

**PONDICHERRY UNIVERSITY  
RAMANUJAN SCHOOL OF MATHEMATICS AND COMPUTER SCIENCE  
DEPARTMENT OF COMPUTER SCIENCE**

**MASTER OF SCIENCE**

**(Computer Science, Mathematics & Statistics - Integrated)**

**(Effective from the academic year 2009-2010)**

**Eligibility for Admission**

Candidates who have secured 55% of marks or above in any one of the following or equivalent, are eligible to apply:

Bachelor's Degree in Computer Science/ Technology/ Applications

**Duration of the Course**

The course duration shall normally be of five years duration spread over four semesters.

**Medium**

The medium of instruction shall be English.

**Passing Minimum**

Passing Eligibility & Classification for the award of the Degree are as per the Choice Based Credit System norms

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**DEPARTMENT OF COMPUTER SCIENCE**  
**MASTER OF SCIENCE`**  
**(Computer Science, Mathematics & Statistics - INTEGRATED)**  
**CURRICULUM**  
(Effective from the academic year 2009-2010)

**FIRST SEMESTER**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Paper Title</b>	<b>Credits</b>
1.	COMS111	Introduction to Computers and Programming in C	3
2.	COMS110	Practical I - C Lab	2

**SECOND SEMESTER**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Paper Title</b>	<b>Credits</b>
1.	COMS121	Data Structures	3
2.	COMS120	Practical II - DS Lab ( <b>Using C</b> )	2

**THIRD SEMESTER**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Paper Title</b>	<b>Credits</b>
1.	COMS 231	Introduction to OOP and Programming in C++	3
2.	COMS 230	Practical III - C++ Lab	2

**FOURTH SEMESTER**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Paper Title</b>	<b>Credits</b>
1.	COMS241	Principles of Operating Systems	3
2.	COMS240	Practical IV- OS Lab	2

**FIFTH SEMESTER**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Paper Title</b>	<b>Credits</b>
1.	COMS351	Database Systems	3
2.	COMS350	Practical V - DBMS Lab	2

**SIXTH SEMESTER**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Paper Title</b>	<b>Credits</b>
1.	COMS361	Java Programming	3
2.	COMS360	Practical VI - Java Lab	2
3	COMS362	Mini Project	3

Note: All Course Codes are to be preceded with 'COMS'.

### SEVENTH SEMESTER

S.No.	Code	Course Title	H/S	Credits
1	411	Design of Algorithms	H	3
2	412	Automata Theory & Formal Languages	H	3
3	413	Computer Architecture and Organization	H	3
4	414	Visual Programming	H	3
5		Elective - I	S	3
6	418	Practical VII - Visual Programming Lab	H	2
7	419	Practical VIII - Algorithms Lab	H	2

### EIGHTH SEMESTER

Sl.No.	Code	Course Title	H/S	Credits
1	461	Unix & Shell Programming	H	3
2	462	Data Communication Networks	H	3
3	463	Software Engineering Concepts	H	3
4	464	Object Oriented System Design	H	3
5	465	Web Technology	H	3
6		Elective II	S	3
7	468	Practical IX –Networks and Unix Lab	H	2
8	469	Practical X – Case Tools Lab (OOAD)	H	2

### NINTH SEMESTER

Sl.No.	Code	Course Title	H/S	Credits
1	511	Principles of Compiler Design	H	3
2	512	Computer Graphics	H	3
3	513	Cryptography and Network Security	H	3
4		Elective III	S	3
5		Elective IV	S	3
6	518	Practical XI- Compiler Design Lab	H	2
7	519	Practical XII - Client/Server Lab	H	2

### TENTH SEMESTER

Sl.No.	Code	Course Title	H/S	Credits
1	561	Project Seminar	H	4
2	562	Project Work	H	4
3	563	Project Report& Viva-voce	H	4

### LIST OF ELECTIVES

<b>Code</b>	<b>Course Title</b>	<b>H/S</b>	<b>Credits</b>
426	Principles of Programming Languages	<b>S</b>	<b>3</b>
528	Middleware Technologies	<b>S</b>	<b>3</b>
530	Multimedia Systems and Applications	<b>S</b>	<b>3</b>
531	E-Commerce	<b>S</b>	<b>3</b>
532	Neural Networks	<b>S</b>	<b>3</b>
533	.NET Framework and C#	<b>S</b>	<b>3</b>
538	Distributed database systems	<b>S</b>	<b>3</b>
540	Artificial Intelligence	<b>S</b>	<b>3</b>
541	Fundamentals of Agent technology	<b>S</b>	<b>3</b>
544	Software Testing and Quality Assurance	<b>S</b>	<b>3</b>
546	Data Mining and Warehousing	<b>S</b>	<b>3</b>
550	Natural Language Processing	<b>S</b>	<b>3</b>
551	Microprocessor Architecture	<b>S</b>	<b>3</b>
552	Decision Support System	<b>S</b>	<b>3</b>
553	Soft Computing	<b>S</b>	<b>3</b>
554	Principles of Distributed Systems	<b>S</b>	<b>3</b>

## **FIRST SEMESTER**

### **COMS 111:INTRODUCTION TO COMPUTERS & PROGRAMMING IN C**

#### **Unit I**

Introduction to computers- Processing Data - Interacting with the Computer - Storing Information in a Computer - Networking and Data Communications - The Operating System and the User Interface - Word Processing and Desktop Publishing Spreadsheets

#### **Unit II**

Database Management - The Internet - Graphics - The New Media - Civilizing Cyberspace - Computers in Business - Management Information Systems - Creating Computer Programs

#### **Unit III**

Introduction to Computer Problem-Solving - Fundamentals Algorithms - Factoring Methods - Array Techniques - Merging, Sorting and Searching - Text Processing and Pattern Searching

#### **Unit IV**

C Programming: C character set, Data types, Declarations, Input-Output statements, Arithmetic Statements, Control statements, Functions.

#### **Unit V**

Pointers: Declarations, Passing to a function. Operations on pointers, pointer and arrays. Array of pointers. Structure: Defining and processing. Passing to a function, Union. Data Files: Open, close, create, process unformatted data files.

#### **Text Books**

1. Peter Norton, "Introduction to Computers" McGraw-Hill, Sixth Edition, Sep-2005.
2. Dromey, "How To Solve It By Computer", Dorling Kindersley (india) Pvt Ltd, 2008.
3. Byron S. Gottfried, "Programming with C", Schaum's Outline Series, TMH, Second Edition, 1998.

#### **References**

1. Peter Norton, "Introduction to Computers", Second Edition, TMH, 1998.
- Kernighan, B.W. and Ritchie, D.M., "The C Programming Language", Prentice Hall of India, 1989.

## **FIRST SEMESTER**

### **PRACTICAL – I**

#### **COMS 110:PROGRAMMING IN C**

1. Simple programs to learn the various data type and control statements
2. String Manipulations
  - a. Counting number of vowels, consonants, words, white spaces in a string
  - b. Reversing a string and check for palindrome
  - c. Finding the number of occurrences of a sub string in a given string
  - d. Sub string replacing and removal
3. Recursion
  - a. Factorial
  - b. Reversing a string
  - c. Fibonacci Sequence
  - d. Tower of Hanoi
4. Matrix Manipulations using functions and Case structure
  - a. Addition & Subtraction
  - b. Multiplication
  - c. Transpose
  - d. Check if the given matrix is a Magic square
5. Searching
6. Sorting
7. Structures
8. Pointers
9. Files

**SECOND SEMESTER  
COMS 121: DATA STRUCTURES**

**Unit – I**

**Introduction:** How to create Programs – How to analyse Programs – **Arrays:** One Dimensional Array, Two - Dimensional Array, Application: Sparse Matrices, String Search – Linear Search, Binary Search – Sorting: Selection, Exchange, Shell sort, sorting by partitioning .

**Unit – II**

**Stacks:** User defined data structure, stack- operations on stack, Implementation of stack as an array, Application- Maze Problem, Evaluation of Expression & Conversion.

**Queues:** Queue, Operations on Queues, Implementing the Queue, Application.

**Unit –III**

**Linked List:** The storage Pool, List representations, Anatomy of a node, Implementing the list operations, inserting into an ordered list, Doubly Linked List, Keeping a stack in a linked list, keeping a Queue in a linked list, Polynomial – Linked list representation.

**Unit –IV**

**Trees:** Basic Terminology, Binary Tree, Representation, Traversal, Binary Search Tree, Threaded Binary Tree, Binary Tree Representation of tree, Application: Game Tree.

**Unit – V**

**Graph:** Definition and terminology, Representation, Traversals, Shortest path, Minimum Spanning Tree, Kruskal’s Algorithm and Prim’s Algorithm.

**Text Book:**

**“Fundamentals of Data Structure”** by Ellis Horowitz & Sahani, Galgotia Publications, New Delhi.

**Reference Book:**

**“Theory and Problem of Data Structure”** by Schaum’s outlining series, Tata McGraw Hill Publications.

**SECOND SEMESTER**  
**PRACTICAL III**  
**COMS 120:DATA Structures LAB (Using C)**

**Data Structures**

1. Linear Search & Binary Search
2. Sort by selection, exchange, quick sort
3. Stacks, Queues using Arrays & Linked List
4. Singly Linked List : Insertion & Deletion
5. Doubly Linked List: Insertion & Deletion
6. Binary Tree Traversal (Inorder, Preorder, Postorder)
7. Graph : BF Search, DF Search Shortest Path & Minimum Spanning Tree

**THIRD SEMESTER**  
**COMS 231:INTRODUCTION TO OOP AND PROGRAMMING IN C++**

**Unit - I**

Introduction to Object Oriented Programming: Software Evolution – OOP paradigm – Concepts, Benefits - Comparison to other programming paradigms -Object Oriented Languages – Applications of Object Oriented Programming.

**Unit – II**

Introduction to of C++ language – Origin of C++ - Advancement over C - Tokens, keywords, Identifiers, Data Types, Variables - Expressions and control structures. Functions: Library functions - numeric functions – string functions - User defined functions: function prototyping – function definition - call by value - call by reference - function overloading - friend and inline functions.

**Unit - III**

Classes and Objects – General structure of a class: member variables, member functions, access specifiers- Constructors and Destructors – Abstract class – Nested classes - Operator Overloading – Type Conversions.

**Unit - IV**

Inheritance – Definition – Types - Single Inheritance – Multilevel Inheritance - Multiple Inheritance – Hierarchical, Hybrid Inheritance – Pointers – Virtual Functions - Console I/O Operations.

**Unit - V**

Files – Classes for File Stream Operations – File pointers - Opening and Closing files – Read and write operations – End of file detection – Updating a file – Error handling during file operations – Templates – Exception handling.

**Text Book:**

E.Balaguruswamy, “Object Oriented Programming in C++” – Tata McGraw Hill Publishing Ltd., New Delhi., 1995.

**Reference Books:**

- 1) Yeswant Kanetkar , “Let us C++” – BPB Publications.,1999
- 2) Robert Lafore , “Object Oriented Programming in C++” –Galgoita,1994.
- 3) Herbert Schilt, “C++ - The Complete Reference”, 3<sup>rd</sup> edition, Tata Mcgrawhill, Pub-ltd., 1999
- 4) John R.Hubbard , “Programming with C++” - Schaum’s Outline Series 1996

**THIRD SEMESTER**  
**PRACTICAL III**  
**COMS 230:C++ LAB**

<b>S.No</b>	<b>Programs</b>
1	Programs using decision and looping statements
2	Program using single, multidimensional arrays
3	Usage of library functions
4	Programs using user defined functions
5	Programs for function overloading
6	Usage of classes and objects
7	Constructors and Destructors
8	Programs for all inheritance types
9	Programs using pointers
10	Programs for operator overloading
11	Implementation of Virtual Functions, friend functions, this pointer and static functions
12	File manipulation operations with clear formatting
13	Programs using command line arguments

**FOURTH SEMESTER**  
**COMS 241:PRINCIPLES OF OPERATING SYSTEMS**

**Unit I**

Introduction Early Operating Systems – Buffering & Spooling – Multiprogramming – Time Sharing – Protection – Operating System Structures.

Process Management: Process Concept – Hierarchy of Process – Critical Section Problem – Semaphores – Process Coordination Problems – Inter Process Communication

**UNIT II**

CPU Scheduling : Scheduling Concepts – Scheduling Algorithms – Algorithms – Algorithm Evaluation – Multiple Processor Scheduling

Deadlock: Deadlock Problem: Characterization – Prevention – Avoidance – Detection – Recovery – Combined Approach to Deadlock Handling.

**UNIT III**

Memory Management: Introduction – Multiple Partition – Paging – Segmentation – Paged Segmentation – Virtual Memory Concept – Overlays – Demand Paging and Performance – Page Replacement Algorithms – Allocation Algorithms – Trashing.

**UNIT IV**

Secondary Storage Management: Physical Characteristics – Disk Scheduling – Disk Scheduling Algorithms – Sector Queuing File Systems: File Operations – Access methods – Allocation Methods – Directory Systems – File Protection – Implementation Issues.

**UNIT V**

Case Studies: Linux and Windows 2000 Operating Systems.

**TEXT BOOKS**

- Silberschatz, Peter Baer Galvin & Greg Gagne, *Operating System Concepts* Seventh Ed., Addison – Wesley Publications..

**REFERENCES**

1. William Stallings, *Operating Systems Internals and Design Principles*, PHI India, Fourth Edition, 2005.
2. H.M. Deitel, *Operating Systems*, Addison-Wesley, 2<sup>nd</sup> Edition

**FOURTH SEMESTER**  
**PRACTICAL IV**  
**COMS 240: OPERATING SYSTEMS LAB**

1. Implement the following CPU scheduling algorithms
  - a. FCFS (b) Round Robin (c) Shortest Job First (d) Priority
2. Implement the mutual exclusion problem using Dekker's algorithm
3. Implement Inter Process Communication Problem (Producer-Consumer/Dining Philosopher Problem) using Semaphores
4. Implement the Best-fit, First-fit and Worst-fit Algorithm for Memory Management
5. Implement Page Replacement Algorithm (FIFO, LRU)
6. Implement Banker's algorithm
7. Implement a simple Text Editor

**FIFTH SEMESTER**  
**COMS 351: DATABASE SYSTEMS**

**UNIT- I**

Introduction - DBMS Basic Concepts - Purpose of Database Systems – Database System / File System - Overall System architecture – Database Languages – Classifications – Data Models.

**UNIT – II**

Entity relationship model: Mapping constraints – Primary Keys – Foreign Keys – Structural Constraints. – ER notations - ER model examples – Enhanced Entity Relationship Model: EER Concepts like Generalization, Specialization, Union, Category, Disjoint, Overlapping etc. EER model examples

**UNIT- III**

Relational DataBase Design – ER/EER to Relational Mapping algorithm - Relational Model: Structure – Formal Query Languages – Relational Algebra – Informal Design Guidelines – Functional Dependencies – Normalization upto Third Normal Form

**UNIT- IV**

SQL – Basics of SQL –DDL – DML – DCL – TCL Commands in detail with examples - PL/SQL: Stored Procedure Concepts – Procedure – Functions – Cursors - Triggers.

**UNIT- V**

Storage and File Structure- - File Organization - Overview of Physical Storage - Organization of Records in Files - Media - Data-Dictionary Storage - Magnetic Disks – RAID - Indexing and Hashing -- Comparison of Ordered Indexing - Basic Concepts - Hashing - Ordered Indices - Bitmap Indices - Static Hashing - Dynamic Hashing.

**Text Books:**

1. Database system concepts – H.F. Korth and A.Silberschatz – McGraw Hill Publication (2005)

**Reference Books:**

1. Fundamentals of Database Systems (Chapters 1, 2, 3, 4.1, 7, 8, 9, 14) – Ramez Elmasri and B. Navathe – Addison Wesley, III Edition

**FIFTH SEMESTER**  
**PRACTICAL V**  
**COMS 350:DBMS LAB**

1. Study of Oracle DDL commands
  - a. To create a table
  - b. To alter a table
  - c. To drop a table
  - d. To create a view
  - e. To drop a view
  
2. Study of Oracle DML commands
  - a. To insert, delete and update rows into a table
  - b. To write a simple queries using SELECT
  - c. To write queries using SELECT and WHERE clause
  - d. To write queries using Logical operators
  - e. To write queries using NULL
  - f. To write queries using NVL function
  - g. To write queries for pattern matching
  - h. To write queries using order by clause
  - i. To write queries using Distinct clause
  - j. To write queries using Arithmetic Expressions
  - k. To write queries using Arithmetic function
  - l. To write queries using group function
  - m. To write queries using Group By clause
  - n. To write queries using Having clause
  - o. To write queries using Character function
  - p. To write queries using Data function
  - q. To write queries using Sub queries
  - r. To write queries using join
  
3. Program to learn Oracle DCL and TCL commands
  
4. Program to learn PL / SQL
  - a. To create a cursor and trigger and work on that
  - b. To create PL/ SQL code for expression
  - c. To create PL/SQL code using control statement
  - d. To create PL/SQL code using sub programs

**SIXTH SEMESTER**  
**COMS 361:JAVA PROGRAMMING**

**UNIT I**

Introduction to JAVA : JAVA features, Java program structure – Java tokens –Java Literals –Java Datatypes-Type Casting Operators –Arrays, Multi Dimensional array – Control statements.

**UNIT II**

Classes-Objects-Methods-method Overloading –Array of Objects . Inheritance: Types-Method Overriding, Abstract classes-Interfaces, packages

**UNIT III**

Overviews of Applets: Applet basics – Applets life cycle-creating an executable Applet in Html file AWT: working with graphics – working with frame window- Using Awt Controls : label – Buttons – Checkbox- Check Box Groups- Choice control.-text field-Multi Threading - Creating Thread – Extending Threads .

**UNIT IV**

Event handling : Event classes – Event Listener Interfaces-handling Mouse Events-Exception handling : Fundamental –using try and catch –throw-finally statements. I/O basics: Input Stream – Output stream-file input stream – file output stream –data input stream –data output stream.

**UNIT V**

Java Swing – Introduction – Advantages – Swing controls. Introduction to servlets – Overview of Java Beans

**TEXT BOOK**

1. E.Balagurusamy , “Programming with Java”, 2<sup>nd</sup> Edition , Tata Mc.Graw-Hill publishing company Ltd .

**REFERENCE**

1. Herbert Schildt - JAVA 2 ( The Complete Reference)- Fourth Edition – TMH ,Fifth Reprint 2002, BPB Publications  
2. C.Xavier , “Programming with Java2 ”,Scitech Publications Ltd.

**SIXTH SEMESTER**  
**PRACTICAL VI**  
**COMS 360:JAVA LAB**

**I Application**

1. Usage of buffered reader class
2. Usage of StringBuffer class
3. Implementation of Point class for image manipulation
4. Usage of calendar class and manipulation
5. Database manipulation using java classes
6. Usage of vector classes
7. Implementing thread based applications and exception handling
8. File Handling

**II Applets**

9. Working with frames and various controls
10. Dialogues and Menus
11. Panel and Layout
12. Graphics
13. Colour and Font

**III Swing**

14. Usage of basic swing controls
15. Usage of swing Menu
16. Simple servlet application

**SEVENTH SEMESTER**  
**COMS 411:DESIGN OF ALGORITHMS**

**UNIT I**

**Introduction:** Data structure concepts - List, Stacks, Queues, Trees, Heaps, Sets, Graphs, Design of Efficient Algorithms and their Computational Complexities. **Divide and Conquer Method:** Binary search, finding maximum and minimum, merge sort, quick sort.

**UNIT II**

**Greedy Method:** Knapsack problem, Minimum spanning trees, Single source shortest path problem. **Dynamic Programming:** Multi stage graphs, All pairs shortest path problem, 0/1 Knapsack problem, Travelling sales man problem.

**UNIT III**

**Search and Traversal Techniques for Graphs:** Tree traversal techniques (inorder, preorder, postorder, levelorder), Graph traversals (BFS, DFS). **Hashing Techniques:** Internal and External hashing methods.

**UNIT IV**

**Backtracking:** Knight's tour, Eight Queen Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem.

**UNIT V**

**Branch and Bound Techniques:** The method, 0/1 Knapsack problem, Travelling Salesman Problem.

**TEXT BOOKS**

1. Ellis Horowitz and Sartaj Sahani, "Fundamentals of computer Algorithms", (Unit I to Unit IV).
2. Robert Sedgewick, "Algorithms in C", (Unit IV - Searching & Sorting Algorithms)

**REFERENCES**

1. Gilles Brassard and Paul Bratley, "Fundamentals of Algorithms", Prentice Hall of India Pvt.Ltd., 1997.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Addition-Wesley , Third Indian Reprint, 2000.

## **COMS 412:AUTOMATA THEORY AND FORMAL LANGUAGES**

(Only statements and applications of Theorems)

### **UNIT I**

Automata Theory: Need for formal models - Finite State Systems – Definition of an Automaton - Non- Deterministic Finite Automaton - Equivalence of DFA and NFA - Finite automata with output ( Mealy and Moore Models ) - Minimization of Finite Automata – Regular Expressions.

### **UNIT II**

Push Down Automata Theory: Context-Free Languages and Derivation Trees – Ambiguity in Context-Free Grammars – Chomsky Normal Form – Greibach Normal Form. Push Down Automata – Definition, Acceptance by Push down Automata – Push down Automata and Context Free Languages- Deterministic push down automata – Non-equivalence of PDA and DPDA.

### **UNIT III**

Turing Theory: Turing Machines – Computable Language and Functions – Techniques for TM Construction – Modification of TM. Non regular languages and Pumping Lemma

### **UNIT IV**

Chomsky Hierarchy: Regular Grammars – Unrestricted Grammars – Context Sensitive Languages. Linear Bounded Automata – Definition – Linear Bounded Automata and Context Sensitive Languages.

Undecidability : Properties of recursive and recursively enumerable languages – Turing Machine Codes – Universal Turing Machine .

### **UNIT V**

Case Studies: Application of Finite Automata – Parsing.

### **TEXT BOOKS**

1. John E.Hopcraft and Jeffery D. Ullman, Rajeev Motwani “Introduction to Automata theory, languages and computations” , Third Edition (2006)

### **REFERENCE**

1. K.L.P. Mishra & N. Chandrasekaran “Theory of computer science Automata, Languages and computation” , PHI
2. Daniel I.A. Cohen," Introduction to computation theory”, John wiley & sons, 2nd edition.

## COMS 413:COMPUTER ARCHITECTURE AND ORGANIZATION

### UNIT I

#### BOOLEAN ALGEBRA AND COMBINATIONAL LOGIC

Review of binary number systems - Binary arithmetic – Binary codes – Boolean algebra and theorems - Boolean functions – Simplifications of Boolean functions using Karnaugh map and tabulation methods – Logic gates.

**Combinational circuits** – Analysis and design procedures - Circuits for arithmetic operations - Code conversion – Introduction to Hardware Description Language (HDL)

### UNIT II

#### DESIGN WITH MSI DEVICES

Decoders and encoders - Multiplexers and demultiplexers - Memory and programmable logic - HDL for combinational circuits.

**Sequential circuits** – Flip flops – Analysis and design procedures - State reduction and state assignment - Shift registers – Counters.

### UNIT III

**Introduction to Organization** - Address Modes - Instruction set - Opcode format.

**Processor Design:** Processor Organization, Arithmetic Logic Unit, Design of Arithmetic Circuit, Design of Logic Circuit, Design of ALU, Status Register, Design of Shifter, Processor Unit, Design of Accumulator, Design of Floating point Arithmetic Unit.

### Unit IV

**Hardwired Control Logic Design:** Control organization, Hardwired control for binary adder/subtractor, Design of Multiplier Control Unit, PLA Control. Micro programmed Control: Microinstructions, Grouping of control signal, Microprocessor sequencing - Microinstructions with next address fields, prefetching of Microinstructions and evaluations, bit slices.

### Unit V

**Memory System Design:** Memory hierarchy, Associative memory, and Virtual memory, Cache memory, Memory management hardware.

#### I/O ORGANIZATION

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

### Text Books

1. M. Morris Mano, “Computer Systems Architecture”, Pearson Education, 3rd Edition, 2003.
2. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 3rd Edition, 2003.
3. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6<sup>th</sup> Edition, Pearson Education, 2003.

## COMS 414:VISUAL PROGRAMMING

### UNIT I

**Introduction to Windows Programming:** Different paradigms of programming – Comparison – Event driven programming – Windows programming fundamentals – Windows messages – Device contexts – Dynamic linking libraries.

### UNIT II

**Visual Basic Programming:** Creating and using Controls – IDE: Menus and Dialogs — Programming fundamentals – Programming user events – Using custom controls and grid control – inbuilt and user defined functions - Debugging - Creating graphics for application – File system controls - Accessing databases with the data controls – VB and the Internet.

### UNIT III

**Visual C++ Programming:** Visual C++ components – Developing simple applications – Microsoft Foundation classes – Controls – Message handling - Document-view architecture – Dialog based applications – Mouse and keyboard events – Reading and writing documents – SDI and MDI environments.

### UNIT IV

**Advanced Features in VB and VC++:** Creating user defined DLL's – Dynamic data transfer functions – User interface classes – Database management with ODBC – Object Linking and Embedding – Communicating with other applications.

### UNIT V

**Introduction to .NET:** Common Language Runtime - Overview of .NET languages - Simple windows applications using VB .NET.

### TEXT BOOKS

- 1.Charles Petzold, “*Windows Programming*”, Microsoft Press, 1995.
- 2.David Kruglirski. J, “*Inside Visual C++*”, Microsoft press, 1993.
- 4.Garry Cornell, “*Visual Basic 6 Ground Up*”, Tata McGraw Hill,1998.Gray J.
- 5.Teach yourself Visual Basic .NET 2003 by Steven Holzner, Second reprint 2004 , Pearson Education

## **COMS 418: VISUAL PROGRAMMING LAB**

1. Design and develop an analog clock
2. Design and Develop an File Explorer
3. Design and Develop an intranet Chatting tool
4. Developing any system utility using win32 API.

## **COMS 461: UNIX AND SHELL PROGRAMMING**

### **Unit I**

Introduction - Features - System structure - Shell & its features - Kernel - Architecture of the UNIX OS - Kernel Data Structure - Overview - Logging in & out - I node and file structure - File system structure and features - Booting sequence & init process.

### **Unit II**

Unit File Hierarchy Concepts - Some Important Directories - Directory Management – File Management – Access Permissions – Mounting – Archiving - Process Management : Listing – Finding – Sending Signals – Priority – Crontab.

### **Unit III**

Shell Programming - Environmental & user defined variables - Argument processing - Shell's interpretation at prompt - Arithmetic expression evaluation - Control structure - Redirection - Background process & priorities of process - Conditional execution - Parameter & quote substitution - Text editor

### **Unit IV**

Advanced shell programming - Filtering units - Awk - Batch process - Splitting, comparing, sorting, Merging & ordering files - Communications with other users - Spooling & Print Management - Backup & Recovery.

### **Unit V**

Memory management - Swapping - Demand paging - Memory management - TCP/IP Network Configuration, Managing Ethernet Connections, Graphical Network - Configuration, Network Configuration Files, Managing Services.

### **Text Books**

1. Maurice J. Bach, "Design of the Unix Operating System", Third Edition, 2000, PHI.
2. Sumitabha Das, "Unix : Concepts and Applications", Third Edition, 2006, Tata McGraw Hill  
ISR Group,
3. Basics of OS, UNIX and SHELL Programming" TMH (2006)

### **Reference Books**

1. Stephen Prata "Advanced Unix -A programmer's Guide.

## **COMS 462:DATA COMMUNICATION NETWORKS**

### **UNIT I**

Introduction to Networks – Topology - Network Architecture - Reference Models - Example Networks – APRANET , NSFNET , Internet - Physical Layer - Transmission media – ISDN - Broadband, Narrowband.

### **UNIT II**

**The Data Link Layer :** Data Link Layer design issues – Error Detection and Correction Methods - Elementary Data Link Protocols – Sliding Window Protocols – Protocol Verification Methods – Channel Allocation – Multiple Access protocols – IEEE 802 Standards.

### **UNIT III**

**The Network Layer:** Network Layer design issues – Routing algorithms – Congestion Control algorithms – Internetworking – Network Layer in Internet.

### **UNIT IV**

**The Transport Protocols:** Transport Service – Transport Protocols – Internet Transport Protocols UDP – TCP - Performance issues.

### **UNIT V**

**The Application Layer:** Application Layer design issues – Domain Name System - Electronic Mail – World Wide Web – Multimedia - Other Applications – Network Security - Basic Cryptography - DES - RSA.

### **TEXT BOOK**

1. Andrew S. Tanenbaum, “COMPUTER NETWORKS” , Fourth Edition, Prentice Hall India.

### **REFERENCE**

1. William Stallings, “CRYPTOGRAPHY & NETWORK SECURITY - Principles and Practices”, Third Edition, Pearson Education.

## **COMS 463:SOFTWARE ENGINEERING**

### **UNIT I**

Introduction, Software process, Software Process Models, CMM levels and KPAs, Linear Sequential Model, Prototype Model, RAD Model, Evolutionary Software Process Model, Analysis concepts and principles, Analysis modelling.

### **UNIT II**

Software process and Project Metrics, Risk Management, Quality Assurance and Quality models – McCall's model, FURPS model and ISO 9126 model, Configuration management.

### **UNIT III**

Software Design, Design Principles, Design concepts, Architectural Design, Procedural Design, Design of Real-time systems.

### **UNIT IV**

Software Testing, Test-case Design, White Box Testing, Black Box testing, Testing GUI and Client/ Server Architecture, Testing Strategies, Unit Testing, Integration testing, Validation testing, System testing, Software Maintenance.

### **UNIT V**

Recent trends in Software Engineering, Cleanroom Software Engineering, Re-engineering, Client/ Server Software Engineering.

### **TEXT BOOK**

1. Roger S. Pressman, "Software Engineering a Practitioner's Approach", McGrawHill, Fifth Edition

### **REFERENCES**

1. Ian Sommerville, "Software Engineering" Vth Edition, Addison Wesley Publications.

## **COMS 464:OBJECT ORIENTED SYSTEM DESIGN**

### **UNIT I**

Overview of Object-oriented systems development – Need for object orientation - Overview of the unified approach -Object Basics -Object-Oriented Systems Development Life Cycle – The software development process- building high-quality software- object-oriented systems development- reusability.

### **UNIT II**

Object-Oriented Methodologies – Unified Modeling Language – Static and dynamic models- why modeling- introduction to the unified modeling language- UML diagrams- UML class diagram- Use-case diagram- UML dynamic modeling- model management- UML extensibility- UML meta-model.

### **UNIT III**

Object-Oriented Analysis Process- identifying Use Cases – Use-case driven object-oriented analysis- business process modeling- Use-case model- Object Analysis-Classification – classifications theory- approaches for identifying classes-Identifying object relationships - identifying attributes and methods- defining attributes by analyzing use cases and other UML diagrams.

### **UNIT IV**

The Object-Oriented Design Process and Design Axioms – the object-oriented design process- object-oriented design axioms- corollaries- Design patterns and frameworks – Describing Design patterns – Façade Design pattern. Designing Classes - the object-oriented design philosophy- UML object constraint language- designing classes- the process- class visibility- designing classes- refining attributes - designing methods and procedures-

### **UNIT V**

Access Layer - designing access layer classes- case study -View Layer- Designing interface objects – user interface design as a creative process- designing view layer classes – User satisfaction and usability testing

Case Study - Analyzing the Bank ATM - Use-case model- developing effective documentation- Relationship analysis - defining attributes - object responsibility - defining methods for - refining attributes - designing methods - Designing the access layer - designing user interface

### **TEXT BOOKS**

1. Ali Bahrami, “Object Oriented System Development”, McGraw Hill International Edition, 1999.
2. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, “DESIGN PATTERNS Elements of reusable Object Oriented Software”, Addison Wesley Professional Computing Series - Pearson Education -2003

## COMS 465:WEB TECHNOLOGY

### UNIT I

**Introduction to Internet:** Web Vs Internet - Internet Address, Ports, Sockets, DNS - firewall - proxy- Internet Service Provider-Internet services-protocols- Static Page Creation: HTML – Cascaded Style Sheets.

### UNIT II

**The Client:** Introduction to Client side scripting – Javascript : Overview – Language Constructs – Window Manipulation – JavaScript Functions- Working with Forms – Cookies.

### UNIT III

**The Server:** Introduction to server side scripting – PHP Language Basics – OOP with PHP – Session Management – Reporting – Database manipulation with PHP and MySql - Authentication and Security.

### UNIT IV:

**The XML :** Introduction – XML syntax – DTD – XML Schema – XML parsers – SOAP – Creating simple web services.

### UNIT V

**AJAX :** Introduction – Creating and sending requests- XML in Javascript and AJAX – Server side AJAX.

### TEXT BOOKS

1. Web Publishing with HTML4, Laure Lemay, Techmedia, First Edition.
2. “Commercial Web Development “, Ivan Bayross.
3. The book of JavaScript : a practical guide to interactive Web pages Thau -- 2nd ed.
4. Web Database Application with PHP and MySQL, 2nd Edition By David Lane, Hugh E. Williams
5. XML – How to program by Deital and Deital, Pearson Education, 2001.

## COMS 511:PRINCIPLES OF COMPILER DESIGN

### UNIT I

**Introduction to Compilers:** Compilers and Translators, structure of a Compiler, Compiler Writing tools, Lexical and syntactic structure of a language - Finite Automata and Lexical Analysis, Role of a lexical analyzer.

### UNIT II

**Syntactic specification of programming languages :** Context free grammars, derivations and parse trees, capabilities of context free grammars Basic Parsing techniques: Shift reduce parsing – Operator precedence parsing – Top-Down Parsing - Predictive Parsers – Automatic Construction of efficient Parsers

### UNIT III

**LR Parsers** – Constructing SLR – Canonical LR and LALR Parsing Tables – Using Ambiguous Grammars – Automatic Parser Generator – Implementation of LR Parsing Tables. **Syntax Directed Translation:** Schemes – Implementation – Intermediate Code – Postfix Notation – Parse Tree and Syntax Trees – Three Address Code – Quadruples and Triples – Translation of Assignment Statements – Boolean Expression – Postfix Translations – Translation with a Top-Down Parser.

### UNIT IV

Symbol Tables, Contents data structures, representing scope information. Run-Time Storage administration, Implementation and storage allocation of simple stack allocation schemes and block structured languages, Error detection and recovery, Lexical Phase Errors, Syntactic Phase errors, Semantic Errors.

### UNIT V

Introduction to Code Optimization, Principle Sources of optimization, Loop Optimization, DAG Representation of basic blocks, Global Data Flow Analysis, Code Generation, Problems in code generation Register allocation and assignment, Code Generation from DAG's, Peephole Optimization.

### TEXT BOOK

1. Alfred Aho, Jeffrey D.Ullman "Principles of Compiler Design", Narosa 25th reprint.
2. Beck

### REFERENCE

1. Alfred Aho, Jeffrey D.Ullman, Ravi Sethi "Compiler Design-Principles Techniques and Tools", 16th reprint, Pearson Education.

## **COMS 518:COMPILER DESIGN LAB**

1. Simulation of Lexical Analyser
2. Regular Expression to NFA Conversion
3. Parser implementation – Recursive Decent, Shift Reduce, Predictive parsers
4. Simple Intermediate Code Generation - Quadruples / Triples generation
5. Developing applications with LEX and YACC Ex. Calculator generation
6. Dynamic Storage Allocation and Overloaded functions

## **COMS 512:COMPUTER GRAPHICS**

### **UNIT I**

Introduction, Overview of Graphics Systems, Video Display Devices, Refresh Cathode Ray Tubes, Raster Scan and Random Scan Displays, Raster Scan and Random Scan Display Processor, Color CRT Monitors, DBST, 3D Viewing Devices, Stereoscopic and VR Systems, Input Devices, Hard Copy Devices.

### **UNIT II**

Output primitives, Line drawing algorithms, Circle Drawing algorithms, Circle drawing algorithms, Polynomials and spline curves, Area filling algorithms, character generation, Attributes of Output primitives, Line, Curve, Area fill, Character and bundled attributes, Anti aliasing techniques.

### **UNIT III**

2D Transformations, 2D viewing, Graphical User interfaces and Interactive Input Methods.

### **UNIT IV**

3D Concepts, 3D Object representations, 3D Transformations, 3D Viewing .

### **UNIT V**

Visible Surface Detection Methods.

### **TEXT BOOK**

1. Donald Hearn and M. Pauline Baker, "Computer Graphics", 2<sup>nd</sup> Edition, Prentice Hall of India.

### **REFERENCES**

1. Steven Harrington, "Computer Graphics – Programming Approach", McGraw Hill.
2. Roy A. Plastock and Gordon Kelley, "Theory and Problems of Computer Graphics", Schaum's Outline Series, McGraw Hill.

## **COMS 513:CRYPTOGRAPHY AND NETWORK SECURITY**

### **UNIT I**

Symmetric Ciphers – Classical Encryption Techniques – Symmetric Cipher Model , Substitution Techniques , Transposition Techniques , Steganography – Block Ciphers and the Data Encryption Standard – Simplified Data Encryption Standard , Block Cipher Principles , The Data Encryption Standard, Strength of Data Encryption Standard, Differential and Linear Cryptanalysis , Block Cipher Design Principles , Block Cipher Modes of Operation.

### **UNIT II**

Advanced Encryption Standard – Evaluation Criteria for Advanced Encryption Standard , The Advanced Encryption Standard Cipher – Substitute Byte Transformation – Contemporary Symmetric Ciphers – Triple Data Encryption Standard , Blowfish ,RC5 , Characteristics of Advanced Symmetric Block Ciphers – Confidentiality using Symmetric Encryption – Key Distribution.

### **UNIT III**

Public Key Cryptography and RSA – Principles – RSA Algorithm, Key Management and other Public Key Cryptosystems – Key Management , Diffie-Hellman Key Exchange , Elliptic Curve Cryptography , Manage Authentication and Hash Functions – Authentication Requirements ,Authentication Functions , Manage Authentication Codes.

### **UNIT IV**

Digital Signatures and Authentication Protocols – Digital Signatures , Authentication Protocols , Digital Signature Standard.

### **UNIT V**

Network Security Practice – Authentication Applications – Kerberos , X.509 Authentication Service – Electronic Mail Security – PGP , Secured MIME, IP Security – Overview , IP Security Architecture , Authentication Header , Encapsulation Security Payload.

### **TEXT BOOK**

1. William Stallings, “CRYPTOGRAPHY & NETWORK SECURITY - Principles and Practices”, Third Edition , Pearson Education.

## COMS 527:PRINCIPLES OF PROGRAMMING LANGUAGES

### UNIT I

**The challenge of programming language design:** Criteria for language design-some possible solutions. Defining syntax: General problem of describing syntax, formal methods of describing syntax, BNF, Syntax Graphs. Syntax and program Reliability.

### UNIT II

**Variables, Expressions and statements:** Variables and assignment statement, Binding Time and Storage Allocation, Constants and initialization, Expressions, Statements-Conditional, Iteration. GOTO and Labels. **Types:** Data types and Typing. Enumerated and elementary, pointer, structured Data types, Type coercion & Equivalence. **Scope and Extent:** Basics, Run-time implementation, an extended Example, Binding, scope & Extent.

### UNIT III

**Procedures:** General features, Parameter evaluation & passing, Call-By-Name, Specification of objects in a procedure, aliasing, Overloading, Generic functions, Coroutines. **Abstract data types:** concept of abstraction, Encapsulation, Introduction to data abstraction, design issues, parameterized abstract data types.

### UNIT IV

**Exception Handling:** Introduction, Exception Handling in PL/I, Exception Handling in Ada, Exception Handling in C++. **Concurrency:** Basic concepts, subprogram-level concurrency, statement-level concurrency, semaphore, Monitors, Message passing.  
**INPUT-OUTPUT.**

### UNIT V

**CASE STUDIES: Functional programming Languages-** Introduction- Mathematical functions- fundamentals of functional programming languages –the first functional programming language LISP - Application of functional languages- **Logic programming Languages** – Introduction to predicate Calculus- An overview of logic programming- Applications of logic programming - **Object-oriented programming Languages** - Introduction – Object oriented programming- Support for object oriented programming in C++.

### TEXT BOOKS

1. Ellis Horowitz, “Fundamentals of programming Languages”, Galgotia Publications, 1998
2. Robert W. Sebesta, “Concepts of programming Languages”, Addison-Wesley , 1996.

## **COMS 528:MIDDLEWARE TECHNOLOGIES**

### **UNIT I**

Client – Server – File Server, Data Base Server, Group Server, Object Server, Web Server  
Middleware – General Middleware – Service Specific Middleware - Client – Client  
Server Building blocks – RPC – Messaging – Peer-to-Peer

### **UNIT II**

EJB – EJB Architecture – Overview of EJB Software Architecture – View of EJB  
Conversation – Building and Deploying EJBs – Roles in EJB

### **UNIT III**

EJB Session Beans – EJB Entity Beans – EJB Clients – EJB Deployment – Building an  
Application with EJB

### **UNIT IV**

CORBA – Distributed Systems – Purpose – Exploring CORBA alternatives –  
Architecture Overview – CORBA and Networking Model – CORBA Object Model –  
IDL – ORB – Building an Application with CORBA

### **UNIT V**

COM – Data Types – Interfaces – Proxy and Stub – Marshalling – Implementing  
Server/Client – Interface Pointers – Object Creation, Invocation, Destruction –  
Comparison of COM and CORBA

### **TEXT BOOKS**

1. Robert Orfali, Dan Harkey, Jeri Edwards, *'The Essential Client/Server Survival Guide'*, Galgotia Publication Pvt. Ltd., 2002.
2. Tom Valesky, *'Enterprise JAVA Beans'*, Pearson Education, 2002.
3. Jeremy Rosenberger, *'Teach Yourself CORBA in 14 days'*, Techmedia, 2000.
4. Jason Pritchard, *'COM and CORBA side by side'*, Addison Wesley, 2000.

### **REFERENCES**

2. Mowbray, *'Inside CORBA'*, Pearson Education, 2002.

## COMS 530: MULTIMEDIA SYSTEMS AND APPLICATIONS

### UNIT I

**Introduction:** Multimedia elements – multimedia applications – System architecture – evolving technologies – defining objects – data interface standards – need for data compression – multimedia databases

### UNIT II

**Multimedia data compression:** Types of compression – Binary image compression – color, gray scale and still video image compression – video image compression – audio compression – fractal compression. Data and file formats: RTF – TIFF – RIFF, MIDI, JPEG, AVI video file formats, MPEG standards.

### UNIT III

**Multimedia I/O technologies:** Pen input – Video and Image display systems – Print output technologies image scanners – digital voice and audio – digital camera – Video images and animation – full motion video. Multimedia storage and retrieval technologies: magnetic media technology – optical media – hierarchical storage management – cache management for storage systems.

### UNIT IV

**Multimedia application design:** Types of Multimedia systems – Virtual reality design – components of multimedia systems – organizing multimedia databases – application work flow design issues. Multimedia authoring systems: Hypermedia application design considerations – user interface design – information access – object display / playback issues.

### UNIT V

**Distributed Multimedia Systems:** Components – Distributed Client-Server operation – multimedia object servers – Multi-Server network topologies – Distributed multimedia databases – Managing distributed objects.

### TEXT BOOKS

1. Prabhat K. Andleigh, Kiran Thakrar, “*Multimedia Systems Design*”, PHI 2002.

### REFERENCES

1. Tay Vaughan, “*Multimedia making it works*” Fifth Edition, TMH, 2001.
2. Jeffery Jefcoat, “*Multimedia Systems and Application*”, TMH.
3. Fred Halsall, “*Multimedia Communication Application Networks, Protocols and Standards*”, Addison Wesley, 2001.

## **COMS 531:E-COMMERCE**

### **UNIT I**

Electronic Commerce Environment and Opportunities: Background – The Electronic Commerce Environment – Electronic Marketplace Technologies – Modes of Electronic Commerce: Overview – Electronic Data Interchange – Migration to Open EDI – Electronic Commerce with WWW / Internet – Commerce Net Advocacy – Web Commerce going forward

### **UNIT II**

Approaches to safe Electronic Commerce: Overview – Secure Transport Protocols – Secure Transactions – Secure Electronic Payment Protocol(SEPP) – Secure Electronic Transaction (SET )- Certificates for Authentication – Security on Web Servers and Enterprise Networks – Electronic cash and Electronic payment schemes: Internet Monetary payment and security requirements – payment and purchase order process - Online Electronic cash

### **UNIT III**

Internet/Intranet Security issues and solutions: The need for Computer Security – Specific Intruder Approaches – Security strategies – Security tools – Encryption – Enterprise Networking and Access to the Internet – Antivirus programs – Security Teams.

### **UNIT IV**

MasterCard / Visa secure Electronic Transaction: Introduction – Business Requirements – Concepts – Payment processing – E-mail and secure e-mail technologies for electronic commerce:Introduction – The Mean of Distribution – A model for message handling – How does e-mail work? MIME: Multipurpose Internet Mail Extensions – S/MIME: Secure Multipurpose Internet Mail Extensions – MOSS: Message Object Security Services

### **UNIT V**

Internet and Web site establishment: Introduction – Technologies for web servers – Internet tools relevant to Commerce – Internet Applications for Commerce – Internet charges – Internet Access and Architecture – Searching the Internet

### **TEXT BOOKS**

1. Daniel Minoli & Emma Minoli, “Web Commerce Technology Handbook”, TataMcGraw-Hill .
2. K.Bajaj & D. Nag, “E-Commerce”, TataMcGraw-Hill.

## **COMS 532:NEURAL NETWORKS**

### **UNIT I**

Introduction, Characteristics of Artificial Neural Networks, Learning in Biological systems and machines, Brain and Computers, Differences in simple neurons.

### **UNIT II**

Perceptron and representation, Learning , Linear separability, Problems with the perceptron training algorithms, Multilayer perceptron, Back propagation training algorithm, Learning difficulties, Applications.

### **UNIT III**

Counter propagation networks, Normal operation, training, Full counter propagation networks, Applications to data compression, Khonen network algorithm, Neighborhoods. Hopfield Nets, Learning, The energy landscape, Storing and recall of patterns, Learning in Boltzman machines, Learning , Applications.

### **UNIT IV**

Statistical methods, Training, Application to general non-Linear optimization problem. Adaptive Resonance Theory, Architecture, Classification, Implementation, Training aids, Characteristics.

### **UNIT V**

Associative memory, Bi-directional associative memory, Structure of types. Optical Neural Networks, Vector matrix multipliers, Holographic correlators, Hopfield net using electro optical matrix multipliers and volume holograms. The cognitron structure, Training, Lateral inhibition, The NeoCognitron structure, Generalization, Training, Application of Neural nets, Pattern Recognition, Decision making system, Medical diagnosis. Recent trends in Neural Nets.

### **TEXT BOOK**

1. Philip D Wasserman, “Neural Computing – Theory and Practice”, Van Nostrand and Reinhold, 1989.

### **REFERENCE**

1. James A Freeman and David M Skapura, “Neural Networks Algorithms, Application and Programming Techniques”, Addison Wesley Publishing Company, 1991.

## **COMS 533:.NET FRAMEWORK AND C#**

### **UNIT I**

Introduction to the .NET Platform – Common Language Runtime(CLR) – The Common Type Specification(CTS) – The Common Language Specifications (CLS) – Assemblies - .NET Base Classes – CLR Debugger.

### **UNIT II**

Introduction to C# - Data Type – Operators – Flow Control and Iteration – Arrays and Strings – Basics of C# Classes – Boxing and Unboxing – Reflection – Interoperability – The Preprocessors – Attributes – Name Spaces.

### **UNIT III**

Object-Oriented Programming in C# - Encapsulation, Inheritance, and Polymorphism – Exception Handling – Garbage Collection – Interfaces – Delegates and Events – Multithreading and Synchronization – Type Reflection and Attributes.

### **UNIT IV**

Introducing Windows Forms - GDI+ - Programming with Windows Forms Controls - The System.IO Namespace - Data Access with ADO.NET.

### **UNIT V**

**Introduction to ASP .NET:** Web Forms - Server Controls – Data Access – LINQ – Security.

### **TEXTBOOKS**

- 1.Robert J.Oberg, “Introduction to C# using .NET”,PHI,2002.
- 2.Andrew Troelsen, “C# and .NET Platform”,Apress, 1<sup>st</sup> edition,2001.
3. Pro ASP.NET 3.5 in C# 2008, Second Edition By Matthew MacDonald and Mario Szpuszta.

## **COMS 538:DISTRIBUTED DATABASE SYSTEMS**

### **UNIT I**

Introduction : Distributed data processing, distributed database design, distributed query processing, distributed directory management, distributed concurrency control, distributed deadlock management, reliability of distributed DBMS, operating system support, heterogeneous databases. Overview of Relational DBMS

### **UNIT II**

Review of computer networks: Data communication concepts, types of networks, protocol standards, broadband networks, wireless networks, Internet. Distributed DBMS Architecture : DBMS standardization, architectural model for distributed DBMS, Distributed DBMS Architecture : client/server systems, peer-to-peer distributed systems.

### **UNIT III**

Distributed Database Design: Alternative design strategies: top-down design process, bottom-up design process, distribution design issues: reasons for fragmentation, fragmentation alternatives, degree of fragmentation, correctness rules of fragmentation, allocation alternatives, information requirements, fragmentation: horizontal fragmentation, vertical fragmentation, hybrid fragmentation. Semantic data control : View management: views in centralised DBMS, updates through views, views in distributed DBMS. Data security : centralized authorization control, distributed authorization control.

### **UNIT IV**

Distributed Concurrency Control : Locking-based concurrency control algorithm, timestamp-based concurrency control algorithms : basic TO algorithm, conservative TO algorithm, optimistic concurrency control algorithms. Deadlock management : deadlock prevention, deadlock avoidance, deadlock detection and resolution. Distributed DBMS Reliability : System, state and failure, reliability and availability, mean time between failures/mean time to report, failure and fault tolerance in distributed systems : reasons for failures, basic fault tolerance approaches and techniques.

### **UNIT V**

Distributed Object Database Management: Object, abstract data types, composition, class, collection, subtyping and inheritance, Object distribution design : horizontal class partitioning, vertical class partitioning , path partitioning, class partitioning algorithms, allocation, replication.

### **TEXT BOOK**

3. M.Tamer Ozsü-Patric Valduriez, "Principles of Distributed Database System" II Edition, Pearson Education.

## **COMS 540:ARTIFICIAL INTELLIGENCE**

### **UNIT-I**

Introduction : Intelligent Agents – Search Strategies – Solving Problems by Searching – Breadth-First – Depth-First – Depth-Limited – Iterative Deepening – Bidirectional – Informed Search Methods – A\* - AO\* - Games as Search Problems – Alpha-Beta Pruning.

### **UNIT-II**

Representation: Propositional Logic – First – Order Logic –Frame Systems and Semantic Networks.

### **UNIT-III**

Reasoning: Inference in First-Order Logic – Forward and Backward Chaining – Resolution – Unification- Logical Reasoning Systems.

### **UNIT-IV**

Planning: Simple Planning Agent – From Problem Solving to Planning – Basic Representations for Planning – Practical Planners – Hierarchical Decomposition – Resource Constraints – Uncertainty – Probabilistic Reasoning Systems.

### **UNIT-V**

Learning: General Model of Learning Agents – Inductive Learning - Computational Learning Theory – Learning in Neural and Belief Networks – Reinforcement Learning – Types of Communicating Agents – Robotics: Tasks, Parts, Configurations Spaces, Navigation and Motion Planning.

### **TEXTBOOKS**

- a. Stuart J.Russell and Peter Norvig, “Artificial Intelligence”, Tata Mc Graw Hill Publisher – 2<sup>nd</sup> Edition.

### **REFERENCES**

1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata Mc Graw Hill Publisher-2<sup>nd</sup> Edition.
2. Dan W.Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall of India.

## COMS 541:FUNDAMENTALS OF AGENT TECHNOLOGY

### Unit I

Introduction – Intelligent Agents – Environments – Intelligent agents – Agents and Objects – Agents and Expert Systems – Agents as Intentional Systems – Abstract Architectures for Intelligent Agents – How to tell an agent what to do – Synthesizing Agents

### Unit II

Deductive Reasoning Agents – Agents as Theorem Provers – Agent-Oriented Programming

Practical Reasoning Agents – Proactical Reasoning Equals Deliberation Plus Means-Ends Reasoning – Means-Ends Reasoning – Implementing a Practical Reasoning Agent

Reactive and Hybrid Agents- Brooks and the Subsumption Architecture – The Limitations of Reactive Agents – Hybrid Agents

### Unit III

Multiagent Interactions – Utilities and Preferences – Multiagent Encounters – Dominant Strategies and Nash Equilibria – Competitive and Zero-Sum Interactions – The Prisoner's Dilemma – Other Symmetric 2 x 2 Interactions – Dependence Relations in Multiagent Systems

Reaching Agreements – Mechanism Design – Auctions – Negotiation – Argumentation Communication – Speech Acts – Agent Communication Languages – Ontologies for Agent Communication – Coordination Languages

### Unit IV

Cooperative Distributed Problem Solving – Task Sharing – Combining Task and Result Sharing – Handling Inconsistency – Coordination – Multiagent planning and Synchronization

### Unit V

Methodologies – Agent-Oriented Analysis and Design Techniques – Pitfalls of Agent Development – Mobile Agents - Applications of Agents

### Text Book

2. Michael Wooldridge, An Introduction to Multiagent Systems, John Wiley & Sons Ltd.2002.

### References

7. Gerhard Weiss, Multi-agent Systems – A Modern Approach to Distributed Artificial Intelligence, MIT Press
8. Walter Brenner et al, Intelligent Software agents, Springer Verlag
9. Nicholas R. Jennings, Michael Wooldridge, Agent Technology: Foundations, Applications and markets, Springer Verlag Publishing.

## **COMS 544:SOFTWARE TESTING AND QUALITY ASSURANCE**

### **UNIT I**

**SOFTWARE TESTING TECHNIQUES:** Software Testing Fundamentals, Psychology of testing - Testing economics, White box testing techniques, Black box testing techniques - Weyuker's adequacy axioms.

### **UNIT II**

**SOFTWARE TESTING STRATEGIES:** SDLC and Testing, Strategic Approach to Software Testing, Unit Testing, Integration Testing, validation Testing, System Testing, The art of debugging, Testing Maturity Models – TMM and TMML.

### **UNIT III**

**TESTING OBJECT ORIENTED SOFTWARE:** Challenges - Differences from testing non-OO Software - Class testing strategies - Class Modality - State-based Testing - Message Sequence Specification, Difference between design based and code testing, Interdependency Testing Models in OO software.

### **UNIT IV**

Introduction to Quality and Quality Control - Evolution of Quality Control - Quality assurance - Quality circles and Quality improvement teams - Benefits of Quality control- Quality and Reliability - Quality costs - Measuring Quality costs - Total Quality Management, Quality Metric Models - McCall's model, FURPS model and ISO 9126 model.

### **UNIT V**

CMM Model and its stages - Introduction to PCMM, CMMI and Six Sigma concepts. Introduction to ISO 9000, ISO 9000 – Part3 for software Quality.

### **TEXT BOOKS**

- Roger S. Pressman, “ Software Engineering. A Practitioners Approach”, Fifth Edition, 2001
2. William E.Perry, " *Effective Methods for Software Testing (2nd Edition)* ", John Wiley & Sons, 2000.
3. Robert V.Binder, " *Testing Object-Oriented Systems: Models Patterns and Tools* ", Addison Wesley, 2000.
- 4.Rajneesh Kapur, ”Getting ISO 9000 in a software organization”, By BPB Publications.
- 5.Allan C Gillies, “ Software Quality theory and management”, Thompson learning.
- 6.Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education.

### **REFERENCES**

1. Glenford J.Myers, "*The Art of Software Testing* ", John Wiley & Sons, 1997.

## **COMS 546: DATA MINING AND WAREHOUSING**

### **UNIT I**

Evolution of database technology – Introduction to data warehousing and data mining - Differences between operational databases and data warehouses.

### **UNIT II**

Data warehouse architecture & design, Hardware & Operational design, Tuning and testing.

### **UNIT III**

Data mining: Data preprocessing, data mining primitives, languages & system architectures, concept description: characterization and comparison, Mining association rules, classification and prediction.

### **UNIT IV**

Cluster analysis, Applications and trends in data mining.

### **UNIT V**

Introduction to Microsoft's OLE DB for Data mining, DBMiner.

### **TEXTBOOKS**

1. Sam Anahory and Dennis Murray, "Data Warehousing in the real world", Addison Wesley 1997.
2. Jiawei Han et, al., "Data Mining: Concepts and Techniques", Morgan Kaufmaan series , 2000.

### **REFERENCES**

1. Usama M.Fayyad, Gregory Piatetsky - Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, "Advances in Knowledge Discovery and Data Mining", The M.I.T Press, 1996.
2. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley & Sons Inc., 1998.
3. Sean Kelly, "Data Warehousing in Action", John Wiley & Sons Inc., 1997

## COMS 550: NATURAL LANGUAGE PROCESSING

### Unit – I

Introduction – Knowledge in Speech and Language Processing – Ambiguity – Models and Algorithms – Language, Thought, and Understanding – The State of the Art and the Near term Future – Some Brief History.

### Unit – II

Morphology and Finite-State Transducers – Survey of English Morphology – Inflectional Morphology – Derivational Morphology – Finite-State Morphological Parsing – The Lexicon and Morphotactics – Morphological Parsing with Finite-State Transducers – Orthographic Rules and Finite-State Transducers – Combining FST Lexicon and Rules – Lexicon-Free FSTs: The Porter Stemmer – Human Morphological Processing.

### Unit – III

Word Sense Disambiguation and Information Retrieval – Selection Restriction-Based Disambiguation – Limitations of Selectional Restrictions – Robust Word Sense Disambiguation – Machine Learning Approaches – Dictionary-Based Approaches – Information Retrieval – The Vector Space Model – Term Weighting – Term Selection and Creation – Homonymy, Polysemy, and Synonymy – Improving User Queries – Other Information Retrieval tasks.

### Unit – IV

Discourse – Reference Resolution – Reference Phenomena – Syntactic and Semantic Constraints on Coreference – Preferences in Pronoun Interpretation – An Algorithm for Pronoun Resolution – Text Coherence – The Phenomenon – An Inference Based Resolution Algorithm – Discourse Structure.

### Unit – V

Machine Translation – Language Similarities and Differences – The Transfer Metaphor – Syntactic Transformations – Lexical Transfer – The Interlingua Idea: Using Meaning – Direct Translation – Using Statistical Techniques – Quantifying Fluency – Quantifying Faithfulness – Search – Usability and System Development.

### Text Book

Daniel Jurafsky and James H. Martin, *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*, Pearson Education, 2002.

### Reference

Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. *Natural Language Processing- A Paninian Perspective*. Prentice Hall India, Eastern Economy Edition.

## COMS 551:MICROPROCESSOR ARCHITECTURE

### Unit I

**Introduction to the Microprocessor** : History - Microprocessor-Based Personal Computer System - Number Systems - Computer Data Formats - **Architecture & Addressing** : Microprocessor Architecture - Real Mode Memory Addressing - Protected Mode Memory Addressing - Memory Paging - Addressing modes.

### Unit II

8086/8088 : Pin-outs and Pin Functions - Clock Generator (8284A) - Bus Buffering and Latching - Bus Timing - Ready and the Wait State - Minimum Mode Verse Maximum Mode .ALP Instructions : Data Movement – Arithmetic and Logic – Program Control. Assembly language With C/C++ .

### Unit III

Memory Interface : Memory Devices - Address Decoding - 8088 and 80188 (8-bit) Memory Interface - Dynamic RAM. Basic I/O Interface : Introduction to I/O Interface - I/O Port Address Decoding - The Programmable Peripheral Interface - The 8279 Programmable Keyboard/Display Interface - 8254 Programmable Interval Timer - Analog-to-Digital (ADC) and Digital-to-Analog (DAC) Conversions

### Unit IV

Interrupts : Basic Interrupt Processing - Hardware Interrupts - Expanding the Interrupt Structure - 8259A Programmable Interrupt Controller - Interrupt Examples . Direct Memory Access and DMA-Controlleed I/O : Basic DMA Operation - The 8237 DMA Controller - Shared-Bus Operation - Disk Memory Systems - Video Displays. Bus Interface : The ISA Bus - The Peripheral Component Interconnect (PCI) Bus - The Parallel Printer (LPT1) Interface - The Serial COM Ports - The Universal Serial Bus (USB) - Accelerated Graphics Port (AGP).

**Unit V** : 80186, 80188, and 80286 - The Pentium and Pentium Pro Microprocessors.

### TEXT BOOKS

- Barry B. Brey, “The Intel Microprocessors 8086/8088,80186/80188,80286,80386, 80486, Pentium & Pentium Pro processors”, Seventh Edition.

### REFERENCES

Gaonkar, “Microprocessor Architecture, Programming and Applications”, Wiley Eastern Ltd., 1987.

## **COMS 552:DECISION SUPPORT SYSTEM**

### **UNIT**

**I**

Decision making, Systems, Modeling, and support – Introduction and Definition – Systems – Models – Modeling process – Decision making: The intelligence phase – The design phase - The choice phase – Evaluation: The implementation phase –Alternative Decision – Making models – Decision support systems – Decision makers - Case applications.

### **UNIT**

**II**

Decision Support System Development: Introduction - Life cycle – Methodologies – prototype – Technology Levels and Tools – Development platforms – Tool selection – Developing DSS Enterprise systems: Concepts and Definition – Evolution of information systems – Information needs – Characteristics and capabilities – Comparing and Integrating EIS and DSS – EIS data access, Data warehouse , OLAP, Multidimensional analysis, Presentation and the web – Including soft information enterprise on systems - Organizational DSS – supply and value chains and decision support – supply chain problems and solutions – computerized systems MRP, ERP, SCM – frontline decision support systems.

### **UNIT III**

Introduction – Organizational learning and memory – Knowledge management – Development –methods, Technologies, and Tools – success –Knowledge management and Artificial intelligence – Electronic document management.  
Knowledge acquisition and validation: Knowledge engineering – Scope – Acquisition methods - Interviews – Tracking methods – Observation and other methods – Grid analysis

### **UNIT IV**

Inference Techniques: Reasoning in artificial intelligence – Inference with rules: The Inference tree – Inference with frames – Model-based and case-based reasoning - Explanation and Meta knowledge – Inference with uncertainty – Representing uncertainty – Probabilities and related approaches – Theory of certainty – Approximate reasoning using

### **UNIT V**

Implementing and integrating management support systems – Implementation: The major issues - Strategies – System integration – Generic models MSS, DSS, ES – Integrating EIS, DSS and ES, and global integration – Intelligent DSS – Intelligent modeling and model management – Examples of integrated systems – Problems and issues in integration.

### **TEXT BOOK**

Efrain Turban, Jay E.Aronson, “Decision Support Systems and Intelligent Systems” 6th Edition, Pearson Education, 2001.

## COMS 553:SOFT COMPUTING

### Unit I

**ARTIFICIAL NEURALS** : Basic-concepts-single layer perception-Multi layer perception-Supervised and un-supervised learning back propagation networks, Application

### Unit II

**FUZZY SYSTEMS:** Fuzzy sets and Fuzzy reasoning-Fuzzy matrices-Fuzzy functions-decomposition-Fuzzy automata and languages- Fuzzy control methods-Fuzzy decision making, Applications

### Unit III

**NEURO-FUZZY MODELLING:** Adaptive networks based Fuzzy interfaces-Classification and Representation trees-Data dustemp algorithm –Rule base structure identification-Neuro-Fuzzy controls

### Unit IV

**GENETIC ALGORITHM:** Survival of the fittest-pictures computations-cross over, mutation-reproduction-rank method-rank space method, Application

### Unit V

**SOFT COMPUTING AND CONVENTIONAL AI:** AI Search algorithm-Predicate calculus- rules of interface - Semantic networks-frames-objects-Hybrid models applications

### References:

1. Jang J.S.R., Sun C.T and Mizutami E - *Neuro Fuzzy and Soft computing* Prentice hall New Jersey, 1998
2. Timothy J. Ross: *Fuzzy Logic Engineering Applications*. McGraw Hill, New York, 1997.
3. Laurene Fauseett: *Fundamentals of Neural Networks*. Prentice Hall India, New Delhi, 1994.
4. George J. Klir and Bo Yuan, *Fuzzy Sets and Fuzzy Logic*, Prentice Hall Inc., New Jersey, 1995
5. Nih. J. Ndssen *Artificial Intelligence*, Harcourt Asia Ltd., Singapore, 1998.

## **COMS 554: PRINCIPLES OF DISTRIBUTED SYSTEMS**

### **UNIT I**

Definition-Goals-Hardware and Software Concepts – Client/Server Model  
Communication - Layered Protocols – RPC-Remote Object Invocation – Message  
Oriented Communication

### **UNIT II**

Threads – Client –Server – Code Migration –S/W Agents Naming Entity – Location  
Mobile Entity

### **UNIT III**

Synchronization- Clock Synchronization-Logical Clocks- Global States-Election  
Algorithms- Mutual Exclusion – Distributed Transaction Consistence and Replication -  
Introduction- Data Centric Consistence- Fault Tolerance- Reliable Client/Server  
Communication- Distributed Commit – Recovery

### **UNIT IV**

Distributed Object Database System CORBA – DCOM - GLOBE.

### **UNIT V**

Distributed File System- Distributed Document Base System-WWW-Distributed Co-  
ordination Base System- JINI

### **TEXT BOOKS**

1. Andrew S.Tanenbaum, Maarten van Steer "Distributed Systems – Principles and  
Paradigms", 2002, Prentice Hall India.

### **REFERENCE**

1.George Coulouris, Jean Dollimore and Tim Kinderberg, “ Distributed Systems :  
Concepts and Design”, Addison Wesley.

