M.Sc. Tech. Industrial Maths. with Computer Applications

Syllabus

Department of Mathematics
Jamia Millia Islamia

COURSE STRUCTURE

First Semester

Paper No.	Title of the Paper	Total Marks
MST101	Real Analysis	100
MST102	Differential Equations and Applications	100
MST103	Discrete Mathematical Structures	100
MST104	Computing Fundamentals & Programming	100
MST105	Computer Based Numerical Methods	100
Practicals Lab-I	Programming in C	50
Lab-II	Numerical Methods	50
	Total = 600	

Second Semester

Paper No.	Title of the Paper	Total Marks
MST201	Linear Algebra	100
MST202	Curves, Surfaces & Applications	100
MST203	Operating Systems	100
MST204	Computer Organization & Architecture	100
MST205	Data Structures	100
Practicals Lab-III	Data Structures using C	50
Lab-IV	UNIX / LINUX Shell Programming	50
	Total = 600	

Third Semester

Paper No.	Title of the Paper	Total Marks
MST301	Topology	100
MST302	Computer Networks	100
MST303	Database Management Systems	100
MST304	Object Oriented Programming	100
MST305	Soft Skills	100
Practicals Lab-V	Programming in Java	50
Lab-VI	Oracle	50
	Total = 600	

Fourth Semester

Paper No.	Title of the Paper	Total Marks
MST401	Functional Analysis	100
MST402	Complex Analysis	100
MST403	Formal Language & Automata Theory	100
MST404	Software Engineering	100
MST405	Internet Technologies	100
Practicals LAB-VII	Programming using J2EE	50
LAB-VIII	Minor Project	50
	Total = 600	

Fifth Semester

Paper No.	Title of the Paper	Total Marks
MST501	Operations Research	100
MST502	Analysis & Design of Algorithm	100
MST503	Data Mining	100
MST504	Artificial Intelligence	100
MST505	Computer Graphics	100
Practicals LAB-IX	MatLab	50
LAB-X	OpenGL	50
	Total =	**600**

Sixth Semester

Paper No.	Title of the Paper	Total Marks
MST601	Project / Dissertation + Viva Voce	200
	Grand Total	**3200**

DETAILED SYLLABUS

Code	Name	Lecture
MST101	**Real Analysis**	4

Unit 1. Countability of sets. Outer and inner Lebesgue measure, Lebesgue measurable sets, Properties of measurable sets, Borel sets and their measurability, Non-measurable sets, Cantor's ternary sets and their properties.

Unit 2. Measurable function, Characteristic function, Step function, Continuous function, Set of measure zero, Borel measurable function, The structure of measurable function.

Unit 3. Riemann integral and its deficiency, Lebesgue integral of bounded function, Comparision of Riemann and Lebesgue integerals, Properties of Lebesgue integral for bounded measurable function, The Lebesgue integeral for unbounded functions, Integral of non-negative measurable functions, General Lebesgue integeral, Improper integral.

Unit 4. Point wise convergence, Convergence almost everywhere, Uniform convergence almost everywhere, Convergence in measure, F. Reisz's theorem on convergence a.e., D.F. Egoroff's theorem, Lebesgue bounded convergence theorem, Lebesgue domainated convergence theorem, Fatou's lemma, Monotone convergence theorem.

L^p-space, Properties of L^p-space, Holder's inequality, Minkowski's inequality and Schwartz's inequality, Convergence in the mean, Riesz-Fischer theorem.

References

1. Royden, H.L.,
   Real Analysis (2nd ed.)
   The Macmillan Co., new York (1968)

2. Jain, P.K. & Gupta V.P.,
   Lebesgue measure and Integration
   Willey Eastern Ltd., New Age Int. Ltd., New Delhi, (1994)

3. Inder K. Rana,
   An Introduction to measure and integration, Narosa Publishing House, Delhi, (1997)

4. D.Somasundaran

   A Second Course in Mathematical Analysis

   Narosa Publishing House, N.Delhi, (2010)

Code	Name	Lecture
MST102	**Differential Equations and Applications**	4

Unit 1. Existence & uniqueness theorem, General theory of Homogenous and nonhomogeneous equations with constant coefficients, Theory of equations with variable coefficients, Method of variation parameter and the formula for particular integral in terms of Wronskian.

Unit 2. Series Solution of second order linear differential equations near ordinary point, Singularity and the solution in the neighborhood of regular singular point, Euler equation and Frobenious method, Solution of Legendre, Bessel, Hypergeometric, Hermite and Lagurre differential equations.

Unit 3. Formulation of heat conduction equation and its solution by variable sepration method, Steadystate condition and the solution of heat conduction problem with non-zero end conditions, Formation of wave equation and the solution of wave equation.

Unit 4. Linear homogeneous boundary value problems, Eigen values and Eigen functions, Sturm Liouville boundary value problems, Non-homogeneous boundary value problems, Green's functions and the solution of boundary value problems in terms of Green's functions.

References

1. Earl A. Coddington,
   An Introduction to Ordinary Differential Equation.

2. Boyce and Diprime.,
   Elementary Differential Equations and Boundary Value Problems.

3. E. Weinberger,
   A first course in partial differential equations

Code	Name	Lecture
MST103	**Discrete Mathematical Structures**	4

Unit 1. Relations and Functions, Equivalence Relations, Partial Order, Recurrence Relations, Solutions of Linear homogeneous Recurrence Relations, Introduction to Mathematical Logic, Propositional Calculus.

Unit 2. Lattices and Boolean algebra, Boolean Functions, Connonical Form (Disjunctive Normal Form) of a Boolean function, Karnaugh Maps.

Unit 3. Graphs and their representations, Walk, Path, Cycle, Circuit, Eulerian Graphs, Connected Graphs, Planar Graphs, Trees, Spanning trees, Binary Tree Traversals.

Unit 4. Linear codes, Hamming Code, Generator and parity check matrix, Hamming distance standard array and Syndrome decoding, introduction to cyclic codes.

References

1. Discrete Mathematics
   K.A. Ross, Charles R.W. Wright,
   Prentice Hall Inc.

2. Discrete Mathematical Structure for Computer Sciences
   Bernard Kolman / Robert C. Busby
   Prentice Hall of India.

3. Theory of Error Correcting Codes
   F.J. Mac. Williams / N.J.A.Sloane,
   North Holland Pub. Co.

4. Graph Theory with Applications to Engineering and Computer Science
   Narsingh Deo,
   Prentice Hall of India.

Code	Name	Lecture
MST104	**Computing Fundamentals & Programming**	4

Computer Fundamentals: Introduction, Computer Architecture, Program, Software, Types of Software, Problem Solving, Top-down Design, Implementation of Algorithms, Flow Chart.

Basic Concepts of C: Introduction to C, Features, Character Set, C Token, Identifier & Keyword, Constants, Variables, Data Types in C , Integer, Floating Point, Character, String, Enumeration, ,Data Declaration & Definition, Operator & Expression Arithmetic, Relational, Logical, Increment & Decrement, Bit wise, Assignment, Conditional, Precedence & Associability of Operators. Managing Console I/O, Control Statements, Selection Statements, If, Nested if, if-else-if, The Alternative, The Conditional Expression, Switch, Nested Switch, Iteration Statements for loop, while loop, do-while loop ,Jump Statements.

Functions: Introduction, Need for User-Defined Function, A Multi-function Program, Definition of Function, Arguments & local variables, Returning and Calling Function by reference & Call by value, Passing Arrays & Strings to Function, Returning Multiple Values, Recursion, Recursive Functions, Storage Class & Scope.

Arrays, Strings & Pointers: Single Dimension Arrays, Accessing array elements, Initializing an array, Multidimensional Arrays Initializing the arrays, Memory Representation Accessing array elements, Passing Single Dimension array to Function, Array & Pointer, Array of Pointers, String Manipulation Functions, The Pointer operator, Pointer Expression, Declaration of Pointer, Initializing Pointer, De-referencing Pointer, Pointer to Pointer, Constant Pointer, Array of Pointers, Pointer to Function.

Structure, Union, Enumeration & File Handling: Structures, Declaration and Initializing Structure, Accessing Structure members, Structure, Assignments, Arrays of Structure, Passing Structure to function, Structure Pointer, Unions, File handling, Introduction, Defining & Opening a File, Closing a File, Input/Output Operations on Files, Command Line Arguments.

Reference:

- E Balagruswamy, Programming in ANSI C, TMH, Third Edition 2005
- R G Dromey, How to Solve by Computer, Pearson Education, Fifth Edition 2007.
- Deitel & Deitel, C: How to Program, Pearson Education, , Third Edition, 2003

Code	Name	Lecture
MST105	**Computer Based Numerical Methods**	4

Unit-1 (6+6):

Solution of algebraic and transcendental equations by Newton-Raphson method for simple and multiple roots and its convergence. Solution of system of non-linear equations by Iteration and Newton-Raphson method. Lagrange's form of interpolating polynomial. Existence and uniqueness of interpolating polynomial, Piecewise interpolation, Hermite and Cubic spline interpolation.

Unit-2 (10)

Least square approximation : Weighted least square approximation. Method of least square for continuous functions, orthogonal polynomials, Gram-Schmidt orthogonalization process and approximation of functions using Chebyshev polynomials.

Unit-3 (6+6)

Numerical integration by Romberg method; Guassian quadrature formula and error estimation. Numerical solution of initial value problems: Runge Kutta method of order four for system of equations and for second and higher order differential equations. Boundary Value problems by Finite difference method and shooting method. Convergence of finite difference scheme.

Unit-4 (10)

Numerical solution of partial differential equations: Parabolic equations- finite difference approximation to partial diff. derivatives, explicit method and Crank-Nicolson method with stability analysis.

Elliptic equations- Standard five point formula, Jacobi's iteration method and Leibmann's method. Hyperbolic equations: Explicit finite difference method.

Reference:

1. S.D. Conte & Carl D. Boor, Elementary Numerical Analysis

2. Iyengar and Jain: Numerical methods for Scientific and Engineering Computations
3. G.D. Smith, Numerical Solution of Partial Differential Equations
4. M.K. Jain, Numerical Solution of Differential Equations
5. Naseem Ahmad, Fundamentals Numerical Analysis with error estimation
6. Gerald & Wheatlay: Applied Numerical Analysis

Code	Name	Lecture
MST201	**Linear Algebra**	4

Unit-I

Vector Space, Subspaces and properties, Quotient Space, Basis and Dimension, Linear Transformation, Rank And Nullity of a Linear Transformation, Sylvester's Law of Nullity.

Unit-II

Algebra of Linear Transformations, Hom(u,v), L(u) Dual Space, Bidual, Direct sum of subspaces, Independent Subspaces.

Unit-III

Matrix of Linear Transformations, Change of Basis, Equivalent and Similar Matrices, Relationship between Hom(u,v) and Mm,n(F). Minimal Polynomials, of a Linear Transformations and its properties, Eigen Values, Eigen Vectors.

Unit-IV

Inner-Product Space, Orthogonality and Orthonormality, Sehwartz inequality, Gram-Schmidt Orthogonalization process, Unitary, Adjoint, Hermition, Skew Hermition, Normal Linear transformation and their properties..

References

- I. N. Herstein, Topics in Algebra.
- P. R. Halmos, Linear Algebra with Problems.
- Hoffman & Kunze, Linear Algebra.
- Surjeet Singh & Q Zameeruddin, Modern Algebra.

Code	Name	Lecture
MST202	**Curves, Surfaces & Applications**	4

Unit-1: Curves in R^3, unit speed curves, tangent to a curve, principal vectors, binormal vector, curvature and torsion, Serret - Frenet formula, Helix, Offset curves, Bertrand Curves.

Unit-2: Surface in R^3, Smooth surface, Tangent , normal and orientibilty, first fundamental form, Conformal mapping of a surface, second fundamental form, normal curvature, geodesic, curvature of curves on a surface.

Unit-3: Principal curvature, Meusnier's theorem, Euler's theorem, Umbilical surface, Guassian and mean curvature, geodesic, geodesic equation, Guass equations, Codazzi- Mainardi equations.

Unit-4: Bezier curves, Properties of Bezier curves, Join of two Bezier curves, subdivision of Bezier curves, Linear, quadratic and cubic Bezier curves, Derivative of Bezier curve, B-spline curves, Derivatives and properties of B-spline curves, B-spline surfaces.

References

1. Elementary Differential Geometry, B.O. Neill, Academic Publishers.
2. Elementry Differential Geometry, Andrew Pressley, Springer.
3. Differential Geometry of Curves and Surfaces, M. P. do Carmo, Prentice Hall.
4. Basics of Computer Aided Geometric Design, M. Ganesh, I. K. International.
5. Introduction to Differential geometry, t. G. Willmore, Oxford University Press.

Code	Name	Lecture
MST203	**Operating Systems**	4

Introduction: Evolution of Operating System, Types and Functions of Operating Systems, Operating System Structure, Operating System Classification, Characteristics of Modern Operating Systems.

Processor Management: Process Overview, Process States and State Transition, Multiprogramming, Multi-Tasking, Levels of Schedulers and Scheduling Algorithms. Process Communication, Process Synchronization, Semaphores, Critical Section and Mutual Exclusion Problem, Classical Synchronization Problems, Characterization of a Deadlock, Deadlock Prevention, Deadlock Avoidance, Multithreading.

Memory Management: Classical Memory Management Techniques, Paging, Segmentation, Virtual Memory - Demand Paging, Page Replacement Policies, Allocation of Frames, Thrashing.

File Management and Mass-Storage Structure: File Concept, Access Methods, Directory Structure, File-System Mounting, File Sharing, Protection, File-system Structure, File-System Implementation, Directory Implementation, Allocation Methods. Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File System NFS. Overview of Disk Scheduling - FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK, Disk Management.

References

- Silberschatz, P.B.Galvin and G. Gagne, **Operating System Concepts** (6th ed.), John Wiley & Sons, Inc., 200.
- A.S. Tanenbaum, **Modern Operating Systems** (2nd ed.), Prentice-Hall of India, 2001.
- William Stallings, **Operating Systems: Internals and Design Principles** (5th ed.), Prentice-Hall of India, 2006.
- Gary Nutt, **Operating Systems: A Modern Approach** (3rd ed.), Addison Wesley, 2004
- D.M. Dhamdhere, **Operating Systems: A Concept Based Approach** (2nd ed.), Tata McGraw-Hill, 2007
- Deitel Deitel Choffnes, **Operating Systems** (3 rd ed.), Pearson Education 2007.

Code	Name	Lecture
MST204	**Computer Organization & Architecture**	4

Unit-I

Information Representation: Number Systems, Binary Arithmetic, Fixed-point and Floating-point representation of numbers, Codes, Complements, Error detecting and correcting codes, Character Representation – ASCII, EBCDIC.
Boolean Algebra: Basic Definitions, Axiomatic definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms.

Unit -II

Digital Logic: Basic Gates – AND, OR, NOT, Universal Gates – NAND, NOR, Other Gates – XOR, XNOR etc. NAND, NOR implementations of digital circuits, Simplification Of Boolean Expressions: Formulation of simplification problem, Karnaugh Maps, Minimal, Combinational Logic Design Procedure, Adders, Subtractors, Code Conversion, Decimal Adder, Magnitude Comparator, Decoders, Encoder, Multiplexers, De-multiplexer

Unit-III

Sequential Logic: Flip-Flops, Clocked RS, D type, JK, T type, State table, state diagram and state equations. Flip-flop excitation tables. Design Procedure, Design of sequential circuit and Counters, Shift registers, Synchronous Counters. Primary Memory, Secondary memory, Cache memory, Memory Hierarchy

Unit-IV

Architecture: Basic architecture of computer, Bus structures, Von Neumann Concept. Zero address, one address, two address and three address machine, Addressing modes, Microprogramming, Micro engine ,Micro instruction , Pipelining, Array processing, vector processing, Synchronous and Asynchronous Data transfer, DMA data transfer.

References

1. M.Morris Mano, 'Computer Engineering Hardware Design', PHI.
2. V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, Prentice Hall of India Pvt. Ltd.
3. Nicholas Carter, Schaum's Outlines Computer Architecture, Tata MH.
4. Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall of India Pvt. Ltd.
5. William Stalling, "Computer Organization and Architecture" Pearson Education

6. J. P. Hayes “Computer Architecture and Organization" McGraw Hill Education India.
7. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, 5th Edition, Mc Graw-Hill Education India
8. M.Morris Mano : Computer System Architecture, Prentice Hall of India.
9. M.Morris Mano, ‘Digital Logic and Computer Design’, PHI.
10. Donald e Givone, Digital principles and Design, TMH (Unit II and V)

Code	Name	Lecture
MST205	**Data Structures**	4

Introduction to Data Structure: Definition of Data Structure, Types & Characteristics of Data Structures, Abstract Data Type (ADT), Algorithms: Algorithm Concepts, Definition of Algorithm, Objectives of Algorithms, Quality of an Algorithm, Space Complexity and Time Complexity of an Algorithm.

Arrays, Stacks and Queues: Characteristics & of an Array, Row and Column Major Implementations of 1 - D, 2-D, 3-D Arrays. Operations on Stack, Stack Implementation using Array and Linked List, Applications of Stack - Polish and Reverse Polish Notations, Recursion, Buddy Systems, Garbage Collection. Operations on Queues, Types of Queues: Linear Queue, Circular Queue, Priority Queue, Double Ended Queue, Queue Implementation.

Linked Lists: Concept of a Linked List, Linear Single and Double Lists, Circular Single and Double List, Operations on Linked Lists. Applications of Linked Lists.

Trees and Graphs: Concepts of a Tree, Definitions of n-ary, Binary Trees, Strictly Binary Tree, Complete Binary Tree, Almost Complete Binary Tree, Level of a Node, Height/Depth of a Tree. Operations on Tree, Tree Search Algorithms, Binary Search Tree, Tree Traversal Algorithms, AVL Trees - Balance of a Node, Weight Balanced Trees. Threaded Binary Tree, Trees Traversal, Huffman Algorithm, Definitions of Vertex Edge and Graph, Types of Graphs – Directed/Undirected, Connected/Disconnected, Cyclic/Acyclic, Representation of Graphs: Adjacency Matrix, Linked List. Graph Algorithm-Warshalls, BFS, DFS, Kuruskal, Prims.

Sorting and Searching: Bubble Sort, Sequential Sort, Shell Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Topology Sort. Linear Search and Binary Search

References:

- Classic Data Structures by D. Samanta, PHI
- Data Structures by S. Lipshutz, Schaum outline series, Tata Mc-graw Hill
- Data Structures Using C & C++ by Tananbaum
- Introduction to Algorithms Cormen, Leiserson, Rivest.

Code	Name	Lecture
MST301	Topology	4

Unit – 1:

Metric Spaces, Open and Closed spheres and sets. Topological Spaces. Closed set, Closure, Dense subsets, Neighborhoods, Interior, Exterior and Boundary of a set, Accumulation points and Derived sets, Bases and Sub bases, Subspaces and Relative topology. The Product topology on two spaces. The Metric topology. Continuous functions and Homeomorphism.

Unit – 2:

First and Second countable spaces, Separable spaces, Second countability and Separability, Separation Axioms, T_i (i = 0,1,2) spaces and their characterizations and basic properties, Regular and Normal Spaces, Urysohn's lemma, Tietze extension theorem.

Unit – 3:

Open covering and Compact spaces, Continuous functions and Compact sets, Finite intersection property, Locally compact spaces, Countable compactness and Sequential compactness, Bolzano Weierstrass property, Lebesgue covering lemma, Total boundedness, Equivalence of compactness.

Unit – 4:

Separation of a space, Connected spaces, Connected sets in the real line, Totally disconnected spaces, Intermediate value theorem, Path connected, Components, Local connectedness, Locally path connected spaces, Continuous functions and connected sets.

Books Recommended

1. J.R. Munkres: Topology (Relevant portions only)
   Pearson Education, 2004.
2. Benjamin T. Sims:
   Fundamentals of Topology (Relevant portions only)
   Macmillan Publishing Co. Inc. N.Y.

Help Books

1. Colin Adams and Robert Franzosa:
   Introduction to Topology Pure and Applied

Pearson Prentice Hall, 2009.

2. G.F. Simmons:
   Introduction to Topology and Modern Analysis
   McGraw Hill Book Company, 1963
3. B.K.Tyagi:
   Metric Spaces
   Cambridge University Press India Pvt. Ltd., 2010

Code	Name	Lecture
MST302	**Computer Networks**	4

Introduction to Computer Networks and its uses: Network categorization and Hardware: Broadcast and point-to point networks, Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Networks (WAN), Inter Networks, Network Software: Protocols, Services, Network Architecture, design issues, OSI Reference Model, TCP/IP Reference Model, review of different layer services, comparison of OSI and TCP/IP model.

Physical Layer and Connectivity devices:
The Physical Layer: different transmission media, guided transmission media- twisted pair cable, coaxial cable, fiber-optics, wireless transmission- radio waves, micro waves, infrared waves; satellite communication, network topologies and architecture, Connectivity devices: Introduction to modems, switch, hub, repeater, gateways, routers, network adopter card, data communication model, digital to analog data and signals, bit rate baud, band width.

Date Link Layer and Medium Access Sub Layer:
Date Link Layer: error detection and correction, error control, flow control, data link protocol, stop and wait protocol, sliding window protocol: A one-bit sliding window protocol, A protocol using go back-N, A protocol using selective repeat, examples of data link protocols: HDLC(High Level Data Link Control), FCS (Frame Check Sequence);Medium Access Sub Layer:channel allocation, ALOHA- pure ALOHA, slotted ALOHA, Medium Access Control, Carrier Sense Multiple Access, CSMA with Collision Detection, wireless LAN protocol, IEEE standards 802 for LANs.

Network Layer, Transport Layer and Application Layer:
Network Layer: services provided to the transport layer, routing algorithms, shortest path routing, flooding algorithms, IP protocol, IP address; Transport Layer: design issues, transport protocols: Inter transport protocol- Transmission Control Protocol (TCP),User Datagram Protocol (UDP);Application Layer:application layer services and protocols- Domain Name System (DNS), electronic mail, file transfer protocol, hypertext transfer protocol, Introduction to Network Security and Cryptography(DES, RSA algorithms), Communication Security(Firewalls).

References:

- B.A. Forouzan, "Data Communication and Networking", TMH, 4th Ed., 2006.
- A.S. Tananbaum, "Computer Networks", 4th Ed., Pearson, 2003.
- W. Stallings, "Data and Computer Communications", 7th Ed., Pearson, 2002.
- Comer E. Doughlas, "Computer Networks and Internet", 2nd Ed., Pearson, 2000.
- Black U, "Computer Networks- Protocols, Standards and Interfaces", PHI, 1996.

Code	Name	Lecture
MST303	**Database Management System**	4

Introduction: Database – Characteristics, Advantages & Disadvantages, Applications. Schemas & Instances. Difference Between Hierarchical, Network and Relational Model. Three Schema Architecture and Data Independence. Client Server Architecture for DBMS. Classification of DBMS.

Data Modeling and Functional Dependency: Data Model, Types, Data Modeling Using E-R Diagram, Entity Type, Entity Sets, Attribute & Keys, Weak Entity. Relational Model Concepts, Relational Database Schemas, Constraint Violations. Relational Algebra and Relational Calculus, Introduction to Tuple Relational Calculus and Domain Relational Calculus, Codd's Rule for Relational Database, Indexes and Hash Indexes.

Functional Dependency and Normalisation: Design Guidelines for Relational Schemas, Functional Dependency, Normal Forms Based on Primary Keys. Definition of First Normal Form, Second Normal Form, Third Normal Form and BCNF.

Higher Normal Forms and Transaction Management: Multivalued Dependency and Fourth Normal Form, Join Dependency and Fifth Normal Form. Inclusion Dependency, Transaction Processing Concepts, Locks, Serializability and Concurrency Control, Database Security.

SQL: Table Creation, Deletion and Modification in SQL, Defining Constraints, Basic Structure of SQL for Data Extraction from Database, Insert, Delete & Update Statements in SQL, Views in SQL, Aggregate Functions , Nested Queries, Introduction of QBE.

PL/SQL: Introduction of PL/SQL, Programming Constructs, Procedures, Functions, Exception handling, Cursors, Triggers and Packages.

References

- "Fundamentals of Database Systems", Elmasri, Navathe, Pearson Education, IVth Edition. Pearson Education.
- "Database system concepts", Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill.
- "An Introduction to Database Systems", C.J.Date, Pearson Education.
- "Data Base System", Michael kifer and et all, Pearson Education..
- "Database Management Systems" ,Ramakrishna, Gehrke;Mcgraw-Hill.
- The Database Book –Principle and Practice" By Narain Gehani, University Press.
- ""A first course in Database Systems", Jeffrey D. Ullman, Jennifer Windon, Pearson Education.

Code	Name	Lecture
MST304	**Object Oriented Programming**	4

Object Oriented Methodology & Java Language Basics: Paradigms of Programming Languages, Evolution of OO Methodology, Basic Concepts of OO Approach, Comparison of Object Oriented and Procedure Oriented Approach, Benefits and Applications of OO Programming, Introduction to Common OO Languages, Introduction to Java, Basic Features of Java, Java Virtual Machine Concepts, Data type, Variables and Arrays, Operators, Control Statements.

Object Oriented Concepts: Classes and Objects, Constructors, Method Overloading, Argument Passing, Recursion, Access Control, Understanding Static. Inheritance and Polymorphism – Inheritance Basics, Access Control, Use of Super, Multilevel Inheritance, Method Overriding, Dynamic Method Dispatching, Preventing Inheritance and Overriding.

Packages, Interface and Exception Handling: Java API Package, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package. Interface – Defining an Interface, Implementing Interface, Applying Interface, Accession of Interface Variable, Interface and Abstract Class. Exception Handling - Exception Types, Handling of Exception using try-catch, Catching Multiple Exceptions, Nested try Statements, Use of throw, throws and finally Clause, Java Built-in Exception, Creating Exception Subclasses.

Multithreading, I/O and String Handling: Thread Models, Main Thread, Creating Threads, Thread Priorities, Life Cycle of Thread, Synchronization in Java, Thread Exceptions, Inter-Thread Communications. I/O Basics, Byte Stream and Character Stream Classes, Reading from and Writing to Console, Reading and Writing Files, Transient and Volatile Modifiers, Stream Tokenizer, Serialization. String – Fundamental of Characters and Strings, String Class, String Operations, String Buffer Class and Methods.

Applet Programming and Advance java Concepts: Applet Basics, Applet Architecture, Applet Initialization and Termination, Writing Applets, HTML Applet Tags, Passing Parameters to Applets, AudioClip Interface, and AppletStub interface. Java Database Connectivity – Different Types of Drivers, Establishing a Connection, Transactions with Database. Overview of Event Handling, AWT Controls, Layout Managers, Menus and Swing.

References

1. Cay Horstmann, **Computing Concepts with Java Essentials** (5th ed.), John Wiley & Sons, 2006
2. Bruce Eckel, **Thinking in Java**, Pearson Education, 2006.

3. H. Schildt, **Java 2: The Complete Reference** (5th ed.), Tata McGraw Hill, 2002
4. Richard Johnson, **An Introduction to Java Programming and Object-Oriented Application Development,** Thomson Learning, 2006
5. Cay S. Horstmann & Gary Cornell, **Core Java Volume I** (7th ed.), Sun Microsystems Press Java Series, 2006
6. Deitel & Deitel, **Java-How to Program** (7th ed.), Prentice Hall, 2006
7. Daniel Liang, **Introduction to Java Programming** (5th ed.), Prentice Hall, 2005
8. J.A. Slack, **Programming and ProbPlem Solving with Java**, Thomson Learning, 1999

Code	Name	Lecture
MST305	**Soft Skills**	4

Self Development and Assessment: Self-Assessment, Self-Awareness, Perception and Attitudes, Values and Belief System, Personal Goal Setting, Career Planning, Self-Esteem, Building of Self-Confidence.

Communication Skill: Components of Communication, Principles of Communication, Barriers, Listening Skills. Verbal Communication - Planning, Preparation, Delivery, Feedback and Assessment of Activities Like Public Speaking, Group Discussion, Presentation Skills, Perfect Interview, Listening and observation Skills, Body language.

Written Communication: Technical Writing –Technical Reports, Project Proposals, Brochures, Newsletters, Technical Articles, Technical Manuals, Official/Business Correspondence, Business Letters, Memos, Progress Report, Minutes of Meeting, Event Reporting, Use of Style, Grammar and Vocabulary for Effective Technical Writing, Use of Tools, Guidelines for Technical Writing, Publishing.

Ethics, Etiquettes and Other Skills: Business Ethics, Etiquettes in social as well as Office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics and ethics as an IT professional, Civic Sense, Managing time, Improving Personal Memory, Study Skills that Include Rapid Reading, Notes Taking, Complex Problem Solving, Creativity.

References:

1. You Can Win – Shiv Khera – Macmillan Books – 2003 Revised Edition
2. 7 Habits of Highly effective people – Stephen Covey
3. Business Communication - M. Balasubramanyam
4. Business Communication - M. Balasubramanyam
5. John Collin, “Perfect Presentation”, Video Arts MARSHAL
6. Jenny Rogers “Effective Interviews”, Video Arts MARSHAL
7. Raman Sharma, “Technical Communications”, OXFORD
8. Sharon Gerson, Steven Gerson “Technical writing process and product”, Pearson Education Asia, LPE third edition.
9. R. Sharma, K. Mohan, Business correspondence and report writing”, TAG McGraw Hill ISBN 0-07-044555-9
10. XEBEC, “Presentation Book 1, 2, 3”, Tata McGraw-Hill, 2000,ISBN 0-40221-3.
11. Tim Hindle, “Reducing Stress”, Essential Manager Series Dk Publishing
12. Sheila Cameron, “Business Student

Code	Name	Lecture
MST401	**Functional Analysis**	4

Unit 1. Normed Spaces, Banach Spaces and Bounded Linear Operators:

Definition and examples, subspaces, some concrete examples of Banach spaces, bounded linear operators, spaces of bounded linear operators, equivalent norms, open mapping and closed graph theorems and their consequences, uniform boundedness principle.

Unit 2. Bounded Linear Functionals:

Examples and basic properties, Forms of dual spaces, Hahm-Banach theorem and its consequences, embedding and reflexivity, adjoint of bounded linear operators, weak convergence.

Unit 3. Inner Product and Hilbert Spaces:

Definitions and examples, orthogonality of vectors, orthogonal complements and projection theorem, orthonormal sets, complete orthonormal sets.

Unit 4. Functionals and Operators on Hilbert Spaces:

Bounded linear functionals, Riesz-Frechet theorem, Hilbert-adjoint operators, self-adjoint operators, normal operators and unitary operators.

Books Recommended:

1. Introductory Functional Analysis and Applications
E. Kreyszig,
John-Wiley & Sons.

2. Introduction to Functional Analysis with Applications
A.H.Siddiqi, Khalil Ahmad and P. Manchanda,
Anamaya Publishers, New Delhi and Anshan Ltd., U.K. (2006).

Code	Name	Lecture
MST402	**Complex Analysis**	4

Unit-I

Representation of Complex Numbers, Analytic Function, Cauchy Riemann Equations, Power Series, Some Elementary Functions, Harmonic Functions.

Unit-II

Properties of Line Integrals, Zeros of an Analytic Function, Cauchy's Theorem, Morera's Theorem, Cauchy's Integral Formula, Cauchy's Inequality, Fundamental Theorem of Algebra, Poisson's Formula, Liouville's Theorem, Rouche's Theorem, The Argument Principle.

Unit-III

Zeros and Poles, Classification of Isolated Singularities, Taylor's and Laurent's Series, Winding Numbers and Residues, Cauchy Residue Theorem and Application in Evaluation of Improper Real Integrals and Evaluation of Sum.

Unit-IV

Conformal Mapping Properties, Schwarg Lemma, Riemann Mapping Theorem (Without Proof), Maximum Modulus Theorem, Analytical Continuation.

References

- Rudin, Real and Complex Analysis
- J. B. Conway, Complex Analysis.
- Alfors, Complex Analysis.
- E. C. Titchmarsh, Complex Analysis.
- B. Choudhary, Complex Analysis.
- Anant R. Shastri – Complex analysis
- Zill Dennis G. & Shanahan Patrick D. – A first course in Complex Analysis with Applications.
- Fundamentals of Complex Analysis with Applications to Engineering and Science, E-B Saff and A-D Snider.

Code	Name	Lecture
MST403	**Formal language & Automata Theory**	4

Unit-I: Definitions: - Alphabets, Strings, Languages, Grammar, automata and other related definitions, various operation on languages :- union, concatenation, negation, reverse, kleen star , intersection etc. Applications of automata in various fields of Computer Science, Engineering and Application. Formal languages and grammars, Construction of grammar for a given language, finding language for a given grammar. Leftmost derivation, rightmost derivations, sentential forms, derivation tree/ parse tree, Ambiguous grammar and languages ,Chomsky Classification of grammar and languages, unrestricted grammar, context sensitive grammar, Context free grammar, Regular Grammar , Right Linear grammar, left linear grammar hierarchy and machines corresponding to formal languages. Problems based on these concepts.

Unit-II: Definition:- DFA, NFA, Moore machine, Mealy machine, Regular Expression. Acceptance of a language by DFA and NFA , configuration of DFA NFA , Constructing DFA for a given language, finding language for a given DFA. Constructing NDFA for a given language, finding language for a given NFA. Converting NFA to DFA, Minimization of DFA, Finding a DFA/NFA from a given Regular Expression, identities on regular expression, Arden's theorem, Finding regular expression from a given DFA/NFA. Epsilon closure, Finding NFA with epsilon move from Regular expression, finding DFA from NFA with epsilon move . Methods to decide whether a given language is regular or not, Kleen's theorem. Closure properties of regular languages. Pumping lemma for regular languages and its applications. Conversion from Mealy to moore machine and vice- versa. Algorithms based on FA. Problems based on these concepts.

Unit-III: Simplification of Context free grammar, elimination of useless symbols,epsilon production and unit production, Normal forms of CFG:- CNF, GNF , converting a given grammar to CNF, converting a given grammar to GNF. Appliaction of CFG, parsing and ambiguity, removing ambiguity from grammar. PDA:- definition and construction. Acceptance by a PDA, Constructing PDA for a given language/grammar, Constructing language/grammar from a given PDA, Closure properties of Context free Languages. Pumping lemma for Context free languages and its application. Algorithms based on PDA .Problems based on these concepts.

Unit-IV: Turing Machine: - definition, construction and its applications, equivalence between TM and unrestricted grammar, TM as language acceptor, language decider and function computer, constructing TM for accepting/deciding a given language, constructing TM for computing a given function, Turing computable Functions, Combining TMs, Copying machine, shifting machine, TM for addition , multiplication, subtraction, division etc. Problems based on these concepts , Universal Turing Machine, halting problem, PCP problem ,Context sensitive language and LBA .

References

[1] J. E. Hopcroft and J. D. Ullman and Rajeev Motwani: Introduction to Automata Theory, Languages and Computation, Pearson Education Asia, 2nd Edition.
[2] H. R. Lewis and C. H. Papadimitriou: Elements of the Theory of Computation, Pearson education asia, 2nd Edition.
[3] J. C. Martin, "Introduction to languages and the Theory of Computation ", Third Edition, Tata Mc-Graw Hill
[4] Peter Linz, "Introduction Formal Languages and Automata ", Narosa, 3rd Edition.
[5] M. Chandrasekaran, and K.L.P. Mishra: Theory of Computer Science: Automata, Language and Computation, Prentice Hall of India .
[6] Kozen , Dexter C., Automata and Computability, Springer(India) Pvt Limited
[7] Kamala krithivasan and Rama R, Introduction to Formal Languages , Automata Theory and Computation, Pearson education.
[8] Thomas A. Sudkamp, An Introduction to the Theory of Computer Science Languages and Machines, Pearson Education.
[9] Alfred V. Aho and Jeffrey D. Ullman ,Principles of Compiler Design, Narosa Publishing House.

Code	Name	Lecture
MST404	**Software Engineering**	4

Introduction: Definition, Program Vs Software, Overview of S/W Engineering Process, Software life cycle Models: Build and Fix, Waterfall, Prototype, Iterative Enhancement Model, Evolutionary, Spiral Model, RAD Model.

Software Requirement Analysis and Specifications: Problem Analysis, Functional & Non-Functional Requirements, User & System Requirements, Requirements Engineering Process, Requirements Elicitation & Analysis Techniques, Requirements Validation, Requirements Management, Metrics for Analysis Model, Data Flow Diagrams, Data Dictionaries, Decision Table, Decision Tree, Software Requirement and Specifications.

Software Project Planning: Objectives, Project Size Estimation, Cost Estimation, Decomposition Techniques, Empirical Estimation Model, COCOMO Estimation Model, Project Scheduling & Tracking, Risk Management: S/W Risks, Risk Identification, Risk Refinement, Risk Monitoring & Management.

Software Design: Introduction, Principles, Abstraction, Refinement, Modularity, Information Hiding, Module Level Concepts: Cohesion, Coupling, Functional Independence, Design Models, Metrics for Design Model, Data Design, Object Oriented Design, User Interface Design, Component Design, Detailed Design Document.

Software Testing and Quality Assurance: Introduction, Error, Faults, Failure and Reliability, Testing Levels: Unit, Integration, Validation and System Testing, Functional and Structural Testing, Test Case Design, Quality Assurance and Standards.

References

- Prof. K.K. Aggarwal & Yogesh Singh: SOFTWARE ENGG:
- Pankaj Jalote, " An Integrated Approach to Software Engg" Narosa Publishing House, New Delhi.
- Pressman"Priciples of Software Engg" TMC, 5th Ed. 2005

Code	Name	Lecture
MST405	**Internet Technologies**	4

Internet Basics: Overview of Internet, History, Web System Architecture, Internet vs. Intranet, Uniform Resource Locator, Protocol used in Internet – TCP/IP, SMTP, PPP, HTTP, Services on the Internet - E-mail, Usenet, FTP, Search Engines, Web Browsers.

An Overview of Java: Data Types, Variable and Arrays, Classes and Objects, Constructors, Method Overloading, Inheritance and Polymorphism, Method Overriding, Abstract Class, Interfaces, Packages, Exception Handling, Multithreading.

Database Connection and XML: Java Database Connectivity – Different Types of Drivers, JDBC API's, Establishing a Connection, Statements & its Type, Record Sets, Transactions with Database. Overview of XML, XML Development Goal, Structure of XML Document, XML Parser.

Servlet Programming: Servlet API Overview, Servlet Life Cycle, Servlet Implementation, Servlet Configuration, Servlet Exception, Requests & Responses, Servlets & JDBC, Servlet Sessions, Context and Collaboration.

JSP Basics and Architecture: JSP Directives, Scripting Elements, Standard Actions, Implicit Objects, Scope, JSP With Beans, JSP & Databases, Creating Custom JSP Tag Libraries using Nested Tags.

References

1. Robert W. Sebesta, **Programming the World Wide Web,** (4th ed.), Addison Wesley, 2007.
2. Bruce Eckel, **Thinking in Java**, Pearson Education, 2006
3. H. Schildt, **Java 2: The Complete Reference** (5th ed.), Tata McGraw Hill, 2002.
4. Dustine R. Callway, **Inside Servlet** (1st edition), Pearson Education, 2001.
5. James Goodwill, **Developing Java Servlets** (2nd Edition), Sams, 2001.
6. Wrox press**, Professional JSP J2EE 1.3 Edition**, Shroff Publishers, 2005.
7. Jim Keogh, **J2EE: The Complete Reference**, TMH, 2002.

Code	Name	Lecture
MST501	Operations Research	4

Unit I

Linear programming: applications and model formulation, Theory of Simplex method, Two Phase Method, Big-M method.

Unit II

Duality in LP, Dual Simplex method, Sensitivity analysis, Integer Programming, Branch and Bound Technique, Dynamic programming, Bellman's Principle of Optimality

Unit III

Queuing Theory, Model-I (M/M/1):(∞/FCFS), Model-II (M/M/1):(N/FCFS), Network analysis, Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), Project Planning with CPM/PERT

Unit IV

Nonlinear Programming, One and Multi Variable Unconstrained Optimization, Kuhn-Tucker Conditions for Constrained Optimization, Quadratic Programming-Wolfe's method, Separable Programming.

References:

1."Operations Research" S. D. Sharma, Ram Nath Kedar Nath.
2."Operations Research – Theory and Application" J. K. Sharma, Macmillian Pub.
3."Mathematical Programming" S. M. Sinha, Elsevier India Pvt. Ltd.
4."Introduction to Operations Research" Hillier and Lieberman, McGraw Hill.
5."Operations Research – An Introduction" H. A. Taha.
6."Linear Programming" G. Hadly, Narosa Publishing House.

Code	Name	Lecture
MST502	**Analysis & Design of Algorithm**	4

Introduction: Algorithm Design Paradigms, Motivation, Concepts of Algorithmic, Efficiency, Run-Time Analysis of Algorithms, Order Notation – Big O, Theta and Omega Notations, Substitution, Iteration and Master's Methods.

Sorting and Searching Techniques: Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Linear Time Sorting: Bucket Sort, Radix Sort and Counting Sort, Searching Techniques: Sequential Search, Binary Search, Multiplication of Large Integers and Strassen's Matrix Multiplication.

Advanced Data Structures: Heaps And Priority Queues, Ordered Binary Trees, AVL Trees, B-Trees, B+ Trees, Binomial Heaps, Red-Black Trees, Topological Sorting.

Algorithm Design Strategies: Divide-and-Conquer Approach, Structure of Divide-and-Conquer Algorithms, Analysis of Divide-and-Conquer Algorithms. Greedy Technique - Overall View of Greedy Paradigm, Prim's Algorithm, Kruskal's algorithm, Dijkstra's Algorithm.

Dynamic Programming: Form of Dynamic Programming Algorithms, Differences between Dynamic Programming and Divide-and-Conquer Approach, Matrix Chain Multiplication, Longest Common Subsequence Problem, Warshall's and Floyd's Algorithms.

NP - Completeness: O/1 Knapsack Problem, Travelling Sales Person Problem, Polynomial Time, Polynomial Time Verification, NP Hard and NP-Complete Problems, Simple NP-Hard Problems.

References

- Cormen Leiserson, Rivest and Stein, Introduction to Algorithms, PHI
- Levitin, A., Introduction to the Design and Analysis of algorithms, Pearson Educatioin.
- Aho, Hopcroft. & Ullman, Design and analysis of algorithms, Pearson Education.
- Horowitz, Sahni, Analysis and Design of Algorithms
- Sar Baase, Gelder, Computer Algorithms, Pearson Education.

Code	Name	Lecture
MST503	**Data Mining**	4

Data Warehouse and OLAP Technology: Introduction to Data Warehouse; Features of Data Warehouse; Operational Database Systems vs. Data Warehouses; Difference Between OLTP and OLAP; Multidimensional Data Models: Data cubes, Star Schema, Snowflake Schema; Concept Hierarchies; OLAP Operations: Roll-up, Drill-down, Slice, Dice, and Pivot; Three-Tier Data Warehouse Architecture; Types of OLAP Servers: ROLAP, MOLAP, and HOLAP.

Introduction to Data Mining: KDD (Knowledge Discover from Databases) Process and Data Mining; KDD Steps; Types of Data for Data Mining, Data Mining Functionalities, Classification of Data Mining Systems; Data Mining Task Primitives; Major Issues in Data Mining.

Data Preprocessing: Introduction to Data Preprocessing; Descriptive Data Summarization: Measuring and Central Tendency and Dispersion of Data; Visualization of Descriptive Data Summaries; Data Cleaning: Handling Missing Values, Filtering Noisy Data – Binning Method; Data Integration; Data Transformation: Smoothing, Aggregation, Generalization, Normalization and Feature Selection; Data Reduction; Data Discretization and Concept Hierarchy Generation.

Association Rule Mining: Market basket Analysis; Frequent Itemsets, Closed Itemsets, and Association Rules; Support and Confidence; Apriori Algorithm for Mining Frequent Itemsets Using Candidate Generation; Generating Association Rules from Frequent Itemsets; Improving the Efficiency of Apriori Algorithm; FP-Growth Algorithm for Mining Frequent Itemsets without Candidate Generation; Mining Closed Frequent Itemsets; Correlation Analysis.

Classification Rule Mining: Introduction to Classification and Prediction; Classification by Decision Induction; Attribute Selection Measures: Information Gain, Gain Ratio, and Gini Index; Tree Pruning; Bayesian Classification: Bayes' Theorem, Naïve Bayesian Classification, Bayesian Belief Networks; Classifier Accuracy Measures: Sensitivity, Specificity, Precision, and Accuracy; Predictor Error Measures; Accuracy Evaluation Methods: Holdout, Random Subsampling, Cross-validation, and Bootstrap; Accuracy Enhancement Methods: Bagging and Boosting.

Cluster Analysis: Introduction to Cluster and Clustering; Features Required for Clustering Algorithms; Data Types and Dissimilarity Measures in Cluster Analysis; Categorization of Clustering Methods; Partitioning-Based Clustering: k-means Algorithms, k-medoids algorithms (PAM, CLARA, CLARANS); Hierarchical Clustering: Agglomerative and Divisive Methods (AGNES, DIANA, BIRCH; Density-Based Clustering: DBSCAN.

References:

- J. Han & M. Kamber: Data Mining Concepts and Techniques, 2nd Ed., Morgan Kaufman
- Witten & E. Frank: Data Mining – Practical Machine Learning Tools and Techniques, 2nd Ed., Morgan Kaufman
- Michael Berry & Gordon Linoff: Data Mining Techniques , Revised Ed.

Code	Name	Lecture
MST504	**Artificial Intelligence**	4

Introduction: AI Problems, Foundation of AI and History of AI Intelligent Agents: Agents and Environments, The Concept of Rationality, The Nature of Environments, Structure of Agents, Problem Solving Agents and Problem Formulation.

Searching: Searching For Solutions, Uniformed Search Strategies – Breadth First Search, Depth First Search, Depth Limited Search, Iterative-Deepening Depth First Search Bi-Direction Search - Comparison. Search with Partial Information (Heuristic Search) Greedy Best First Search, A* Search, Memory Bounded Heuristic Search, Heuristic Functions. Local Search Algorithms: Hill Climbing, Simulated, Annealing Search, Local Beam Search, Genetical Algorithms. Constrain Satisfaction Problems: Backtracking Search for CSPS Local Search for Constraint Satisfaction Problems.

Knowledge Representation & Reasons Logical Agents: Knowledge – Based Agents, the Wumpus World, Logic, Propositional Logic, Resolution Patterns in Propos Ional Logic, Resolution, Forward & Backward. Chaining. First Order Logic. Inference in First Order Logic, Propositional Vs. First Order Inference, Unification & Lifts Forward Chaining, Backward Chaining, Resolution.

Planning: Classical Planning Problem, Language of Planning Problems, Expressiveness and Extension, Planning With State – Space Search, Forward States Spare Search, Backward States Space Search, Heuristics for Stats Space Search. Planning Search, Planning With State Space Search, Partial Order Planning Graphs.

Learning: Forms of Learning, Induction Learning, Learning Decision Tree, Statistical Learning Methods, Learning With Complex Data, Learning With Hidden Variables – The EM Algorithm, Instance Based Learning, Neural Networks.

References

- Introduction to Artificial Intelligence – Rajendra Akerkar, PHI.
- Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Education.
- Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition,
- Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).
- Artificial Intelligence and Expert Systems – Patterson PHI
- Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson
- PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.

Code	Name	Lecture
MST505	**Computer Graphics**	4

Overview of Graphics Systems: Overview of Computer Graphics; Video Display Devices; Raster Scan Display; Random Scan Display; Cathode Rays Tube (CRT) Display Device; Direct View Storage Tube (DVST) Display Device; Flat Panel display: Plasma Panel Display, Thin Film Electroluminescent Display, Light Emitted Diode (LED) Display Device, Liquid Crystal Display Device; Color CRT Display Devices: Beam-Penetration Method, Shadow-Mask Method.

Line, Curves and Surfaces: Line Drawing Algorithm, DDA Algorithm, Bresenham's Line Drawing Algorithm, Bresenham's Circle Drawing Algorithm, Mid-Point Circle and Ellipse Drawing Algorithm, Bezier Curves, 4 point and 5 point Bezier Curves using Bernstein Polynomials, B-Spline Curves, Computing control points given end slopes for a specified curve segment, Scan-Line Polygon Fill Algorithms, Boundary Fill and Flood-Fill Algorithms.

Two Dimensional Geometric Transformation, Viewing and Clipping: Basic Transformations: Translation, Rotation, Scaling; Other Transformations: Reflection and Shearing Operations; Transformation between Cartesian Coordinate Systems; Viewing: The viewing Pipeline, Viewing Coordinate Reference Frame, Window to Viewport Coordinate Transformation; Clipping: Point clipping; Line Clipping; Cohen-Sutherland Line Clipping Algorithm, Liang-Barsky Line Clipping Algorithm, Liang-Barsky Line Clipping Algorithm to Clip a Line Against Non-Rectangular Convex Polygon, Polygon Clipping: Sutheland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping; Text clipping.

Three Dimensional Geometric Transformations and Clipping: Basic Transformations: Translation, Rotation, Rotation with Rotation Axis Parallel to one of the Principal Axis, General Rotation, Scaling; Other Transformations: Reflections, Shears; Three Dimensional Line Clipping: Mid-Point Subdivision Line Clipping Algorithm, Liang-Barsky Line Clipping Algorithms..

Projection, Fractal Generation, Shading and Surface Rendering: Projection: Types of Projections, Perspective Projection Transformation with Center at Origin, Perspective Projection Transformations with center at C0(a, b, c), Orthographic Projection Transformation with Projection Plane as one of the Standard Plane, Orthographic Projection Transformation with Projection Plane Passes Through R0(x0, y0, z0) and Normal Vector is N=n1i+n2j+n3k, Isometric Projection Transformation; Fractal Geometric: Fractal Generation Procedure, Classification of Fractal, Fractal Dimension, Fractal Construction Methods; Shading: Shading Algorithms, Shading Model, Illumination Model; Hidden Surface Detection: Z-Buffer Method, A-Buffer Method, Scan Line Method.

References

- D. Hearn and P. Baker, “Computer Graphics”, Prentice Hall 2nd Edition, 19999.
- R. Plastock and Z.Xiang, “ Computer Graphics”, 2nd Edition Schaum’s Series, McGraw Hill, 2001.
- Foley et. al., “Computer Graphics Principles & practice”, Addison Wesley, 1999.
- David F. Rogers, “Procedural Elements for Computer Graphics”, McGraw Hill Book Company, 1985.
- W. Newman and R. Sproul, “Principles of Interactive Computer Graphics, McGraw-Hill, 1973.
- Rogars and Adams “Mathematical elements of computer graphics” Mc Graw Hill
- Edward Angele, Interactive Computer Graphics, A top-down approach with OpenGL , Addisen Wesley.
- Woo, Open GL Programming, Pearson Education