cycles. (4)

BRANCH & BOUND : Method – Example – 0/1 knapsack (4)

NP-HARD, NP-COMPLETE CLASSES : Basic concepts – Non deterministic algorithms – satisfiability problem – NP-hard and NP-complete Problems – Cooks theorem (informal proof). (5)

Total L : 45

REFERENCES:

1. Sahni Sartaj, " Data Structures, Algorithms and Application in C++", Silicon Press, Hyderabad, 2005.
2. Pai G A V, "Data Structures and Algorithms"', Tata McGraw Hill, New Delhi, 2008.
3. Ellis Horowitz and Sahni Sartaj, " Fundamentals of Computer Algorithms", Galgotia , New Delhi, 1999.
4. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest "Introduction to Algorithms", Prentice Hall, New Delhi, 2009.
5. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, New Delhi, 2007.

13SA52 COMPUTER GRAPHICS

3 0 0 3

GRAPHICS INPUT - OUTPUT DEVICES: Introduction, Raster scan Displays - Random scan displays - Direct view storage tubes –Flat panel displays – Mouse – Track Ball – Joy Stick -Digitizers-Touch panels. (4)

TWO DIMENSIONAL GRAPHICS: Basic transformation - Matrix representation and homogeneous coordinates - composite transformations - Line drawing algorithms: DDA and Bresenham's algorithms - Circle generation algorithms: Midpoint circle algorithm - Point clipping - Line clipping: Cohen Sutherland algorithm - Polygon clipping: Sutherland Hodgeman algorithm - Line covering. (8)

THREE DIMENSIONAL GRAPHICS: 3D transformations - viewing 3D graphical data - orthographic, oblique, perspective projections - hidden lines and hidden surface removal. (4)

CURVES AND SURFACES: Parametric representation of curves - Bezier curves - B-Spline curves - parametric representation of surfaces - Bezier surfaces - curved surfaces - ruled surfaces - quadric surfaces. (7)

RASTER GRAPHICS: Fundamentals: generating a raster image, representing a raster image, scan converting a line drawing, display characteristics, speed of scan conversion, natural images - Solid area scan conversion: Scan conversion of polygons, Y-X algorithm, properties of scan conversion algorithms - Interactive raster graphics: painting model, moving parts of an image, feedback images. (8)

ANIMATION GRAPHICS: Design of Animation sequences - animation function - raster animation - key frame systems - motion specification -morphing - tweening. (7)

COMPUTER GRAPHICS REALISM: Tiling the plane - Recursively defined curves - Koch curves - C curves - Dragons - space filling curves - fractals - Grammar based models - graftals - turtle graphics - ray tracing. (7)

Total L: 45

REFERENCES:

1. Donald Hearn and Pauline Baker M, " Computer Graphics C Version", Pearson Education, New Delhi, 2008.
2. Foley James D, Vandam Andries and Hughes John F, "Computer Graphics : Principles and Practice", Addison- Wesley, New Delhi, 1999.
3. William M Newmann and Robert F Sproull, "Principles of Interactive Computer Graphics", McGraw Hill, New Delhi, 2002.
4. Roy A Plastock , "Computer Graphics", Schaum's series, Tata McGraw Hill Education, New Delhi, 2007.
5. Amarendra N Sinha and Arun D Udai , “Computer Graphics”, Tata McGraw Hill, New Delhi, 2008

13SA53 COMPUTER NETWORKS

3 0 0 3

INTRODUCTION : Network Goals – Applications of Networks – Types of Networks –Network Topologies - OSI Reference Model – TCP/IP Model (6)

DATA COMMUNICATION CONCEPTS: Physical media – Transmission of signals – Bandwidth – Data encoding techniques – Error detection and correction – Theory of frequency and time division multiplexing - Concept of circuit switching and packet switching (10)

LOCAL AREA NETWORKS : Introduction – Advantages of LANs – MAC addresses – Introduction to IEEE standards – IEEE 802.3 , 802.5 – Interconnecting devices: Bridges, switches and routers. (7)

TCP/IP: The need for an internet – Mapping TCP and OSI models – IP Addressing overview – Special Addresses -The IP datagram – Transmission control protocol(TCP) – Ports, connection and endpoints – TCP segment format – UDP – Format of UDP messages (8)

NETWORK APPLICATIONS: Electronic mail – Simple Mail Transfer Protocol(SMTP) - Overview of MIME –Hypertext transfer Protocol(HTTP) – DNS. (7)

NETWORK SECURITY – Introduction – Ciphering techniques – Public key encryption – Digital signatures – Firewalls – IPSec – Concept of VPN. (7)

Total L: 45

REFERENCES:

1. Behrouz A Forouzan , “Data Communication and Networking”, McGraw Hill, New Delhi, 2007
2. William Stallings, “Data and Computer Communications”, Prentice Hall, New Delhi, 2006
3. James F Kurose and Keith W Rose, “ Computer Networking – A Top Down approach featuring the Internet”, Addison Wesley, New Delhi, 2005
4. Alberto Leon Garcia and Indra Widjaja, “Communication Networks: Fundamental Concepts and key architectures”, McGraw Hill, New Delhi, 2006
5. Douglas E Comer, “ Internetworking with TCP/IP”, Prentice Hall, New Delhi, 2003
6. Behrouz A Forouzan, “TCP/IP Protocol Suite”, Prentice Hall, New Delhi, 2008

13SA54 NUMBER THEORY AND CRYPTOGRAPHY

3 0 0 3

MATHEMATICAL BASICS: Divisibility-Division Algorithm, Euclidean Algorithm; Primes-Fundamental Theorem of Arithmetic: Arithmetic function-Euler totient function (n) : Introduction to Congruence- Definition, properties, Ring of integer modulo n, Prime field, Chinese remainder Theorem, Euler, and Fermat Theorem: Primitive roots- Legendre, Jacobi, and Quadratic Reciprocity. (12)

CRYPTOGRAPHIC BASICS: Definitions and Illustrations: Symmetric-Key Cryptography-Classic Ciphers, Stream Ciphers, LFSRs, Modes of Operation, DES, AES - Attacks. (8)

PUBLIC-KEY CRYPTOGRAPHY: Ideas behind PKC, Digital Envelopes and PKCs, RSA Cryptosystem, ElGamal Cryptosystem and Discrete Logs, Elliptic Curve systems. (10)

SIGNATURE SCHEMES: Introduction, ElGamal Signature Scheme, Digital Signature Standard, One-time Signatures, Undeniable Signatures, Fail-stop Signatures: Signatures and Hash functions, The Birthday attack, Discrete Log Hash function, Hash functions from Cryptosystems, Message Digest. (8)

KEY DISTRIBUTION AND KEY AGREEMENT: Introduction, Blom's Scheme, Diffie-Hellman Key Predistribution, Kerberos, Diffie Hellman Key exchange. (7)

Total L: 45

REFERENCES:

1. Richard A. Mollin, " Introduction to Cryptography" Chapman & Hall/CRC, Boca Raton, 2007
2. Douglas R Stinson, "Cryptography Theory and Practice", CRC Press, Boca Raton, 1995.
3. Alfred J, Menezes, Paul C, Van Oorschot and Scott A Vanstone, " Hand Book of Applied Cryptography", CRC Press, Boca Raton, 2010.
4. Neal Koblitz " A course in Number Theory and Cryptography", Springer Verlag, New York, 2004.
5. Josef Pieprzyk, Thomas Harjono and Jenifer Seberry, " Fundamentals of Computer Security", Springer-Verlag, New York, 2009.
6. William Stallings, "Cryptography and Network Security - Principles & Practice", Prentice Hall, New Delhi, 2006.
7. Gustavus J. Simmons, "Contemporary Cryptology" IEEE Press, New Jersey, 1992.

13SA55 DIGITAL IMAGE PROCESSING

3 0 0 3

DIGITAL IMAGE PROCESSING: Elements of a Digital image processing system – Structure of the Human eye – Image formation and contrast sensitivity – Sampling and Quantization – Neighbours of a pixel – Distance measures – Photographic firm structure and exposure – Film characteristics – Linear scanner – Video camera – Image processing applications. (6)

IMAGE TRANSFORMS: Introduction to Fourier transform – DFT – Properties of two dimensional FT – Separability, Translation, Periodicity, Rotation, Average value – FFT algorithm – Walsh transform – Hadamard transform – Discrete Cosine transform. (5)

IMAGE ENHANCEMENT: Definition – Spatial domain methods – Frequency domain methods – Histogram modification technique – Neighborhood averaging – Media filtering – Lowpass filtering – Averaging of multiple images – Image sharpening by differentiation and high pass filtering. (8)

IMAGE RESTORATION: Definition – Degradation model – Discrete formulation – Circulant matrices – Block circulant matrices – Effect of diagnolization of circulant and block circulant matrices – Unconstrained and constrained restorations – Inverse filtering – Wiener filter – Restoration inspatial domain. (8)

IMAGE ENCODING: Objective and fidelity criteria – Basic encoding process – The mapping – The quantizer – The coder – Differential encoding – Contour encoding – Runlength encoding – Image encoding relative to fidelity criterion – Differential pulse code modulation. (8)

IMAGE ANALYSIS AND COMPUTER VISION: Typical computer vision system – Image analysis techniques – Spatial feature extraction – Amplitude and Histogram features. Transform features – Edge detection – Gradient operators – Boundary extraction – Edge linking – Boundary representation – Boundary matching – Shape representation. (10)

Total L: 45

REFERENCES:

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Prentice Hall, New Delhi, 2007.
2. Kenneth R Castleman, "Digital Image Processing", Pearson Education, New Delhi, 2007.
3. Anil K Jain., "Fundamentals of Digital Image Processing", Prentice Hall, New Delhi,1995

13SA56 GRAPH THEORY AND ITS APPLICATIONS

3 0 0 3

BASICS: Introduction to Graph Models, Structure and representation , Euler, Hamiltonian, shortest path algorithms (Revision) (3)

SPANNING TREES: DFS, BFS algorithms, Minimum spanning trees using Prim's and Kruskal's algorithms, cycles and Edge cuts – Applications. (6)

CONNECTIVITY: k connected graphs, characterization of 2-connected graphs, constructing reliable networks (6)

EULER AND HAMILTONIAN GRAPHS: Characterization of Euler graphs, necessary sufficient conditions for the existence of Hamiltonian cycles, Chinese – Postman – problem, approximate solutions of traveling salesman problem. (8)

GRAPH COLORINGS: Vertex colorings, Map – colorings, Edge colorings – Applications. (7)

MATCHINGS: Berge's Theorem, Halls theorem, Tuttes perfect matching theorem – k-matchings (reduction to perfect matching problem), job – assignmet problem. (7)

NETWORK FLOWS AND APPLICATIONS: Flows and cuts in Networks, Maximum – flow problem, flows and connectivity – Applications. (8)

Total L: 45

REFERENCES:

1. Jonathan L. Gross, Jay Yellen, "Graph Theory and its Applications", CRC Press, New York, 2006
2. D.B.West, "Introduction to Graph Theory", Prentice Hall of India, New Delhi, 2004.
3. J.A.Bondy and U.S.R Murty, "Graph Theory", Springer, New York, 2008.

13SA57 INTELLIGENT INFORMATION RETRIEVAL

3 0 0 3

INTRODUCTION: Overview of IR systems - Historical perspectives - Goals of IR - The impact of the web on IR - The role of artificial intelligence (AI) in IR – Experimental evaluation of IR: Performance metrics: recall, precision, and F-measure; evaluations on benchmark text collections - Document representation: Statistical characteristics of text. Basic Query Processing : Query Operations and Languages - Relevance feedback, Query expansion, Query languages - Data Structure and File Organization for IR – Automatic Indexing and Indexing Models. (12)

RETRIEVAL MODELS: Similarity Measures and Ranking - Boolean Matching - Vector Space Models - Probabilistic Models – ranked retrieval; text-similarity metrics - TF-IDF (term frequency/inverse document frequency) weighting - cosine similarity – Basic Tokenizing, Indexing, and Implementation of Vector-Space Retrieval: Simple tokenizing, stop-word removal, and stemming; inverted indices; efficient processing with sparse vectors; Java implementation. (8)

TEXT REPRESENTATION: Word statistics; Zipf's law; Porter stemmer; morphology; index term selection; using thesauri. Metadata and Markup languages (SGML, HTML, XML). (5)

SEARCH AND FILTERING TECHNIQUES: Relevance Feedback - User Profiles - Collaborative Filtering - Document and Term Clustering, Document Categorization. Web Search : IR Systems and the WWW - Search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, Google Page Rank); shopping agents - Heterogeneous Information Sources - Intelligent Web Agents (8)

TEXT CATEGORIZATION AND CLUSTERING: Categorization algorithms: Rocchio; naive Bayes; decision trees; and nearest neighbor. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to information filtering; organization; and relevance feedback. (4)

RECOMMENDER SYSTEMS: Collaborative filtering and content-based recommendation of documents and products. Information Extraction and Integration : Extracting data from text; XML; semantic web; collecting and integrating specialized information on the web. (6)

WEB MINING AND ITS APPLICATIONS (2)

Total L: 45

REFERENCES:

1. Christopher D. Manning, Prabhakar_Raghavan and Hinrich_Schütze, "Introduction to Information Retrieval", Cambridge University Press, Cambridge, 2008.
2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto," Modern Information Retrieval", Addison Wesley, New Delhi, 2011.
3. D A Grossman and O Freider, " Information retrieval: Algorithms and Heuristics", Springer, New York, 2004..
4. Van Rijsbergen C J, "The Geometry of Information Retrieval", Cambridge University Press, Cambridge, 2004.
5. Soumen Chakrabarti, "Mining the Web", Morgan Kaufmann Publishers, 2003.

13SA58 MACHINE LEARNING

3 0 0 3

INTRODUCTION: Overview of machine learning, related areas, applications, software tools (4)

PARAMETRIC REGRESSION: linear regression, polynomial regression, locally weighted regression, numerical optimization, gradient descent, kernel methods. (8)

GENERATIVE LEARNING: Gaussian parameter estimation, maximum likelihood estimation, Bayesian estimation (6)

DISCRIMINATIVE LEARNING: linear discrimination, logistic regression, logit and logistic functions (6)

NEURAL NETWORKS: the perceptron algorithm, multilayer perceptrons, backpropagation, nonlinear regression, multiclass discrimination, training procedures, localized network structure, dimensionality reduction interpretation-Support vector machines (7)

GRAPHICAL AND SEQUENTIAL MODELS: Bayesian networks, conditional independence, Markov random fields, inference in graphical models, belief propagation, Markov models, hidden Markov models, decoding states from observations, learning HMM parameters. (7)

DIMENSIONALITY REDUCTION: feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling, manifold learning. (7)

Total L: 45

REFERENCES:
1. Alpaydin E., Machine Learning, MIT Press, Cambridge, 2010.
2. Bishop C, Pattern Recognition and Machine Learning, Springer, New York, 2006.
3. Duda R, Hart E, and Stork D, Pattern Classification, Wiley-Interscience, New Delhi, 2000.
4. Mitchell T, Machine Learning, McGraw-Hill, New Delhi, 1997.
5. Hastie T, Tibshirani R and Friedman J, Elements of Statistical Learning, Springer, New York, 2001.

13SA59 MATHEMATICAL FINANCE

3 0 0 3

FINANCIAL MATHEMATICS: Introduction, basic terminologies, assumptions, derivative securities. (6)

FORWARD AND FUTURES CONTRACTS: Introduction, forward contract, forward price formula, value of a forward contract, future contract, futures pricing, swaps, value of commodity swap (10)

RISK FREE ASSETS: Introduction, Simple interest, periodic compounding, streams of payments, continuous compounding. Money market: zero coupon bonds, coupon bonds. (10)

PORTFOLIO MANAGEMENT: Introduction, risk and return, expected return, standard deviation as risk measure, two securities, risk and expected return on a portfolio. (8)

OPTION PRICING: Introduction, basic definitions and preliminaries, behavior of option prices with respect to variables, pay-off curves, single period and multi period Binomial lattice models. (11)

Total L: 45

REFERENCES:
1. S. Chandra, S. Dharmaraja, Aparna Mehra and R. Khemchandani, Financial Mathematics – An Introduction, Narosa Publishing House, New Delhi, 2013.
2. Marek Capinski and Tomasz Zastawniak, Mathematics for Finance – An Introduction to Financial Engineering, Springer, United Kingdom, 2011

13SA60 NUMERIC SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS

3 0 0 3

INTRODUCTION TO FINITE-DIFFERENCE METHODS: Direct approximations, Taylor series approach and numerical errors, even grid system, uneven grid system, applications to PDEs – regular boundaries, Dirichlet problems, Neumann problems, applications to PDEs –irregular boundaries, Dirichlet problems, Neumann problems, non-rectangular coordinates, polar coordinates. (11)

ELLIPTIC EQUATIONS: The steady two-dimensional heat equation/ Laplace equation, Poisson equation, direct method, Liebmann's method, successive over-relaxation method, alternating direction implicit method. (12)

PARABOLIC EQUATIONS: The time-dependent one dimensional heat equation/diffusion equation, Two dimensional heat equation, numerical instability, forward time central space method, Crank-Nicolson method. (11)

HYPERBOLIC EQUATIONS: The one dimensional wave equation, Two dimensional wave equation, central time central space method, the method of characteristics, mathematical basis, numerical formations. (11)

Total L: 45

REFERENCES:
1. G. D. Smith, Numerical Solutions to Partial Differential Equations, Oxford University Press, USA, 1986.
2. G. Evans, J. Blackledge, P. Yardley, Numerical Methods for Partial Differntial Equations, Springer, New York, 2001.
3. Chung-Yang Lam, Applied Numerical Methods for Partial Differential Equations, Prentice Hall, New Delhi,1994.

13SA61 STOCHASTIC DIFFERENTIAL EQUATIONS

3 0 0 3

SOME MATHEMATICAL PRELIMINARIES: Probability spaces - Random variables - Stochastic processes – Brownian motion. (7)

ITO STOCHASTIC CALCULUS: Ito Integrals - Construction of its integrals - Properties (9)

THE ITO FORMULA AND THE MARTINGALE REPRESENTATION THEOREM: The one-dimensional Ito formula - The multi-dimensional Ito formula – The Martingale representation theorem. (9)

STOCHASTIC DIFFERENTIAL EQUATIONS: Construction of stochastic differential equations - an existence and uniqueness result- weak and strong solutions. (10)

METHOD OF SOLVING STOCHASTIC DIFFERENTIAL EQUATIONS: Linear stochastic differential equations - Reducible stochastic differential equations - Some explicitly solvable equations. (10)

Total L: 45

REFERENCES:

1. Peter E Kloeden and Eckhard Platen," Numerical Solution of Stochastic Differential Equations", Springer-verlag, New York, 1999.
2. Bernt Oksendal , "Stochastic Differential Equations -An Introduction with Applications", Springer – Verlag, New York, 2003.
3. Sasha Cyganowski, Peter Kloeden and Jerry Ombach, "From elementary Probability to Stochastic Differential Equations with Maple", Springer - Verlag,New York, 2002.

13SA62 WAVELET TRANSFORM

3 0 0 3

CONTINUOUS WAVELET TRANSFORM : Wavelet Transform –a first level introduction – The uncertainty principle and time frequency tiling – properties (4)

DISCRETE WAVELET TRANSFORM: Introduction- Haar scaling functions and function spaces- Nested spaces – Haar wavelet functions- Orthogonality of $\phi(t)$ and $\Psi(t)$ – Normalization of Haar bases at different scales –Daubechies Wavelets (6)

DWT AND RELATION TO FILTER BANKS: MRA- Signal decomposition (analysis)-Signal reconstruction (synthesis) (4)

GENERATING AND PLOTTING OF PARAMETRIC WAVELETS: Introduction – Orthogonality conditions and Parameterization – Polyphase matrix and recurrence relation – Pollen – type parameterization of wavelet bases – precise numerical evaluation of ϕ and Ψ. (8)

BIORTHOGONAL WAVELETS: Introduction- Biorthogonality in vector space- Biorthogonal wavelet system- signal representation using Biorthogonal wavelet systems- Biorthogonal analysis- Biorthogonal synthesis- construction of Biorthonormal wavelet systems (8)

WAVELET PACKET ANALYSIS: Haar wavelet packets-Applications- Best basis selection for signal or image compression (4)

LIFTING SCHEME: Introduction- Geometrical foundations of Lifting scheme – mathematical preliminaries for polyphase factorization (6)

APPLICATIONS: Signal denoising – image compression. (5)

Total L: 45

REFERENCES:

1. Daubechies I, "Ten Lectures on Wavelets", CBMS-NSF Regional Conference Series in Applied Mathematics, 2004.
2. Mallat S, "A Wavelet Tour of Signal Processing", Academic Press, New Delhi, 2009.
3. Soman K P and Ramachandran K I, "Insight into Wavelets", Prentice Hall, New Delhi, 2006.
4. Agostino Abbate, Casimer M, Decusatis and Pankaj K Das, "Wavelets and Subbands : Fundamentals and Applications", Birkhauser, Boston, 2002.
5. Sidney Burrus C, Ramesh A Gopinath and Haitao Guo , "Introduction to Wavelet and Wavelet Transform", Prentice Hall, New Delhi, 1998.
6. David F Walnut, "An Introduction to Wavelet Analysis", Birkhauer, Boston, 2004.

ONE CREDIT COURSES

13SAK01 ABSTRACT ALGEBRA

1 0 0 1

GROUP THEORY: (Revision – Groups, subgroups and cyclic groups, normal subgroups and quotient groups). Sylow's Theorem, Applications (5)

RING THEORY: Definition and examples of rings, Some special classes of rings , ideals and quotient rings , more ideals and quotient rings, the field of quotients of an integral domain, Euclidean rings (7)

FIELDS: Fields, finite fields (3)

Total L: 15

REFERENCES:

1. Herstein I N, "Topics in Algebra", Wiley India (P) Ltd, New Delhi , 2011.
2. John B Fraleigh, "A First Course in Abstract Algebra", Pearson Education, New Delhi, 2003.
3. John A Beachy, William D Blair, "Abstract Algebra", Overseas Press India, New Delhi, 2011.

13SAK02 ALGEBRAIC NUMBER THEORY

1 0 0 1

ALGEBRAIC NUMBERS: Algebraic numbers- Conjugates and Discriminants, Algebraic Integers - Integral Bases - Norms and Traces- Rings of Integers. (4)

QUADRATIC AND CYCLOTOMIC FIELDS: Quadratic fields and cyclotomatic fields (4)

FACTORIZATION INTO IRREDUCIBLES: Trivial factorization - Factroization into irreducible - Examples of non-unique factorization into irreducible, Prime Factroization - Euclidean Domains- Euclidean Quadratic fields – Consequences of unique factorization- The Ramanujan -Nagell Theorem. (7)

Total L: 15

REFERENCES:

1. Steward and D.Tall, "Algebraic Number Theory and Fermat's Last Theorem" A.K.Peters Ltd., Natick, Mass. 2002.
2. Jody Esmonde Ram Murty M, Problems in Algebraic Number theory, Springer, New York 2005
3. Richard A Mollin, "Algebraic Number Theory", CRC Press, Boca Raton,2011

13SAK03 BASICS OF ASTRONOMY

1 0 0 1

SPHERICAL TRIGNOMETRY : Sphere, spherical triangle, polar triangle, Napier's rules. (2)

CELESTIAL SPHERE : Celestial sphere, diurnal motion, celestial axis, equator, celestial horizon, celestial coordinates, four systems of coordinates, sidereal time, latitude of a place, morning and evening stars. (5)

THE EARTH : Zones of earth, terrestrial latitudes and longitudes, radius of earth, rotation of earth, dip of horizon, twilight, Kepler's laws (8)

Total L: 15

REFERENCES:

1. Dinah L. Moche, "Astronomy", John Wiley & Sons, USA, 2000.
2. Karl F. Kuhn and Theo Koupelis, "In quest of the universe", Jones and Bartlett Publishers, USA,2001

13SAK04 FINITE ELEMENT METHOD

1 0 0 1

Approximate methods of analysis, approximating methods, method of weighted residuals, Rayleigh-ritz method. (4)

Different Approches in FEM, introduction, General steps in FEM, Different approches used in FEM. (5)

Finite elements and interpolation functions, interpolation functions, one- dimensional elements, two dimensional elements. (6)

Total L: 15

REFERENCES:

1. Rao S S, "The Finite element Method in Engineering", Pergammon Press, New York, 1989.
2. Reddy J N, "An Introduction to Finite Element Method", McGraw-Hill International Student Edition, New Delhi, 2005.
3. Y.M. Desai, T.I. Eldho, A.H. Shah, "Finite element method with applications in Eigineering", Pearson publisher, New Delhi, 2011.

13SAK05 MEASURE THEORY

1 0 0 1

LEBESGUE MEASURE: Introduction, outer measure, measurable sets and Lebesgue measure, a non-measurable set, measurable functions, Little wood's three principles. (6)

THE LEBESGUE INTEGRAL: The Riemann integral, Lebesgue integral of a bounded function over the set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergence in measure. (9)

Total L: 15

REFERENCES:

1. H.L. Royden, "Real analysis", Pearson Education, New Delhi, 2007.
2. Walter Rudin, "Principles of Mathematical Analysis" , Mc Graw Hill, New Delhi, 1987.
3. Tom M Apostol, " Mathematical Analysis", Narosa Publishing House, New Delhi, 2002.

13SAK06 RELIABILITY ENGINEERING

1 0 0 1

RELIABILITY THEORY: Introduction to reliability, history of reliability, definition of reliability, Hazard rate and mean time to failure, bathtub curve, conditional reliability, normal, exponential and Weibull failure laws. (4)

SYSTEM RELIABILITY : Series system, combined series, parallel systems, high level versus low level redundancy – k – out – of n redundancy, complex configurations, decomposition, enumeration, system structure function, minimal cuts and minimal paths. (6)

STATE DEPENDENT SYSTEMS: Markov analysis, load sharing system, standby systems, degraded systems. (5)

Total L: 15

REFERENCES:

1. Charles E Ebeling, " Reliability and Maintainability Engineering", Tata McGraw Hill , New Delhi 2010,.
2. Trivedi K S, " Probability and Statistics with Reliability, Queueing and Computer Science Applications", Prentice Hall, New Delhi, 2003.

13SAK07 SOFTWARE ENGINEERING

1 0 0 1

SOFTWARE ENGINEERING: Introduction, Project vs Product, project execution types and models. (2)

PROJECT DELIVERY METHODOLOGY: SDLC, Agile, waterfall vs agile, estimation Techniques, WBS, top-down and bottom-up approach, planning/scheduling, artifacts/deliverables, project roles & responsibilities (3)

REQUIREMENTS MANAGEMENT: SRS, FRS, BRD, wireframes, categories, types, requirement gathering/elicitation techniques, requirement traceability matrix (2)

DESIGN & DEVELOPMENT: High-level and low-level design, Architectures, design principles, construction. (2)

RISK, CONFIGURATION AND QUALITY MANAGEMENTS: Types of risks (Quantitative & Qualitative), artifacts vs deliverables, configurable items, release management, ISO Model, ETVX standards. (6)

Total L: 15

REFERENCES:

1. Pressman R S, "Software Engineering – A Practitioner's Approach", McGraw Hill, New Delhi, 2008.
2. Shari Lawrence Pfleeger, "Software Engineering Theory and Practice", Pearson Education, New Delhi, 2006
3. Ian Sommerville, "Software Engineering", Addison Wesley, New Delhi, 2006.

13SAK08 STATISTICAL QUALITY CONTROL

1 0 0 1

FUNDAMENTALS OF STATISTICS: Frequency distribution, Measures of central Tendency – Measures of Dispersion - other Measures – Concept of a population and a sample – Normal curve test for normality. (3)

CONTROL CHARTS FOR VARIABLES: Control chart techniques – State of control – Specifications – Process capability – six sigma – Different Control charts. (4)

CONTROL CHARTS FOR ATTRIBUTES: Control charts for Nonconforming units – Control charts for count of Nonconformities – A quality Rating system. (3)

ACCEPTANCE SAMPLING: Lot – by – Lot – Acceptance Sampling plans for Attributes – for continuous production and for variables. (5)

Total L: 15

REFERENCES:

1. Dale 1 + Bester field, "Quality Control", Pearson Education, New Delhi, 2008
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Eswar Press, Chennai, 2000.

13SAK09 SUPPORT VECTOR MACHINE AND ITS APPLICATIONS

1 0 0 1

SUPPORT VECTOR MACHINE: Introduction, theory of optimization, Lagrange multipliers. (7)

EVOLUTION OF SVM AND APPLICATIONS: Origin of Kernel methods – Support Vector Machine(SVM) – Formulation and Computation – Linear Classifier assuming Complete separability – SVM formulation with two variables – Derivation of Lagrangian Dual form of Linear SVM in matrix form – Non-linear SVM and Kernel trick, Breast Cancer Diagnosis, Classifying Iris Plants using SVM in MATLAB (8)

Total L: 15

REFERENCES:

1. K.P. Soman, R.Loganathan and V.Ajay, "Machine Learning with SVM and Other Kernel Methods", PHI Publications, New Delhi, 2011.
2. Simon O. Haykin, **"**Neural Networks and Learning Machines", Prentice Hall, New Delhi, 2009.