COURSES OF STUDIES

FOR

2 yr. M.Sc.

In

Mathematics & Computing

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

Course Structure for 2Yr M.Sc in Mathematics & Computing

1ST Semester				2nd Semester			
Theory		**Contact Hours**		**Theory**		**Contact Hours**	
Code	**Subject**	**L-T-P**	**Credit**	**Code**	**Subject**	**L-T-P**	**Credit**
MMCC101	Real Analysis	3-1-0	4	MMCC201	Topology	3-1-0	4
MMCC102	Probability	3-1-0	4	MMCC202	Advance Numerical Method	3-0-0	3
MMCC103	Graph Theory	3-1-0	4	MMCC203	Complex Analysis	3-1-0	4
MMCF107	RDBMS	3-0-0	3	MMCC204	Computatio nal Algebra	3-0-0	3
MMCF108	OOPs Using C++	3-0-0	3	MMCC205	Advanced Calculus	3-1-0	4
MMCF109	Theory of Computation	3-0-0	3	MMCF207	Design & Analysis of Algorithm	3-0-0	3
		Total	21			**Total**	21
Practical/Sessional				**Practical/Sessional**			
Code	**Subject**	**L-T-P**	**Credit**	**Code**	**Subject**	**L-T-P**	**Credit**
MMCF151	OOPs Lab	0-0-3	2	MMCC251	MAT Lab	0-0-3	2
MMCF152	RDBMS Lab	0-0-3	2	MMCC252	Numerical Methods lab	0-0-3	2
		Total	4			**Total**	4
		Total	21+4=25			**Total**	21+4=25

3rd Semester				**4th Semester**			
Theory		**Contact Hours**		**Theory**		**Contact Hours**	
Code	**Subject**	**L-T-P**	**Credit**	**Code**	**Subject**	**L-T-P**	**Credit**
MMCC301	Abstract Algebra	3-1-0	4	MMCF407	Soft Computing	3-0-0	3
MMCC302	Functional Analysis	3-1-0	4		Elective-I	3-1-0	4
MMCC303	Partial Differential Equation	3-0-0	3		Elective-II	3-1-0	4
MMCF304	Statistics	3-0-0	3				
MMCF305	Operation Research	3-0-0	3				
MMCF307	Data Communication & networking	3-1-0	4				
		Total	21			**Total**	11
Practical/Sessional				**Practical/Sessional**			
Code	**Subject**	**L-T-P**	**Credit**	**Code**	**Subject**	**L-T-P**	**Credit**
MMCC351	Optimization Lab	0-0-3	2	MMCC451	Seminar (Twice in a Week)		4
MMCC352	Statistical Lab	0-0-3	2	MMCC452	Project		10
		Total	4			**Total**	14
		Total	21+4=25			**Total**	11+14=25

List of Elective-I			List of Elective-II		
Sl. No.	Code	Subject	Sl. No.	Code	Subject
1	MMCE401	Numerical optimization	1	MBEE401	Advanced Software Engineering
2	MMCE402	Computational Finance	2	MBEE402	Parallel & Distributed Computing
3	MMCE403	Bio-Informatics	3	MBEE403	Cloud Computing
4	MMCE404	Big Data	4	MBEE404	Mobile Computing
5	MMCE405	Fuzzy & Rough Set Theory			

MMCC 101 REAL ANALYSIS (3-1-0)

Module – I : (14 Hours)

Lebesgue measure: Introduction, outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable function.

The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, The integral of a non negative function, The general Lebesgue integral.

Module –II : (14 Hours)

Measure and Integration: measure spaces, measureable functions, Integration, General convergence theorem, Signed measures, The Random-Nikodyn theorem, The L^p spaces.

Measure and Outer measure: Outer measure and measurability, The extension theorem, The Lebesgue-Stieltjes integral, Product measures, Integral operators, Inner measure, Extension by sets measure zero.

Module –III : (12 Hours)

Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation.

The Riemann Stieltjes Integrals: Introduction, Notation, The definition of Riemann Stieltjes Integral, Linear operators, Integration by parts, Change of variable in Riemann Stetiltjes integrals, Reduction to a Riemann Integral, Euler's summation formula, Monotonically increasing integrals.

Text Book :

1. Real Analysis by H.L Royden(3rd edition)
Chapter 3(3.1 to 3.5), Chapter(4.1 to 4.4), Chapter(11), Chapter(12.1 to 12.7).
2. Mathematical analysis by Tom M.Apostol,2nd Edition,Addison-Wesley publication company Inc. Newyork,1974.
Chapter6(6.1 to 6.8), Chapter7(7.1 to 7.11)

Reference Book :

1. Bartle, R.G. Real Analysis, John Wiley and Sons Inc., 1976.
2. Rudin,W. Principles of Mathematical Analysis, 3rd Edition. McGraw Hill Company, New York, 1976.
3. Malik,S.C. and Savita Arora. Mathematical Anslysis, Wiley Eastern Limited.New Delhi, 1991.
4. Sanjay Arora and Bansi Lal, Introduction to Real Analysis, Satya Prakashan, New Delhi, 1991.
5. Gelbaum, B.R. and J. Olmsted, Counter Examples in Analysis, Holden day, San Francisco, 1964.

6. A.L.Gupta and N.R.Gupta, Principles of Real Analysis, Pearson Education, (Indian print) 2003.
7.Measure theory and integration by G. De. Barra (willey estern ltd)

MMCC 102 Probability (3-1-0)

Module : I (14 Hours)

Random Variables and Distribution

Random Variable and some important Distributions **;** The Exponential Distribution ; The Reliability, Failure Density and Hazard Function ; Functions of a Random Variable ; Jointly Distributed Random Variables ; Order Statistics ; Distribution of Sums ; Functions of Normal Random Variables.

Expectation

Moments ; Expectation of Functions of More Than One Random Variable ; Inequalities and Limit Theorems.

Module : II (12 Hours)

Conditional Distribution & Conditional Expectation

Introduction ; Mixture Distributions ; Conditional Expectation ; Random Sums.

Stochastic Processes

Introduction ; Classification of Stochastic Processes ; The Bernoulli Process ; The Poisson Process ; Renewal Processes.

Module : III (14 Hours)

Discrete- Parameter Markov Chains

Introduction ; Computation of n-step Transition Probabilities ; State Classification and Limiting Distributions ; Distribution of Times between State Changes ; Irreducible Finite Chains with a periodic States ; Discrete- Parameter Birth-Death Processes ; Finite Markov Chains with Absorbing States : Analysis of Program Execution Time.

Continous - Parameter Markov Chains

The Birth-Death Process, Markov Chains with Absorbing States.

Text Book :

1. Probability & Styatistics with Reliability, Queuing and Computer Science Applications : Kishore S. Trivedi, PHI.

Reference Books :

1. Modern Probability Theory, B. R Bhatt,. , Wiley Eastern.
2. Introduction to Probability Theory and Mathematical Statistics, V. K. Rohatgi, ,

Wiley Eastern.

3. Linear Statistical Inference and Its Applications, C. R. Rao, Wiley Eastern.

MMCC 103 GRAPH THEORY (3-1-0)

Module - I (12 Hours).

Trees and Fundamental Circuits: Definition and properties of trees, Pendant vertices in a tree, distance and centers in a tree, rooted and binary trees, spanning trees, fundamental circuits, Finding all spanning of a graph, spanning trees in a weighted graph.

Module -II (14 Hours)

Cut sets and their properties,all cut sets in a graph, Fundamental circuits and fundamental cut sets, connectivity and separability, Network flows.

Planar and dual graph: Planar graphs,Kuratowski's two graphs, different representation of a planar graph , detection of planarity, geometric dual.

Module -III: (14 Hours)

Matrix representation of a graph:Basic ideas of Incidence matrix, sub matrix, circuit matrix fundamental circuit matrix, cut set matrix, path matrix and adjacency matrix, Coloring :Chromatic number, chromatic partitioning ,chromatic polynomial,matching ,covering.

Text Book :

1. Graph theory with applications to Engineering and Computer science,

Narsingh Deo , PHI.

Chapter-3(3.1-3.5,3.7-3.10), 4 (4.1- 4.6), 5 (5.2-5.6), 7(7.1-7.4), 8(8.1 – 8.5)

Reference Book:

1. Graph theory with applications by C. Vasudev, New Age International Publishers

2. A First look at Graph theory - Johan

MMCF107 Relational Database Management System(3-0-0)

Module I : (10 hours)
Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages. Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II : (10 hours)
Relation Query Languages, Relational Algebra and Relational Calculus, SQL.
Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.
Query Processing Strategy.

Module III: (10 hours)
Transaction processing: Recovery and Concurrency Control. Locking and Timestamp based Schedulers.
Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques

Text Books:

1. Database System Concepts by Sudarshan, Korth (McGraw-Hill Education)

2. Fundamentals of Database System By Elmasari & Navathe- Pearson Education

References Books:

(1) An introduction to Database System – Bipin Desai, Galgotia Publications

(2) Database System: concept, Design & Application by S.K.Singh (Pearson Education)

(3) Database management system by leon &leon (Vikas publishing House).

(4) Fundamentals of Database Management System – Gillenson, Wiley India

(5) Database Modeling and Design: Logical Design by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau, “”, 4th Edition, 2005, Elsevier India Publications, New Delhi

MMCF108 C++ and Object Oriented Programming (3-0-0)

Module I (10 hrs)
Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II (12 hrs)
Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.
Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.
Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.
Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.
Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III (08 hrs)
Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.
Template: template classes, template functions.
Namespaces: user defined namespaces, namespaces provided by library.

Text Books:

1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)

2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:

1. Big C++ - Wiley India

2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)

3. “C++ and Object Oriented Programming” – Jana, PHI Learning.

4. “Object Oriented Programming with C++ “- Rajiv Sahay, Oxford

5. Mastering C++ - Venugopal, McGraw-Hill Education (India)

“Object Oriented Programming with C++”, David Parsons, Cengage Learning.

MMCC 109 THEORY OF COMPUTATION (3-0-0)

Module – I : (10 Hours)

Alphabet, languages and grammars. Production rules and derivation of languages. Chomsky hierarchy of languages. Regular grammars, regular expressions and finite automata (deterministic and nondeterministic). Closure and decision properties of regular sets. Pumping lemma of regular sets. Minimization of finite automata. Left and right linear grammars.

Module – II : (10 Hours)

Context free grammars and pushdown automata. Chomsky and Griebach normal forms. Parse trees, Cook, Younger, Kasami, and Early's parsing algorithms. Ambiguity and properties of context free languages. Pumping lemma, Ogden's lemma, Parikh's theorem. Deterministic pushdown automata, closure properties of deterministic context free languages.

Module – III : (10 Hours)

Turing machines and variation of Turing machine model, Turing computability , Type 0 languages. Linear bounded automata and context sensitive languages. Primitive recursive functions. Cantor and Godel numbering. Ackermann's function, mu-recursive functions, recursiveness of Ackermann and Turing computable functions. Church Turing hypothesis. Recursive and recursively enumerable sets.. Universal Turing machine and undecidable problems. Undecidability of Post correspondence problem. Valid and invalid computations of Turing machines and some undecidable properties of context free language problems. Time complexity class P, class NP, NP completeness.

Text Books:

1.Introduction to Automata Theory, Languages and Computation: J.E. Hopcroft and J.D Ullman, Pearson Education, 3rd Edition.
2.Introduction to the theory of computation: Michael Sipser, Cengage Learning
3.Theory of computation by Saradhi Varma, Scitech Publication

Reference Books:

1.Introduction to Languages and the Theory of Computation: Martin, Tata McGraw Hill, 3rdEdition
2.Introduction to Formal Languages, Automata Theory and Computation: K. Kirthivasan, Rama R, Pearson Education.
3.Theory of computer Science (Automata Language & computations) K.L. Mishra N. Chandrashekhar, PHI.
4.Elements of Theory of Computation: Lewis, PHI
5.Theory of Automata and Formal Languages: Anand Sharma, Laxmi Publication
6.Automata Theory: Nasir and Srimani , Cambridge University Press.
7.Introduction to Computer Theory: Daniel I.A. Cohen, Willey India, 2nd Edition.

MMCF 151 Object Oriented Programming Lab (0-0-3)

1. Programs on concept of classes and objects.(1 class)

2. Programs using inheritance.(1 class)

(i) Single inheritance
(ii) Multiple inheritance
(iii) Multi level inheritance
(iv) Use of virtual base classes

3. Programs using static polymorphism.(1 class)

(i) Function overloading
(ii) Ambiguities while dealing with function overloading

4. Programs on dynamic polymorphism.(1 class)

(i) Use of virtual functions
(ii) Use of abstract base classes

5. Programs on operator overloading.(1 class)

(i) Operator overloading using member operator functions.
(ii) Operator overloading using non member operator functions.
(iii) Advantages of using non member operator functions.

6. Programs on dynamic memory management using new, delete operators.(1 class)

7. Programs on copy constructor and usage of assignment operator.(1 class)

8. Programs on exception handling .(1 class)

9. Programs on generic programming using template function and template class.(1 class)

10. Programs on file handling.(1 class)

MMCF152 Relational Database Managements System Lab(0-0-3)

1. Use of SQL syntax: insertion, deletion, join, updation using SQL. (1 class)
2. Programs on join statements and SQL queries including where clause. (1 class)
3. Programs on procedures and functions. (1 class)
4. Programs on database triggers. (1 class)
5. Programs on packages. (1 class)
6. Programs on data recovery using check point technique. (1 class)
7. Concurrency control problem using lock operations. (1 class)
8. Programs on ODBC using either VB or VC++. (1 class)
9. Programs on JDBC. (1 class)
10. Programs on embedded SQL using C / C++ as host language. (1 class)

MMCC 201 Topology (3-1-0)

Module –I : (14 Hours)

Countable and uncountable set, Infinite sets and the Axiom of choice, Well-ordered sets. Topological spaces, Basis and sub basis for a topology, The order, product and subspace topology, closed sets and limit points. Continues function and homeomorphism, Metric topology, Connected spaces, connected subspaces of the real line, Components and local connectedness.

Module –II : (14 Hours)

Compact spaces, Basic properties of compactness, Compactness and finite intersection property, Compact subspaces of the real line, Compactness in metric spaces, Limit point compactness, Sequential compactness and their equivalence in metric spaces, Local compactness and one point compactification.

Module –III : (12 Hours)

First and second countable spaces, Lindelo''f space, Separable spaces, separable axioms, Hausdorff, Regular and normal spaces. The Urysohn lemma, completely regular spaces, The Urysohn metrization theorem, Imbedding theorem, Tietn extension Theorem, Tychonoff theorem, Stone-Cech campactification.

Text Book :

1. Topology, J.R. Munkhres, 2e, Pearson Education, 2000.

Chapter: 1(7,9,10),2(excluding section 22), 3, 4 (excluding section 36), 5.

Reference Book :

1. Introduction to general Topology, by K.D.Joshi, Wiley Eastern Ltd., 1983.
2. Foundation of General Topology, by W.J. Pervin, Academic Press, 1964.
3. General Topology, by S.Nanda and S.Nanda, Macmillan India.

MMCC 202 Advanced Numerical Methods(3-0-0)

Module –I (10 Hours)

Solution of equations in one and two variables:mullers method,for two variables;fixed pt iteration,Newton's method.

Interpolation;Hermite,cubic spline and piecewise interpolation.

Numerical differentiation;first order derivative,higher order derivative

Module -II :(10 Hours)

Numerical integration;Romberg integration,Gaussian quadrature(2-pt,3-pt,4-pt),asymptotic error formula and their applications ,automatic numerical integral,singular integrals.

Numerical solution to ODE;Multistep methods,midpt method,trapezoidal method,a lower order predictor- corrector method,convergence and stability theory for multistep methods,

Module -III: (10 Hours)

Matrix eigen vaue problem;power method ,shifted power method,inverse power ,RQ-method,error and stability results.

Numerical solution to partial differential equations; parabolic ,elliptic ,Hyperbolic equations using finite difference method.

Text Book ::

1. An Introduction to Numerical Analysis by Kendall E. Atkinson
2. Advanced numerical methods ,L.V. Fusset.

Reference Books :

1.Numerical methods for Scientific and Engineering Computation , M.k.Jain,S.R.K.Iyengar.

2. Numerical methods for Engineers by Chapra & Canale , TMH

MMCC 203 Complex Analysis (3-1-0)

Module-I (14 Hours)

The complex number system: The real numbers, The field of complex numbers, the complex plane, polar representation and roots of complex numbers, Line and half planes in the complex plane. Power series and radius of convergence, analytic function ,Power series representation of analytic functions, Cauchy-Riemann equation , analytic function as mapping and its Mobius transformation.

Module-II (14 Hours)

Complex integration: Zeros of analytic function, entire function, Liouville's theorem, fundamental theorem of algebra, , maximum modulus theorem, Index of a closed curve, Cauchy's theorem and Cauchy's integral formula, Morera's theorem.

Module-III (12Hours)

Classification of singularity, Poles ,absolute convergence, Laurent series development ,Residue theorems, evaluation of integrals by using residue theorem, Argument principle, Rouche's theorem, Maximum Modulus theorem, Schwarz's Lemma.

Text Book :

1. Functions of one Complex variable- J. B. Conway (springer Verlag , International student edition , Narosa Publishing house,

Chapter-1(1.1-1.5),Chapter-3(3.1- 3.3),Chapter-4(4.2 - 4.5),Chapter-5(5.1-5.3) , Chapter-6(6.1 - 6.2).

Reference Books:

1. A Text book of Complex variable: by M.L Khanna (Meerut Publication)

MMCC 204 Computational Linear Algebra (3-0-0)

Module – I (10 Hours)

System of Linear equation, Matrix Algebra, Matrix Equation, Matrix Inversion, Characteristics roots, Canonical forms , Caley -Hamilton Theorem ,Lu Factorization, Application of system of linear equation ,Vectors in n dimensional spaceR_n Linear combination, Linear independence, Linear dependence,

Module – II (10 Hours)

Vector space, Subspace, Basis, Dimension, Coordinates and change of basis, Linear Transformation, Null space and range, Isomorphism, linear transformation, Similarity of Matrix, Application to computer graphics,

Module – III (10 Hours)

Eigen values and Eigen vectors, Diagonalization, Application to Markov Chain, Inner product space, Orthonormal basis, Orthogonal complements, Application to least square approximation. Quadratic form, Singular value decomposition.

Text Book :

1. Introduction to Linear Algebra with Application By :- De Franza, Gagliardi, TMH.

MMCC 205 Advanced Calculi (3-1-0)

Module –I (14 Hours)

Special Function

Some special functions: Bessel's function, Legender polynomial(function),Gamma, Beta, error functions; Integral transforms: Fourier transform , Z-transform

Module –II (14 Hours)

Calculus of variation:

Variation of a functional, Euler-Lagrange equation

Variational problems with fixed boundaries, variational problem with Moving boundaries, sufficient conditions for an extremum, direct methods in variational problem. Variational methods for boundary value problems in ordinary and partial differential equations.

Module –III (12 Hours)

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigen functions, resolvent kernel.
.

Text Books:

1 Linear Integral Equation by Santi Swarup; Krishna publications

2) calculus of variation by A.S. Gupta ;PHI

Chapter-1(1.1-1.6),2(2.1-2.3),3(3.1-3.6),4(4.1-4.2),6(6.1-6.3)

MMCF 207 Design and Analysis of Algorithm (3-0-0)

Module- I: (12 Hours)

Introduction to design and analysis of algorithms, Growth of Functions (Asymptotic notations, standard notations and common functions), Recurrences, solution of recurrences by substitution, recursion tree and Master methods, worst case analysis of Merge sort, Quick sort and Binary search, Design & Analysis of Divide and conquer algorithms.

Heapsort : Heaps, Building a heap, The heapsort algorithm, Priority Queue, Lower bounds for sorting.

Module – II : (16 Hours)

Dynamic programming algorithms (Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence)

Greedy Algorithms - (Assembly-line scheduling, Achivity- selection Problem, Elements of
Greedy strategy, Fractional knapsac problem, Huffman codes).

Data structure for disjoint sets:- Disjoint set operations, Linked list representation, Disjoint set forests.

Module – III : (12 Hours)

Graph Algorithms: Breadth first and depth-first search, Minimum Spanning Trees, Kruskal and Prim's algorithms, single- source shortest paths (Bellman-ford and Dijkstra's algorithms), All- pairs shortest paths (Floyd – Warshall Algorithm). Back tracking, Branch and Bound.

Fast Fourier Transform, string matching (Rabin-Karp algorithm), NP - Completeness (Polynomial time, Polynomial time verification, NP - Completeness and reducibility, NP-Complete problems (without Proofs), Approximation algorithms (Vertex-Cover Problem, Traveling Salesman Problem).

Text Book:

T.H. Cormen, C.E. Leiserson, R.L. Rivest, C.Stein : Introduction to algorithms - 2nd edition, PHI,2002. Chapters: 1,2,3,4 (excluding 4.4), 6, 7, (7.4.1), 8 (8.1) 15 (15.1 to 15.4), 16 (16.1, 16.2, 16.3), 21 (21.1,21.2,21.3), 22(22.2,22.3), 23, 24(24.1,24.2,24.3), 25 (25.2), 30,32 (32.1, 32.2) 34, 35(35.1, 35.2)

Reference Books:

1.Algorithms – Berman, Cengage Learning

2.Computer Algorithms: Introduction to Design & Analysis, 3rd edition-by Sara Baase, Allen Van Gelder, Pearson Education

3.Fundamentals of Algorithm-by Horowitz & Sahani, 2nd Edition, Universities Press.

4.Algorithms By Sanjay Dasgupta, Umesh Vazirani – McGraw-Hill Education

5.Algorithm Design – Goodrich, Tamassia, Wiley India.

MMCC 251 MATLAB LAB(0-0-3)

1. Write a Matlab program to find a Eigen Value by using basic power method.
2. Write a Matlab program to find Eigen Value by Rayleigh Quotient Method.
3. Write a Matlab program to interpolate using the given pair of values of X & Y by Hermite interpolation
4. Write a Matlab program to interpolate a set of data using Trigonometric Polynomial.
5. Write a Matlab program to find the FFT for the given data points.
6. Write a Matlab program to find the solution of heat Equation using explicit & implicit method.
7. Write a Matlab program to find the solution of linear programming problem.
8. Write a Matlab program to find the solution of Integer programming problem.
9. Write a Matlab program to find the solution of Travelling Salesman problem.
10. Write a Matlab program to find the solution of Quadratic programming problem

MMCC 252 NUMERICAL METHODS LAB(0-0-3)

1. Write a computer oriented algorithm & the corresponding C Program to fit a st. line of the form y = a x + b, for a given data, using the method of least square.
2. Write a computer oriented algorithm & the corresponding C Program to fit a nth degree polynomial of the form $y = \sum_{i=0}^{n} c_i x^i$ for a given data by the method of least square.
3. Write a computer oriented algorithm & the corresponding C Program to find the smallest positive root using fixed point iteration method.
4. Write a computer oriented algorithm & the corresponding C Program to find the smallest positive root using Newton- Raphson method.
5. Write a computer oriented algorithm & the corresponding C Program to find the solution of the system of linear equations using Gauss Seidel Method.
6. Write a computer oriented algorithm & the corresponding C Program to interpolate y using the given pair of values of x and y by Lagrange's interpolation.
7. Write a computer oriented algorithm & the corresponding C Program to find the derivative at the initial point using Newton 's Forward Difference Method.
8. Write a computer oriented algorithm & the corresponding C Program to find the derivative at the final point using Newton 's Backward Difference Method.
9. Write a computer oriented algorithm & the corresponding C Program to integrate Numerically using Trapezoidal & Simpson's Rule.
10. Write a computer oriented algorithm & the corresponding C Program to integrate Numerically using Gauss Quadrature Rule.
11. Write a computer oriented algorithm & the corresponding C Program to solve the Differential Equation. $\frac{dy}{dx} = f(x, y),\ y(x_0) = y_0$ at the specified pivotal points by using the Runge-Kutta Method of 4th order.

COURSES OF STUDIES

FOR

2 yr. M.Sc.(2nd yr)

In

Mathematics & Computing

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

MMCC-301 ABSTRACT ALGEBRA (3-1-0)

Module-I (14 hours)

Normal subgroup, Isomorphism theorem, Automorphisms, Permutation group: Cyclic decomposition and Alternating group A_n. Structure theorems for groups: Direct Product, finitely generated abelian group. Structure theorem for groups: Invariants of a finite abelian group, Sylows theorem. Unique factorization domain, Principal ideal domain, Euclidean domains, polynomial rings over UFD.

Module-II(13 hours)

Algebraic extension of fields: Irreducible polynomials and Einstein criterion, Adjunction of roots, Algebraic extension. Algebraically closed fields, Normal separable extensions: splitting fields, normal extensions. Normal separable extension: Multiple roots, Finite fields, Separable extensions.

Module-III (13hours)

Galois Theory: Automorphism groups and fixed field s, Fundamental theorem of Galois theory. Application of Galois theory to classical problems: Roots of unity and Cyclotomic polynomials, Cyclic extensions, Polynomials solvable by radicals, Symmetric functions, Ruler and compass constructions.

Text Book

P.B. Bhattacharya, S.K Jain and S.R.Nagpaul: Basic Abstact Algebra, Cambridge University Press. Chapter : 5 (Art 2,3), 7(Art 1,2), 8(Art 1-4), 11 (Art 1-4), 15(Art 1-3), 16(Art 1,2), 18(1-5).

Reference Books:

1. **Vivek Sahai and Vikas Bist :** Algebra (Narosa publication House).

2. **I.S. Luthar and I.B.S. Passi :** Algebra Vol. 1 Groups (Narosa publication House).

3**. I.N. Herstein :** Topics in Algebra (Wiley Eastern Ltd.).

4. **Surjit Singh and Quazi Zameeruddin :** Modern Algebra (Vikas Publishing House).

5. **S.K. Jain & S.R. Nagpal :** Basic Abstract Algebra (Cambridge University Press 1995).

MMCC – 302 FUNCTIONAL ANALYSES (3-1-0)

MODULE-I(14 Hours)

Normed spaces, continuity of linear maps, Hahn-Banach theorems, Banach spaces.

Uniform bounded principle, Application-Divergencce of Fourier Series of Continuous Functions, closed graph theorem, open mapping theorem, bounded inverse theorem, Spectrum bounded Operator.

MODULE-II(13 Hours)

Duals and transposes, duals of $L^p[a,b]$ and $C[a,b]$.

Inner product spaces, orthonormal sets, approximation and optimization, projections, Riesz representation theorem.

MODULE-III(13 Hours)

Bounded operators and adjoints on a Hilbert space, normal, unitary and self adjoint operators.

Text book :

B. V. Limaye : Functional Analysis (2nd Edition)- New Age International Limited.

Chapter-2 (5-8), chapter-3 (9-12), chapter-4 (13,14), chapter-6 (21-24), chapter-7 (25,26)

Reference book :

1) Erwin Kreyszig, Introductory Functional Analysis with Applications, John Wiley and Sons (Asia), pvt.ltd., 2006.
2) John B. Conway, A course in Functional Analysis, 2nd edition, Springer verlag, 2006

MMCC-303 PARTIAL DIFFERENTIAL EQUATIONS (3-0-0)

MODULE-I(10 Hours)

PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER: Formation and solution of PDE- Integral surfaces - Cauchy Problem order equation -Orthogonal surfaces - First order non-linear - Characteristics Compatible system -Charpits method. Classification of Second order PDE-Canonical forms-Adjoint operators-Riemans method.

MODULE-II(10 Hours)

ELLIPTIC DIFFERENTIAL EQUATIONS: Derivation of Laplace and Poisson equation - BVP - Separation of Variables - Dirichlet's,Problem and Newmann Problem for a rectangle - Solution of Laplace equation in Cylindrical and spherical coordinates - Examples.

PARABOLIC DIFFERENTIAL EQUATIONS: Formation and solution of Diffusion equation - Dirac-Delta function - Separation of variables method - Solution of Diffusion Equation in Cylindrical and spherical coordinates - Examples.

MODULE-III(10 Hours)

HYPERBOLIC DIFFERENTIAL EQUATIONS: Formation and solution of one-dimensional wave equation - canocical reduction - IVPd'Alembert's solution - IVP and BVP for two-dimensional wave equation – Periodic solution of one-dimensional wave equation in cylindrical and spherical coordinate systems - Uniqueness of the solution for the wave equation - Duhamel's Principle -Examples.

Text Book

K. Sankar Rao, Introduction to Partial Differential Equations, 2nd Edition, Pearson India, New Delhi. 2005

Chapters: 0: (0.4 to 0.11 ,(omit 0.11.1)), 1 : (1.1 to 1.5), 2 : (2.1, 2.2 , 2.5 to 2.7, 2.10 to 2.13) , 3 : (3.1 to 3.7 and 3.9), 4: (4.1 to 4.12 ,(omit 4.5, 4.6 & 4.10)).

Reference Books

1. **R.C.McOwen,** Partial Differential Equations, 2nd Edn. Pearson Eduction, New Delhi,2005.

2**. I.N.Sneddon**, Elements of Partial Differential Equations, McGraw Hill, New Delhi,1983.

3**. R. Dennemeyer**, Introduction to Partial Differential Equations and Boundary ValueProblems, McGraw Hill, New York, 1968.

4. **M.D.Raisinghania**, Advanced Differential Equations, S.Chand & Company Ltd., NewDelhi, 2001.

MMCC- 304 STATISTICS (3-0-0)

MODULE:-I(12 Hours)

Random Sampling ,some important statistics ,sampling distributions , sampling distributions of Means, sampling distribution of S^2 , t distribution , F distribution.Classical Methods of Estimations , estimating mean of a single Sample, standard Error of a point estimate, prediction intervals ,Tolerance limits , Estimating the difference between Two means of Two samples , Paired observations ,Estimating a proportion and variance of a single sample , Estimating the difference between two proportions of two samples, Estimating the ratio of Two variances, Maximum likelihood Estimations .

MODULE:-II(10 Hours)

Statistical Hypothesis ,Testing of Statistical Hypothesis, one and two tailed test, Use of P – values for decision making in testing hypothesis, Test concerning a single mean when variance is known and unknown ,Confidence interval & relationship to Confidence interval estimations, Two Samples : Test on Two means , Test on single proportions, test on two proportions, one and two sample tests concerning variances, Goodness of Fit test, test for independence .

Introduction to Linear regression , The simple Linear regression models, Least square & Fitted models , properties of least square Estimators , inference concerning the regression coefficients , prediction , choice of regression models ,analysis of Variances approach, , simple linear regression case study, Correlation

MODULE:-III(8 Hours)

Multiple Linear regression and certain nonlinear regression model: Introduction, estimating the coefficients, Linear regression models using matrices, properties of least square Estimators ,inferences in multiple linear regression, choice of fitted model through hypothesis testing,Special case of Orthogonality, special nonlinear models for non ideal conditions ,potential misconceptions and hazards .

TEXT BOOK :-

1. R.E.Walpole, R.H.Myers,S.l.Myers. Probability and Statistics for Engineers & Scientists, 8th edition, Pearson Education

Chapters:8,9,10,11,12,

REFERENCE BOOK:

1. Rohatgi, V. K. Introduction to theory of probability and Mathematical Statistics (John Wiley & Sons)
2. Wilks, S. S. Mathematical Statistics (John Wiley)
3. Gupta & kapoor :- Mathematical Statistics
4. Taylor, H. M. and Karlin, S. (1984) An Introduction to Stochastic Modelling. (Academic Press)
4. Bhat B.R. :Stochastic Models: Analysis and Applications (New Age Internationals)
5. Morrison, D.F.(1990) Multivariate Statistical Methods (McGraw Hill Co.)(3rd ed.)

MMCC- 305 OPERATIONS RESEARCH (3-0-0)

Module-I (10 Hours)

Modeling of problems and principle of modeling. **Linear programming**: Formulation of LPP, Graphical solution, Simplex method, BigM method, II Phase method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method.

Module -II (10 Hours)

Assignment problems: Hungarian method for solution of Assignment problems.
Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems.
Simulation and Modeling : Introduction to simulation and modeling.
Markov analysis : Introduction to markov processes, State and Transition Probabilities, Transition Diagram, n-step transition probabilities.

Module -III (10 Hours)

Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline. **Non-linear programming**: Introduction to non-linear programming. **Unconstraint optimization**: Fibonacci and Golden Section Search method. **Constrained optimization with equality constraint**: Lagrange multiplier, **Constrained optimization with inequality constraint**: Kuhn-Tucker condition.

Recommended text books

1. A. Ravindran, D. T. Philips, J. Solberg, *" Operations Research- Principle and Practice*", Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, " *Optimization for Engineering Design*", PHI Learning Pvt Ltd

Recommended Reference books:

1. **S**tephen G. Nash, A. Sofer, *" Linear and Non-linear Programming*", McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," *Engineering Optimization*", Second edition, Wiley India Pvt. Ltd
3. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, "*Operations Research*", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, *" Operations Research*", Eighth Edition, Tata McDraw Hill
5. P.K.Gupta, D.S.Hira, "*Operations Research*", S.Chand and Company Ltd.
6. Kanti Swarup, P. K. Gupta, Man Mohan, "*Operations Research*", Sultan Chand and Sons.

MMCF 307-DATA COMMUNICATION & NETWORKING (3-1-0)

Module – I(14 Hrs)

Overview of Data Communications and Networking. Physical Layer : Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals. Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing : FDM , WDM , TDM , Over view of OSI Model

Module –II (13 Hrs)

Data Link Layer Error Detection and correction: Types of Errors, Detection, Error Correction Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC. Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack, Multiple Access and Random Access,

Module – III (13 Hrs)

Network Layer: Host to Host Delivery: Internetworking, addressing and Routing Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6 Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service.

Application Layer :

Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) ,HTTP

Text Books:

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th Ed

3. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed

Reference Book :

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India .

MMCC 351 Optimization Lab (0-0-3)

1. Introduction to linear programming problem , solving lpp by mat lab(Introduction)
2 Solve various simplex problem using mat lab Function
3. Solve Transportation and assignment problem using ,Any suitable simulator
4 Compare. between Transportation ,Assignment problem by Using mat lab
5 Explore queuing theory for scheduling, resource allocation, and traffic flow applications using mat lab
6 Elementary concept of Modelling and Simulation using Mat-lab
7 Solve Various Decision Problem Using mat lab
8 Introduction to Non linear Programming by any suitable simulator
9 Iterative method for optimization problem by any suitable simulator
10 Application of non linear programming using Mat lab

MMCC 352 Statistical Lab (0-0-3)

1. Introduction to statistical problem by mat lab.
2. Finding Correlation ,Regression by the use of mat lab.
3. T- test , Chi square test by using mat lab.
4. Testing of hypothesis, confidence interval by using mat lab.
5. Statistical validation of various types of data by using mat lab.
6. Design and modeling of Binomial and Poisson distribution by mat lab.
7. Generation of random numbers , by any simulator.
8. Simple integration by random numbers ,mat lab implementation.
9. Finding 1^{st},2^{nd} moments by using mat lab.
10. General statistical application in validation of medical related data.

MMCF-407 SOFT COMPUTING (3-0-0)

Module - I (12 Hrs.)

Introduction to Soft Computing, Artificial Neural Network(ANN) : Fundamentals of ANN, Basic Models of an artificial Neuron, Neural Network Architecture, Learning methods, Terminologies of ANN, Hebb network, Supervised Learning Networks: Perception, MLP, Architecture of a Back propagation Network : back propagation, Learning Effect of Tunning parameters of the Back propagation, Adaline , Madaline, RBF Network, Associative memory: Auto, hetero and linear associative memory, network, Adaptive Resonance Theory ART1, ART2, Applications .

Module - II (12 Hrs.)

Fuzzy logic Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, De fuzzi fication Methods, Fuzzy rule based reasoning GENETIC ALGORITHMS Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modelling : Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA..

Module – III (6 Hrs.)

Hybrid Soft Computing Techniques Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based back propagation Networks: GA based weight determination applications: Fuzzy logic controlled genetic Algorithms soft computing tools, Applications.

Text Book : Principles of Soft Computing- S.N.Sivanandan and S.N.Deepa, Wiley India, 2nd Edition,2011

Reference Book :

1. Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI
2. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. Vijayalakshmi Pai, Phi.

ELECTIVE-I

MMCE- 401 NUMERICAL OPTIMIZATION (3-1-0)

Module – I: **(14 hrs)**

Introduction; Continuous versus Discrete optimization, constrained and unconstrained optimization, global and local optimization ,stochastic and deterministic optimization, optimization algorithms , convexity ,line search methods

Module – II: **(14 hrs)**

Conjugate Gradient Methods, Practical Newton methods, Quasi –Newton methods. Calculating derivatives.

Module – III: **(12 hrs)**

Non linear Least-squares problem; Modeling, the Gauss-Newton method, large-residual problems; Non linear equation; Newton's method for non-linear equation, Inexact Newton methods , tensor methods.

Text book: 1 .**Numerical Optimization by***Jorge Nocedal,Stephen J. Wright,* **Springer publication**.

Reference Book : 1.Numerical optimization with applications by Suresh Chandra, Jayadeva,Aparna Mehra , Narosa publication.

MMCE-402 COMPUTATIONAL FINANCE (3-1-0)

Module-I(14 Hr.)

Stochastic process: Markov process, Wiener process, Geometric Brownian Motion, Ito Integral, Ito's Lemma.

Basic concepts of financial- Stock options, Forward and Futures, Speculation, Hedging, put-call parity, Principle of non-arbitrage pricing, Computation of volatility.

Module-II(14 Hr.)

Derivation of black- scholes differential equation and Black-scholes Option Pricing formula, Greeks and Hedging strategies.

Module-III(12 Hr.)

Finite difference methods for partial differential equations-finite difference approximation to derivatives, Explicit and implicit and methods for parabolic equations, Iterative methods for solution of a system of linear algebraioc equations, Two dimensional Parabolic equations- alternating – directimplicit method, Convergence, Stability and Consistency of finite difference schemes.

Text Book : 1 .J. BAX and G. Chacko-Financial Derivatives : Pricing, Application and Mathematics-Cambridge Univ. Press, 2004.

2. G. D. Smith : Numerical Solution of Partial Differential Equations, Oxford University Press.

3. P. Wilmott : Qualitative Finance-John Wiley, 2000.

4. P. Copinsui and T. Zastawrian : Mathematics for Finance-an Introduction to Financial Engineering, Springer Verlag.

5. J. C. Hull : Options, Futures and others Derivatives-PHI, 2003

MMCE- 403 BIOINFORMATICS (3-1-0)

Module-I(14 hours)

Molecular Biology and Biological Chemistry: The Genetic Material, Gene structure and Information Content, Protein Structure and Function, The nature of Chemical bonds, Molecular Biology Tools, Genomic Information Content, *Data Searches and Pairwise Alignments*: Dot Plot, Simple Alignments, Gaps, Scoring Matrices, Needleman and Wunsch Algorithm, Global and local Alignments, Database searches, Multiple sequence Alignments, *Substitution Patterns*: Patterns of substitutions within Genes, Estimating Substitution numbers, Variations in evolutionary rates between Genes, Molecular clocks, evolution in Organelles.

Module-II(14 hours)

Distance based methods of Phylogenetics: History of Molecular Phylogenies, Phylogenetic trees, Distance matrix methods, Maximum likelihood approaches, Multiple sequence Alignments, *Character Based methods of Phylogenetics*: Parsimony, Inferred ancestral sequences, Strategies for Faster searches, Consensus trees, tree confidence, Comparison of Phylogenetic methods, Molecular Phylogenies.

Module-III(12 hours)

Genomics and Gene Recognition: Prokaryotic genomes, Prokaryotic gene structure, GC-content Prokaryotic genomes, Prokaryotic gene density, Eukaryotic genomes, Eukaryotic gene structure, Open reading frames, GC-content Eukaryotic genomes, Gene expression, Transposition, Repetitive elements, Eukaryotic gene density, *Protein and RNA structure prediction*: Amino acids, Polypeptide composition, Secondary structure, Tertiary and quaternary structure, Algorithms for Modeling Protein Folding, Structure prediction, Predicting RNA secondary structures, *Proteomics*: from Genomes to Proteomes, Protein classification, Experimental techniques, Inhibitors and drug design, Ligand screening, X-ray crystal structures, NMR structures, Empirical methods and prediction techniques, Postranslational modification prediction.

.

Text Books:

1. Dan E. **Krane**, Michael L. **Raymer**, "*Fundamental Concepts of Bioinformatics*", First Edition, 2003, Pearson Education, Inc. New Delhi.
2. Teresa **Attwood**, David **Parry-Smith**, "*Introduction to Bioinformatics*", 1999, Pearson Education, Inc. New Delhi.

Reference Books:

1. Shuba **Gopal**, A. **Haake**, R. P. **Jones**, P. **Tymann**, "*Bioinformatics: A Computing Perspective*", First Edition, 2009, McGraw-Hill Education (India), New Delhi.
2. Yi-Ping P. **Chen**, "*Bioinformatics Technologies*", 2006, Springer India Pvt. Ltd., New Delhi.
3. Arthur **Lesk**, "*Introduction to Bioinformatics*", 2009, Oxford University Press, ISBN-13: 978-0199208043.
4. Bryan **Bergeron**, "*Bioinformatics Computing*", 2003, PHI Learning. New Delhi.
5. Zoe Lacroix, Terence Critchlow, "*Bioinformatics: Managing Scientific data*", 2009, Elsevier India Pvt. Ltd., New Delhi.

MMCE 404 BIG DATA (3-1-0)

MODULE – I(14 HR.)

What is Big data , challenges in processing big data ,Technology and support for big data Hadoop, History and use case of Hadoop , Hardware Recommendation and statistics

MODULE –II(14 HR.)

Hadoop and distributed file system, Significance of HDFS in Hadoop , Features of HDFS ,Data storage in HDFS (Introduction about blocks , Data replication), Accessing HDFS (CLI(Command line interface)and JAVA based approach).

MODULE –III(12 HR.)

Map Reduce Architecture ,Performance and working features of map reduce, Map reduce programming model PIG(Introduction to apache PIG ,Map reduce versus Apache Pig, Different data types in Pig, Introduction to hive and hive architecture.

TEXT BOOKS :

1. Big Data: A Revolution That Will Transform How We Live, Work, and Think.
   Book by Kenneth Cukier and Viktor Mayer-Schönberge

References:

1. Big Data Imperatives, Soumendra Mohanty, Madhu Jagadeesh, Harsha Srivatsa, Apress, e-book of 2012
2. Big Data Analytics:Disruptive Technologies for Changing the Game, *Dr. Arvind Sathi,,* First Edition
   October 2012, IBM Corporation
3. Mining of Massive Datasets, Anand Rajarama, Jure Leskovec, Jeffrey D. Ullman.E-book, 2013

MMCE 405 Fuzzy and Rough Set Theory (3-1-0)

Module-I (13 hours)

Crisp sets and Fuzzy sets **:** Introduction – crisp sets an overview – the notion of fuzzy sets –basic concepts of fuzzy sets – membership functions – methods of generating membership functions – defuzzification methods- operations on fuzzy sets - fuzzy complement – fuzzy union – fuzzy intersection – combinations of operations – General aggregation operations.

Module-I (15 hours)

Fuzzy arithmetic and Fuzzy relations: Fuzzy numbers- arithmetic operations on intervals- arithmetic operations on fuzzy numbers- fuzzy equations- crisp and fuzzy relations – binary relations – binary relations on a single set – equivalence and similarity relations – compatibility or tolerance relations. Fuzzy measures – belief and plausibility measures – probability measures – possibility and necessity measures – possibility distribution - relationship among classes of fuzzy measures.

Module-I (12 hours)

Fuzzy Logic and Applications **:** Classical logic : an overview – fuzzy logic – approximate reasoning - other forms of implication operations - other forms of the composition operations – fuzzy decision making –fuzzy logic in database and information systems - fuzzy pattern recognition – fuzzy control systems.

Text Book:

1. George J Klir and Tina A Folger , Fuzzy sets, Uncertainty and Information, Prentice Hall of India, 1988.
2. H.J. Zimmerman, Fuzzy Set theory and its Applications, 4th Edition, Kluwer Academic Publishers, 2001.
3. Goerge J Klir and Bo Yuan , Fuzzy sets and Fuzzy logic: Theory and Applications. Prentice Hall of India, 1997.

Reference Book :

1. Hung T Nguyen and Elbert A Walker, First Course in Fuzzy Logic, 2nd Edition , Chapman & Hall/CRC, 1999.
2. Jerry M Mendel, Uncertain Rule – Based Fuzzy Logic Systems ; Introduction and New Directions, PH PTR, 2000.
3. John Yen and Reza Langari, Fuzzy Logic : Intelligence Control and Information, Pearson Education, 1999.
4. Timothy J Ross, Fuzzy Logic with Engineering Applications, McGraw Hill International Editions, 1997.

ELECTIVE - II

MBEE 401: ADVANCED SOFTWARE ENGINEERING (3-1-0)

Module-I (15 hours) Introduction: Object orientation & Object oriented development, Modeling Concepts: Modeling as a design technique, Class Modeling, advanced class modeling, State Modeling, advanced State Modeling, Interaction Modeling, advanced Interaction Modeling.

Module-II (13 hours) Analysis and Design: Process overview, system Conception, Domain Analysis, System Design, Class design.

Module-III (12 hours) Implementation: Implementation Modeling, Object Oriented (OO) Languages, Databases, Programming Style.

Text Books: 1. Michael R. Blaha and James R Rambaugh, "Object-Oriented Modeling and Design with UML", Second Edition, 2005, Pearson Education, Inc. New Delhi. Chapters: 1 to 8, 10, 11, 12, 14, 15, 17, 18, 19, 20.

2. Mark Priestley, "Practical Object-Oriented Design with UML", Second Edition, 2006, McGraw-Hill Education, India. New Delhi.

Reference Books: 1. Grady Booch, "Object-Oriented Analysis and Design with Applications", Third Edition, 2007, Pearson Education, Inc. New Delhi.

2. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, 2005, Pearson Education, Inc. New Delhi.

3. Mike O'Docherty, "Object Oriented Analysis and Design: Understanding System Development with UML 2.0", 2005, Wiley India Pvt. Ltd., New Delhi.

4. John W. Satzinger, Robert B. Jackson, Stephen D. Burd, "Object-Oriented Analysis and Design with the Unified Process", 2006, CENGAGE Learning India Pvt. Ltd., New Delhi.

5. James Rumbaugh, Grady Booch, Ivar Jacobson, "The Unified Modeling Language Reference Manual", 2nd Edition, 2004, Pearson Education, Inc. New Delhi.

MBEE 402 PARALLEL AND DISTRIBUTED COMPUTING (3-1-0)

Module - I (12 Hrs.) .

Introduction to parallel computing. Parallel programming platforms: Trends in microprocessor Architectures, Limitations of memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication costs in parallel machines, Routing mechanisms for interconnection network, Impact of process processors mapping and mapping techniques

Module –II (12 Hrs)

Principles of parallel algorithm design: Preliminaries, Decomposition techniques, Characteristics of tasks and interactions, Mapping techniques for load balancing, Methods for containing. Interactions overheads, Parallel algorithm models. Basic communication operations: One-to-All Broadcast and All-to-One Reduction, All-to-All broadcast and reduction All-Reduce and prefix sum operations, scatter and gather, All-to-All personalized communication, circular shift, Improving the speed of some communication operation

Module – III (16 Hrs)

Analytical modeling of parallel programs: Performance metrics for parallel systems, Effect of granularity of performance, scalability of parallel system, Minimum execution time and minimum cost-optimal execution time, Asymptotic analysis of parallel programs, other scalability metrics. Programming using the message passing paradigm:

Principle of message – Passing programming, Send and receive operations, The message passing interface, Topologies and embedding, Overlapping communication with computation, collective communication and computation operations, Groups and communicators.

Dense matrix algorithm:

Matrix-vector multiplication, Matrix-matrix algorithm, Solving a s.

Text Book:

1. Introduction to Parallel Computing, Second Edition, Ananth Gram, Anshul Gupta, George Karypis, Vipin Kumar Person Education.
2. Parallel computing Theory and Practice, Second Edition, Michael J. Quinn, TMH.
3. Advanced Computer Architecture: Parallelism, Scalability, Programmability, Kai **Hwang**, McGraw-Hill.

Reference Books :

1. Distributed Computing: Principles and Applications ,Mei-Ling **Liu**, 2004, Pearson Education, Inc. New Delhi.
2. Introduction to Distributed Algorithms ,Gerard **Tel**, Second edition, 2002, Cambridge University Press / Foundation Books India, New Delhi.

MBEE 403 Cloud Computing (3-1-0)

Module-I (14 hr.)

Cloud Computing Basics
Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the Cloud. The Business Case for Going to the Cloud - Cloud Computing Services, Business Applications, Deleting Your Datacenter, Salesforce.com, Thomson Reuters. Benefits , Limitations, Security Concerns and Regulatory issues

Module-II (13 hr.)

Organization and Hardwar Infrastructure of **Cloud Computing**
Cloud Computing with the Titans - Google, EMC, Net App, Microsoft, Amazon, Salesforce.com, IBM Partnerships Clients, Security, Network, Services. Accessing the Cloud - Platforms, Web Applications, Web APIS ,Web Browsers. Cloud Storage - Overview, Cloud Storage Providers, Standards - Application, Client, Infrastructure, Service.

Module-III (13 hr.)

Application and Services Provided by Cloud computing
Industries Software plus Services (Overview, Mobile Device Integration, Providers, Microsoft Online), Server Solutions, Thin Clients and different case studies Case Studies

Text Books:

1. Cloud Computing- A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGraw Hill.

MBEE-404 MOBILE COMPUTING (3-1-0)

Module - I (14 Hrs)

Introduction to Personal Communications Services (PCS) : PCS Architecture, mobility management, Networks signaling, Global System for Mobile Communication (GSM) System overview : GSM Architecture, Mobility management, Network signaling. General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard, Mobile IP.

Module –II (14Hrs)

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML), Wireless Local Loop (WLL) : Introduction to WLL Architecture, wireless Local Loop Technologies. Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) Vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000

Module - III (12 Hrs)

Global Mobile Satellite Systems ; case studies of the IRIDIUM, ICO and GLOBALSTAR systems. Wireless Enterprise Networks : Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. Server-side programming in Java, Pervasive web application architecture, Device independent example application.

Text Books: 1. Mobile Communication: J. Schiller, Pearson Education
2. Mobile Computing: P.K. Patra, S.K. Dash, Scitech Publications.
3. Mobile Computing: Talukder, TMH, 2nd Edition.

Reference Books: 1. Pervasive Computing: Burkhardt, Pearson Education.
2. Principles of Mobile Computing: Hansmann, Merk, Springer, 2nd Edition.
3. Wireless Communication & Networking: Garg, Elsevier
4. Third Generation Mobile Telecommunication Systems: P. Stavronlakis, Springer.
5. The Wireless Application Protocol: Sandeep Singhal, Pearson Education.