SYLLABUS FOR M.TECH.- (INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS)

(For the Colleges Affiliated under Pune University)

FOR THE YEAR I (SEMESTER I, II)

SEMESTER I

MIM- 101 Real Analysis
MIM- 102 Algebra I
MIM- 103 Discrete Mathematical Structure I
MIM- 104 C Programming
MIM- 105 Elements of Information Technology
MIM- 106- Lab work (Assignment List)

SEMESTER II

MIM- 201 Real and complex Analysis
MIM- 202 Algebra II
MIM- 203 Discrete Mathematical Structure - II
MIM- 204 Database Fundamentals
MIM- 205 Data Structure Using C
MIM- 206 Lab work (Assignment List)

MIM -101 : Real Analysis

Topic 1 : Metric Spaces and its Topology:
1.1 Metric Spaces Definition and Examples, k-cells, convex sets, open closed ball, properties
1.2 Definitions: Neighborhood, limit point, isolated points, closed sets, interior points, open sets, perfect sets bounded sets, dense sets, examples and properties
1.3 Definitions: Open cover, compact sets, examples and properties. Theorem of Weierstrass
1.4 Connected sets, definition of separated sets, connected sets and properties
Topic 2: Numerical Sequences and series
2.1 Convergent Sequences, Definition and Examples Properties
2.2 Subsequences: Definition and properties
2.3 Cauchy Sequences: Definition, Examples and properties, definition of complete metric space, examples, definition of Monotonic Sequences and its properties
2.4 Upper and lower limits, definition examples and properties
2.5 Convergence of some special sequences
2.6 Series: definition, examples and properties, series of non- negative terms, Cauchys condensation test and examples
2.7 The Number e
2.8 Root and ratio tests, examples
2.9 Power series, definition radius of Convergence, examples and properties
2.10 Summation by parts, absolute convergence
Topic 3: Continuity:
3.1 Limits of functions definition, examples and properties
3.2 Continuous functions definition examples and properties,
3.3 Continuity and Compactness
3.3.1 Bounded Set: Definition
3.3.2 Continuous image of a compact set is compact and related properties
3.3.3 Definition of Uniform Continuity and related properties
3.4 Continuity and Connectedness: continuous image of connected set is connected and related properties
3.5 Discontinuities, definition, examples
3.6 Monotonic functions definition, examples and properties
Topic 4: Differentiation:
4.1 Derivative of a real function, definition examples and properties

4.2 Mean Value Theorem
4.3 Continuity of derivatives,
4.4 Taylors theorem
4.5 Differentiation of a vector valued function

Topic 5: Riemann Stieljes Integral :

5.1 Definition and existence of the integral, related properties
5.2 Properties of the integral
5.3 Integration and differentiation
5.4 Integration of vector valued functions

Topic 6: Sequences and series of function:

6.1 Discussion of main problem- with examples
6.2 Uniform convergence: Definition and properties
6.3 Uniform convergence: and continuity
6.4 Uniform convergence: and integration
6.5 Uniform convergence: and differentiation

Text Book: Walter Rudin : Principles of Real Analysis, 3rd Edition Art 2.15 to 2.42, 2.45 to 2.47, Art. 3.1 to 3.46, Art. 4.1 to 4.18 4.19(Statement only), 4.22 to 4.28, 4.29 (Statement only), 5.1 to 5.12,5.15 to 5.19, 6.1 to 6.15, 6.20, to 6.25, Art 7.1 to 7.17.

MIM 102- ALGEBRA I

Chapter 1:- Groups
1.1 Definitions and Examples
1.2 Simple properties of Groups based on axioms
1.3 Order of an Element Definition, properties and Examples
1.4 Subgroups
1.4.1. Definition and Examples
1.4.2. Necessary and Sufficient conditions for a non-empty subet to be a subgroup
1.4.3. Properties of Subgroups
1.5 Cyclic groups
1.5.1. Definitions and Examples
1.5.2. Properties
1.6 Counting Principle (Without Proof)
1.7 Cosets- Definition, Examples & Properties
1.8 Lagranges theorem and its corollaries
Chapter- 2:- Normal Subgroups
2.1. Definition and Examples
2.2. NAS conditions for Subgroups
2.3. Properties of Normal Subgroups
2.4. Simple Groups, An is Simple for n = 5 (without proof)
2.5 Quotient Group, Definition and Examples.
2.6. Properties of Quotient groups
Chapter- 3:- Homomorphism
3.1 Definitions and Examples
3.2 Simple Properties
3.3 Isomorphism- Definition and Examples
3.4 Fundamental theorem of homomorphism & application
3.5 Cayleys theorem
Chapter- 4:- Normal Subgroups
4.1 Definition and Examples; (Permutation as composition of function)
4.2 Definition of S_n and discussion of S_3 in detail
4.3 Cycles, Transpositions
4.4 Every Permutation is a product of disjoint cycles (without proof)
4.5 Even and odd permutations, order of a permutation
4.6 Alternating group A_n.
4.7 $S_n/A_n \cong \{-1, 1\}$.

Chapter- 5:- Sylows theorems
5.1. Class Equations
5.1.1. Conjugate of an element- Definition & Examples
5.1.2. Conjugacy relation is and equivalence relation, Conjugacy Class
5.1.3. Normaliser, Centraliser, Center of a group.
5.1.4. Class equation
5.1.5. a belongs to Z(G) iff N (a) = G
5.1.6. Centre of a p-group is nontrivial.
5.1.7. Every group of order p-square is abelian.
5.2. Cauchy' s theorem (Statements only)
5.3. Sylow's theorems (without proofs) only problems.
Chapter- 6:- Rings
6.1. Definitions & Examples
6.2. Simple Properties of Rings.
6.3.Commutative ring, ring with unity, integral domain, field, skew field definitions, examples and interrelationships between them.
6.4. Subrings- Definition, Examples, Properties.
6.5. Characteristic of an integral domain.
Chapter- 7:- Ideals & Quotient Rings
7.1. Definitions & Examples
7.2. Properties of ideals, Prime Ideals, Maximal Ideals.
7.3. Quotient rings
Chapter- 8:- Homomorphism & Isomorphism of rings
8.1. Definitions & Examples
8.2. Properties of ring homomorphisms
8.3.Fundamental theorem of ring homomorphisms & its applications.
Chapter- 9:- Euclidean Rings
9.1. Definitions & Examples
9.2. Properties
9.3. Polynomial ring F[x] over a field F.
9.4. F [x] is a Euclidean Ring.
9.5. Irreducible polynomials over a field
9.6. Polynomials over the field of rationals
Gauss lemma and Eisenstein's criterion for irreducibility

Text Books:-

1) I. N. Herstein- Topics in Algebra, Macmillan Indian Edition
2) J.B. Fraleigh Abstract Algebra, 5th edition
3) S. Gopalkrishanan, Algebra

MIM 103 Discrete Mathematical Structures-I

1. Formal Logic :

1.1 Logic:

Introduction, Proposition, Simple proposition, Compound proposition, Truth value, Prepositional Calculus, operators, Conjunction, Disjunction, Conditional statement, Biconditional statement, converse, contra positive and Inverse, Precedence of logical operators, Translating in English sentences into symbolic form logical implication.

1.2 Propositional Equivalences: Introduction, Logical equivalences, Tautology, Contradiction, Logic rules.

1.3 Predicates and Quantifiers: Introduction, Universal quantifier, existential quantifier, counter example, binding variables, negating quantifiers, translating sentences into logical expressions, nested quantifier, order of quantifiers, truth value of quantifier.

1.4 Methods of proof: Introduction, theorem, proof, rules of inference, argument, valid argument, invalid argument, direct method of proof, indirect method of proof, rules of inference for quantified statements.

2. Counting:

The Basic of Counting, the Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients. Inclusion-Exclusion and Applications of Inclusion-Exclusion.

3. Semigroups and Monoids:

Semigroup: Introduction examples, free semigroup, monoid, subsemigroup, submonoid. Isomorphism and homomorphism of semigroups and monoids. Product and quotients of semigroups, natural homomorphism, fundamental theorem of homomorphism.

4. Lattices:

Lattices Introduction: Partial order, Hasse diagram, join and meet operation, chain, examples, product of lattices, laws of lattices, Idempotency, Commutativity, Associativity, Absorption. Principal of duality Types of lattices, Complete, distributive, bounded, Modular sublattices, complementary lattice, unique complement, relative complement. Quotient lattices.

5. Boolean Algebra

Introduction, Boolean expressions and Boolean function, Boolean identities, principle of duality. Sum of products expansions: Literal, minterm, disjunctive normal form, c conjunctive normal form, Logic Gates: Introduction, OR gate, AND gate, circuit diagram, full adder, half adder. Minimization of

circuits: Introduction, Karnaugh map, (2 variables, 3 variables), Prime implicant, essential prime implicant, Quine-McCluskey Method, minterm, bit string, cover,

Text Books:

1. K.H. Rosen : Discrete Mathematics and its Applications (TATA McGraw-HILL), 5th Edition

Chapter 1 Section 1.1, 1.2, 1.3, 1.4, 1.5, 1.6.

Chapter 4 Section 4.1, 4.2, 4.3, 4.4.

Chapter 6 Section 6.5, 6.6 and Chapter 10.

2. Kolman, Busby, Ross and Rehman : Discrete Mathematical Structures, Pearson Education, Fifth Edition Chapter 9 Section 9.1, 9.2, 9.3

3. Vijay Khanna : Lattices and Boolean Algebra, Vikas Publication Chapter 2 (Thm 2.5, 2.6, 2.7, 2.8, 2.9, 2.11) complete lattices, sublattices. Chapter 3 Complements (Thm 3.17, 3.18) Homomorphisms (Thm 3.20, 3.21, 3.23, 3.27, 3.29). Chapter 4 (Thm 4.1, 4.2, 4.3) Distributive lattice (Thm 4.11, 4.12, 4.13, 4.14, 4.15) Principle of duality.

Reference Books:

(1) Applied Abstract Algebra by Rudolf Lid1 and Gunther Pilz, 2nd edition (Springer),

(2) Discrete Mathematics by Lipschutz (Schaums Series).

MIM-104 : C Programming

1. Programming languages (1 Lecture)
1.1 Machine language
1.2 Assembly language
1.3 High level languages
1.4 Compilers and Interpreters
2. Introduction to C (1 Lecture)
2.1 History
2.2 Structure of a C program
2.3 Functions as building blocks
2.4 Application Areas
2.5 C Program development life cycle
3. C Tokens (8 Lectures)
3.1 Keywords
3.2 Identifiers
3.3 Variables
3.4 Constants character, integer, float, string, escape sequences
3.5 Data types built-in and user defined
3.6 Operators and Expressions: Operator types (arithmetic, relational, logical, assignment, bitwise, conditional , other operators) , precedence and associativity rules.
4. Input and Output (1 Lecture)
4.1 Character input and output
4.2 String input and output
4.3 Formatted input and output
5. Control Structures (5 Lectures)
5.1 Decision making structures: If, if-else, switch
5.2 Loop Control structures: While, do-while, for
5.3 Nested structures
5.4 break and continue
6. Functions in C (6 Lectures)
6.1 What is a function?
6.2 Advantages of Functions
6.3 Standard library functions
6.4 User defined functions: Declaration, definition, function call, parameter passing (by value), return keyword,
6.5 Scope of variables, storage classes

6.6 Recursion
7. Arrays (4 Lectures)
7.1 Array declaration, initialization
7.2 Types one, two and multidimensional
7.3 Passing arrays to functions
8. Pointers (6 Lectures)
8.1 Pointer declaration, initialization
8.2 Dereferencing pointers
8.3 Pointer arithmetic
8.4 Pointer to pointer
8.5 Arrays and pointers
8.6 Functions and pointers passing pointers to functions, function returning pointers, pointer to function
8.7 Dynamic memory allocation
9. Strings (3 Lectures)
9.1 Declaration and initialization
9.2 Standard library functions
9.3 Strings and pointers
9.4 Array of strings.
10. Structures and Unions (4 Lectures)
10.1 Creating structures
10.2 Accessing structure members (dot Operator)
10.3 Array of structures
10.4 Passing structures to functions
10.5 Nested structures
10.6 Pointers and structures
10.7 Unions
10.8 Difference between structures and unions
11. C Preprocessor (2 Lectures)
11.1 Format of Preprocessor directive
11.2 File Inclusion directive
11.3 Macro substitution, nested macro, argumented macro
11.4 Conditional compilation
12. Command Line Arguments (1 Lecture)
12.1. Accessing command line arguments
13. File Handling (3 Lectures)
13.1 Streams
13.2 Types of Files

13.3 Operations on files
13.4 Random access to files

References:

1. Kernighan and Ritchie : The C Programming language

2. Forouzan and Gilberg : Structured Programming approach using C, Thomson learning publications

3. Herbert Schildt : Complete C Reference

MIM-105 Elements of Information Technology

1. Introduction

1.1 Concept of Information Technology and its applications
1.2 What is a computer?
1.3 Basic structure of a computer
1.4 Characteristics of computers
1.5 History of computers
1.6 Types of computers

2. Input Output Devices

2.1 Introduction
2.2 Input Devices
2.3 Output Devices

3. Data Representation

3.1 Representation of data
3.2 Types of number systems
3.3 Need for binary systems
3.4 Representation of characters
3.4.1 The ASCII code
3.4.2 The EBCDIC code

4. Computer memory and storage devices

4.1 What is a memory?
4.2 Primary memory
4.3 Cache memory
4.4 Secondary memory and Storage devices

5. Introduction to Operating systems

5.1 Concept of Software
5.2 Classification of software
5.3 What is Operating system(O.S.) ?
5.4 Services provided by operating system
5.5 Types of Operating Systems
5.5.1 Batch OS ,
5.5.2 Multiprogramming OS
5.5.3 Time sharing system
5.5.4 Real time system
5.5.5 Distributed system

6. File Organization

6.1 Introduction

6.2 Physical/Logical files
6.3 Special characters in files
6.4 Fields and record organization
6.4.1 Fixed length records
6.4.2 Variable length records
6.5 Types of file organization
6.6 Overview of Indexes
6.6.1 Dense Index
6.6.2 Sparse Index
6.6.3 Clustered / Unclustered indexes
6.6.4 Tree structured indexing ISAM B+ tree index

7. Computer Networking

7.1 Communication
7.1.1 Concept of communication
7.1.2 Communication media
7.2 Networking
7.2.1 Network Goals
7.2.2 Applications of networks
7.2.3 Types of Networks
7.2.4. Topologies
7.2.5. Components of networks
7.2.6 Protocols
7.2.7 World Wide Web(WWW)

References :

. V. Rajaraman : Fundamentals of Computers
. Raghuramakrishnan : Database Systems
. Henry Korth : Database Systems
. Nawathe : Database Systems
. Andrew N. Tanenbaum : Computer Networks
. Silbertz, Korth : Operating System Concepts

MIM 106 Lab Work

Assignments List

1. Write Simple C Programs (Using operators only) Area of Triangle, Circle, Simple and Compound Interest, Celsius to Fahrenheit

2. Roots of Quadratic Equations.

3. Write a C program to accept a decimal number and convert it to Binary, Octal and Hexadecimal equivalent

4. Write a menu driven program to check if a given number is perfect / prime/ palindrome.

5. Computing sinx and cosx series.

6. Write a menu driven program to multiply and subtract and transpose of the given matrices.

7. Display the single digit sum of the given number recursively.

8. String Manipulations using pointers

a. String length

b. Display substring from a given position and up to the given number of characters

c. Concatenate two strings

d. Uppercase to Lowercase

e. String compare Without using Standard Library functions

9. Write a C program to Insert and Delete an element in an array using Pointers.

10. Write a C program to accept information of n students having fields: Rollno, Name,Class,Grade(A/B/C) Display the information of those students who have A grade.

11. Write a program to add 2 matrices of size mXn using dynamic memory allocation.

12 Write a C program to create a file and count the number of words, lines and characters in the file.

13. Write a C program to encrypt /decrypt the contents of a file using command line arguments.

MIM -201 Real and Complex Analysis

Section I: Lebesgue Theory

Topic 1: Lebesgue Theory
1.1 Introduction
1.2 Outer measure: Definition and properties
1.3 Measurable sets and Lebesgue measure: Definition and properties
1.4 Non-measurable set: example
1.5 Measureable functions: properties
1.6 Littlewoods three principles
Text Book: Real Abalysis, H. L. Royden, PHI (third edition) Chapter 3 Art. 1-6
The Lebesgue Integral
1.7 The Riemann Integral
1.8 The Lebesgue Integral of a bounded function over a set of finite measure:
1.8.1 Definition and properties
1.8.2 Bounded convergence theorem 1.9 The integral of a non-negative function
1.9.1 Properties
1.9.2 Fatous lemma
1.9.3 Monotone convergence theorem
1.10 The General Lebesgue Integral
1.10.1 Lebesgue convergence theorem
Text Book: Real Analysis, H. L . Royden, PHI (Third Edition) Chapter 4 Art. 1-4

Section II Complex Analysis

Topic 1: Complex Numbers: Revision (no questions on this portion be asked)
1.1 Definition of complex numbers and properties
1.2 Geometric interpretation
1.3 Topology of the complex plane
Topic 2 : Analytic fuctions
2.1 Fuctions ,limits and continuity: Definition and properties
Text Book: Foundations of Complex Analysis, S. Ponnusamy, Narosa, (4th reprint 2002) Art. 2.1: Definition 2.1, 2.2, examples, definitions 2.3, 2.4, 2.5, 2.6, Theorem 2.1, Theorem 2.2 (Statement only), Definition 2.7,

2.8,2.9,2.10 with examples, Theorem 2.3,2.4,2.5, Theorem 2.6 (Statement only)
2.2 Differentiability: Definition and properties, Text Book: Foundations of Complex Analysis, S. Ponnusamy, Narosa (4th reprint 2002) Art 2.2 : Definition 2.14,2.15,2.16, Definition 2.16,2.17,2.18 Theorem 2.17,2.18,2.19,2.20, Definition 2.19,2.20,2.21,2.22 Theorem 2.23 **2.3 Power Series as an Analytic function** 2.3.1 Definition of power series, radius of convergence, Root test (Statement Only) Examples for finding radius of convergence, Taylor series and Maclaurin series

Text Book: Foundation of Complex Analysis, S. Ponnusamy, Narosa (4th reprint 2002) Art 2.3 Definition 2.24, Theorem 2.25, 2.26, 2.27, 2.28 (Statement of these theorems only)
2.4 Zeros of an analytic function Theorem 2.37 of Art 2.7
3. Complex Integration
3.1 Curves in the complex plane
3.2 Basic properties of complex integral
3.3 Winding number or index number
3.4 Cauchy Goursat theorem (Statement only)
3.5 Homotopy and homotopy version of Cauchys theorem (Statement of theorem only)
3.6 Moreras theorem
3.7 Cauchys integral formula
3.8 Taylors theorem, Cauchys inequality, Laurent series
3.9 Maximum modulus principle and maximum modulus theorem
3.10 Cross ratio, Mobius trasformation
3.11 Liouvilles theorem
Text Book : S. Ponnusamy : Foudations of Complex Analysis, Narosa, (4th reprint2002)
Art 3.1: Definition 3.1,3.2
Art 3.2 : Definition 3.3,3.4,3.5, Theorem 3.1, Definition 3.6, Theorem 3.2, Corollary 3.1, Theorem 3.3 and its corollaries
Art 3.3 : Definition 3.7, theorem 3.4, Theorem 3.5, 3.6
Art 3.4 : Theorem 3.9 (Statement only)
Art 3.5 : Theorem 3.13, Theorem 3.14 (Statement only)
Art 3.6 : Theorem 3.15
Art 3.7 : Theorem 3.16, 3.17, Theorem 3.18, 3.19 (Statement only), Theorem 3.22, Corollary 3.16, Theorem 3.25
Art 3.8 : Definition 3.14, Theorem 3.14, Theorem 3.28 corollary 3.17

Art 3.9 : Definition 3.15, Theorem 3.31, Theorem 3.33, Definition 3.16, 3.17, 3.18 Theorem 3.40, corollary 3.21
Art 3.11 Theorem 3.45, Theorem 3.47, corollary 3.24
4. Classification of Singularities:
4.1 Isolated and non-isolated singularities
4.2 Removable singularities
4.3 Poles
Text Book: S. Ponnusamy: Foundations of Complex Analysis, Narosa, (4th reprint 02)
Art 4.1: Definition 4.1: Definition 4.1 and examples.
Art 4.2 : Definition and Examples, Theorem 4.1 (Statement only)
Art 4.3 : Definition and examples
5. Calculus of Residues
5.1 Residue at finite point
Text Book: S. Ponnusamy: Foundations of Complex Analysis, Narosa, (4th reprint 02)

Art : Examples

5.2 Cauchys residue theorem and evaluation of integrals using it 5.3 Rouches theorem Text Book: S. Ponnusamy: Foundations of Complex Analysis, Narosa, (4th reprint)

Art 5.1, Theorem 5.1, 5.2, 5.3, 5.4, 5.6, 5.7 (Statement only), Theorem 5.10, 5.11,

MIM 202 Algebra II

Chapter 1 : -Vector Spaces 1.1 Definitions & Examples 1.2 Simple properties of Vector Spaces 1.3 Subspaces: Definition, Examples, Necessary and sufficient conditions 1.4 Sum, Direct sum, Intersection of Subspaces 1.5 Quotient Space
1.6 Liner Span: Definition & Properties 1.7 Liner Dependence & Independence Definition examples & Props 1.8 Basis and dimension of vector Space, Dimension of subspaces, Dimension of Quotient space 1.9 Coordinates relative to a basis coordinate vector, coordinate matrix Chapter 2 : -Linear Transformations

2.1 Definition, Examples 2.2 Simple properties 2.3 Representation of a linear transformation as a matrix, change of basis 2.4 Rank Nullity theorem 2.5 Algebra of linear transformation 2.6 Dual Spaces, Dual Basis Chapter 3 : -Eigenvalues & Eigenvectors of a Linear Transformation

3.1 Definition and Examples 3.2 Eigenvalues & Eigenvectors of a sq matrix 3.3 Properties Cayley Hamilton theorem 3.4 Diagonalization 3.5 Annilator of a subspace Definition and Examples Chapter 4 : -Inner Product Spaces

4.1 Definition & Examples, properties 4.2 Cauchy Schwartz inequality 4.3 Orthonormal vectors, Orthogonal Complements 4.4 Orthonormal sets and bases 4.5 Gram Schmidt orthogonalization process Chapter 5 Extension Fields

5.1 Introduction to Extension Fields 5.2 Vector Spaces 5.3 Algebraic Extensions, Finite Fields

Chapter 6 Automorphisms & Galois Theory
6.1 Automorphisms of Fields
6.2 The Isomorphism Extension theorem
6.3 Splitting Fields
6.4 Separable Extensions
6.5 Totally Inseparable Extensions
6.6 Galois Theory

Text Books:

1. I. N. Herstein: Topics in Algebra, Macmillan Indian Edition
2. J. B. Fraleigh: Abstract Algebra, 5th Edition
3. K. Hoffmann R Kunze, Linear Algebra PHI
4. S. Gopalakrishanan: Algebra

MIM 203 Discrete Mathematical Structures-II

Graph Theory

1. Graph: Definition, Vertex, Edge, Terminal vertices , self loop, incidence, adjacency finite, Infinite graphs degree of a vertex. Isolated vertex, pendant vertex, Null graph, Hand shaking Lemma, Regular graph, complete graph, Bipartite graph, Complete bipartite graph. Theorem 1.1

2. Isomorphism, Examples, Subgraph.

3. Operations on graphs: Union, Intersection, ring sum, sum of 2 graphs, fusion, Deletion of a vertex (edge), Decomposition of a graph.

4. Connected graph: walk path, circuit, component Theorem 2.1, 2.2, 2.3.

5. Euler graph: Definition examples, Chinese postman problem, Fleurys algorithm. Arbitrarily Traceable graph. (Theorem 2.4, 2.6)

6. Trees: Definition, Pendant vertex in a tree, Distance and Centres in a tree. Rooted and binary trees, Spanning trees, rank nullity, Fundamental circuit, Fundamental cutest, vertex connectivity, edge connectivity, spanning tree, weighted graph, Kruskals algorithm. (Theorem 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 6.7, 3.9, 3.11)

7. Planner graph: Introduction Kuratowskis two graphs (K5, K3) Eulers theorem, problems (Theorem 5.1, 5.2, 5.6)

8. Matrix Representation: Incidence matrix, adjacency matrix, properties.

9. Directed graph definition: Incident out of a vertex, incident into a vertex, indegree, outdegree, isolated vertex, pendant vertex, Types of digraphs, Simple Asymmetric, Symmertic, complete, Complete symmetric digraph, complete asymmetric digraph, Arborercence definition.

10. Graph theoretic algorithms: Dijkstras algorithm, Warshall Floyd algorithm, Depth first search on a graph. (Theorem 11.5, 11.6)

11. Networks: Flows and Cuts: Network, sink, source capacity, Flow, Maximal Flow, f-saturated, f- unsaturated. Ford and Fulkerson Algorithm

    Section 8.1 and 8.2. Theorem 8.1, Theorem 8.2 (statement only)
    [Chapter-8 of Graph Theory by John Clark and Allan Holton]

12. Coloring: Vertex Coloring: K-coloring, K-colourable, Chromatic Number, K-Chromatic.
    Vertex colouring Algorithm: Simple Sequential Colouring, LargestFirst Sequential Algorithm (Welsh and Powell) SmallestLast Sequential Algorithm.

    Edge Colouring: Definition and Concept Only.

    [Ch-6 of Graph Theory by John Clark and Allan Holton Section 6.1, 6.2, 6.5.]

Text Books:

1. N. Deo : Graph Theory with Applications to Comp. Sc. and Engineering. PHI Publication.
2. John Clark and Allan Holton : Graph Theory.

Reference Books:

1. Douglas B. West : Introduction to Graph Theory, 2nd Edition, Pearson Education.

MIM-204 :Database Fundamentals

1. Introduction of DBMS Overview, File system Vs DBMS, Describing and storing data (Data models (relational, hierarchical, network)), Levels of abstraction , data independence, Queries in DBMS (SQL : DDL, DML,DCL,TCL), Structure of DBMS, People who deal in DBMS, Advantages of DBMS

2. Conceptual Design (E-R model) Overview of DB design, ER data model (entities, attributes, entity sets, relations, relationship sets) , Additional constraints (key constraints, participation constraints, weak entities, aggregation / generalization, conceptual design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER), Conceptual design for small to large enterprises, Case studies .

3. Relational data model Relations (concepts, definition), Conversion of ER to Relational model , integrity constraints (key, referential integrity, general constraints)

4. Relational algebra Preliminaries, Relational algebra (selection, projection, set operations, renaming, joins, division)

5. Relational calculus Tuple calculus, Calculus Versus Relational algebra

6. SQL DDL (create, drop, alter), forms of a basic SQL query (egs, expressions, strings in SQL), union / intersection / except, nested queries(introduction, correlated queries, set comparison operators), Aggregate operators (group by, having), aggregate functions, Null values (comparison using NULL, logical connections (AND,OR,NOT) impact on SQL commands, outer joins, disallowing NULL), examples on SQL (case studies) , Creating functions in PLSQL, cursors, triggers

7. Functional dependency Introduction to schema refinement (problems caused by redundancy, use of decomposition, Problems related to decomposition, functional dependencies(definition, closure (F+, (attribute)+),loss less-join decomposition. Normalization & its forms (1NF, 2NF, 3NF, BCNF)

References :

1. Raghuramakrishnan : Database Systems
2. Henry Korth : Database Systems
3. Nawathe : Database Systems
4. C.J.Date : An Introduction to Database Systems (Pearson education 7th edition)

5. Bipin Desai : Introduction to Database Systems (Asian Students edition)

6. Postgresql , OReilly publications

MIM 205 : Data Structures using C

1. Introduction
   1.1 Data, Data types, Abstract Data Type
   1.2 Data Structures
   1.3 Linear & Nonlinear data structures
   1.4 Algorithm Analysis

2. Arrays
   2.1 Arrays as ADT
   2.2 1-D,2-D,Multidimensional Arrays
   2.3 Applications
   2.4 Polynomial Representation in one variable(Using array of structure)

3. Stacks
   3.1 ADT, Push and Pop operations
   3.2 Stack implementation using array
   3.3 Stack applications
   3.3.1 Infix to Postfix conversion of expression
   3.3.2 Expression evaluation
   3.3.3 Recursion

4. Queues ADT , Insert and Delete operations Queue implementation using array Types Priority Queue, Circular queue, Dequeue

   4.4 Queue applications: 4.4.1 CPU Scheduling Algorithms FCFS , Round Robin algorithm

5. Linked List Concept , Operations : Insert, Delete, Traversal Static implementation using arrays Dynamic implementation Doubly Linked list Circular list Linked list applications : Stacks and Queues as Linked Lists Merging of two linked lists

6. Trees
   6.1 Terminology and Concepts
   6.2 Binary Tree Representation
   6.2.1 Static implementation using arrays
   6.2.2 Linked representation
   6.2.3 Binary Search Tree
   6.2.4 Operations on Binary search tree -Insert, Delete

6.2.5 Tree Traversals
6.3 Representing General Trees as binary tree

7. Searching and Sorting
Searching
Concept and need
Techniques

Linear search, Binary search, Indexed sequential search

Sorting

Concept and Need

Performance criteria

Techniques

Comparison Based-(Bubble, Quick, Insertion, Merge)

Linear order sorting-(Counting)

8. Graphs
8.1 Terminology and concepts
8.2 Graph Representation: Adjacency matrix, Adjacency list, Adjacency multilist
8.3 Traversals: Depth first and Breadth first

Reference Books:

1. Tanenbaum, Langsam, Augenstein : Data structures using C, PHI 1994
2. D. Samanta : Classic Data Structures, PHI 2002

MIM 206: Lab Work

Assignment list

1. Infix to postfix (fully parenthesized)
2. Evaluation of postfix expression
3. Implementation of reservation system using queues
4. Merging of two linked lists
5. Creation of binary search tree of integers and displaying its traversals
6. To count the number of steps of quick sort and merge sort
7. Conversion of adjacency matrix to adjacency list and calculate in degree and out degree of each vertex of the graph
8. Assignments related to SQL (DML, DDL statements) Each assignment will contain 2 to 3 small case studies to create relations with specified constraints & insert records to it & query on it.
9. 3 to 4 Assignments on PL/Pgsql (creating simple functions, functions demonstrating use of cursors, creating & demonstrating the use of database triggers)

UNIVERSITY OF PUNE
Board of Studies in Mathematics
M.Sc. Tech. Industrial Mathematics with Computer Applications
SYLLABUS

Part-II
Sem-III
MIM-301: Numerical Analysis
MIM-302: Software Engineering (OOSE)
MIM-303: Object Oriented Programming in JAVA
MIM-304: Operating Systems
MIM-305: Theoretical Computer Science
MIM-306: Lab Course based on MIM 303 and MIM 304
Sem-IV
MIM-401: Topology
MIM-402: Networking
MIM-403: Web Technologies (Client and Server side)
MIM-404: Design and Analysis of Algorithms
MIM-405: Elective I
MIM-406: Project course
ELECTIVES
MIM-405 Electives (Departmental Course)
Any one of:
(A) Measure and Integration
(B) Statistical and Numerical Methods
(C) Cryptography and Network Security
(D) Soft Computing-I (Fuzzy Logic and Neural Networks)
(E) Computer Graphics
(F) Data Mining & Warehousing
(G)Topics in Comp. Maths-I
(H) Emerging Tech-I

MIM 301 Numerical Analysis (Semester III)

1. Iterative solutions of Nonlinear Equations : Bisection Method, Fixed-Point iteration, Newton's method, Secant method, Acceleration of convergence, Newton's method for two nonlinear equations, Polynomial equation methods.

2. Polynomial Interpolation : The Lagrange interpolation polynomial, Divided difference interpolation, Aitken's Algorithm, Finite difference formulas, Choice of nodes and non convergence of polynomial interpolation.

3. Systems of Linear equations:Gauss elimination with partial pivoting, Error analysis, Matrix factorization methods (Doolittle reduction, crout reduction), Iterative refinement, Iterative techniques, Guess-Seidel iteration Acceleration and successive overrelaxation.

4. Numerical Calculus: Numerical differentiation, Forward difference Quotient, Central difference quotient, Interpolatory quadrature (order of methods), Newton-Cotes methods, Error estimates for trapezoidal rule and Simpson's rule.

5. Numerical solution of Differential Equations : Euler's method, Analysis of Euler's method, Order of Euler's method, Runge-Kutta method, One step modified and midpoint methods, Runde-Kutta methods for systems of equations.

6. The Eigen value problem : Power method, Gerschgorin Disk Theorem, Eigenvalues of symmetric matrices, Jacobi method, Householder transformation.

Reference Books :

1. John H. Mathews : Numerical Methods for Mathematics, Science and Engineering (Prentice-Hall) 2nd Edition. Sections : 1.3, 2.1 to 2.7, 3.4 to 3.7, 4.2 to 4.4, 6.1 to 6.2, 7.1 to 7.4, 9.2 to 9.7, 11.1 to 11.4

2. K.E. Atkinson : An introduction to numerical Analysis (John Wiley Sons).

3. James L. Buchanan and Peter R. Turner : Numerical Methods and Analysis (McGraw-Hill).

4. F.B. Hildebrand : Introduction to Numerical Analysis (Mc-Graw Hill -Indian Edition).

5. M.K. Jain, S.R. K. Iyengar, R.K. Jain : Numerical Methods for Scientific and Engineering Competition (Wiley Eastern Limited).

MIM 302 Software Engineering (OOSE) (Semester III)

1. Introduction
   1.1.Software, attributes of good software
   Software Engineering
   Software process
   Challenges facing software engineering.

2. Socio-technical systems
   System, System properties
   System Engineering
   Critical systems,
   System dependability, availability, reliability, safety and security

3. Software processes
   Software process models
   Process iteration
   Process activities

4. Software Requirements
   Functional and nonfunctional requirements
   User requirements
   Software requirements document
   Requirements engineering
   Feasibility studies, elicitation and analysis
   4.5 Requirements validation

5. System Models
   Context models
   Behavioral models
   Data models

6. Distributed Systems Architectures
   Client server architectures
   Distributed object architectures

7. Object Oriented Design
   Objects and Object Classes
   An object oriented design process
   Design Evolution

8. User Interface Design
   Design Issues
   UI Design Process User Analysis User Interface Prototyping Interface Evaluation

9. Rapid software Development
   Agile methods
   Extreme programming
   Rapid application development

10. Verification and validation
    Verification and validation
    Software Inspections
    Automated static analysis
    Verification and formal methods

11. Software testing
    System testing
    Component testing
    Test case design
    Test automation

Reference Books:

1. Software Engineering (7th Edition) by Ian Sommerville Pearson education

2. Software Engineering A Practitioners Approach 6th, 7th Edition Roger S. Pressman [McGraw Hill International Edition]

MIM 303 Object Oriented Programming in Java (Semester III)

1. Introduction to Object Oriented Concepts [2]
   1.1.Object, Class
   1.2. Encapsulation, Abstraction, Data Hiding, Inheritance, Polymorphism,
   1.3.Message Passing, Dynamic binding
   1.4.History of Object Oriented languages
   1.5. Comparison with structured programming.

2. Introduction to The Java Technology [2]
   2.1.The Java platform, Java buzzwords, API, JVM
   2.2.Java compiler, bytecodes
   2.3.java editions

3. Main features of Java language [3]
   3.1.Introduction to Java, Writing & compiling Java programs-the main method
   3.2.Command line arguments, String class, Primitive data types, Variables and assignment, javadoc comments
   3.3.Expressions, Data conversion, Interactive programs, Boolean data type and expressions,
   If, Switch statements, For, While, Do statements, Creating, calling methods, Parameter passing, Returning values, Overloading methods, Scope of variables.

4. Arrays [3]
   4.1.Defining and initializing arrays, new operator, using arrays
   4.2.passing arrays to methods, returning arrays from methods
   4.3.command-line arguments
   4.4.2-dimensional arrays

5. Objects and Classes [4]
   5.1.Defining Class, Creating object, reference variables,
   5.2.Visibility modifiers public, private, protected
   5.3.Object members and class members (static), Arrays of objects, this keyword, Wrapper Classes

6. Packages and Interfaces [4]
   6.1.Concept of package, Package and import keywords

6.2.Concept of interfaces, Implementing interfaces
6.3.Use of predefined packages
6.4.Use of predefined interfaces Comparable and Comparator

7. Inheritance and Polymorphism [6]
   7.1.Superclass and Subclass extends keyword, super keyword, Overriding members
   7.2.Protected data members-Object Class and its toString() method, Abstract Classes
   7.3.Final classes, methods and variables, instance of operator
   7.4.dynamic binding , Casting objects

8. Exceptions and Exception handling [4]
   8.1.Exception class hierarchy
   8.2.Checked and unchecked exceptions
   8.3.Try, catch, throw, throws finally keywords
   8.4.Creating user defined exceptions.

9. Text and File I/O [3]
   9.1.Predefined I/O classes
   9.2.Simple I/O operations using console and files
   9.3.The File class

10. GUI and Event Handling using Java [10]
    10.1.Introduction to AWT and Swing
    10.2.Creating containers and components (JFrame, JPanel, JButton, JTextField, JCheckBox, JRadioButton, JMenu, JList, JTable)
    10.3.Layout Managers
    10.4.Delegation event model -Event sources, event listeners, event classes.

11. JDBC [5]
    11.1.The Design of JDBC
    11.2.The Structured query language
    11.3.Basic JDBC programming concepts
    11.4.Query Execution
    11.5.Scrollable and updatable result sets.

12. Introduction to collections [2]
    12.1.Concrete Collections
    12.1.1. Linked List

12.1.2. Array Lists
12.1.3. Hash Sets
12.1.4. Tree Sets
12.1.5. Maps

Reference Books:

1. Java : How to Program, Deitel & Deitel, Prentice Hall
2. Core Java 2: Volume I Fundamentals, Cay S. Horstmann and Gary Cornell; Prentice-Hall 2002. ISBN 0130471771
3. Core Java 2: Volume II Advanced Features, Cay S. Horstmann and Gary Cornell; Prentice-Hall 2001. ISBN 0130927384
4. Java: The Complete Reference, Herbert Schildt. Fifth Edition
5. Introduction to Java Programming, Daniel Liang

Important URLs : http://java.sun.com/reference/docs/

MIM-304 Operating Systems

1. Introduction of Operating system [6]

   1.1.What do Operating Systems do?

   1.2.Operating system structure

   1.3.Operating system operations

   1.4.Process management

   1.5.Memory management

   1.6.Storage management

   1.7.Operating system services

   1.8.User operating system Interface

   1.9.System calls : types of system calls

   1.10.System programs: types of system programs, shell as a system program.

2. File System [6]

   2.1.File Concept : File types, File operations

   2.2.Access methods

   2.3.Directory structure : Device directory contents ,Operations

   2.4.Protection

   2.5.File system structure

   2.6.Allocation methods

   2.7.NFS

3. CPU scheduling [5]

   3.1.Process-concept : process state, PCB

   3.2.Operations on processes

   3.3. Scheduling concepts

   3.4. Scheduling queues

   3.5. Schedulers

   3.6. Scheduling criteria

3.7. Scheduling algorithms

3.8. Multiple processor scheduling

4. Deadlocks [5]

4.1. System model

4.2. Deadlock characterization

4.3. Methods of Handling Deadlocks

4.4. Deadlock prevention

4.5. Deadlock avoidance

4.6. Deadlock detection

4.7. Recovery from deadlock

5. Threads [4]

5.1. Overview

5.2. Multithreading models

5.3. Threading Issues

5.4. Pthreads

5.5. Java Threads

6. Process Synchronization [6]

6.1.Background

6.2.The critical-section problems

6.3.Petersons solution

6.4.Synchronization Hardware

6.5.Semaphores

6.6.Classic Problems of Synchronization

7. I/O System [4]

7.1.Overview

7.2.I/O hardware

7.3.Application I/O Interface

7.4.Kernel I/O Subsystem

8. Memory management [8]

   8.1.Background

   8.2.Logical Vs Physical address space

   8.3.Swapping

   8.4.Contiguous allocation

   8.5.Paging

   8.6.Segmentation

   8.7.Segmentation with paging Combined system

   8.8.Virtual memory concept Overlays, Demand paging, Page replacement algorithms.

Reference Books :

1. Operating System principles A. Silberschatz, P. Galvin, G. Gagne
2. Modern Operating system by Tanenbaum , PHI Publication

MIM-305 Theoretical Computer Science (Semester III)

1. Preliminaries
   1.1.Sets, operations on sets, finite and infinite sets.
   1.2.Symbol, alphabet, string, prefix and suffix of strings.
   1.3.Formal language.

2. Formal languages
   2.1.Chomsky hierarchy
   2.2.Validating machines for languages
   2.3.Kleene closure and positive closure
   2.4.Operations on languages (Union, Intersection and Concatenation)

3. Regular Languages
   3.1.Regular Expressions : Definition, example and identities.
   3.2.Finite automata : concept
   3.3.DFA : definition and examples.
   3.4.NFA : definition and examples.
   3.5.Language accepted by FA and NFA with ϵ moves.
   3.6.Regular Expression to FA : method and problems.
   3.7.NFA to DFA : method and problems.
   3.8.Minimization of DFA : problems using table methods.
   3.9.FA with output : moore and mealy machines. : Definition and their equivalence.
   3.10.Applications of FA : Pumping lemma and examples.
   3.11.Closure Properties : Union, Intersection, Concatenation, Complement and Kleene closure

4. Context free languages
   4.1.CFG : Definition and examples.
   4.2.Ambiguous grammar : concept and example.
   4.3.Simplification of CFG : removing useless symbols, removing unit productions and removing nullable symbols : method and problems.
   4.4.Normal forms : CNF and GNF : method and problems.
   4.5.Regular grammar : definition equivalence of FA and regular grammar.
   4.6.PDA : Basic concept, definition, DPDA and NPDA.
   4.7.Construction of PDA using empty stack and final state method : examples using stack method.

4.8.Equivalence between acceptance by final state and empty stack method and examples.
4.9.Equivalence between PDA and CFG (in GNF) : method and examples

5. Properties of CFL
   5.1.Pumping Lemma for CFL : methods and problems
   5.2.Closure properties of CFLs : Union, Concatenation and Kleene closure : methods and examples

6. Turing Machines
   6.1.Recursive and recursively enumerable languages
   6.2.Introduction to LBA (Basic model) and CSG.
   6.3.Definition of TM
   6.4.Basic Model
   6.5.Design of TM for language recognition
   6.6.Types of TM (Multitape TM, NonDeterrministic TM, Universal TM, Restricted TM).
   6.7.Undecidable Problem, Halting Problem of TM

Reference Books:

1. Languages and Machines Thomas A. Sudkamp Third Edition
2. Introduction to Automata theory, languages and computation John E. Hopcroft, Jeffery D. Ullman.
3. Introduction to Computer Theory Daniel I.A. Cohen
4. Principles of Compiler Design Alfred V. Aho, Jeffery D. Ullman.
5. Theory of Computer Science (Automata languages and computation) K. L. P. Mishra and N. Chandrasekharan
6. Introduction to languages and theory of Computation John C. Martin.

MIM-401 Topology (Semester IV)

1. Definition and examples of topological spaces. Closed sets. Closure. Dense subsets. Neighbourhoods. Interior. Exterior and Boundary. Accumulation Points and derived sets. Bases and sub-bases. Subspaces and relative topology.

2. Continuous functions and homeomorphism.

3. First and Second Countable Spaces. Lindelof Spaces. Separable spaces. Second Countability and Separability.

4. Separation axioms, their Characterizations and basic properties. Urysohn's Lemma.

5. Compactness. Continuous functions and Compact sets. Basic properties of Compactness Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness and one point compactification. Compactness in metric spaces. Equivalence of Compactness. Countable Compactness and Sequential Compactness in metric spaces. Statement of Tychonoffs Theorem.

6. Connected spaces. Connectedness on the real line. Components.

Reference:

1. Topology, A First Course, J.R. Munkres, Prentice Hall of India Pvt. Ltd.

2. Basic Topology, Armstrong, Springer Verlag (Indian Edn)

3. Topolgy, K.D.Joshi.

MIM 402 Computer Networks (Semester IV)

1. Network Models [2]
   1.1. Reference Models
   1.1.1. The OSI Reference Model
   1.1.2. TCP/IP Reference Model
   1.1.3. Comparison of the OSI and TCP/IP reference models
   Book 1 chap 1, unit 1.4.

   2. Physical Layer [10]
   2.1.Tasks Performed Book 2, Pg 45-47
   2.2.Signals
   2.2.1. Analog and Digital
   2.2.2. Analog signals
   2.2.3. Digital signals
   Book 2, Chapter 3, Units 3.1 3.3

   2.3.Digital Transmission
   2.3.1. Line coding
   2.3.1.1. Some characteristics of Line coding
   2.3.1.2. Line coding scheme
   Book 2, chapter 4, Unit 4.1, pages 85-93.

   2.4.Sampling
   2.4.1. PAM
   2.4.2. PCM
   Book 2, chapter 4, Unit 4.3, Pages 98-101

   2.5.Transmission Mode
   2.5.1. Parallel Transmission
   2.5.2. Serial Transmission
   Book 2, chapter 4, Unit 4.4

   2.6.Transmission Media
   2.6.1. Guided Media
   2.6.2. Unguided Media (Wireless)
   Book 2, chapter 7, Units 7.1, 7.2

   2.7.The Public Switched Telephone Network
   2.7.1. Structure of the telephone Network
   2.7.2. Switching Circuit, Message and Packet
   Book 1, Chapter 2, Unit 2.5.1 and 2.5.5

3. Data Link Layer [8]
3.1.Data Link Layer Design Issues
3.1.1. Services provided to the network layer
3.1.2. Framing
3.1.3. Error control
3.1.4. Flow control
Book 1, chapter 3, unit 3.1

3.2.Error Detection and Correction
3.2.1. Types of Errors Single bit and burst errors
3.2.2. Detection
3.2.3. Error Correction
Book 2, chapter 10, Units 10.1 10.3

3.3.Elementary Data Link Protocols
3.3.1. Unrestricted Simplex protocol
3.3.2. A simplex stop-and wait protocol
3.3.3. A simplex protocol for a noisy channel
Book 1, chapter 3, Unit 3.3

3.4.Sliding Window protocols
3.4.1. One-bit sliding window protocol
3.4.2. A protocol using Go Back N
3.4.3. A protocol using Selective Repeat
Book 1, chapter 3, Unit 3.4

4. The Medium Access Sublayer [8]
4.1.The Channel Allocation Problem
4.1.1. Static Channel Allocation in LANs and MANs
4.1.2. Dynamic channel allocation in LANs and MANs.
Book 1, chapter 4, unit 4.1

4.2.Multiple Access
4.2.1. Random Access
4.2.2. Controlled Access
4.2.3. Channelization FDMA, TDMA, CDMA concepts
Book 2, chapter 13, Units 13.1 13.3, Pages 320-321

4.3.Local Area Networks : Ethernet
4.3.1. Traditional Ethernet
4.3.2. Fast Ethernet

4.3.3. Gigabit Ethernet
Book 2, chapter 14, Unit 14.1 14.3

4.4.Data Link Layer Switching
4.4.1. Bridges from 802.x to 802.y
4.4.2. Local Internetworking
4.4.3. Spanning tree Bridges
4.4.4. Remote Bridges
4.4.5. Repeaters, Hubs, Bridges, Switches, Routers and Gateways
4.4.6. Virtual LANs.
Book 1, chapter 4, Unit 4.7 4.5.Wireless LANs
4.5.1. IEEE 802.11 Architecture: BSS and ESS, Station types
4.5.2. Bluetooth Architecture : Piconets and scatternet -Book 2, chapter 15, Unit 15.1, Page 361-363 and Unit 15.2, Page 372374

5. Network Layer [12]

5.1.Network Layer Design Issues

5.1.1. Store and Forward Packet Switching

5.1.2. Services Provided to the Transport Layer

5.1.3. Implementation of Connectionless Services

5.1.4. Implementation of Connection oriented services

5.1.5. Comparison of Virtual Circuit and Datagram Subnets

Book 1, chapter 5, unit 5.1

5.2.Addressing

5.2.1. Internet Address

5.2.2. Classful Address

5.2.3. Subnetting

5.2.4. Classless Addressing

5.2.5. Dynamic Address Configuration

Book 2, chapter 19, Units 19.2

5.3.Routing Algorithms

5.3.1. Optimality Principle

5.3.2. Shortest Path Routing

5.3.3. Flooding

5.3.4. Distance Vector Routing

5.3.5. Link State Routing

-Book 1, Chapter 5, Unit 5.2.1 5.2.5

5.3.6. Routing Techniques Routing Table

5.3.6.1. Next hop Routing

5.3.6.2. Network specific Routing

5.3.6.3. Host specific routing

5.3.6.4. Default Routing

5.3.7. Static versus Dynamic Routing Table

5.3.8. Routing Table for Classful Addressing Book 2, chapter 19, Unit 19.1

5.4.Congestion Control

5.4.1. Concept

5.4.2. General Principles of Congestion Control

5.4.3. Congestion Control Prevention Policies Book 1, chapter 5, Unit 5.3,5.3.1,5.3.2

5.5.Internetworking

5.5.1. How networks Differ -Book 1, chapter 5, Unit 5.5.1

5.6.Network Layer Protocols

5.6.1. ARP

5.6.2. IP

5.6.3. ICMP

-Book 2, chapter 20, Unit 20.1-20.3

2. Transport Layer

6.1.The Transport Service

6.1.1. Services provided to the Upper layers

6.1.2. Transport Service primitives

Book 1, chapter 6, unit 6.1.1, 6.1.2

6.2.Elements of Transport Protocols

6.2.1. Addressing

6.2.2. Connection Establishment

6.2.3. Connection Release

6.2.4. Flow Control and Buffering

6.2.5. Multiplexing

6.2.6. Crash Recovery Book 1, chapter 6, Unit 6.2 Pages 492 -513

6.3.The Internet Transport Protocols : UDP

6.3.1. Introduction to UDP

6.3.2. Remote Procedure Call

Book 1, chapter 6, Units 6.4.1, 6.4.2

6.4.The Internet Transport Protocols : TCP

6.4.1. Introduction to TCP

6.4.2. The TCP Protocol

6.4.3. The TCP Segment Header

Book 1, chapter 6, Units 6.5.1, 6.5.3, 6.5.4

3. Upper Layer Protocols [2]

7.1 SMTP, FTP, Telnet, HTTP (functionality and applications only)

Reference Books

1. Computer Networks , A. S. Tanenbaum, 4th Edition
2. Data Communication and Networking, Behrouz Forouzan, 3rd Edition

MIM 403 Web Technologies (Semester IV)

1. Fundamentals
   1.1.Introduction to Internet
   1.2.WWW
   1.3.Web browser
   1.4.Web Server
   1.5.Uniform Resource Locator
   1.6.Multipurpose Internet Mail Extensions 1.7.HTTP

2. Introduction to HTML
   2.1.Origin and evolution of HTML
   2.2.Basic Syntax, Basic Text Markup
   2.3.Images
   2.4.Hyperlinks
   2.5.Lists
   2.6.Tables
   2.7.Forms
   2.8.Frames

3. Client side programming using JavaScript
   3.1.Overview of JavaScript
   3.2.Object Orientation and JavaScript
   3.3.Basic Syntax
   3.4.Primitives, Operations and Expressions
   3.5.Screen output and keyboard input
   3.6.Control Statements
   3.7.Object creation and modification
   3.8.Arrays, functions
   3.9.Constructors
   3.10.Pattern Matching using regular expressions

4. Server side scripting using Perl
   4.1.Origins and uses of Perl
   4.2.Scalars and their operations
   4.3.Assignment statement and simple input output
   4.4.Control statements
   4.5.Fundamentals of Arrays
   4.6.Hashes

4.7.References
4.8.Functions
4.9.Pattern matching
4.10.File I/O

5. Using Perl for CGI programming
   5.1.Introduction to CGI
   5.2.CGI linkage
   5.3.Query String Format
   5.4.CGI.PM Module
   5.5.Cookies

6. Introduction to PHP 6.1.Origins and uses of PHP
   6.2.Overview of PHP
   6.3.Basic Syntax
   6.4.Primitives, Operations and expressions
   6.5.Output
   6.6.Control Statements
   6.7.Arrays, Functions
   6.8.Pattern Matching
   6.9.Form Handling
   6.10.Files

7. Introduction to XML
   7.1.Introduction
   7.2.Syntax
   7.3.XML Document structure
   7.4.Document type definition
   7.5.Namespaces
   7.6.XML Schemas
   7.7.Displaying raw XML documents
   7.8.Displaying XML documents with CSS
   7.9.XSLT style sheets
   7.10.XML processor

8. Servelets
   8.1.Overview of Servlets :background
   8.2.Servlet details: life cycle,
   8.3.Servlet API

8.4.The JavaX.servlet package 8.5.Reading servlet parameters
8.6.JavaX.Servlet.http package
8.7.Handling http request and responses
8.8.Using cookies
8.9.Session tracking.

Reference Books:
1. Programming the World Wide Web Robert W. Sebesta (3rd Edition)
2. Java the complete reference Herbet Schildt 7th edition.

MIM 404: Design and Analysis of Algorithms-I (Semester IV)

1. Mathematical Foundation
   1.1.Growth functions
   1.2.Summations
   1.3.Recurrences Substitutions, iterations, master methods
   1.4.Amortized Analysis

2. Sorting
   2.1.Heap Sort
   2.2.Quick Sort
   2.3.Merge Sort
   2.4.Sorting in linear time

3. Dynamic Programming
   3.1.Matrix chain multiplication, longest common subsequence, optimal polygon triangulation

4. Greedy Algorithm
   4.1.An activity selection problem
   4.2.Elements of the greedy strategy
   4.3.Hauffman codes

5. Graphs
   5.1.Traversals, topological sort
   5.2.Minimum spanning trees
   5.3.Single source shortest Path : Dijkstras & Bellman Ford Algorithm
   5.4.All Pair shortest path
   5.5.Maximum flow problems

6. NP-completeness
   6.1.Polynomial time
   6.2.Polynomial time verification.
   6.3.NP-completeness and reducibility.
   6.4.NP-completeness proofs
   6.5.NP-completeness problems.

7. Approximation algorithms
   7.1.The vertex-cover problem
   7.2.the traveling salesman problem

Reference Books

1. Introduction to Algorithms -T.H. Coremen, C.E. Leiserson, R.L. Rivest Prentice Hall India

MIM 405: C : Cryptography and Network Security

(Semester IV)

1. Conceptual foundation of Information Systems Security:

1.1.Concepts and Terminology: Threats, Attacks, Vulnerabilities, Risks, Risk Assessment and Mitigation,

1.2.Security Confidentiality, Integrity, Availability, Identification, Authentication, Authorization, Accountability, Privacy

2. Cryptography:

2.1.Techniques

2.2.Mathematical foundation

2.3.Stream Ciphers

2.4.Block Ciphers

2.5.Cryptanalysis.

3. Symmetric / Secret Key Encryption

3.1. Algorithm Types and Modes

3.2.DES (Data Encryption Standard)

3.3.Double DES

3.4.Triple DES

3.5.AES (Advanced Encryption Standard)

3.6.IDEA (International Data Encryption Algorithm)

3.7.Blowfish

3.8.RC5

4. Public Key Encryption

4.1. Principles of public key crypto-systems

4.2. mathematical foundation

4.3.RSA algorithm

4.4.key management

4.5.Deffie-Hellman key exchange

4.6.Elliptic curve cryptography

4.7.Digital Signatures using DSA (Digital Signature Algorithm)

4.8.DSS (Digital Signature Standard)

4.9.RSA

5. Message Integrity techniques

5.1.MD5

5.2. SHA

6. PKI

6.1.Public Key Infrastructure and Trust Hierarchy
6.2.Digital Certificates
6.3.transaction certificates
7. Authentication techniques:
7.1.passwords, pass-code, pass-phrase
7.2.challengeresponse, biometrics-based registration and authentication,
7.3.Kerbores
8. Internet Security protocols
8.1.SSL/TLS
8.2.TSP
8.3.SET
8.4. 3 D Secure protocol
8.5.Electronic money
8.6.email security (PGP, PEM, S/MIME)
9. IP Security
9.1. IPSec
9.2.VPN
10.Server Security
10.1.Concepts
10.2. Design and Implementation of Firewalls
10.3.Intrusion Detection Systems (IDS)
10.4.Intrusion Prevention Systems (IPS)
11.Virus Threats including Network Viruses, Worms
12.Data Hiding and Steganography
Reference Books :
1. Atul Kahate," Cryptography And Network Security TMH
2. William Stallings," Cryptography And Network Security Prentice Hall / Pearson Education

MIM 405: D: Soft Computing -I (Semester IV)
Fuzzy Logic and Neural Networks

1. Foundations of Fuzzy Systems
1.1.From Crisp to Fuzzy Sets
1.2.Representing Fuzzy Elements
1.3.Basic Terms and Operations
1.4.Properties of Fuzzy sets
1.5.Fuzzy Measures
1.6.Fuzzification
1.7.Fuzziness and Probability Theory
1.8.Membership Function Shape Analysis
1.9.The Extension Principle
1.10.Alph-cuts and the Resolution Principle
2. Fuzzy Relations
2.1.Composition of Fuzzy Relations
3. Arithmetic Operations of Fuzzy Numbers
3.1.The alpha-cut method
3.2.The Extension Principle Method
4. Linguistic Descriptions and their Analytical Forms
4.1.Fuzzy linguistic descriptions
4.2.Fuzzy Relation Inferences
4.3.Fuzzy Implication and Fuzzy Algorithms
5. Defuzzification Methods
5.1.Centre of Area Defuzzification
5.2.Centre of Sums Defuzzification
5.3.Mean of Maxima (MOM) Defuzzification
6. Fuzzy Logic in Control and Decision Making Applications
6.1.Fuzzy Controllers
6.2.Fuzzy Decision Making
7. Artificial neurons, neural network and architecture
7.1.Neuron abstraction
7.2.Neuron signal functions
7.3.Architectures: feedforward and feedback
7.4.Salient properties and application domains of neural networks
8. Geometry of binary threshold neurons and their networks
8.1.Pattern recognition and data classification
8.2.Convex sets, convex hulls and linear separability

8.3.Space of Boolean functions
8.4.Pattern Dichotomizers
8.5.Capacity of a simple threshold logic neuron
8.6.XOR problem
8.7.Multiplayer networks
9. Perceptrons and LMS
9.1.Learning and memory
9.2.From synopses to behaviour
9.3.Learning algorithms
9.4.Error correction and gradient descent rules
9.5.The learning objectives for TLNs
9.6.Pattern space and weight space
9.7.Perceptron learning algorithm
9.8.Perceptron convergence algorithm
9.9.Perceptron learning and Non-separable sets
9.10.alpha-Least Mean Square Learning
9.11.MSE Error Surface and its Geometry
9.12.Steepest Descent Search with Exact Gradient Information
9.13.Mue-LMS : Approximate Gradient Descent
10.Backpropagation
10.1.Multilayered Network Architecture
10.2.Backpropagation Learning Algorithm
10.3.Practical Considerations in implementing BP algorithm
10.4.Structure Growing Algorithms
10.5.Fast relatives of Backpropagation
10.6.Universal Function Approximation
10.7.Applications of Feed forward Neural Networks
11.Attractor Neural Networks
11.1.Associative Learning
11.2.Hopfield Network

Reference Books:

1. Fuzzy Sets and Fuzzy Logic, Theory and Applications, George.J.Klir, Bo Yuan; PHI, 2005.

2. Fuzzy Sets, Uncertainty and Information, George J.Klir, Tina A.Folger, PHI, 2005 Edition 2005.

3. Fuzzy Logic with Engineering Applications Timothy J. Ross

4. Neural Networks, A Classroom Approach, Satish Kumar, Tata McGraw-Hill Publishing Company Limited, ISBN : 0-07-048292-6

5. Artificial Neural Networks by Kishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka, Penram International Publishing (India), ISBN : 81-900828-3-3

6. Neural Networks, A Comprehensive Foundation by Simon Haykin, Pearson Education, ISBN : 81-7758-852-4

MIM 405: E : Computer Graphics (Semester IV)

1. Input / Output Devices
   1.1 Light pens, Joystics, Digitilizers.
   1.2 Refreshing Display Devices
   1.3 Random and Raster scan display devices
   (Book 2 : Chapter 1, First Edition)

2. Line generation and Area filling Algorithms
   2.1 Bresenham line generation algorithms.
   2.2 Scan Line
   2.3 ood fill and Boundary fill algorithms for polygon domains.
   (Book 2: Chapter 6, for Cyrus Beck Algorithm Book 3: article 3.5)

3. Line Clipping Algorithms
   3.1 Cohen Sutherland algorithm
   3.2 Cyrus Beck Algorithm
   3.3 Liang Barsky Algorithm
   (Book 1 : Chapter 2 or Book 2 : Chapter 5)

4. Transformation into 2-D
   4.1 Translation, rotation, scaling and shearing transformation
   4.2 Reflection about any arbitrary line.
   4.3 Homogenous Coordinates
   (Book 1: Chapter 2 or book 2: Chapter 5)

5. Projections
   5.1 Parallel projection, Isometric projection
   5.2 Cabinet and Cavelier Oblique projections
   5.3 Perspective projective
   5.4 Vanishing Points.
   5.5 1 point and 2 point perspective projective (Book 1: Chapter 3 or book 2: Chapter 9)

6. Representing Curves & Surfaces:
   6.1 Polygon Meshed
   6.2 Hemite & Bezier Cubic Curves
   6.3 B-Spline
   6.4 Uniform, Non Uniform , Open and non open B-splines
   6.5 Bicubic surface,patches

6.6 Conditions for smooth joining of curves and surface patches
(book 2 : chapter 10)

7. Hidden line/ surface elimination algorithms
   7.1 Z buffer algorithms
   7.2 Depth sort algorithm
   7.3 Area subdivision method
   7.4 Floating horizon algorithm
   (Book 2: chapter 13, 13.1, 1 13.8)

Reference Books:

1) Mathematical Elements for Computer Graphics Roger and Adams (McGraw Hill) 2) Computer Graphics C Version Hearn and Baker (Pearson Education) 3) Procedural Elements for Computer Graphics David Rogers (Tata Mcgraw Hill)

MIM 405: F : Data Mining and Data Warehousing (Semester IV)

1. **Introduction**

1.1.Motivation and importance
1.2.What is Data Mining?
1.3.Data Mining on What Kind of Data?
1.4.Data Mining Functionalities
1.5.Are all of the Patterns Interesting?
1.6.Classification of Data Mining Systems
1.7.Data mining Task Primitives
1.8.Integration of a Data Mining System with a Database or Data Warehouse System
1.9.Major Issues in Data Mining

2. **Data Preprocessing**

2.1.Why Preprocess the Data?
2.2.Descriptive Data Summarization
2.3.Data Cleaning
2.4.Data Integration and Transformation
2.5.Data Reduction
2.6.Data Discretization and Concept Hierarchy Generation

3. **Data Warehouse and OLAP Technology : An Overview**

3.1.What is a Data Warehouse?
3.2.A Multidimensional Data Model
3.3.Data Warehouse Architecture
3.4.Data Warehouse Implementation
3.5.From Data Warehousing to Data Mining

4. **Mining Frequent Patterns, Associations, and Correlations**

4.1.Basic Concepts and Road Map
4.2.Efficient and Scalable Frequent Itemset Mining Methods
4.3.Mining Various Kinds of Association Rules

5. Classification and Prediction

5.1.What is Classification? What is Prediction?
5.2.Issues Regarding Classification and Prediction
5.3.Classification by Decision Tree Induction
5.4.Bayesian Classification
5.5.Rule-Based Classification
5.6.Classification by Backpropagation
5.7.Support Vector Machines

5.8.Associative Classification : Classification by Association Rule Analysis
5.9. Lazy Learners (or Learning from Your Neighbors)
5.10.Other Classification Methods
5.11.Prediction

6. Cluster Analysis

6.1.What is Cluster Analysis?
6.2.Types of Data in Cluster Analysis
6.3.A Categorization of Major Clustering Methods
6.4.Partitioning Methods
6.5.Hierarchical Methods
6.6.Density-Based Methods
6.7.Grid-Based Methods
6.8.Outlier Analysis

7. Mining Time-Series, and sequence Data [2]

7.1.Mining Time-Series Data
7.2.Mining Sequence Patterns in Transactional Databases

8. Mining Object, Spatial, Multimedia, Text, and Web Data [2]

8.1.Mining the World Wide Web

Reference Books:

1. Data Mining Concepts and Techniques , J.Han and M. Kamber, 2nd edition

2. Data Mining, Introduction and Advanced Topics, Margaret H. Dunham and Sridhar, Pearson Education, ISBN 81-7758-785-4

3. Data Mining Techniques, Arun K Pujari, Universities Press (India) Limited, ISBN 81-7371-380-4

4. Data Mining, Pieter Adriaans & Dolf Zantinge: (pearson Education Asia), ISBN 81-7808-425-2. Addison Wesley Longman (Singapore)

5. Data Mining Techniques for Marketing, Sales and Customer Relationship Management, Michael J. A. Berry and Gordon S. Linoff, Wiley-Dreamtech India Pvt. Ltd., ISBN 81-265-0517-6

MIM 405: H : Emerging Technologies I (.Net) (Semester IV)

1. The philosophy of .Net [4]
1.1.Introducing building blocks of the .Net Platform
1.2.Overview of .Net Assemblies
1.3.Role of CIL
1.4.The role of .NET type metadata
1.5.Assembly Manifest
1.6.Understanding CTS, CLS, CLR
2. The C# Programming language [5] 2.1.System.Console Class
2.2.Method Parameter modifiers
2.3.Value Types and Reference types
2.4.Boxing and Unboxing Operations
2.5..Net Enumerations
2.6.System.Object
2.7.System Data Types
2.8.System.String Data Type
2.9.Net Array types
3. Object-Oriented Programming with C#. [3]
3.1.C# Class Type
3.2.C#s Encapsulation services
3.3.C#s Inheritance support
3.4.Programming for Containment/Delegation
3.5.C#s Polymorphic support
4. Understanding Object Lifetime [3]
4.1.Understanding Generations
4.2.The System.GC type
4.3.Building finalizable objects
4.4.Building disposable objects
5. Exception Handling [4]
5.1.Role of .NET exception handling
5.2.Configuring the state of Exception
5.3.System Level Exceptions
5.4.Application level Exceptions
6. Interfaces and Collections [3]
6.1.Implementing interface in C#
6.2.Interfaces as parameters
6.3.Arrays of Interface type

6.4.Building Interface Hierarchies

7. Introducing .NET Assemblies [2]

7.1.Role, Format of .NET Assembly

7.2.Single-File, Multiple-File Assemblies

7.3.Private Assemblies

7.4.Shared Assemblies

8. Type Reflection, Late Binding, and Attribute-based programming [2]

8.1.Necessity of Type Metadata

8.2.Understanding Reflection

8.3.Building custom metadata viewer

8.4.Understanding Late Binding

8.5.Understanding Attributed programming

9. Building multithreaded applications [2]

9.1.Role of Thread Synchronization

9.2.The Asynchronous nature of delegates

9.3.The System.Threading.Thread Class

10.The System.IO Namespace [2]

11.System.Windows.Forms [6]

12.Database Access with ADO.NET [6]

12.1.ADO.NET Data providers

12.2.The System.Data Types

12.3.Understanding Connected layer of ADO.NET

12.4.Understanding the Disconnected layer of ADO.NET

13.ASP.NET Web Pages and Web Controls [5]

14.ASP.NET 2.0 Web Applications. [2]

Reference Books:

1. Pro C# 2005 and the .NET 2.0 Platform Andrew Troelson

2. CLR via C# -Jeffery Richter ;

MIM 406 Lab course (Semester IV)

Part A:

Web programming related assignments. These assignments will be evaluated internally for 40 marks.

Part B :

Project-evaluated for 60 Marks.

MIM - 501 : Operations Research & Optimizing

Unit 1. Introduction to Operational Research
Introduction to O.R., Necessity of OR in Business and Industry, Scope of OR in modern management, OR and Decision Making.

Unit 2. Linear programming Formulation, Identification of decision variables, Constructing Objective Functions and Constraints, Assumptions, Methods of Solution: Graphical Method, Simplex method.

Unit 3. Duality theory and Sensitivity Analysis Duality theory: Existence of Dual of a LP problem, Primal Dual relationships in formulation and their solutions. Sensitivity analyses or Post Optimality Analysis: Dual Simplex Method, Changes affecting feasibility, Changes affecting optimality.

Unit 4. Transportation and Assignment problems The transportation algorithm: Formulation as a LP problem, Determination of Initial solutions, Stepwise Improvement to obtain optimal solution, Special cases Such as Multiple, Unbalanced, Degeneracy etc., The assignment model: Formulation as TP, The Hungarian method of solution.

Unit 5. Network models Critical Path Analysis (CAP): Network representation of simple projects., Critical path computation: Construction of time schedule, Crashing of project duration.

Unit 6. Game theory Formulation of Two-person Zero-sum game: Solution of simple games, Mixed strategy games, Solving using Graphical Method, Solving Using LP, Saddle point Condition.

Reference books:

1. Introduction to Operations Research, Frederick S.Hiller and Gerald J. Lieberman, McGraw-Hill Companies

2. Operations Research An introduction, Hamdy A. Taha, Prentice-Hall

3. Quantitative Technoques, L.C. Jhamb, Everest Publishing house.

4. Operation Research , S.D. Sharma, Kedar Nath Ram Nath and Co. Meerut Publishers.

MIM-502: Statistical and Numerical Methods

1. Errors in Numerical calculations.
   Errors and their Computations
   A General error Formula
   Error in a series Approximation

2. Solution of Algebraic and Transcendental Equations.
   The Bisection Method
   The Method of False Position
   The Iteration Method
   Newton-Raphson Method

3. Interpolation
   Finite differences
   Newton's formulae for interpolation
   Lagrange's Interpolation

4. Numerical Integration.
   Trapezoiadal Rule
   Simpson's 1/3-rule
   Simpson's 3/8-rule

5. Linear System of Equations
   Matrix Inversion Method
   Gauss elimination
   Gauss-Jordan Method
   Gauss-Seidel Method
   LU decomposition Method

6. Review of Theory of probability
   Sample Space, Events
   Probability of an event
   Conditional Probability and independence

7. Random Variables
   Random Variable, Discrete and continuous random variable
   Probability distribution of a discrete and continuous random variable
   Distribution function, Mean and Variance

8. Standard probability distributions Binomial(n,p)
   Poisson(λ)
   Exp(θ)
   Uniform(a,b)
   Normal(μ, σ^2)

9. Correlation and Regression analysis
   Product Moment Correlation Coefficient
   Linear Regression
   Method of least squares for estimation of regression coefficients

10. Testing of Hypothesis
    Large sample tests:
    One sample test for mean
    One sample test for proportion
    Two sample test for mean
    Two sample test for proportion
    Small sample tests:
    One sample test for mean
    Two Sample test for mean
    χ^2 Test for independence of attributes
    χ^2 Test for goodness of fit.

Reference Books:

1. Introductory Methods of Numerical Analysis: S.S.Sastry,
2. Numerical Methods: E Balgurusamy
3. Computer Oriented Numerical Methods: V.Rajaraman
4. Computer Oriented Statistical and Numerical Methods: E.Balgurusamy
5. Probability and Statistics for Engineers and Scientists: Walpole,Myers,Myers,Ye

MIM-503: Modelling and Simulation

1. INTRODUCTION Systems, Modelling, General Systems theory, Concept of simulation, Simulation as a decision making tool, types of simulation.

2. RANDOM NUMBERS Pseudo random numbers, methods of generating random variables, discrete and continuous distributions, testing of random numbers

3. DESIGN OF SIMULATION EXPERIMENTS Problem Formulation, data collection and reduction ,time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation

4. SIMULATION LANGUAGES Comparison and selection of simulation languages, study of any one simulation language

5. CASE STUDIES Development of simulation models using simulation language studied for systems like queuing systems, Production systems, Inventory systems, maintenance and replacement systems and Investment analysis

BOOKS:

Geoffrey Gordon, "System Simulation" 2nd Edition, Prentice Hall, India, 2002.

Narsingh Deo,"System Simulation with Digital Computer, "Prentice Hall, India, 2001.

MIM-504: Advanced Operating Systems

Chapter -1: Architectural Overview
- Historical Perspective
- Design & Features
- Product Packaging
- OS Architecture
- Kernel Mode Components
- User Mode Components

Chapter-2: HAL & Kernel
- System Architecture
- HAL & Kernel Functionality
- Interrupt & IRQL
- DPC & APC
- MP Synchronization
- Synchronization Objects
- System Service Dispatching
- Exception Handling

Chapter-3: Process Manager
- Job, Process, Thread & Fiber
- Thread States
- Priority & Quantum
- UP & MP Scheduling
- PE File Format

Chapter-4: Memory Manager
- Virtual Address Space
- Address Translations
- PFN Database
- Memory Allocation
- Page Faults & Mapped Files
- Section Objects & PPTEs
- Cache & TLB
- AWE, PAE, Win64, NUMA

Chapter-5: Object Manager
- Executive Objects
- Object Structure
- Reference Counting
- Object Name Space

Chapter -6: Registry

- Registry Concepts
- Registry Organization
- Registry Storage

Chapter -7: Services

- Service Architecture
- Service Control Manager
- System Services
- SVCHOST

Reference Books:

1. The design of the unix Operating System By Mauris Bach

2. Microsoft Windows Internals, Fourth Edition By Mark E. Russinovich, David A. Solomon

3. Inside Microsoft Windows 2000, Third Edition (Microsoft Programming Series) By David A. Solomon, Mark E. Russinovich

Site for windows internal syllabus

www.codemachine.com/WindowsInternals