Savitribai Phule Pune University

Department of Mathematics

Syllabus for **M.Sc.** (Industrial Mathematics with Computer Applications)

(To be implemented from Academic year 2015-2016)

Course Structure –

Duration: The entire Programme is a Three year and six semester full time Programme.

No. of Courses: For semesters 1,2 and 3, there will be FIVE courses. For semester 4 and 5, there will be 5 or 6 courses. The last semester will be Industrial training/Institutional project and 0 or 1 or 2 theory courses. For every course except the course MT-601 there will be 4 hours classroom teaching and 1 hours would be reserved for either Laboratory work/Problem solving session/ related activity

Award of Credits –

Each Theory course will be of 5 credits. For every course in all the semesters there will be two aspects of the conduct of the course first is the theory course and second is practical/laboratory work for each course. Each semester is of 5 courses and 25 credits (This is not applicable for Industrial training in 6^{th} semester of M.Sc..).

ATKT Rules –

- Each regular student will have to appear for all the 25 credits of the respective semester.
- Student who wishes to take admission to the second year M.Sc.. should have obtained at least 25 credits out of 50 credits of the First year M.Sc.

Evaluation Rules –

- Each course will carry 100 marks except MT-601.
- There will be Continuous Evaluation (CA) and End Term Evaluation mechanism (ETE) for each course and carry 50 marks each.
- The assessment of 15 credits towards VI^{th} semester (Full Time Industrial Training / Institutional project) will be carried out as follows:
    1. A student will inform the department about the joining date of the above mentioned training.
    2. The student will have to make minimum two presentations, one in the third month and the other at the end of the training programme. These presentations will be considered towards CA.
    3. The student will have to submit a Dissertation/Report to the department which will be assessed towards course credits.
- 50% marks of the course towards CA will be based on tests (minimum 2). In addition, a teacher may consider one or more of the following evaluation systems.
    1. Home Assignment(s)
    2. Seminar/Presentation by the student
    3. Laboratory assignment
    4. Group Discussions
    5. Research Paper Review

6. Technology Demonstration
7. Mini projects in group of maximum 2 members.

- If a student fails in a course of any semester then the student can appear only for the End of Semester Examination of the following semester. However he/she can improve the continuous assessment (CA) performance in any of the forthcoming semesters in which the course is subsequently conducted and in this case, the student will have to appear for End of Semester Examination also for the said course.

Completion of Degree Programme

1. In order to pass the M.Sc. (Industrial Mathematics with Computer Applications) Course a student has to obtain 150 credit points i.e., a student has to pass 28 subjects (including Soft Skills (Audit course)) along with the degree project. Those students who wish to complete degree project in Industries are allowed maximum 7 subjects in semester IV and semester V, so that the student can complete only degree project in semester VI.
2. If a student has failed in a course then the said course will not be taken into account for calculating GPA and overall grade. In fact, all the courses in which a student has passed will be taken into account for calculating the GPA and overall grade.
3. The policies and procedures determined by University will be followed for the conduct of examinations and declaration of the result of a candidate

M.Sc. First Year

Semester: I (Minimum Credit: 25, Core course is compulsory)

	Course	Title of the course	Hours/ Week	Credit
Core	MT-101	Algebra	5	5
Core	MT-102	Linear Algebra	5	5
Core	MT-103	Discrete Mathematics	5	5
Core	MT-104	Computer Organization	5	5
Core	MT-105	Programming in C	5	5

Semester: II (Minimum Credit: 25, Core course is compulsory. Extra Course is an Audit Course)

	Course	Title of the course	Hours/ Week	Credit
Core	MT-201	Foundations of Analysis	5	5
Core	MT-202	Differential Equations	5	5
Core	MT-203	Data Structures	5	5
Core	MT-204	Programming in C++	5	5
Core	MT-205	Operating Systems	5	5

M.Sc. Second Year

Semester: 3 (Minimum Credit: 25, Core course is compulsory)

	Course	Title of the course	Hours/ Week	Credit
Core	MT-301	Complex Analysis	5	5
Core	MT-302	Database management systems	5	5
Core	MT-303	Theory of Computer Science	5	5
Core	MT-304	Design and Analysis of Algorithms	5	5
Core	MT-305	Computer Graphics	5	5

M.Sc. Second Year

Semester: 4 (Minimum Credit: 25, Maximum Credits: 35, Core courses are compulsory)

From elective courses student can select one or Two courses.

	Course	Title of the Course	Hours/ Week	Credit
Core	MT-401	Operations Research	5	5
Core	MT-402	Rings and Fields	5	5
Core	MT-403	Software Engineering	5	5
Core	MT-404	Computer Networks	5	5
Core	MT-405	Programming with JAVA	5	5
Elective	MT-406	Computational Geometry	5	5
Elective	MT-407	Data Mining	5	5
Elective	MT-408	Artificial Intelligence	5	5
Elective	MT-409	Cryptography	5	5
Elective	MT-410	Evolutionary Computing and Image Processing	5	5
Elective	MT-411	Advanced DBMS	5	5
Elective	MT- 412	Probability and Statistics	5	5

M.Sc. Third Year

Semester: 5 (Minimum Credit: 25, Maximum Credits: 35, Core courses are compulsory)

From elective s student can select three courses for Minimum credit and Five for Maximum Credit

	Course	Title of the course	Hours/ Week	Credit
Core	MT-501	Coding Theory	5	5
Core	MT-502	Mathematics course	5	5
Elective	MT-503	Programming with Advanced Java	5	5
Elective	MT-504	Programming with DOT NET	5	5
Elective	MT-505	Programming using mobile technologies	5	5
Elective	MT-506	Compiler construction	5	5
Elective	MT-507	Integral Transforms	5	5
Elective	MT-508	Financial Mathematics	5	5
Elective	MT-509	Advanced Algorithms	5	5
Elective	MT-510	Managerial Techniques using Operations Research	5	5
Elective	MT-511	Mathematical Modeling and Simulation	5	5
Elective	MT-512	Fuzzy Sets and Fuzzy Logic	5	5
Elective	MT-513	Cloud Computing	5	5
Elective	MT -514	Object Oriented Modelling and Design	5	5
Elective	MT-515	Software Project Development	5	5
Elective	MT-516	Differential Geometry	5	5

Semester: 6 (Minimum Credit : 15, Maximum Credits: 25 Core course is compulsory)

Subject	Paper	Title of Paper	Hours/ Week	Credit
Core	MT-601	Industrial Training /Institutional project	--	15
Elective	MT-602	A student can select at most two electives from the list of electives provided in semester IV and semester V.	5	5
Elective	MT-603		5	5

MT 101 : Algebra

1. Introduction to Groups : Symmetries of a Square , The Dihedral Groups, Definition and Examples of Groups, Elementary Properties of Groups.

2. Subgroups and Cyclic Groups: Terminology and Notation , Subgroup Tests, Examples of Subgroups, Properties of Cyclic Groups, Classification of Subgroups of Cyclic Groups, Properties of Cosets, Lagrange's Theorem and Consequences.

3. Permutation Groups : Definition and Notation ,Cycle Notation , Properties of Permutations, An application of Cosets to Permutation Groups, The Rotation Group of a Cube and a Soccer Ball.

4 . Group Homomorphism and Isomorphism: Definition and Examples of Homomorphism, Properties of Homomorphism. Definition and Examples of Isomorphism, Properties of Isomorphism , Cayley's Theorem, The First Isomorphism Theorem, Automorphism.

5. External Direct Products : Definition and Examples, Properties of External Direct Products, The Group of Units Modulo n as an External Direct Product, Applications.

6. Normal Subgroups and Factor Groups: Normal Subgroups, Factor Groups, Applications of Factor Groups, Internal Direct Products.

7. Fundamental Theorem of Finite Abelian Groups: The Fundamental Theorem, The Isomorphism Classes of Abelian Groups.

Prescribed Book:

• Joseph A. Gallian, Contemporary Abstract Algebra (Fourth Ed.), Narosa, 1999. (Part 2 : Groups)

Reference Book:

• P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra (Second Ed.), Cambridge Univ. Press (Indian Ed. 1995).

• I. S. Luthar and I. B. S. Passi, Algebra-Vol. 1: Groups, Narosa, New Delhi, 1996.

MT 102 Linear Algebra

Gaussian elimination, echelon forms, properties of determinants, complexity of calculating determinants.

Vector spaces, subspaces, linear independence, basis, dimension, linear transformations.

Orthogonal vectors and subspaces, orthogonal matrices, projections, least squares, orthogonal basis Gram Schmidt.

Eigenvalues and eigenvectors, diagonalisation, Jordan form, difference equations, A^k, Differential equations, and e^{At}.

Positive definite matrices, maxima, minima, saddle points, singular value decomposition, matrix norms, condition numbers, computation of eigenvalues, iterative methods for Ax=b.

Prescribed books :

1. Linear Algebra and its applications, by Gilbert Strang.
2. 2. Linear Algebra and its applications, by David Lay.

MT103 Discrete Mathematics

1. Order Relations and Structures: Partially ordered set, Extremal Elements of Partially ordered sets, Lattices, Finite boolean algebras, Functions on boolean algebras, Circuit designs.

2. Trees: Trees, Labeled Trees, Tree Searching, Undirected Trees, Minimal Spanning Trees

3. Topics in Graph Theory: Graph, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Transport Networks, Matching Problems, Coloring Graphs,

4. Combinatorics: Combination, Permutation, Generating Functions, Odinary and Exponential Generating unctions, Recurrence Relation, Methods of Solution of Recurrence Relatiion , Substitution Method, Characteristic Method, Generating Function Method, Principle of Inclusion and Exclusion.

Prescribed Books:

• Kolman, Busby, Ross, Discrete Mathematical Structures,Fifth Edition (Pearson Education).

• Purna Chandra Biswal, Discrete Mathematics and Graph Theory, Second Edition (PHI.).

Reference Book:

- Alan Tucker, Applied Combinatorics, Forth Edition (John Willey).

MT 104 Computer Organization

Overview of Computer Organization: Introduction, Basic Terms and Notation, Programmer's View, Advantages of High-Level Languages, Why Program in Assembly Language? Architect's View, Implementer's View. The Processor: Pipelining, Memory: Basic Memory Operations, Byte Ordering, Two Important Memory Design Issues, Input/Output, Historical Perspective, Technological Advances

Introduction to Digital Logic: Introduction, Basic Concepts and Building Blocks, Logic Functions, Boolean Algebra, Logic Circuit Design Process, Deriving Logical Expressions from Truth Tables, Simplifying Logical Expressions, Generalized Gates, Multiple Outputs, Implementation Using Other Gates

Combinational Circuits: Introduction, Multiplexers and Demultiplexers, Decoders and Encoders, Comparators, Adders, Programmable Logic Devices, Arithmetic and Logic Units

Sequential Logic Circuits: Introduction, Clock Signal, Latches, Flip-Flops, Example Sequential Circuits, Sequential Circuit Design

Processor Organization and Performance: Introduction, Number of Addresses, Flow of Control, Instruction Set Design Issues, Microprogrammed Control, Performance

RISC and CISC processor architectures

CISC (case study of Intel Processors)

RISC (case study of ARM processors)

Memory System Design : Introduction, A Simple Memory Block , Techniques to Connect to a Bus, Building a Memory Block, Building Larger Memories Cache Memory : Introduction , How Cache Memory Works , Why Cache Memory Works, Cache Design Basics

Virtual Memory: Introduction, Virtual Memory Concepts, Page Table Organization, Page Table Entries, The Translation Look aside Buffer, Page Table Placement, Inverted Page Table Organization, Segmentation

Input / Output Organization Introduction, Accessing I/O Devices, I/O Data Transfer, Error Detection and Correction, System Buses and their architecture.

Interrupts: Introduction, taxonomy of Interrupts, Hardware Interrupts, Software Interrupts, and Exceptions.

References:

1.Computer System Architecture 3 Edition (Paperback), M. Morris Mano, Pearson Education, ISBN-9788131700709

2.Computer Architecture and Organization : An Integrated Approach (Paperback), Miles Murdocca, Vincent Heuring, Wiley, ISBN-9788126511983

3.Digital Logic and Computer Design 1st Edition (Paperback), M. Morris Mano, Pearson Education, ISBN-9788177584097

4.Computer Organization and Design : The Hardware/Software Interface 4 Edition (Paperback), David A. Patterson, John L. Hennessy, , Morgan Kaufmann Publishers, ISBN-9788131222744

5.Computer Organization, Design and Architecture,Shiva 0004 Edition (Hardcover), Sajjan G. Shiva,CRC Press, ISBN-9780849304163

MIM 105 : Numerical Recipes in C

1. Introductory Concepts: Introduction to computer, computer characteristics, types of programming languages, introduction to C.

2. C Fundamentals: The character set, identifier and keywords, data types, constants, variables and arrays, eclarations, expressions, statements, symbolic constants.

3. Operators and Expressions: Arithmetic operators, unary operators, relational and logical operators, assignment operators, library functions.

4. Data Input and Outputs: Preliminaries, single character input-getchar() function, single character output-putchar() function, entering input data-scanf() function, writing output data- printf() function, formatted inputoutput-gets() and puts() functions.

5. Preparing and Running a Program: Planning and writing a C Program, compiling and executing the program.

6. Control Statements: Preliminaries, the while statement, the do- while statement, the for statement, nested loops, the if-else statement, the switch statement, the break statement, the continue statement, the comma operator, the goto statement.

7. Functions: A brief overview, defining a function, accessing a function, passing arguments to a function, specifying argument data types, function prototypes, recursion.

8. Program Structures: Storage classes, automatic variables, external variables, static variables, multifile programs, more about library functions.

9. Arrays: Defining an array, processing an array, passing arrays to a function, multidimensional arrays, arrays and strings.

10. Pointers: Fundamentals, pointer declarations, passing pointer to a function, pointer and one dimensional arrays, operations on pointers, pointers and multidimensional arrays, array of pointers, pointer to a function, passing functions to other functions, more about pointer declarations.

11. Structures and Unions: Defining a structure, processing a structure, user-defined data types (typedef), structures and pointers, passing structure to a function, self-referential structures, unions.

12. Data Files: Opening and closing a data file, creating a data file, processing a data file, unformatted data files.

Practical should cover the programs in C of the following methods/ topics in Numerical Analysis :

- bisection method.
- Newton’s method
- Secant method
- Newton’s method for two non linear equations
- divided difference interpolation formula
- Aitken’s formula
- Hermite’s interpolation,
- double interpolation.

- Gauss Elimination method, Gauss-Jordan method,
- Linear equation solution, LU decomposition
- Gauss- Seidel iteration.
- Numerical differentiation,
- Numerical Integration
- Trapezoidal rule
- Simpson's 1/3 –rule
- Simpson's 3/8 rule
- Numerical Solution of Ordinary differential Equations by Taylor series: Solution
- Numerical Solution of Ordinary differential Equations by Picard Method of successive approximations
- Numerical Solution of Ordinary differential Equations by Euler's Method and by Modified Euler Method
- Numerical Solution of Ordinary differential Equations by Runge- Kutta Methods.
- Jacobi method to find eigenvalues and eigenvectors of a real symmetric matrix.
- Householder method to find eigenvalues and eigenvectors of a real symmetric matrix.

Prescribed Books:

1. Byron S, Gottfried, Programming with C, Schaum'sOutline series.
2. W. H. Press, S. A. Teukolsky et. al., Numerical recipies in C, The art of Scientific Computing.
3. Yashwant Kanetkar, Let us C, BPB Publications.

Reference Book:

Brian W, Kernighan, Dennis M, Ritchie, The C Programming Language, Prentice Hall Publication.

MIM 201 : Foundations of Analysis

1. A Taste of Topology: Metric space concepts, Compactness, Connectedness, Coverings, Cantor sets.

2. Functions of a Real Variable: Differentiation, Reimann integration, Series.

3. Function Spaces: Uniform convergence and C0[a, b], Power series, Compactness and equicontinuity in C0.

4. Multivariate Calculus: Derivatives, Higher derivatives, Smooothness classses, Implicit and inverse functions.

5. Lebesgue Theory: Outer measure, Measurability, Regularity, Lebesgue integrals.

Prescribed Book:

• C. C. Pugh, Real Mathematical Analysis, Springer, New Delhi, 2004. (Ch. 2: Sec 1 to 5; Ch. 3, Ch. 4: Sec 1 to 5; Ch. 5: Sec 2 to 5; Ch. 6: Sec 1 to 4.)

Reference Books:

• N. L. Carothers, Real analysis, Cambridge University Press India, 1999.

• H. Royden, Real Analysis, Third Edition, Prentice Hall of India, 1988.

MT 202 : Differential Equations

1. Prerequisites: Linear equations of the first order.

2. Linear equations with constant coefficients : Second order homogeneous equations, Initial value problems, Linear dependence and independence, Nonhomogeneous equations of n-th order, Algebra of constant coefficients.

3. Linear equations with variable coefficients : Initial value problems, Solutions of the homogeneous equation, Wronskian and linear independence, Reduction of order, Nonhomogeneous equations, Legendre equation.

4. Linear Equations with regular singular points : Euler equation, Second order equation with regular singular points, Exceptional cases, Bessel equation.

5. Existence and uniqueness of solutions to first order equations: Separation of variables, exact equations, Method of successive approximations, Lipschitz condition, Approximation to and uniqueness of solutions.

6. Existence and uniqueness of solutions to systems and n-th order equations: Complex n-dimensional space, Systems as vector equations, Existence and uniqueness of solutions to systems, Existence, Uniqueness for linear systems and equations of order n.

Prescribed Book:

• E. A. Coddington, An Introduction to Ordinary Differential Equations (Prentice- Hall).

Reference Book:

G. F. Simmons and S. G. Krantz, Differential Equations (Tata McGraw-Hill).

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MT-203: Data Structures

Introduction to Data Structures Abstract Data Types, review of arrays and strings, structures and pointers concepts in C/C++, recursion and its efficiency.

Stacks: Operations and applications (Infix, Postfix and prefix expression handling),

Queues: Operations and applications,

Circular Queues: Operations and applications, Concept of Double ended Queue and Priority Queues

Linked Lists: Operations and applications of Linear linked list, Circular linked list, Doubly linked list.

Trees: Binary Trees, Binary Tree Representations, Operations (insert/delete), Tree Traversal Techniques, Threaded Binary Tree. Applications of Trees, Search Trees: AVL Tree (single and double rotations), B-Trees

Graphs: Representation (Matrix/Adjacency) and Traversal (Depth First Search/Breadth First Search), Spanning Trees, Minimal Spanning Tree (Prim's and Kruskals's algoritm), Shortest Paths and All Pair Shortest Path, Dijkstra's, Floyd-Warshall Algorithms.

Hash Table: Hash Table: Hash Function, Collision and its Resolution, Separate Chaining, Open Addressing (linear probing, quadratic probing, double hashing), Rehashing, Extendible Hashing

Searching Techniques: Linear Search, Binary Search (array/ binary tree) methods.

Sorting Techniques: General Background, Sorting Techniques: Bubble Sort, Insertion Sort, Selection Sort, Quick sort, Merge sort, Heap sort and Radix Sort

References:

- ADTs, Data Structures, and Problem Solving with C++, Author: Larry R Nyhoff, ISBN: 9788131764701, Pearson Education
- Data Structures and Algorithms in C++, 2nd Edition Michael T. Goodrich, Roberto Tamassia, David M. Mount, Wiley
- Algorithms and Data Structures: The Basic Toolbox, Mehlhorn, Kurt, Sanders, Peter, Springer, ISBN:9783540779773
- Data Structures Using C and C++ 2 Edition, (Paperback), Yedidyah Langsam, Aaron M. Tenenbaum, Moshe J. Augenstein, PHI Learning ISBN:9788120311770

MT-204: Programming with C++

Review of C Language: functions, Pointers, Structures, Array, file handling

Introduction: What is object-oriented programming? Why Do We Need Object-Oriented Programming characteristics of Object-Oriented Languages. C++ and C

C++ Programming Basics: Output Using cout, Directives. Input With cin. Type bool. The setw Manipulator. Type Conversions.

Functions: Returning values From Factions. Reference Arguments, Overloaded Function, Inline Function. Default Arguments. Returning by Reference.

Object and Classes:

Making sense of core object concepts (Encapsulation Abstraction, Polymorphism, Classes,

Massages Association, Interfaces) Implementation of Class in C++, C++ Objects as Physical Object, C++ Object as Data Types Constructor. Object as Function Arguments. The Default Copy Constructor, Returning Object From Function. Structures and Classes. Classes Objects and Memory Static Class Data. Const Data. Const and Classes.

Arrays and String: Arrays Fundamentals. Arrays as Class Member Data. Arrays of Object. String. The Standard C++ String Class.

Operator Overloading: Overloading Unary Operators. Overloading. Binary Operators. Data Conversion. Pitfalls of Operators Overloading and Conversion. Keywords Explicit and Mutable

Inheritance: Concept of Inheritance, Derived Class And Base Class, Derived Class Constructors, Overriding Member Function, Inheritance In The English Distance Class, Class Hierarchies, Inheritance And Graphics Shapes, Public And Private Inheritance, Levels Of Inheritance, Multiple Inheritance, Ambiguity In Multiply Inheritance, Aggregation: Classes Within Classes, Inheritance And program Development.

Pointer: Addresses And pointer, The Address-Of Operator &, Pointer And Arrays, Pointer And Faction, Pointer And C- Types String, Memory Management: New And Delete, Pointers To Objects, Debugging pointers.

Virtual Function: Virtual Function, Friend Function, Static Function, Assignment and Copy Initialization, This Pointer, Dynamic Type Information.

Streams and Files: Streams Classes, Stream Errors. Disk File I/O with Streams, File Pointers, Error Handling In File, I/O File I/O With Member Function, Overloading the Extraction And Insertion Operator, Memory As A Stream Object, Command line Arguments, and Printer Output.

Templates : Generic programming, template functions, defining a class template, using a template class, using template with family of classes, template versality, template specilization, inheritance.

Exception Handling : Exception, the exception mechanism, exception versality, multiple try blocks, exception and classes, exception and inheritance, the exception class.

References:

- C++ Primer Plus, Stephen Prata, Pearson, ISBN 9788131786987,
- Programming in C++, Ashok Kamthane, Pearson, ISBN 9788131791448
- Introduction to Programming with C++, Y. Daniel Liang, Pearson, ISBN 9788131760659 ,
- The C++ Programming Language , B. Stroustrup Addison-Wesley ISBN 978-0321563842

MT-205: Operating Systems

- Basics: Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems
- Understanding the System Calls
- Process Management: Process Scheduling - Uniprocessor scheduling algorithms, Multiprocessor and Real-time scheduling algorithms, Process Synchronization - Peterson's Solution, Bakery Algorithm, Hardware Support to Process Synchronization, Semaphores, Critical Regions, Monitors - Deadlock prevention, deadlock avoidance and Deadlock Detection and Recovery - Bankers Algorithm, Threads
- Memory Management: Segmentation and space allocation, Basics of linking and loading, Demand Paging, Page replacement algorithms, Analysis of page allocation policies - Working Set
- File Systems: Contiguous, Sequential and Indexed Allocation, File system interface, File System implementation,
- I/O System: Disk Scheduling, Device drivers - block and character devices, streams, Character and Block device switch tables
- Protection and Security - Accessibility and Capability Lists
- Case Study of Unix/Linux Operating System with reference to Process Management, Memory Management and File Management

References:

- Operating System Concepts 8 Edition (Paperback), Peter B. Galvin, Abraham Silberschatz, Gerg Gagne,Wiley,ISBN:9788126520510

- Operating Systems, Nutt, , Pearson Education ISBN:9788131723593
- Operating Systems, William Stallings, Pearson, ISBN:9788131725283,
- Operating Systems, Haldar & Aravind, Pearson , ISBN: 9788131715482,
- Understanding the Linux Kernel 3rd Edition (Paperback), Daniel P Bovet, Marco Cesati, O'Reilly, ISBN: 9788184040838
- The Design of the UNIX Operating System (Paperback), Maurice J. Bach, PHI Learning, ISBN-9788120305168
- UNIX System Programming Using C++ (Paperback), Terrence Chan, PHI Learning, ISBN:9788120314689

MT 301 Complex Analysis

1. Pre-requisites:

(a) Topological and Analytical Preliminaries: Point sets in the plane, sequences, compactness, stereographic projection, continuity.

(b) Elementary Functions: Exponential functions, mapping properties, logarithmic function, complex exponents.

2. Analytic Functions: Cauchy-Riemann Equations, analyticity, harmonic functions.

3. Power Series: Sequences, uniform convergence, Maclaurin and Taylor series, operations on power series.

4. Complex Integration and Cauchy's Theorem: Curves, parameterizations, line integral, Cauchy's Theorem.

5. Applications of Cauchy's Theorem: Cauchy's integral formula, Cauchy's inequality and applications, maximum modulus theorem.

6. Laurent Series and Residue Theorem: Laurent series, classification of singularities, evaluation of real integrals, argument principle.

7. Bilinear Transformations and Mappings: Basic mappings, linear fractional transformations, other mappings.

Prescribed Book:

J. B. Conway, *Functions of one complex variables*,

Narosa Publishing House.

N. B. : Students are also required to use suitable mathematical softwares to solve relevant problems.

MT 302 Database Management System

- Nature of Business Systems and Data Processing.
- Data Models, ER Model, ER Diagrams, UML Class Diagrams
- Relational model and query languages (relational algebra and calculus, SQL).
- Integrity and Security.
- Database design and normalization.
- XML and xquery Storage structures.
- Indexing and Hashing Techniques

- Query processing and optimization, transactions, concurrency control and recovery Introduction to decision support and data analysis, data warehousing and data mining
- Information Retrieval.
- Introduction to NoSQL e.g. MongoDB,

Important Note: Teacher is supposed to take the practicalsrelated to SQL query writing using any of the open source RDBMS engine e.g. MySQL/PostgreSQL. Some part of evaluation should be reserved for the practical aspects

Reference Books

1. Abraham Silberschatz,Henry F. Korth and S. Sudarshan,Database System Concepts
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems
3. Ramez Elmasri and Shamkant Navathe, Fundamentals of Database Systems

MT 303 Theoretical Computer Science

- Preliminaries : Symbol, Alphabet, String, Prefix&& Suffix of Strings, Sets, Operations on sets, Finite & infinite sets, Russell's Paradox, Formal Language Relation, Equivalence Relation,(reflexive, transitive and symmetric closures)Principle of Induction
- Regular Languages :Regular Expression: Definition, Examples, & Identities Finite Automata: Concept DFA: Definition & examples NFA: Definition, examples, Language accepted By FA,NFA with ∈- moves , Regular Expression to FA: Method and Problems -NFA with ∈- moves to NFA, NFA to DFA: Method Problems : Minimization of DFA: Problem using Table Method , Subset Construction for NFA with ∈-moves to DFA conversion, Application of FA: Pumping Lemma & Examples Closure Properties: Union, Intersection, -Concatenation, Complement, & Kleene Closure
- Context Free Languages -Chomsky Hierarchy -CFG : Definition & examples, Ambiguous Grammar : Concept & Examples Simplification of CFG : Removing Useless Symbols, removing unit productions and removing Nullable symbols: Methods & Problems -Normal Forms : CNF & GNF : Method & Problems -Regular Grammar : Definition ,Equivalence of FA & Regular Grammar
- Push Down Automaton : Basic Concept , Definition (DPDA & NPDA)Construction of PDA using empty stack and final State method : Examples using stack method Equivalence between acceptance by final state And Empty stack method & examples Equivalence between PDA & CFG (in GNF): Method and examples Properties of Context Free Languages Pumping Lemma for CFL : methods & problems, Closure Properties of CFL's(Union, Concatenation, & Kleene Closure) : Method & Examples)
- Turing Machine -Recursive & recursively enumerable language -Introduction to LBA (Basic Model) & CSG. -Definition of TM, -Design of TM for language recognition, Types of Turing Machine (Multitape TM, Non-Deterministic TM, Universal TM, Restricted TM) Undecidable Problem, Halting Problem of TM Simple Arithmetic Problems on Unary Numbers using TM , RAM model of computation

  Important Note: The LEX tool on Linux is to be used to address the understanding of the Language and grammar aspects in this course. Few laboratory sessions are expected to be covered. Some marks are to be reserved in Continuous Evaluation/Assessment for the laboratory assignments/work.

Reference Books:

1. Introduction to Automata Theory , Languages ,And Computation (2ndEdition Pearson education) By –John E. Hopcroft , Rajeev Motwani, Jeffrey D. Ullman
2. An Introduction to Formal Languages and Automata, Peter Linz, Jones &Barlett Student Edition, ISBN: 9789380853284
3. Fundamentals of Theory of Computation, Principals and Practice, Greenlaw, Hoover, Elsevier, ISBN:9781558604742
4. Introduction to Computer Theory By - Daniel I.A. Cohen (John Wiley & Sons (ASIA) Pvt Ltd. 2ndEdition)
5. An Introduction to the Theory of Computer Science Languages& Machine (3rdEdition Pearson education) By Thomas A. Sudkamp
6. Introduction to Languages and the theory of Computation By– John C.Martin (Tata McGraw –Hill Edition, 2ndEdition)
7. Theory of Computer Science (Automata Languages And Computation By – K.L.P. Mishra & N. Chandrasekaran (Prentice –Hall India 2ndEdition)

MT 304 Design and analysis of Algorithms

1. Mathematical Foundation: Growth Functions, Summations, Recurrences Substitutions, Iterations, Master Methods, Counting and probability
.
2. Sorting :Heap Sort, Quick Sort, Merge Sort, Sorting in linear Time, Medians and Order Statistics.
3. Dynamic Programming : Matrix chain Multiplication, longest common subsequence, optimal polygon triangularisation.
4. Greedy Algorithm.
5. Graphs : Traversals, Topological sort, Minimum spanning trees, single source shortest path, All pair shortest path, Maximum flow problems.
6. Sorting Networks : Comparision, bitonic sort and merge sort networks.
7. Parallel Algorithms : CRCW, EREW algorithms efficiency sorting linear system problem, Matrix Operations, Strassens Algorithm and matrix inversion.
8. FFT :Polynomials DFT, FFT.
9. Number Theoretic Algorithm : Rabin - Karp, KMP, Bower - Moore algorithms.
10. Geometric Algorithms : Finding convex hall, closes pair of points, linear programming problem.
11. NP Completeness : P and NP classes, NP completeness and reducibility.
12. Approximation Algorithms : Vertex cover problem, traveling salesman problem, set covering and subset sum problems.

Prescribed Book:
• T. H Coreman, Leiserson, Rivest, Introduction to Algorithms .

MT 305 Computer Graphics

1. Introduction to Computer graphics : Introduction to computer graphics & graphics systems, Four components of Computer Graphics Representation, Presentation , Interaction and Transformations, Uses of Computer Graphics, Graphics Primitives – Pixel/Point ,Raster v/s Vector ,RGB color model, intensity, Programming essentials – event driven programming. OpenGL library

2. Input devices and Interaction tasks: Essential Functionalities for Interaction – Locator, valuator , pick and choice; Hardware used for interaction – Input devices – key board, mouse, trackball, tablets, light pen;Basic Interaction tasks – Position, Selection
3. Presentation and Output devices: Presentation Graphics - frame buffer, display file, lookup table;Display devices, Random and Raster scan display devices; CRT, Plotters and Printers
4. Point, Line and Polygon primitives Scan conversions, run length encoding , Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Scan converting polygons, fill algorithms, Boundary fill algorithm, flood fill algorithm
5. 2D Transformations and viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, Reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline; Window to viewport co-ordinate transformation , clipping operations , point clipping , line clipping; Cohen Sutherland algorithm, Midpoint subdivision algorithm, Cyrus beck algorithm; Polygon clipping , Sutherland Hodgman algorithm, Weiler-Atherton Algorithm
6. 3D transformation & viewing: 3D transformations: translation, rotation, scaling & other transformations; Rotation about an arbitrary axis in space, reflection throughh an arbitrary plane; general parallel projection transformation; Three dimensional viewing, Parallel and Perspective projections
7. Curves and Surfaces: Polygon meshes, Representing polygons; Parametric curves, Hermite Curves, Bezier curves, B-spline curves
8. Hidden surfaces Elimination: Depth comparison, Z-buffer algorithm, Back face detection; BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal – geometry; Color & shading models Light & color model; interpolative shading model; Texture
   Important Note: Students are expected to implement the algorithms taught in this course using OpenGL/Graphics library with C language on Linux Platform. Some marks are to be reserved in Continuous Evaluation/Assessment for the laboratory assignments/work.

Reference Books:

1. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Ed.) – Pearson Education.
3. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – TMH.
4. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH
5. F. S. Hill, Stephen Kelly, Computer Graphics using OpenGL, PHI Learning
6. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH

MT 401 Operations Research

Unit I - Kuhn – Tucker conditions of Optimality – Quadratic Programming
(Sections 19.2.2B, 20.2.2)
Unit II - Inventory Models
(Sections 14.1 to 14.3)
Unit III - Queuing Models
(Section 15.1, 15.2, 15.4, 15.5)
Unit IV - Project Scheduling By PERT – CPM
(Sections 13.1 to 13.4)

Unit V - Simulation Modeling with SIMNET – II
(Sections 17.1 to 17.10)

Textbook :
Hamy A.Taha, Operations Research, Fifth Edition, Prentice Hall of India.

N. B. : Students are also required to use suitable mathematical software to solve relevant problems.

MT 402 Rings and Fields

Rings, integral domains, ideals homomorphisms, polynomial rings, factorization, divisibility, vector spaces extension fields, algebraic extensions, finite fields constructions.

Textbook : J. A. Gallian Contemporary Abstract Algebra, Narosa Chapters 12-23

MT 403 Software Engineering

- Concepts of software management, The software crisis, principles of software engineering, programming in the small Vs programming in the large
- Software methodologies/processes, The software life cycle, the waterfall model and variations, introduction to evolutionary and prototyping approaches
- Software measurement , Requirements analysis, requirements
- Solicitation, analysis tools, requirements definition, requirements specification, static and dynamic specifications, requirements review. (just revisited)
- Software architecture
- Software design, Design for reuse, design for change, design notations, design evaluation and validation
- Implementation, Programming standards and procedures, modularity, data abstraction, static analysis, unit testing, integration testing, regression testing, tools for testing, fault tolerance
- User considerations, Human factors, usability, internationalization, user interface, documentation, user manuals Documentation, Documentation formats, tools
- Project management, Relationship to life cycle, project planning, project control, project organization, risk management, cost models, configuration management, version control, quality assurance, metrics
- Maintenance, The maintenance problem, the nature of maintenance, planning for maintenance
- Tools and environments for software engineering, role of programming paradigms, process maturity
- Introduction to Capability Maturity Model People Capability Maturity Model
- Software Acquisition Capability Maturity Model Systems Engineering Capability Maturity Model
- IEEE software engineering standards

Important Note: students who take this course are supposed to work in a group of 2 to 3 and are expected to carry out a minor project (software development) which is absolutely necessary and will be used for continuous evaluation by the respective faculty member teaching this course.

References:

1. Software Engineering, Ian Sommerville, Addison Wesley, (Note : This is also the preferred textbook for the IEEE Software Engineering Certificate Program.)
2. The Engineering of Software, Dick Hamlet, Joe Maybee, Addison Wesley,

3. Introduction to the Team Software Process, Watts S. Humphrey, Addison Wesley,
4. Software Engineering A Practitioner's Approach European Adaption, Roger S. Pressman, McGraw Hill,
5. Software Engineering Theory and Practice, Shari Lawrence Pfleeger, Prentice Hall,
6. Practical Software measu0rement, Bob Huges, McGraw Hill,
7. Human Computer Interaction, ., Dix, Finlay, Abowd and Beale, Prentice Hall,
8. Software Project Management, ., Bob Huges& Mike Cotterell, McGraw Hill

MT 404 Computer Networks

- Introduction: Network Hardware, Network Software, Preference Models, Network Standardization.
- Physical Layer: Theoretical basis for data communication, Guided Transmission Media, Wireless transmission,
- Data Link Layer: Design issues, Error detection and Correction: Type of errors, detection and correction of errors Data Link Control & Protocol: Flow & error control, Stop And Wait ARQ, Go –Back -N ARQ, Select Repeat ARQ, HDLC
- The Medium Access Sublayer Channel Allocation Problem, Multiple Access Protocols, Ethernet (Cabling, Encoding) Wireless LANs Bluetooth Architecture, Bluetooth Applications, Data link layer switching: repeaters, hubs, bridges, switches, routers, gateways.
- Network Layer: Design issues, Routing algorithms, Congestion control algorithms, quality of service.
- Transport Layer: Transport Service, Elements of Transport protocols
- Application Layer: DNS, Electronic mail, WWW.
  Important Note: Students are expected to implement the algorithms taught in this course using libraries with C language on Linux Platform. Some marks are to be reserved in Continuous Evaluation/Assessment for the laboratory assignments/work.

Reference Books

1. Computer Networks, 5/e, Andrew S. Tanenbaum, David J Wetherall, Pearson Education
2. Computer Networking: A Top-Down Approach, 5/e, James F. Kurose, Keith W. Ross, Pearson Education
3. Data Communications and Networking, Forouzan, McGraw-Hill

MT 405 Programming with Java

1. Introduction to Java Programming - Overview, Java Tools, Java Byte Code
2. Elementary Programming Concepts : Variables and Identifiers, Java keywords, Data Types, Operators, Expression, Constants, Statements, Arrays
3. Classes and Packages : Defining classes, Static Members, Using packages, Access Specifiers, Constructors, Finalisers referencing objects
4. Inheritance, nested and inner class : Extending classes, Abstract Class Interface, Super Keyword, Final classes, Constructors and Inheritance, Dynamic Binding, Overriding methods

5. Exception and Input and Output : Byte streams, Character streams, File i/o basics, Introduction to exception, Try and catch block and finally block, Inbuilt Exception.
6. String Handling and Exploring Java.lang : String Operations, Character Extractions, Data Conversions, Modifying strings.
7. Applet and Event Handling and Controls
8. Input and Output package : Object serialization, reader and writer
9. Swings : - Layout Manager Layout Manager swing Controls Components Organizers, Jlish, Jtree, Jtables, Dialogue, File chooser, color chooser.
10. JDBC : The design of JDBC, JDBC programming concepts making the connection, statement and result set class, Executing SQL commands, Executing Queries.
11. Multithreading : Running multiple threads, The runnable interface Threads priorities Daemon, Thread States, thread groups Synchronization and Interthread Communication Deadlocks.

Prescribed Book:
• Herbert Schildt, A Complete Reference Java 2.

MT 406 Computational Geometry

1. Geometric primitives [Chap. 1]
2.Line intersection [Chaps. 2] plus randomized incremental
3. Triangulation and visibility and [Chaps. 3,15]
4. Linear programming in two and three dimensions [Chap. 4]
5. Orthogonal range searching [Chaps. 5,10]
6. Point location and Binary Space Partitions [Chaps. 6,12]
7. Voronoi diagrams and Delaunay triangulation [Chaps. 7,9]
8. Convex hulls [Chap. 11]
9. Non-orthogonal range searching [Chap. 16]
10. Curved Elements (Bezier, B-Splines)
11. Curve Reconstruction (reconstruction a curve(surface) from sample points)
12. 3-Dimensional Geometry

Prescribed Book :
Computational Geometry Algorithms and Applications, 2nd ed., by de Berg, van Kreveld, Overmars, and Schwarzkopf (Springer-Verlag, 2000).

N. B. : Students are also required to use suitable mathematical software to solve relevant problems.

MT 407 Data Mining

1. **Introduction to Data Mining**

- Basic Data Mining Tasks
- DM versus Knowledge Discovery in Databases

- Data Mining Issues
- Data Mining Metrics
- Social Implications of Data Mining
- Overview of Applications of Data Mining

2. **Introduction to Data Warehousing**

- Architecture of DW
- OLAP and Data Cubes
- Dimensional Data Modeling-star, snowflake schemas
- Data Preprocessing – Need, Data Cleaning, Data Integration & Transformation, Data Reduction

- Machine Learning
- Pattern Matching

3. **Data Mining Techniques**

- Frequent item-sets and Association rule mining: Apriori algorithm, Use of sampling for frequent item-set, FP tree algorithm
- Graph Mining: Frequent sub-graph mining, Tree mining, Sequence Mining

4. **Classification & Prediction**

- Decision tree learning: [3 hrs]
  Construction, performance, attribute selection

  Issues: Over-fitting, tree pruning methods, missing values,

  continuous classes

  Classification and Regression Trees (CART)

- □□Bayesian Classification: [6 hrs]
- Bayes Theorem, Naïve Bayes classifier,
- Bayesian Networks
- Inference
- Parameter and structure learning
- □□Linear classifiers [4 hrs]
- Least squares, logistic, perceptron and SVM classifiers
- □□Prediction [3 hrs]
- Linear regression
- Non-linear regression

5 **Accuracy Measures**

Precision, recall, F-measure, confusion matrix, cross-validation, bootstrap

6. **Software for data mining and applications of data mining**

R, Weka, Sample applications of data mining

7. **Clustering**

- k-means
- Expectation Maximization (EM) algorithm
- Hierarchical clustering, Correlation clustering

8. **Brief overview of advanced techniques**

- Active learning
- Reinforcement learning
- Text mining
- Graphical models
- Web Mining

Reference Books:

1. Data Mining: Concepts and Techniques, Han, Elsevier
2. Margaret H. Dunham, S. Sridhar, Data Mining – Introductory and Advanced Topics, Pearson Education
3. Tom Mitchell, ―Machine Learning‖, McGraw-Hill, 1997
4. R.O. Duda, P.E. Hart, D.G. Stork. Pattern Classification. Second edition. John Wiley and Sons, 2000.
5. Christopher M. Bishop, ―Pattern Recognition and Machine Learning‖, Springer 2006
6. Raghu Ramkrishnan, Johannes Gehrke, Database Management Systems, Second Edition, McGraw Hill International
7. Ian H. Witten, Eibe Frank Data Mining: Practical Machine Learning Tools and Techniques, Elsevier/(Morgan Kauffman),

MT 408 Artificial Intelligence

- Introduction to Artificial Intelligence What is AI? Early work in AI, AI and related fields AI problems and Techniques
- Problems, Problem Spaces and Search : Defining AI problems as a State Space Search: example Production Systems Search and Control Strategies Problem Characteristics Issues in Design of Search Programs Additional Problems
- Heuristic Search Techniques Generate-and-test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Mean-Ends Analysis
- Knowledge Representation Representations and Mappings, Approaches to Knowledge Representation, Knowledge representation method, Propositional Logic, Predicate logic, Representing Simple facts in Logic, Representing Instances and Isa relationships, Computable Functions and Predicates, Resolution, Forward and backward chaining
- Slot – and – Filler Structures : Weak Structures, Semantic Networks, Frames, Strong Structures, Conceptual Dependencies, Scripts
- Game Playing : Minimax Search Procedures, Adding alpha-beta cutoffs
- Planning: An example Domain: The Blocks world, Component of a planning system, Goal stack planning, Nonlinear planning ,Hierarchical Planning
- Learning : What is learning, Rote Learning, Learning by taking advice, Learning in problem solving, Learning from examples, Explanation based learning

Important Note: Teacher is supposed to take the practical implementation of the some of concepts in AI using Prolog language. Some marks are to be reserved in Continuous Evaluation/Assessment for the laboratory assignments/work.

Reference Books:

1. Artificial Intelligence, Tata McGraw Hill, 2nd Edition, by Elaine Rich and Kevin Knight
2. Artificial Intelligence: A Modern Approach by Stuart Russell, Peter Norvig, Prentice Hall, ISBN 0-13-103805-2
3. Introduction to Artificial Intelligence and Expert System, Prentice Hall of India Pvt. Ltd., New Delhi, 1997,2nd Printing, by Dan Patterson.
4. Introduction to TURBO PROLOG, BPB Publication, by Carl Townsend

MT 409 Cryptography

1. Introduction : Overview of course, Classical cryptography [parts of Chapter 1].
2. Secret Key Encryption : Perfect Secrecy - One time pads [Chapter 2.1], Stream ciphers and the Data Encryption Standard (DES) [Chapter 3 (excluding 3.6)], The Advanced Encryption Standard (AES) - adopted September 2000.
3. Public Key Encryption : Factoring and the RSA encryption [Chapter 4.1 - 4.4], Discrete log. Diffie-Hellman Key Exchange [Chapter 8.4 (only pages 270-273)]. ElGamal encryption [Chapter 5 (only pages 162-164)] , Digital Signatures [Chapter 6 (excluding 6.5 - 6.6)], One-time signatures, Rabin and ElGamal signatures schemes, Digital Signature Standard (DSS).
4. Hashing : Motivation and applications. Cryptographically Secure Hashing. [Chapter 7.1-7.3,7.6], Message Authentication Codes (MAC). HMAC, Network Security , Secure Socket Layer (SSL), I Psec.,Secret Sharing, Definition. Shamir's threshold scheme [Chapter 11.1], Visual secret sharing schemes.

Prescribed Book :
D. R. Stinson. *CRYPTOGRAPHY: Theory and Practice.* CRC Press. 1995.
N. Koblitz : A course in number theory and cryptography. Springer.

MT 410 Evolutionary Computing and Image Processing

Evolutionary Computing:
Introduction, Possible Applications, Pros. And Cons. Principles of Evolutionary Computation, Historical Perspectives. , Genetic Algorithms, Evolutionary Strategies, Evolutionary Programming, Introduction to Representations, Binary Strings, Real-Valued Vectors, Various Selection Strategies, Introduction to Search Operators, Crossover and Mutation, Ant Colony Optimization, Combinatorial Function Optimization Problems, Exploration and Exploitation Fundamentals, Applications, Introduction to Particle Swarm Optimisation Monte-Carlo Methods and Simulated Annealing, Different Annealing Strategies, Introduction to Tabu Search, Introduction to Multi-objective Optimisation, Constraint Optimisation, Various Strategies, Introduction to Biogeography - based Optimisation, Case Studies

Digital Image Processing:
Introduction: Definition and origins of digital image processing (DIP), Example fields that use DIP, Fundamental steps and components in DIP Digital image fundamentals: Visual perception, Light and electromagnetic spectrum, Image sensing and acquisition, Image sampling and quantization, Basic relationships between pixels. Image enhancement in the spatial domain: Gray-level transformations, Image Histograms, Enhancement using arithmetic/logic operations, Smoothing and Sharpening, Spatial filters (Laplacian/Gradient. Image enhancement in the frequency domain: Discrete Fourier transform (DFT) and frequency domain, Smoothing and Sharpening with

frequency-domain filters (Ideal, Butterworth, and Gaussian), Laplacian filters, The Convolution and Correlation theorems. Morphological image processing: Dilation and Erosion, Opening and Closing, Hit-or-miss transform, Basic morphological algorithms, Boundary extraction, Region filling. Image segmentation: Detection of discontinuities - Point, line, and edge, Region-based segmentation, Region growing, Region splitting and merging. Representation and description: Shape Representation, Chain codes, Polygonal approximations, Signatures, Boundary segments,, Skeletons, and descriptors, Shape numbers, Fourier descriptors, Statistical moments, Regional and Topological descriptors, Texture, and Moments

Reference Books

For Digital Image Processing

1. Gonzalez, R. C. and Woods, R. E. [2002/2008],Digital Image Processing, 2nd/3rd ed., Prentice Hall
2. Sonka, M., Hlavac, V., and Boyle, R. [1999], Image Processing, Analysis and Machine Vision (2nd edition), PWS Publishing, or (3rd edition) Thompson Engineering, 2007
3. Gonzalez, R. C., Woods, R. E., and Eddins, S. L. [2009], Digital Image Processing Using MATLAB, 2nd ed., Gatesmark Publishing, Knoxville, TN
4. Anil K. Jain [2001],Fundamentals of digital image processing (2nd Edition), Prentice-Hall, NJ

For Evolutionary Computing

1. Multi-Objective Optimization Using Evolutionary Algorithms, Kalyanmoy Deb, John Wiley & Sons
2. Multi-Objective Optimization Using Evolutionary Algorithms [Hardcover], Kalyanmoy Deb , Deb Kalyanmoy
3. Essentials of Metaheuristics,Second Edition Sean Luke
4. Genetic Algorithms, David E. Goldberg, Pearson Education India.
5. Genetic Algorithms: The Design of Innovation , David E. Goldberg, Kumara Sastry, Springer-Verlag New York Incorporated
6. Introduction to Evolutionary Algorithms, Xinjie Yu, Mitsuo Gen, Springer Science & Business Media

MT 411 Advanced Database Management System:

1. Relational Database Management Systems Implementation Techniques

   PL/SQL – Basics overview, Transactions- Savepoint, cursor, Database objects- procedures, functions, packages, Triggers

   Programmatic SQL – Embedded SQL, Dynamic SQL and ODBC Standard

   Query optimization, Subqueries, creating Oracle database objects, User access control in ORACLE

   Concurrency control – Locks, Timestamping

   transaction management – ACID properties, Transaction processing

   Database performance tuning

2. Emerging Database management system technologies

   Object oriented database management systems, Parallel Databases, Distributed Databases

New database applications and environments e.g. Data warehousing, multimedia

3. Data Warehousing

   Architecture – Operational Data, load manager, meta data, DW tools and technologies ,ETL tools Admin and management tools

4. Database Security :

   Defense mechanisms, statistical database auditing & control, security based on previleges, PL/SQL security – Locks-Implicit locking ,types and levels of locks, explicit locking, Oracles's named exception handlers

MT 501 Coding Theory

1. Error detection: correction and decoding: Communication channels, Maximum likelihood decoding, Hamming distance, Nearest neighbor / minimum distance decoding, Distance of a code.
2. Linear codes: Vector spaces over finite fields, Linear codes, Hamming weight, Bases of linear codes, Generator matrix and parity check matrix, Equivalence of linear codes, Encoding with a linear code, Decoding of linear codes, Cossets, Nearest neighbor decoding for linear codes, Syndrome decoding.
3. Cyclic codes: Definitions, Generator polynomials, Generator and parity check matrices, Decoding of cyclic codes, Burst-error-correcting codes.
4. Some special cyclic codes: BCH codes, Definitions, Parameters of BCH codes, Decoding of BCH codes.

Reference:

1. San Ling and Chaoing Xing, Coding Theory- A First Course
2. Applied Abstract Algebra - Lid and Pilz 2nd Edition

N. B. : Students are also required to use suitable mathematical software to solve relevant problems.

MT 502 Mathematics course

MT 503 : Advanced JAVA

1. JAVA Basic Reviews
Java streaming - Networking - Event handling - Multithreading - Byte code Interpretation - Customizing application - Data Structures - Collection classes.

2. Distributed Computing
Custom sockets - Remote Method Invocation - Activation - Object serialization -Distributed garbage collection - RMI - IIOP - Interface definition language - CORBA - JINI overview.
3. JAVA Beans And Swing
Bean concepts - Events in bean box - Bean customization - Persistence - Application - deployment using swing - Advanced swing techniques - JAR file handling.
4. JAVA Enterprise Applications
JNI - Servlets - Java Server Pages - JDBC - Session beans - Entity beans - Programming and deploying enterprise Java Beans - Java transactions.
5. Related JAVA Techniques
Java Media Frame work - 3D graphics - Internationalization - Case study - Deploying n-tier application, E- commerce applications.
Reference Books:
1. Deitel and Deitel , Java How to program, Prentice Hall , 4 th Edition, 2000.
2. Gary Cornell and Cay S. Horstmann, Core Java Vol 1 and Vol 2 , Sun Microsystems Press, 1999.
3. Stephen Asbury, Scott R. Weiner, Wiley, Developing Java Enterprise Applications, 1998.

MT504 : MS.NET

1. Introducing .NET Platform: .NET and Windows DNA .NET Architecture
2. Features of .NET Platform: Multilanguage Support, Platform and Processor Independence, Memory Management, Versioning, Deployment, Interoperability with Unmanaged Code.
3. .NET Architecture: .NET Runtime, Managed/Unmanaged Code, Intermediate Language, Common Language Specification/Common Type System, .NET Base Class Library (BCL), Assemblies, Metadata, Assemblies and Modules, Assembly Cache, Reflection, Just In Time Compilation, Garbage Collection, Object Oriented in .NET.
4. Introducing C hash Programming: Data Types, Control Structures, Properties and Indexers, Delegates and Events, Exception Handling, Basics of Inheritance.

MT 515 Software Project Management

1. Project Management Overview : Project Initiation ,Planning, Execution, Monitoring and Closing phases, Project Charter
2. Scope Management : Scope planning, Verification, Scope Change control
3. Time Management: Estimation, Developing Schedule, Managing Schedule using tool (MS-Project)
4. Cost Management : Customer engagements, Project types, Costing, Cost Control, Profitability

5. Quality Management : Project Quality Metrics, Quality Assurance and Control technqiues, tools, Internal and External Audits, ISO, CMMi assessment, Customer Expectations
6. Human Resource Management : Project Organisation, Resource change management, Training, Roles and responsibilities
7. Communications Management : Internal, External communication, reporting
8. Risk Management : Risk Assessment and Control, Risk Monitoring and Control
9. Procurement Management : Procuring H/W and S/W
10. Integration Management : Historical Information, Baselined Plan, Schedule, Quality, Deliverables, Efforts, Resources, Risks and Communication