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)


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.


**Reference Books:**

   **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


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

   Agile methods
   Extreme programming
   Rapid application development

10. Verification and validation [4]
    Verification and validation
    Software Inspections
    Automated static analysis
    Verification and formal methods

11. Software testing [4]
    System testing
    Component testing
    Test case design
    Test automation

Reference Books:

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

7.1. 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, instanceof 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.

   9.1. 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
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
   5.1. Overview
   5.2. Multithreading models
   5.3. Threading Issues
   5.4. Pthreads
   5.5. Java Threads

6) Process Synchronization
   6.1. Background
   6.2. The critical-section problems
   6.3. Peterson’s solution
   6.4. Synchronization Hardware
   6.5. Semaphores
   6.6. Classic Problems of Synchronization

7) I/O System
   7.1. Overview
   7.2. I/O hardware
   7.3. Application I/O Interface
   7.4. Kernel I/O Subsystem

8) Memory management
   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:

2. Operating System principles — A. Silberschatz, P. Galvin, G. Gagne
3. 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.
   3.9. 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.
   4.5. Regular grammar: definition equivalence of FA and regular grammar.
   4.6. PDA: Basic concept, definition, DPDA and NPDA.
   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 CFL’s: 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, NonDeterministic 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
MIM-401 Topology (Semester IV)


2. Continuous functions and homeomorphism.


Reference:
2. Basic Topology, Armstrong, Springer Verlag (Indian Edn)
3. Topolgy, K.D.Joshi.
1. Network Models
   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
   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
   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

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

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 372-374

5. Network Layer
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
6. 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

7) Upper Layer Protocols

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

Reference Books

2. Data Communication and Networking, Behrouz Forouzan, 3rd Edition
1. Fundamentals [2]
   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 [4]
   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 [8]
   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

   4.1. 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:
MIM 404 Design and Analysis of Algorithms- I (Semester IV)

1. Mathematical Foundation [8]
   1.1. Growth functions
   1.2. Summations
   1.3. Recurrences Substitutions, iterations, master methods
   1.4. Amortized Analysis

2. Sorting [6]
   2.1. Heap Sort
   2.2. Quick Sort
   2.3. Merge Sort
   2.4. Sorting in linear time

3. Dynamic Programming [8]
   3.1. Matrix chain multiplication, longest common subsequence, optimal polygon triangulation

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

5. Graphs [10]
   5.1. Traversals, topological sort
   5.2. Minimum spanning trees
   5.3. Single source shortest Path : Dijkstra’s & Bellman Ford Algorithm
   5.4. All Pair shortest path
   5.5. Maximum flow problems

6. NP-completeness [8]
   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.

   7.1. 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
   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]
   2.1. Techniques
   2.2. Mathematical foundation
   2.3. Stream Ciphers
   2.4. Block Ciphers
   2.5. Cryptanalysis.

   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 [8]
   4.1. Principles of public key crypto-systems
   4.2. Mathematical foundation
   4.3. RSA algorithm
   4.4. Key management
   4.5. Diffie-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 [2]
   5.1. MD5
   5.2. SHA
6. PKI [3]
   6.1. Public Key Infrastructure and Trust Hierarchy
   6.2. Digital Certificates
   6.3. Transaction certificates

7. Authentication techniques: [4]
   7.1. Passwords, pass-code, pass-phrase
   7.2. Challenge-response, biometrics-based registration and authentication,
   7.3. Kerbores

   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)

   9.1. IPSec
   9.2. VPN

    10.1. Concepts
    10.2. Design and Implementation of Firewalls
    10.3. Intrusion Detection Systems (IDS)
    10.4. Intrusion Prevention Systems (IPS)


12. Data Hiding and Steganography [1]

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 [8]
   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 [4]
   2.1. Composition of Fuzzy Relations

   3.1. The alpha-cut method
   3.2. The Extension Principle Method

   4.1. Fuzzy linguistic descriptions
   4.2. Fuzzy Relation Inferences
   4.3. Fuzzy Implication and Fuzzy Algorithms

5. Defuzzification Methods [2]
   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 [3]
   6.1. Fuzzy Controllers
   6.2. Fuzzy Decision Making

7. Artificial neurons, neural network and architecture [3]
   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

   8.1. 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 Feedforward Neural Networks

11. Attractor Neural Networks
11.1 Associative Learning
11.2 Hopfield Network
Reference Books:

3. Fuzzy Logic with Engineering Applications – Timothy J. Ross
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 Flood 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:

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

1. Introduction [8]
   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 [8]
   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

   3.1. 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 [6]
   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 [8]
   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
   7.1. Mining Time-Series Data
   7.2. Mining Sequence Patterns in Transactional Databases

8. Mining Object, Spatial, Multimedia, Text, and Web Data
   8.1. Mining the World Wide Web

Reference Books:

1. Data Mining Concepts and Techniques, J.Han and M. Kamber, 2\textsuperscript{nd} edition
MIM 405: H : Emerging Technologies – I (.Net)  
(Semester IV)

1. The philosophy of .Net  
   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  
   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#.  
   3.1. 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  
   4.1. Understanding Generations  
   4.2. The System.GC type  
   4.3. Building finalizable objects  
   4.4. Building disposable objects

5. Exception Handling  
   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  
   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
   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
   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
   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


12. Database Access with ADO.NET
   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

14. ASP.NET 2.0 Web Applications.

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.