PONDICHERRY UNIVERSITY

REGULATIONS AND SYLLABUS

for

Master of Technology
(Computer Science and Engineering)

(For CBSC System in Pondicherry University)

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Eligibility for Admission

Candidates who have secured 55% of marks or above in any one of the following or equivalent, are eligible to apply are B. Tech./B.E. in Computer Science & Engg. /Information Technology

(OR)

M.C.A/ M. Sc. in Computer Science / Information Technology / Software Engg. with Bachelor's degree in Computer Science / Computer Applications / Mathematics / Statistics / Electronics / Physics / Applied Sciences

Duration of the Course

The course duration shall normally be of two years duration spread over four semesters. The maximum duration to complete the course shall be 4 years.

Medium

The medium of instruction shall be English.

Passing & Classification

Passing & Classification for the award of the M. Tech (Computer Science & Engineering) Degree shall be as per the norms of CBCS System of Pondicherry University.

CURRICULUM

(Effective from the academic year 2009 – 2010)

H – Hard Core Subject
S – Soft Core Subject

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

I Semester

Sl.No.	Code	Course Title	H/S	Credits
1	613	Mathematical Foundations of Computer Science		4
2	611	Design and Analysis of Algorithms	H	3
3	612	Advanced Software Engineering	H	3
4	614	Advanced Computer Architecture	H	3
5	615	Computer Network Protocols	H	2
7	616	Software Lab I (Algorithms and case Tools)	S	3
6		Elective I	H	3
			Total	21

II Semester

Sl.No.	Code	Course Title	H/S	Credits
1	621	Modern Operating System Design	H	4
2	622	Advanced Database Systems	H	3
3	623	Network Security	H	3
4	624	Software Lab II (Operating Systems and Network Lab)	H	2

5	625	Design Patterns and Object Oriented Systems Design	S	3
6		Elective II	S	3
7		Elective III	S	3
			Total	21

III Semester

Sl.No.	Code	Course Title	H/S	Credits
1	711	Compiler Design	H	4
2	712	Internet and Web Technologies	H	3
3		Elective IV	S	3
4	714	Project work – Phase-I	H	8
			Total	18

IV Semester

Sl.No.	Code	Course Title	H/S	Credits
1	721	Project Work	H	6
2	722	Project Report and Viva-Voce	H	6
			Total	12
			Grand Total	**72**

LIST OF ELECTIVES

Sl.No.	Code	Course Title
1	651	Agent Technology
2	652	Knowledge Engineering
3	653	Evolutionary Algorithms
4	654	Software Architecture
5	655	Bioinformatics
6	656	Design Patterns
7	657	User Interface Designs
8	658	Software Metrics
9	659	Software Reuse
10	661	Real Time Systems
11	662	Dependable Systems
12	663	Network Security
13	664	Software Testing
14	665	Microprocessor Based System Design
15	666	Neural Networks
16	667	Pattern Recognition
17	668	Multimedia Systems
18	669	Mobile Computing
19	670	E-Commerce
20	660	Distributed Systems
21	671	Pervasive and Ubiquitous Computing
22	672	Information Storage Architecture
23	673	Sensor Networks
24	674	Image Processing
25	675	Bio-Metrics

COMS 613 - Mathematical Foundations of Computer Science

UNIT-I:
Mathematical Logic: Statements and notations – Connectives - Well formed formulas - Tautology – Equivalence of formulates - Tautological implications - Duality law - Normal forms. **Predicates** - The statement functions – Variables and quantifiers - Free & Bound variables - Theory of inference: Validity using Truth Tables – Rules of inference – Consistency of premises - Automatic Theorem Proving.

UNIT-II:
Set Theory: Basic concepts of set theory – Inclusion of equality of sets – Power sets – Operations of sets – Ordering and relations – Partial ordering – Partial ordered sets and Hasse diagram - Functions: Inverse Function - Composition of functions - Recursive Functions - Lattices and Properties – Boolean algebra and identities.

UNIT-III:
Elementary Combinatorics: Basics of counting, Combinations & Permutations, with repetitions - Constrained repetitions - Binomial Coefficients - Binomial Multinomial theorems -   The principles of Inclusion and Exclusion - Pigeon hole principle and its applications.

UNIT-IV:
Recurrence Relations: Generating Functions - Function of Sequences - Calculating Coefficient of generating functions - Recurrence relations - Solving recurrence relation by substitution and Generating functions - Characteristics roots solution of in homogeneous Recurrence Relation.

UNIT-V
Graph Theory: Basic concepts of Graphs – Trees - Spanning Trees - planar Graphs and Applications - Isomorphisms - Subgraphs – Bipartite graphs - Euler circuits - Hamiltonian graphs - Chromatic Numbers of graphs

TEXT BOOKS:
1. Discrete and Combinatorial Mathematics- An Applied Introduction-5th Edition – Ralph. P.Grimaldi. Pearson Education, Pvt. Ltd – Delhi (2004).
2. Discrete Mathematical Structures with applications to computer science, Trembly J.P. & Manohar .P, Tata McGraw Hill Comp (1997).
3. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel, T.P. Baker, Prentice Hall (1986).

REFERENCE BOOKS:
1. Discrete Mathematical Structures, Bernand Kolman, Roberty C. Busby, Sharn Cutter Ross, Prentice-Hall of India.
2. Discrete Mathematics for Computer science, Garry Haggard and others, Thomson
3. Elements of Discrete Mathematics, C.L. Liu, McGraw-Hill Book Comp. (1997)
4. Discrete Mathematics, R. Johnsonbaugh, Prentice Hall (1997)
5. Discrete Mathematics and its applications; Kenneth, H.R., McGraw – Hill Comp. Inc., New York (1988).
6. Discrete Mathematics (Elementary and Beyond); L. Lova'sz, J. Pelikan, and K. Veszergombi; springer – verlag New York, Inc., (2003).

COMS 611 – DESIGN AND ANALYSIS OF ALGORITHMS

Prerequisite: Knowledge of Data Structure and Computer Programming.

Unit I

Introduction – Divide and Conquer technique – Greedy algorithms

Unit II

Dynamic Programming – Exploring graphs – Backtracking – Branch and Bound

Unit III

Probabilistic Algorithms – Numerical probabilistic algorithms – Monte Carlo Method – Las Vegas Algorithm.

Unit IV

Introduction to Parallel Algorithms – simple examples – parallel sorting – Computational Complexity – introduction to NP – completeness

Unit V

Heuristic and approximate algorithms – approximate counting – application toreal time systems.

References:

1. Gilles Brassard and Paul Bratley, Fundamental of Algorithms, Prentice-Hall of India 1997
2. Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press, 1995.

COMS 612 – ADVANCED SOFTWARE ENGINEERING
Prerequisite*:* Knowledge of Software Engineering

Unit I

Software Engineering Process Paradigms – Project management – Process and Project Metrics – Software estimation – Empirical estimation models – planning – Risk analysis – Software project scheduling and Tracking.

Unit II

System, Process and Product Engineering Hierarchies – Requirement Engineering and its phases, Building the Analysis Models: Concepts, Data Flow Model, Control Flow Model, State Charts and Transition Models, Quality Function Deployment, Language and Tools, Requirements Validation Metrics.

Unit III

Software Design Concepts and Principles, Data Design, Software Architectural Styles – Analysis of Architectural Designs – Architectural Design Metrics, Design Structure Quality Index Estimation, User interface design models and process –Interface Design Activities, Component Level Design and Notations, Component Level Design Metrics.

Unit IV
Principles of Software Testing – White-Box Testing Techniques and its Variants, Black-Box Testing Techniques and its Variants, Integration, Validation and System Testing, Debugging.

Unit V

Software Quality Assurance – Quality Metrics and Models, Software Reliability Theory – – Software Maintenance – Software Configuration Management - Reverse Engineering and Re-engineering, Introduction to CASE Tools and Case Studies.

References:

1. Roger Pressman. S., Software Engineering : A Practitioner's Approach, (4th Edition), McGraw Hill, 1997.
2. I. Sommerville, Software Engineering, V Edition: Adison Wesley, 1996.
3. Pfleeger, Software Engineering, Prentice Hall, 1999.
4. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli Fundamentals of Software Engineering, Prentice Hall of India, 1991.

Advanced Computer Architecture

UNIT I

Overview of modern processor architectures: Advanced processor design: CPU pipelining, Data path and Control Design, Data and Control Hazards. Memory Hierarchy: Cache and Cache Coherence - Bus Architecture

UNIT II

Types of parallel machine: Vector Pipeline Architectures - Replicated Architectures: SIMD/MIMD - Shared Memory and Distributed Memory. Instruction level parallelism, Dynamic scheduling of instructions, Branch Prediction and Speculation

UNIT III

Performance Comparison: Dataflow - Virtual Concurrency - Branch prediction - Caches, including the TLB - Emulated instruction sets - VLIW - Out of order execution - Latency hiding. Multithreading and Network processor architectures

UNIT IV

Basic multiprocessor design: Shared memory and message passing; Network topologies.

UNIT V

Case Studies: iA64 - Linux clusters - IBM SP - Microcontrollers, including the PIC - Real-time processors, including TMS320

1. Main Text: Patterson and Hennessy, *Computer Organization and Design*, Morgan Kaufman Publisher
2. Shen, J. and Lipasti, Mikko. *Modern Processor Design: Fundamentals of Superscalar Processors* McGraw Hill, 2005

Reference: Hennessy and Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufman Publisher

COMPUTER NETWORK PROTOCOLS

UNIT I
Networks and Services, Approaches to Network Design, The OSI Reference Model; Overview of TCP/IP Architecture, Application Protocols and TCP/IP Utilities, Internet Architecture – Interconnection through IP Routers, Internet Protocol (IP), User datagram protocol (UDP).

UNIT- II
Routing Cores - peers – Algorithms – Autonomous Systems – Exterior Gateway Protocol Multicast Address. Internet Group Management Protocol (IGMP) and Implementation. TCP/IP over ATM networks: ATM cell Transport , Adaptation Layer, IP Address Building in an ATM network – Logical IP subnet Concept – ATM-ARP packet format. Domain name system , Remote Login (Telnet, Rlogin) – File Transfer and Access (FTP, TFTP, NFS), Electronic mail (SMTP, MIME) – Internet Management (SNMP, SNMPV2) – Internet Security and Firewall Design – Post Office Protocol (POP) – Network News Transfer Protocol (NNTP).

UNIT III
TCP/IP over view- The Transport Layer: TCP and UDP. Elementary TCP Sockets. TCP Client-Server Example. I/O Multiplexing: The select and poll Functions. Socket Options. Elementary UDP Sockets. Elementary Name and Address Conversions.

UNIT IV
The Client Server Model and Software Design, Concurrent Processing in Client-Server Software, Iterative, Connectionless Servers (UDP), Iterative, Connection-Oriented Servers (TCP), Concurrent, Connection-Oriented Servers (TCP). Single-Process, Concurrent Servers (TCP). Multiprotocol Servers (TCP, UDP), Multiservice Servers (TCP, UDP). Uniform, Efficient Management of server. Concurrency in clients.

UNIT V
TCP/IP Architecture, The Internet Protocol, Limitations of IPv4 and Introduction to IPv6, User Datagram Protocol, Transmission Control Protocol, DHCP, Introduction to Internet Routing Protocols

REFERENCE BOOKS:
1. A. Leon-Garcia, Indra Widjaja, "Communication Networks", Tata McGraw Hill, 2000
2. William Stallings, " Data and Computer Communications", Pearson Education, 7th Edition
3. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall India, 4th Edition, 2003
4. W.Richard Stevens: TCP/IP Illustrated vol 1: The Protocols, Pearson Edun. Asia, 2000.
5. Douglas Comer: Internetworking with TCP/IP vol.1: Principles, Protocols and Architecture, Prentice Hall, 4th edition, 2000.

COMS 621 – MODERN OPERATING SYSTEMS DESIGN

Prerequisite: Knowledge of Computer Architecture and Algorithms

Unit I

Introduction – Operating Systems and services – CPU Scheduling approaches – Process synchronization – Semaphores – Deadlocks – Handling deadlocks – Multithreading.

Unit II

Memory management – Paging – Segmentation – Virtual Memory- Demand paging – Replacement Algorithms.

Unit III

Disk Scheduling approaches – File systems – Design issues – User interface to file systems – I/O device management.

Unit IV

Distributed OS – Design issues in Distributed OS.

Unit V

Case study – Design and implementation of the UNIX OS, Process model and structure – Memory management – File system – UNIX I/O management and device drivers.

Reference:

1. Andrews S. TanenBaum, Modern Operation system, PHI, Second Edition
2. Abraham Silberschatz Peter B. Galvin, Operating System Concepts, 5th Edition, Addision Wesley Publishing co., 1998.
3. M. J. Bach, Design of the UNIX Operating system, Prentice Hall, 1986.

511 ADVANCED DATABASE MANAGEMENT SYSTEMS

Aim
To expose the students to the latest industry relevant topics in modern Data Base Management Systems.
Objective
To enable the students to understand and appreciate and to design a Parallel and Distributed Database and to learn and practice various Datamining and Warehousing tools.
Pre-requisite
Introduction to Database Management Systems and to Datastructure.

Contents

DATABASE DESIGN AND TUNING
Introduction to physical database design – Guideline for index selection – Overview of database tuning – Conceptual schema tuning – Queries and view tuning – Impact of concurrency – Introduction to query optimization.

PARALLEL AND DISTRIBUTED DATABASE
Parallel DBMS: Architecture – Query evaluation – Query optimization – Parallelizing individual operations.
Distributed DBMS: Architecture – Storing data – Cataloguing – Query processing – Updations – Transactions – Concurrency and Recovery.

DATA MINIG AND DATA WAREHOUSING
Data Mining: Introduction – Counting co-occurences – Mining for rules – Tree structured rules – Clustering – Similarity search over sequences.
Data Warehousing: Definition and terminology – Characteristics – Data modeling – Data warehouse Vs Views – Typical functionality of a warehouse.

EMERGING DATABASE TECHNOLOGIES
Mobile Databases: Mobile computing architecture – Mobile environment characteristics – Data management issues.
Multimedia Databases: Nature of Multimedia data and applications – Data management issues – Multimedia database applications
Object Database System: Abstract data types – Objects identity and reference types – Inheritance – Database design for ORDBMS – ODMG data model and ODL – OQL.

References
1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, III Ed., McGraw Hill Publications.
2. Ramez Elmasri & B.Navathe: Fundamentals of Database Systems, V Ed., Addison Wesley, 2008.
3. H.F. Korth and A.Silberschatz: Database system concepts, III Ed., McGraw Hill Publications.

NETWORK SECURITY

UNIT I
INTRODUCTION
Introduction to Security in Networks - Elements of Security - Precepts of Security - Threat - Sniffing - External Threat - Types of External Threats - Denial of Service Attack - Kinds of security breaches - Virus -Worms -Trojans - Threats & Countermeasures - Trends in Security – Plan of attack - Points of vulnerability -Security Objectives and Services.

UNIT- II
CRYPTOGRAPHY
Basic encryption and decryption – Encryption techniques – Characteristics of good encryption systems – Secret key cryptography – International Data Encryption Algorithm – Advanced Encryption Standard – Elliptic Curve Cryptography - Hash and MAC algorithms - Public Key encryptions – Introduction to number theory - RSA algorithm – Diffie-Hellman Key Exchange algorithm.

UNIT III
DIGITAL SIGNATURE AND AUTHENTICATION PROTOCOLS
Digital Signatures - Digital Signature standard - Digital Signature and Authentication Protocols - Authentication Protocols - – Elliptic Curve cryptography - Trusted intermediaries – Security handshake pitfalls

UNIT IV
Virtual Private Network (VPN): Evolution, Types, Architecture, Tunneling, Design Issues, Implementation, Security Issues – Firewall: Elements, Design Principles, Architecture, Packete Filtering, Bastion Host – Trusted System - Intrusion Detection system (IDS): Requirements, Classification, Types, Honeypots.

UNIT V
SECURITY AUDITING AND E-MAIL SECURITY
Security Monitoring and Auditing - Designing an Auditing System, Implementation Considerations, Auditing to Detect Violations of a security Policy, Auditing Mechanisms, Audit Browsing - Electronic mail security – PEM and S/MIME security protocol – Pretty Good Privacy

REFERENCE BOOKS:
1. William Stallings, Cryptography and Network Security: Principles and Standards, Prentice Hall India, 3rd Edition, 2003
2. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security: Private Communication in a public world, Prentice Hall India, 2nd Edition, 2002
3. Charles P. Pleeger, Security in Computing, Person Education Asia.
4. William Stallings, Network Security Essentials: Applications and standards, Person Education Asia, 2000

Design Patterns and Object Oriented Systems Design

Unit-1 Software Architecture: Introduction to Software Architecture- Scope of software architectures - Arriving at an architecture - Domain-specific software architectures (DSSA) -Architectural Styles-Service-Oriented Architectures

Unit- 2 Design Patterns: introduction to design patterns – A case study- Design pattern catalog: creational, structural, behavioural patterns

Unit-3 Object oriented analysis: Identifying use cases - Object Analysis - Classification – Identifying Object relationships - Attributes and Methods.

Unit-4: Object oriented design: Design axioms - Designing Classes – Access Layer - Object Storage - Object Interoperability

Unit-5: Introduction to AOSE: High-Level Methodologies – Design Methods – Agents in the real world

TEXT BOOKS

1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999 (Unit I, III, IV, V).

2. Martin Fowler, "UML Distilled", Second Edition, PHI/Pearson Education, 2002. (UNIT II)

3. E. Gamma, R. Helm, R. Johnson, and J. Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software. Addison Wesley, 1995.

4. D.E. Perry and A.L. Wolf, Foundations for the Study of Software Architecture, ACM SIGSOFT Software Engineering Notes, vol. 17, no. 4, pp. 40-52, October 1992.

REFERENCE BOOKS

1. Stephen R. Schach, "Introduction to Object Oriented Analysis and Design", Tata McGraw-Hill, 2003.

2. James Rumbaugh, Ivar Jacobson, Grady Booch "The Unified Modeling Language Reference Manual", Addison Wesley, 1999.

3. Hans-Erik Eriksson, Magnus Penker, Brain Lyons, David Fado, "UML Toolkit", OMG Press Wiley Publishing Inc., 2004.

4. W. Tracz. **DSSA (Domain-Specific Software Architecture) Pedagogical Example.** *ACM SIGSOFT Software Engineering Notes*, July 1995.

5. A survey of **Agent-Oriented Software Engineering**. Amund Tveit.. Norwegian University of Science and Technology. May 8, 2001 *csgsc.idi.ntnu.no/2001/pages/papers/atveit.pdf*

COMPILER DESIGN

UNIT I
Introduction: Compilers-Grammars-Languages-Phases of compiler-compiler writing tools-Errors-Lexical phase errors, syntactic phase errors, semantic phase errors

UNIT II
Lexical analyzer: Role of lexical analyzer-input Buffering –Specification and Recognition of tokens –Language for specifying Lexical analyzer-Finite Automata-Regular expression to NFA-Optimization of DFA based pattern matches–Design of a Lexical Analyzer Generator

UNIT III
Syntax analyzer: Parsers-CFG-derivations and parse trees-capabilities of CFG- Top own parsing-Bottom Up parsing – LR parsing- SLR parsing -LALR parsing – CLR parsing – Operator Precedence – Predictive Parsing.

UNIT IV
 Intermediate code generation: Syntax Directed Translation scheme-Implementation of Syntax Directed Translators-Intermediate codepostfix notation, parse trees and syntax trees-Trees three address code –uadruples, Triples –Translation of Assignment statements –Boolean expressions-Declaration –Flow control statements –Back patching.

UNIT V
Code optimization: Principal source of optimization-Issues in the design of a code generator-Run-Time storage management –Basic blocks and flow graphs Next use information-Simple code generator –DAG representation of basic blocks-Peephole optimization – Code Generation

References:
1. A.V.Aho, Ravi Sethi,J. D.ullman, Compilers –principles ,Techniques and tools, Addison Wesley publishing company,1988.

2. Allen I.Holub, compiler Design in C, Prentice Hall of India, 1993.
3. Kenneth C. Louden, Compiler Construction: Principles & Practice, Thomson Learning 2003
4. Muchnick, Advanced Compiler Design: Implementation, Acadamic Press.
5. Rajini Jindal , Compilers Construction & Design , Umesh Publications , Delhi.2002
6. Ronald Mak ,Writing Compilers and Interpreters, 2nd Edition , John Miler &Sons , 1996 .

COMS 712 - INTERNET AND WEB TECHNOLOGIES

UNIT I
The internet Architecture: Introduction – Evolution – Components – advantages - Web platform architecture – web application architecture – Classification of internet standards and technologies.

UNIT- II
The client: Introduction – Browser dependent issues – Client Caching - DOM basics – Events manipulation – Object basics - Form and Data manipulation – Advanced DOM techniques – Error handling – XML and client side scripting.

UNIT III
The Server: Introduction – components - Request and responses – Rendering dynamic contents – Manipulation of database from server side scripting- caching in server side - performance measures – Authentication and security – access controls in web servers.

UNIT IV
Web documents distribution and caching : caching the web data - Interactions with enterprise server , application server etc. Web services : architecture, design and implementation issues , advantages and applications of web services.

UNIT V
Web2.0 : Introduction, Technology overview - Ajax – Overview – Rethinking the web application – Core technology – Security in AJAX – case study on AJAX frameworks and libraries.

REFERENCE BOOKS:
1. Guide to Web Application and Platform Architectures (Springer Professional Computing), 2004.
2. Stefan Jablonski, Ilia Petrov, Christian Meiler, Udo Mayer, 2003
3. Professional JavaScript for Web developers – Nicholas C Zakas Web Server Programming Neil Gray, 2003
4. Ajax in Action By Dave crane, Eric Pascarello and Darren James, 2005

COMS 651 – AGENT TECHNOLOGY

Prerequisite : Basic knowledge of Artificial Intelligence, Object Oriented Systems

Unit I

Introduction – What are agents – Abstract architectures for intelligent agents – Concrete architecture for intelligent agents – Agent Programming languages Multi-agent Systems and Societies of Agents – Introduction – Agent Communications – Agent Interaction Protocols – Societies of Agents.

Unit II

Distributed Problem Solving and Planning – Introduction – Task Sharing – Result Sharing – Distributed Planning – Distributed Plan Representations- Distributed Planning and Execution. Search Algorithms for Agents – Constraint satisfaction – Path finding problem – Two player games.

Unit III

Distributed Rational Decision making – Introduction Evaluation Criteria – Voting – Auctions – Bargaining _ General Equilibrium market mechanisms – Contract nets – coalition formation Learning in multi-agent systems – general characterization – Learning and activity coordination – Learning about and from other agents – Learning and communication.

Unit IV

Computational Organization Theory – Introduction Organizational Concepts useful in modelling organizations Formal Methods in DAI – Logic based representation and reasoning.

Unit V

Agents Development frameworks and languages – Development tools – applications of agents. Agent Oriented methodologies – Agent oriented analysis and design, Gaia methodology, MASE, OPEN process framework, Tropos, Agent UML.

Reference:

1. Gerhard Weiss, Multi-agent systems – A modern approach to Distributed Artificial Intelligence, MIT press
2. Michael Wooldridge, Introduction to Multi-agent systems, John Wiley & Sons, June 2002.
3. Walter Brenner et al, Intelligent Software agents, Springer Verlag

4. Nicholas R. Jennings, Michael Woodridge, Agent Technology : Foundations, Applications and markets, Springer Verlag Publishing.
5. M. Luck, M. Marik, O. Stopenkova, R. Trappl, Multi-agent systems and Applications, Springer Verlag Publishing.
6. Jeffery M. Bradshaw, Software Agents, AAAI press.
7. Mark D'Inverno, Michael Luck, Understanding Agent Systems, Springer Verlag.
8. M.P. Singh, A.S. Rao, Formal Methods in Distributed Artificial Intelligence – Logic based representation and reasoning.
9. Michael Wooldridge, Reasoning about Rational Agents, MIT Press.
10. M. Huhns, M.P. Singh, Morgan Kaufmann, Readings in Agents, Springer Verlag.

COMS 652 – KNOWLEDGE ENGINEERING
Prerequisite: Basic knowledge of Artificial Intelligence

Unit I

Introduction to Artificial intelligence – AI applications – Importance of knowledge cognition theories – types of knowledge – methods of systematization of knowledge – inference methods – organization and classification of factual knowledge – KBS – Types of KBS – heuristics : types of heuristics – KBS life cycle.

Units II

Knowledge acquisition: Role of Knowledge engineer – fact finding by interviews, reasoning probability theory, fuzziness in reasoning, induction, repertory gird.

Unit III

Knowledge representation: Propositional logic,, predicate logic, production rules, frames, semantic nets, conceptual graphs.

Unit IV

Ontolgies, search methods, reasoning methods, methodologies for intelligent systems development.

Unit V

Case study on Knowledge based systems.

Reference:

1. Peter Smith, "An introduction to knowledge engineering", Thomson computer press, 1996.
2. Alismith, "An introduction to Knowledge engineering", Knowledge operators, GP parameters.

COMS 653- EVOLUTIONARY ALGORITHMS

Prerequisite: Knowledge of Algorithms.

Unit I

Introduction to evolutionary computing – Genetic algorithm (GA) : steps in GA, Genome (individual) representation, fitness, selection methods. Operators in GA, GA parameters.

Unit II

Case study on GA applications (Travelling salesman problem, sequence alignment in Bioinformatics, …)

Unit III

Genetic programming (GP): Steps in GP, individual representation, initial population, tree creation methods, fitness assessment, individual slection methods, GP operators, GP parameters.

Unit IV

Introduction to parallel genetic programming, distributed genetic programming, parallel distributed GP.

Unit V

Case study on GP applications (symbolic regression, multiplexer, artificial ant, keep-away soccer, wall-following behaviour,..)

Reference:

1. David E. Goldberg, "Genetic algorithm in search, optimization and machine learning".
2. Wolfgangbanzhaf, et.al,, "Genetic programming : An introduction: On the automatic evolution of computer programs and its applications", MIT press.
3. John Koza, "Genetic programming: On the programming of computers bymeans of natural section, MIT press, 1992.
4. John Koza, "Genetic programming II : Automatic discovery of reusable programs", MIT press, 1994
5. John Koza, "Genetic programming III : Darwinian invention and problem solving", Morgan kaugmann publisher, 1999
6. John Koza, "Genetic programming IV : Routine human competitive machine intelligence", Kluwer academic publisher3, 2003

COMS 654 – SOFTWARE ARCHITECTURE

Prerequisite: Basic knowledge of Software Engineering

Unit I

Introduction – Software Architecture – Definition – Prospects - State of Art – Architecture Business Cycle – Why Software Architecture is important? – Architectural Structures – Architectural Styles – Pipes and Filters – Layered Systems – Repositories – Process Control – Other familiar Architecture – Heterogeneous Architecture – Organizing Architectural Styles – Refinements of Styles – Using Styles in System Design

Unit II

Architectures and Quality Attributes – Achieving Qualities - Achieving Quality goals with Architectural Styles – Unit Operations – Applying Unit Operations to User – Interface Software – Ramifications of Addressing Quality Attributes – Case Studies – World Wide Web – CORBA

Unit III

Software Architecture Analysis Method (SAAM) – How and Why of Analyzing Software Architecture – Overview of SAAM – Example of SAAM Application – SAAM applied to Financial Management System – SAAM applied to Revision – Control System – Observations of SAAM – Architecture Reviews – Costs and Benefits – Review Techniques – The Review Practice – Case Study – Air Traffic Control.

Unit IV

Architecture Description Languages – Introduction – Capturing Architectural Information in an ADL – ADLs help in System Development – Choosing an ADL – Example of an ADL – Comparison of ADLs – Architecture-Based Development – Forming the Team Structure – Creating a Skeletal System – Patterns in Software Architecture – Ensuring conformance to an Architecture – Building Domain – Specific Language – Case Study – Flight Simulation

Unit V

Product Lines – Creating products and Evolving a Product Line – Organizational Implications of a Product Line – Component-Based Systems – Case Study in Product Line Development – Communitywide reuse of Architectural Assets – Reference Architecture – Open Systems – The process of Engineering an Open System – Standards – Software Architecture in the future – Architecture and Legacy Systems – Achieving an Architecture – From Architecture to System.

Reference:

1. Mary Shaw & David Garlan, Software Architecture – Perspectives on an emerging discipline, Prentice Hall of India, 3rd Indian Reprint, 2000
2. Len Bass, Paul Clements & Rick Kazman, Software Architecture in Practice, Pearson Education Asia, 3rd Indian Reprint, 2002
3. Relevant Journal Papers and Web Resources

COMS 655 – BIOINFORMATICS

Unit I

Introduction to Bioinformatics – Bioinformatics – Basic definition – Challenges in Bioinformatics – Role of www in Bioinformatics – Introduction to DNA, RNA and proteins – Central Dogma of Molecular Biology – Replication of DNA – Transcription of DNA – Translation of mRNA – Accessing 3D molecules through ID representation – Genetic code – Codons and Anticodons – Open Reading Frames(ORF) – Public Database, GenBank, SWISSPROT, EMBL – Sequence formats – Research areas in Bioinformatics.

Unit II

Sequence Analysis and Pairwise alignment – Need for sequence analysis and alignment – Pairwise alignment – Local and Global alignment – Gap penalties - Scoring matrices, PAM, Blosum- Dynamic programming methods for pairwise alignment – Needleman Wunsch Algorithms – SmithWaterman Algorithm, Case study : Identification of transmembrane regions – Pest regions – GCAT rich regions, finding tandem repeats in sequences – Database search tools – BLAST.

Unit III

Multiple Sequence Alignment – Need for multiple sequence alignment – Scoring methods – sum of Scores – COFFEE scoring – Dynamic Programming Methods – Progressive alignment – Exact methods – Heuristic Methods – Genetic algorithm for DNA for MSA – Finding Conserved regions and motifs – Genetic algorithms for DNA sequencing – Gene classification – case study of MSA tools – CLUSTAL, PILEUP.

Unit IV

Phylogenetic Tree Reconstruction – Phylogenetic Tree – Definition and Terminologies – Application of Phylogenetic Tree Reconstruction – MSA & Phylogenetics – Tree Reconstruction methodologies – Distance Based : UPGMA, Neighbour joining, Fitch & Margoliash method – Character based: Small parsimony and Large parsimony, Fitch algorithm, Sankoff's algorithm, Maximum likelihood approach – Evolutionary Models – Consensus tree – Bootstrapping Algorithms for phylogeny : Exact methods – Branch & Bound Genetic algorithm for Phylogeny.

Unit V

Role of Agents in Bioinformatics – Data warehousing techniques for bioinformatics – Distributed Computing for Bioinformatics application – Bioinformatics & Grid Computing – Evolutionary algorithms for bioinformatics.

Reference:

1. Sundararajan, R. Balaji, "Introduction to Bioinformatics ", Himalaya Publishing House, First edition, 2002
2. Bryan Bergeron, "Bioinformatics Computing ", PHI, 2003
3. David Mount, "Bioinformatics : Sequences & Genome Analysis" , Vol-5, 2002
4. Gary B. Foeel, David E. Corne, "Evolutionary Computing in Bioinformatics" , Morgan Kaufman Publishers, 2003

Note: For Units IV and V, Lecture Notes and Research Papers in the Internet.

COMS 656 –DESIGN PATTERNS

Unit I

Introduction – History and origin of patterns – Pattern envy and ethics – Prototyping – Testing.

Unit II

Design Patterns – Kinds of pattern – Quality and elements – patterns and rules – Creativity and patterns.

Unit III

Frameworks – Algorithms and frameworks for patterns.

Unit V

Catalogs – Patterns catalogs and writing patterns.

Unit V

Advanced Patterns – Anti-patterns – Case studies in UML and CORBA.

References:

1. Eric Gamma, Richard Helm, Ralph Johnson, John Vissides, Grady Booch, "Design Patterns", Addision Wesley, 1995
2. Craig Larman, "Applying UML and Patterns ", Prentice Hall, 1998.
3. Thomas Mowbray and Raphel Malveaux, "CORBA and Design Patterns" , John Wiley, 1997.
4. William J. Brown et al. "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

COMS 657 – USER INTERFACE DESIGN

Unit I

Human Factors – Human Factors of Interactive Software – Interaction evices.

Unit II

Models – Theories – Principles and Design Guidelines for User Interface Design – Object – Action Interface Model – Principles for Design – Data display and entry guidelines.

Unit III

Design Process – User Interface Design Process – Usability Testing – Usability Requirements and Specification procedures and techniques.

Unit IV

Information Related – Information Search – Visualization and the WWW.

Unit V

Usability – Usability of Web Sites and Case Study of e-commerce sites.

References:

1.   Ben Schneiderman, "Designing the User Interface ", Addison Wesley, 2000
2.   Jacob Nielsen, "Usability Engineering ", Academic Press, 1933
3.   Alan Dix et al, "Human – Computer Interaction ", Prentice Hall, 1993
4.   Alan Cooper, "The Essentials of User Interface Design", IDG Books, 1995

COMS 658 – SOFTWARE METRICS

Unit I

Measurements Theory – Fundamentals of measurement – Measurements in Software Engineering – Scope of Software metrics – measurements theory – Goal based framework – Software Measurement validation.

Unit II

Data Collection and Analysis – Empirical investigation – Planning experiments – Software metrics data Collection – Analysis methods – statistical methods.

Unit III

Products Metrics – Measurement of internet product attributes – size and structure – External product attributes – measurement of quality.

Unit IV

Quality Metrics – Software quality metrics – Product quality – Process quality – metrics for software maintenance – Case studies of Metrics program – Motorola – Hp and IBM

Unit V

Management Metrics – Quality management models – Rayleigh Model – Problem Tracking report (PTR) model – Reliability growth model – model evaluation – Orthogonal classification.

References:

1. Norman E. Fentar and Share Lawrence Pflieger, "Software metrics", International Thomson Computer press, 1997
2. Stephen H. Kin, "Metric and models in software quality engineering", Addison Wesley 1995.
3. William A. Florac and Areitor D. Carletow, "Measuring Software Process" Addison – Wesley, 1995.

COMS 659 - SOFTWARE REUSE

Unit I

Introduction – Organizing Reuse – Introduction – Motivation for Reuse – Reuse driven organizations – Managing a reuse project – the characteristics of reuse of project – Roles in reuse projects – Adopting a project to reuse – Reuse tools.

Unit II

Reuse Metrics – Managing a repository – The REBOOT component model – Classification – Configuration management of the repository – Managing the repository – Computer supported cooperative working – Process metrics for reuse – Product metrics – Cost estimation – Forming a reuse Strategy – Assessing reuse maturity.

Unit III

Reusable Components – Practicing reuse – Generic reuse development processes – Develop for reuse – Develop with reuse – Testing reusable components – Object oriented components – Techniques and life cycles – Object oriented development for reuse – Detailed design for reuse – Implementation for reuse – Verification, test and validation.

Unit IV

Reuse Phases – Development with reuse – with reuse specific activities – Common reuse processes – Phase of development with reuse – Impact of reuse on development cycle.

Unit V

Clean Room Software Engineering – Re-engineering for reuse – Methodology – Retrieving objects in non-object oriented code-Measurements – Tools support for re-engineering – Overview of clean room software engineering – Phases in clean room method – Box structures algorithms – Adapting the box structures.

References:

1. Even-Andre Karisson, "Software Reuse – A Holistic Approach ", John Wiley and Sons 1996.
2. Karma McClure, "Software Reuse Techniques – Additional reuse to the systems development process ", Prentice Hall, 1997.

COMS 660 – ADVANCED DATABASE SYSTEMS

Unit I

Relational Database – Relational Model – Querying – Storage Structures – Query Processing –Normalization.

Unit II

Object Oriented Database – Introduction to Object Oriented Databases – Approaches – Modeling and Design – Persistence – Transaction – Concurrency – Recovery – Database Administration.

Unit III

Emerging Systems – Enhanced Data Models – Client/Server Model – Data Warehousing and Data Mining – Web Database – Mobile Database.

Unit IV

Current Issues – Rules – Knowledge Bases – Active and Deductive Database – Distributed Database and parallel database.

Unit V

Database Design Issues – Security – Integrity – Consistency – Database Tuning – Optimization and Research Issues.

References:

1. Gary W. Hanson and James V. Hanson, Database Management and Design, Prentice Hall of India Pvt. Ltd., 1999.
2. Alex Benson, Stephen Smith and Kurt Thearling, Building Data Mining Applications for CRM, Tata McGraw Hill, 2000.
3. R. Elmasri and S.B. Navathe, Fundamentals of Database Systems, Addision Wesley, 2000
4. N. Tamer Ozsu & Patrick Valduriez, Principles of Distributed Database Systems, Prentice Hall International Inc., 1999.

COMS 661 – REAL TIME SYSTEMS

Unit I

Introduction – Real Time Systems – Embedded Systems – Pervasive Computing – Information Access Devices – Smart Cards – Embedded Controllers – Hardware Fundamentals.

Unit II

RTOS – Real Time Operating Systems – Memory Management – Processes, Threads, Interrupts, Events – User Interface.

Unit III

Real Time UML – Requirements Analysis – Object Identification strategies – Object Behaviour – Real-Time Design Patterns.

Unit IV

Software Development – Concurrency – Exceptions – Tools – Debugging Techniques – Optimization – Case Studies.

Unit V

Connectivity – Wireless Connectivity – Blue Tooth – Other short Range Protocols – Wireless Application Environment – Service Discovery – Middleware.

References:

1. R.J.A. Buhr, D.L. Bailey, "An Introduction to Real-Time Systems", Prentice-Hall International, 1999
2. B.P. Douglass, "Real-Time UML 2nd Edition ", Addision-Wesley, 2000.
3. D.E. Simon, "An Embedded software Primer ", Addison-Wesley, 1999
4. J. Schiller, "Mobile Communications ", Addision-Wesley, 2000
5. V. Hansmann, L. Merk, M.S. Nicklous, T. Stober, "Prevasive Computing Handbook", Springer 2001

COMS 662 – DEPENDABLE SYSTEMS

Unit I

System Structure and Reliability – Fault prevention and fault tolerance – Anticipated and unanticipated faults – Software/Hardware introduction – Interpreters and multilevel systems – Atomic actions – System Specification – Erroneous transition and states – Components and Design Failures – Errors and Faults.

Unit II

Fault Tolerance – Principles – Redundancy – Exception and exception handling – System Design – SIFT and FTMP design strategies.

Unit III

Error Detection – Measures and mechanism – structuring error detections – Damage confinement and Assessment, protections – protection in multilevel systems.

Unit IV

Error Recovery – State restoration – forward and backward error recovery checkpoints and audit trails – Recovery cache – Recovery in concurrent systems – Fault treatment – Fault location – System repair.

Unit V

Software fault Tolerance – Recovery block schemes – Acceptable tests – N Version programming – Software reliability and analysis.

References:

1. Anderson and PA Lee, "Fault Tolerance Principles Practice ", PHI 1981.
2. Pradhan D.E. (Ed.), "Fault Tolerant Computing – Theory and Techniques " Vol. I and II, Prentice Hall, 1986.
3. Trivedi K, "Probability and Statistics with Reliability, Queuing and Computer Science and Applications " Prentice Hall, 1981.

COMS 663 – NETWORK SECURITY

Unit I

Introduction – Attacks – Services – Mechanisms – Conventional Encryption – Classical and Modern Techniques – Encryption Algorithms – Confidentiality.

Unit II

Public Key Encryption – RSA – Elliptive Curve Cryptology – Number Theory Concepts.

Unit III

Message Authentications – Hash Functions – Digest Functions – Digital Signatures – Authentication protocols.

Unit IV

Network Security Practice – Authentication Applications – Electronic Mail Security – IP Security Web Security.

Unit V

System Security – Firewalls – Current Standards.

References:

1. Stallings, "Cryptography & Network Security – Principles & Practice ", Prentice Hall, 1998
2. Bruce. Schneider, "Applied Cryptography, 2nd Edition " Toha Wiley & Sons 1996.
3. Douglas R. Stinson, "Cryptography – Theory and Practice", CRC press 1995.

COMS 664 – SOFTWARE TESTING

Unit I

Software Testing Principles – Need for testing – Psychology of testing – Testing economics – SDLC and Testing, Testing Maturity Models – Weyuker's adequacy axioms and Software Testing, Introduction to Defect Detectors, Design of Test Cases, Structure of Fault and Error reports.

Unit II

Testing Techniques: White box testing techniques: Statement coverage – Branch Coverage – Condition Coverage – Decision/Condition coverage – Multiple condition coverage – Dataflow coverage – Mutation testing – Automated code coverage analysis. Black box testing techniques: Boundary value analysis – Robustness testing – Equivalence partitioning, Finite state testing, Regression Testing.

Unit III

Testing Strategies: Level of testing – Unit, Integration and System Testing models. Testability and Related Issues: Design for Testability – Observability & Controlability – Design by Contract – Assertions and Invariants, Pre and Post condition –Challenges of real world testing – Scope of Testing optimization, – GUI Capture/Playback – Stress Testing – Testing Client – Server applications – Testing compilers and language processors – Testing web-enabled applications..

Unit IV

Testing Object Oriented Software – Challenges and Differences between Testing of Non-Object Oriented and Object Oriented Softwares – Testing of Object Oriented constructs, The Role of OOAD concepts in Testing of Object Oriented Constructs.

Unit V

Software Testing Measurement and Associated Metrics, Control of Software Testing, The role of software testing coverage criteria in testing control, Coverage criteria design and implementation, Automated Tools for Software Testing, Static code analyzers – Test case generators.

References:

1. Glenford J. Myers, "The Art of Software Testing", John Wiley & Sons 1979
2. Boris Beizer, Black-Box Testing: "Techniques for Functional Testing of Software and Systems", John Wiley & Sons 1995

3. P.C. Jorgensen, "Software Testing – A Craftman's Approach", CRC Press 1995
4. William E. Perry, "Effective Methods for Software Testing (2nd Edition)", John Wiley & Sons 2000
5. Robert V. Binder, "Testing Object-Oriented Systems: Models Patterns and Tools", Addision Wesley 2000
6. Boris Beizer, "Software Testing Techniques (2nd Edition)", Van Nostrand Reinhold 1990.

COMS 665 – MICROPROCESSOR BASED SYSTEM DESIGN

Unit I

Review of 8086 – Architecture and Programming – Architectural features of the advanced processors of the Intel family – i386, i486, Pentium processors and Multimedia extensions – Applications.

Unit II

Programming Issues – Programming aspects of the above processors – IA64 architecture.

Unit III

Control Applications – Microprocessors for control applications – Micro controller based design of a system – Real time control using micro controllers.

Unit IV

Interfacing – Interfacing with peripheral devices – Peripheral controllers – Bus concepts – Bus standards – Examples – Choosing a bus standard for an application.

Unit V

Special Purpose Processors – Coprocessors, DSP processors, Graphic processors and their applications.

References:

1. Barrey B. Brey, The INTEL Microprocessor 8086/8088, 80186, 286, 386, 486, Pentium and Pentium Proprocessor – Architecture, programming and interfacing, PHI, 1998.
2. Barrey B. Brey, Programming the 80286, 80386, 80486, and Pentium-based Personal Microprocessor Manuals (available at Websites).
3. Microprocessor Manuals (available at Websites).
4. Texas instruments/Analog Devices Manuals for Graphic Processors and DSP Processors.

COMS 666 – NEURAL NETWORKS

Unit I

Back Propagation – Introduction to Artificial Neural Systems – Perceptron – Representation – Linear separability – Learning – Training algorithm – The back propagation network – The generalized delta rule – Practical considerations – BPN applications.

Unit II

Statistical methods – Hopfield nets – Cauchy training – Simulated annealing – The Boltzmann machine. Associative memory – Bi-directional associative memory – Applications.

Unit III

Counter Propagation Network and Self Organizing Maps – CPN building blocks – CPN data processing. SOM data processing – Applications.

Unit IV

Adaptive Resonance Theory and Spatio Temporal Pattern – Classification – ART network description – ART1 – ART2 – Application. The formal avalanche – Architecture of spatio temporal network – The sequential competitive avalanche field – Applications of STNs.

Unit V

Neo – Congnitron – Cognitron – Structure & training – The neocognitron architecture – Data processing – Performance – Addition of lateral inhibition and feedback to the recognition. Optical neural networks – Holographic correlators.

References:

1. James Freeman A. and David Skapura M., Neural Networks – Algorithms, Applications & Programming Techniques Addison Wesley 1992.
2. Yegnanarayana B., Artificial Neural Networks, Prentice Hall of India Private Ltd., New Delhi 1999.

COMS 667 – PATTERN RECOGNITION

Unit I

Pattern Classifier – Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions– Minimum distance pattern classifier.

Unit II

Unsupervised Classifications – Clustering for unsupervised learning and classification – Clustering concept – C-means algorithm – Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

Unit III

Structural Pattern Recognition – Elements of formal grammars – String generation as pattern description – Recognition of syntactic description – Parsing – Stochastic grammars and applications – Graph based structural representation.

Unit IV

Feature Extraction and Selection – Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection.

Unit V

Recent Advances – Neural network structures for Pattern Recognition – Neural network based pattern associators – Unsupervised learning in neural Pattern Recognition – Self organizing networks – Fuzzy logic – Fuzzy pattern classifiers – Pattern classification using Genetic Algorithms.

References:

1. Robert J. Schalkoff, Pattern Recognition : Statistical Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publications Company, London 1974
3. Duda R.O., and Hart P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

COMS 668 – MULTIMEDIA SYSTEMS

Unit I

Introduction – Multimedia applications – System architecture – Objects of Multimedia systems – Multimedia database.

Unit II

Compression and File Formats – Types of compression – Image compression – CCITT-JPEG – Video image compression – MPEG–DVI Technology – Audio compression – RTF format – TIFF file format – RIFF file format – MIDI – JPEG DIB – TWAIN.

Unit III

Input/Output Technologies – Traditional devices – Pen input – Video display systems – Scanners – Digital audio – Video images and animation.

Unit IV

Storage and Retrieval – Magnetic Media – RAID – Optical media – CD-ROM – WORM – Juke box – Cache management

Unit V

Application Design – Application classes – Types of systems – Virtual reality design – Components – Database – Authority Systems – Hyper media – User interface design – Display/Playback issues – Hypermedia linking and embedding.

References:

1. Andleigh PK and Thakrar K, Multimedia Systems Design, Prentice Hall, 1996.
2. Vaughan T, Multimedia, Tata McGraw Hill, 1999
3. Koegel Buford JFK, Multimedia Systems, Addison Wesley Longman, 1999
4. Mark J. B., Sandra K.M., Multimedia Applications Development using DVI technology, McGraw Hill, 1992.

COMS 669 – MOBILE COMPUTING

Unit I

Introduction – Medium access control – Telecommunication systems – Satellite systems – Broadcast systems.

Unit II

Standards – Wireless LAN – IEEE 802.11 – HIPERLAN – Bluetooth.

Unit III

Adhoc Networks – Characteristics – Performance issues – Routing in mobile hosts.

Unit IV

Network issues – Mobile IP – DHCP – Mobile transport layer – Indirect TCP – Snooping TCP – Mobile TCP – Transmission / time-out freezing – Selective retransmission – Transaction oriented TCP.

Unit V

Application Issues – Wireless application protocol – Dynamic DNS – File systems – Synchronization protocol – Context-aware applications – Security – Analysis of existing wireless network.

References:

1. J. Schiller, Mobile Communications, Addision Wesley 2000
2. http://www.bluetooth.com/
3. William C. Y. Lee, Mobile Communication Design Fundamentals, John Wiley 1993.

COMS 670 – E-COMMERCE

Unit I

Introduction – Infrastructure of Electronic Commerce – Networks – Packet Switched Networks – TCP/IP Internet Protocol – Domain name Services – Web Service Protocols – Internet applications – Utility Programs – Markup Languages – Web Clients and Servers – Intranets and Extranets – Virtual private Network.

Unit II

Core Technology – Electronic Commerce Models – Shopping Cart Technology – Data Mining – Intelligent Agents – Internet Marketing – XML and E-Commerce.

Unit III

Electronic Payment Systems – Real world Payment Systems – Electronic Funds Transfer – Digital Payment – Intranet Payment Systems – Micro Payments – Credit Card Transactions – Case Studies.

Unit IV

Security – Threats to Network Security – Public Key Cryptography – Secured Sockets Layer – Secure Electronic Transaction – Network Security Solutions – Firewalls.

Unit V

Inter/Intra Organizations Electronic Commerce – EDI- EDI application in business – legal, Security and privacy issues – EDI and Electronic Commerce – Workflow Automation and Coordination – Customization and Internal commerce – Supply chain Management,

References:

1. Ravi Kalakota and Andrew B. Whinston, Frontiers of Electronic commerce, Addison Wisely 1996.
2. Pete Loshin, Paul A. Murphy, Electronic Commerce, II Edition, Jaico Publishers 1996.
3. David Whiteley, e-Commerce : Strategy, Technologies and Applications - McGraw Hill, 2000

COMS 623 – DISTRIBUTED SYSTEMS

Prerequisite: Knowledge of Algorithms and Networks

Unit I

Characterization of Distributed Systems: Introduction, Examples, Key, Characteristics, Historical background. **Design Goals:** Introduction, Basic Design Issues, User requirements.

Unit II

Inter Process Communication: Introduction, Building Blocks, Client Server communication, Group communication. **Remote Procedure Calling :** Introduction, Design Issues, Implementation, Asynchronous RPC.

Unit III

Distributed Operating Systems : Introduction, the kernel, Process and threads, naming and protection, Communication and invocation, virtual memory. **File Service :** A model: Introduction, File service Components, Design issues, Interfaces, Implementation Techniques – **CASE studies** – Introduction, Math, Chorous, Unix Emulation in Mach and Chorus.

Unit IV

Name Services : Introduction, The SNS a name service model, Discussion of SNS and further design issues. **Time and Co-ordination** : Introduction, synchronizing physical clock-logical time and logical clock-distributed co-ordination.

Unit V

Shared data and transaction : Conversation between client and server Fault tolerance and recovery, Transactions and nested transactions. **Distributed shared Memory :** Design and implementation issues, Sequential consistency and Levy, Release consistency and mining, Other consistency models.

References:

1. George Couloursis, Jean Dallamore and Tim Kinderberg, " Distributed Systems : Concepts and Design ", Addision Wesley.
2. Tanenbaum A.S., "Modern Operating Systems", Prentice Hall, Englewood Clifs NJ.

Pervasive and Ubiquitous Computing

UNIT I

Introduction: Pervasive computing - View of pervasive computing – Consequences for Pervasive networks. **Privacy**: User Awareness – context – accessibility – authentication.

UNIT – II

SECURITY IN PERVASIVE COMPUTING: Security: Secure services – registration/deregistration– secure discover & Secure delivery – authenticated – authorized – confidential – genuine – anonymous – application security.
Physical security: Identification and authentication– network operation – protection for layers – routing – network management – security. **Security Technologies**: Public Key Infrastructure (PKI) – terms of PKI – Simple Public Key Infrastructure (SPKI) – terms of SPKI – Role Based Access Control (RBAC) – terms of RBAC. **Public key Infrastructure**: Password based public key infrastructure – Prior context– Diffie – Hellman method – Self organized public key infrastructure – Graph– Trust graph.

UNIT III

ISSUES, CHALLENGES AND ATTACKS : Issues: Authentication vs. Recognition – Identity management – Security and Availability – Dynamic Trust model and Context – awareness – Privacy Issues. **Assumptions made in security analysis**: Social basis – threat assumptions – existence of a trusted computing base **Challenges**: Challenges on attacks – computation power – lack of clarity and firewall approach. **Attacks**: Software attacks – description – drawbacks – Physical attacks – Invasive probing – non–invasive probing– non–invasive measurements – Environmental attacks.

UNIT IV   LOCAL AREA AND WIDE AREA WIRELESS TECHNOLOGIES

IEEE 802.11 technologies – Infrared technologies – Bluetooth networks (OBEX Protocol) – Personal Area Networks – Mobility Management – Mobile IP – Establishing Wide area wireless networks – Concept and structure of ”cell” – Call establishment and maintenance – Channel management – Frequency Assignment techniques.

UNIT V   PROTOCOLS AND APPLICATIONS   9

Networking protocols – Packet switched protocols – Routing Protocols for Sensor Networks – Data Centric Protocols – Hierarchical Protocols – Location – based protocols – Multimedia Messaging Service (MMS) Protocols – Wireless Application Protocol (WAP) – Applications of Pervasive Computing – Retail – Healthcare – Sales force automation – Tracking applications.

REFERENCES

1. Akkins, Derk, "Internet security professional reference", 2nd edition, Techmedia publications, 1997.
2. Scott, Charlie,"Virtual privacy networks", O'Reilly publication, 2000.
3. Swaminathan. Tara and Elden, Charles, "Wireless security and privacy", Pearson education Asia publication, 2003
4. F.Adelstein, S.K.S. Gupta, "Fundamentals of Mobile and Pervasive Computing" Tata McGraw Hill, 2005.
5. Ashoke Talukdar and Roopa Yavagal, "Mobile Computing", Tata McGraw Hill, 2005

Information Storage and Management

Prerequisites

To understand the content and successfully complete this course, a student must have an understanding of computers, operating systems, networking, and databases. Experience in specific segments of storage infrastructure would also be helpful to fully assimilate the course material.

Course Objectives

Upon successful completion of this course, participants should be able to:

• Evaluate storage architectures, including storage subsystems, DAS, SAN, NAS, CAS
• Define backup, recovery, disaster recovery, business continuity, and replication
• Examine emerging technologies including IP-SAN
• Understand logical and physical components of a storage infrastructure
• Identify components of managing and monitoring the data center
• Define information security and identify different storage virtualization technologies

Unit I: Introduction to Storage Technology

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

(10 periods)

Unit II: Storage Systems Architecture

Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system

(10 periods)

Unit III: Introduction to Networked Storage

Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN , Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfills the need , Understand the appropriateness of the different networked storage options for different application environments

(10 periods)

Unit IV: Information Availability & Monitoring & Managing Datacenter

List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime, Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures , Architecture of backup/recovery and the different backup/recovery topologies , replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities

Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center

(15 periods)

Unit V: Securing Storage and Storage Virtualization

Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes

(5 periods)

Case Studies

The technologies described in the course are reinforced with EMC examples of actual solutions.

Realistic case studies enable the participant to design the most appropriate solution for given sets of criteria.

Reference Books:

1. EMC Corporation, Information Storage and Management, Wiley, ISBN number: 04702942134.

2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill , Osborne, 2003.

3. Marc Farley, "Building Storage Networks", Tata McGraw Hill ,Osborne, 2001.

4. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

SENSOR NETWORKS

UNIT I

SENSOR NETWORKS

Sensor Networks: A Bridge to the Physical Word - Introduction to various sensors like Temperature – Humidity – Pressure – Introduction to Sensor networks – motivation – applications – sensors – architectures – and platforms for Wireless sensor networks – Sensor Node Architecture – Sensor Network Architecture – Sample sensor networks applications – Design challenges – Performance metrics

UNIT II   LOCALIZATION AND TRACKING

A tracking scenario – sensing model – Collaborative localization – Bayes state estimation – distributed representation – Tracking multiple objects – Ranging techniques – Range based localization algorithms – location services

UNIT – III

Data Storage and Manipulation & Security . Data-centric Routing and Storage in Sensor Network - Compression Techniques for Wireless Sensor Networks

Security. Security for Wireless Sensor Networks- Key Distribution Techniques for Sensor Networks- Watermarking Techniques**.**

UNIT IV

NETWORKING SENSORS AND NETWORK PLATFORMS

MAC for sensor networks – Geographic – Energy – aware routing – Attribute – based routing – Sensor node Hardware (Berkeley Motes) – TinyOS – nesC – Tiny GALS – NS – 2 – TOSSIM – PIECES.

UNIT V

RFID BASICS

Introduction – transponder and reader architecture – types of tags and readers – frequencies of operation – selection criteria for RFID systems – information processing in the transponder and reader – fundamental operating principles – antennas for RFIDs.

References

1. Wireless Sensor Networks , Raghavendra, Cauligi S.; Sivalingam, Krishna M.; Znati, Taieb (Eds.)

1st ed. 2004. Corr 2nd printing, 2005, 442 p., Hardcover
ISBN: 978-1-4020-7883-5

2. Wireless Sensor Networks, F. Zhao and L. Guibas, Morgan Kaufmann, San Francisco, 2004.

Digital Image Processing

UNIT I

DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS: lements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

UNIT II

IMAGE ENHANCEMENT TECHNIQUES: Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging – Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Smoothing – Sharpening filters – Homomorphic filtering.

UNIT III

IMAGE RESTORATION: Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition.

UNIT IV

IMAGE COMPRESSION :Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding-DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG,Basics of Vector quantization.

UNIT V

IMAGE SEGMENTATION AND REPRESENTATION : Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes-Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture

TEXT BOOKS
1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education 2003.

REFERENCES
1. William K Pratt, Digital Image Processing John Willey (2001)
2. Image Processing Analysis and Machine Vision – Millman Sonka, Vaclav hlavac,
Roger Boyle, Broos/colic, Thompson Learniy (1999).
3. A.K. Jain, PHI, New Delhi (1995)-Fundamentals of Digital Image Processing.
4. Chanda Dutta Magundar – Digital Image Processing and Applications, Prentice Hall of
India, 2000

BIO-METRICS

UNIT I

Introduction to Biometrics Authentication: biometrics authentication-Traditional methods for personal authentication - Some definitions of biometrics authentication technologies and systems. Software and hardware biometrics systems - Image processing and pattern recognition in living body, including human head & face, the mechanism of human eye, hand & skin characteristics.

UNIT II

Biometrics Sensors and Data Acquisition: Biometric data acquisition and database - **Biometrics Pre-processing:** The related biometrics preprocessing technologies - including: noise removing, edge sharpening, image restoration, image segmentation, pattern extraction and classification.

UNIT III

Biometrics Feature Extraction: Basic elements in pattern recognition system - and some basic introduction of pattern recognition systems on biometrics (such as fingerprint, palm-print, finger, hand, face, iris, and face, as well as dental, DNA, and retina recognition). **Features Matching and Decision Making:** Various matching methods: including PCA and LDA - Introduce decision theory and their examples.

UNIT IV

Design and Implementation of Biometric Systems
Basic approaches of automated biometrics identification and verification systems - Various performance comparison and their analysis for large population authentication, accuracy and reliability of authentication in an *e*-world.

UNIT V

Biometric Authentication Applications
Various applications, including access control like a lock or an airport check-in area; immigration and naturalization; welfare distribution; military identification; banking, e.g., check cashing, credit card, ATM (automated teller machine); computer login; intruder detection; smart card; multi-media communication; WWW and an electronic purse; sensor fusion; decision fusion; categorization: e.g., age and gender; industrial automation; gesture interpretation; efficient enrollment; audio-visual tracking; stock market; on-line shopping; compact embedded systems and other commercialized services.

Indicative reading list and references:
Zhang, D., 2000, *Automated Biometrics: Technologies & Systems*, Kluwer Academic Publisher, USA.

Zhang, D., 2003, *Palmprint Authentication*, Kluwer Academic Publishers, USA.
Zhang, D (ed.), 2002, *Biometrics Solutions for Authentication in an e-World*, Kluwer Academic
Publishers, USA.
Jain, et al., (eds), 1999, *Biometrics: Personal Identification in Networked Society*, Kluwer Publisher.
Sid-Ahmed, M.A., 1995, *Image Processing*, *Theory, Algorithms, & Architectures*, McGraw-Hill.
Awcock. G.W., et al., 1996, *Applied Image Processing*, McGraw-Hill.
IEEE Transaction on *Pattern Analysis and Machine Intelligence*.
IEEE Transaction on *Image Processing.*