Syllabus –I semester

MTC0E-101 Advanced Computer Architecture

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**

Final Theory paper: 60 Marks; Time: 3 Hrs

Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Parallel computer models:

The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers.

Program and network properties:

Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit 2

System Interconnect Architectures:

Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors:

Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Unit 3

Pipelining:

Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Memory Hierarchy Design:

Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Unit 4

Multiprocessor architectures:

Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization,

Enterprise Memory subsystem Architecture:

Enterprise RAS Feature set: Machine check, hot add/remove, domain partitioning, memory mirroring/migration, patrol scrubbing, fault tolerant system.

Text Books:

- Kai Hwang, "Advanced computer architecture"; TMH. 2000
- D. A. Patterson and J. L. Hennessey, "Computer organization and design", Morgan Kaufmann, 2nd Ed. 2002

Reference Books:

- J.P.Hayes, "computer Architecture and organization"; MGH. 1998.
- Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication. 1998.
- V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI. 2002.
- R.K.Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications, 2003
- Kai Hwang and Zu, "Scalable Parallel Computers Architecture", MGH. 2001
- Stalling W, "Computer Organisation & Architecture", PHI. 2000
- D.Sima, T.Fountain, P.Kasuk, "Advanced Computer Architecture-A Design space Approach,"Addison Wesley,1997.
- M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing. 1998
- D.A.Patterson, J.L.Hennessy, "Computer Architecture :A quantitative approach"; Morgan Kauffmann feb,2002.
- Hwan and Briggs, " Computer Architecture and Parallel Processing"; MGH. 1999.

MTC0E-103 ADVANCED COMPUTER NETWORKS

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**

Final Theory paper: 60 Marks; Time: 3 Hrs

Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

MAC Protocols for high speed and wireless networks - IEEE 802.3 standards for fast Ethernet, gigabit Ethernet, 10G, and 100VG-AnyLAN, IEEE 802.11, 802.15, and 802.16 standards for Wireless PAN, LAN, and MAN

Unit 2

IPv6: IPv4 versus IPv6, basic protocol, Header- extensions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, DHCPv6, IPv6 Routers and Routing.

Mobility in networks – Mobility Management: Cellular architecture, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, Mobile IP and IPv6.

Unit 3

IP Multicasting. Multicast routing protocols, address assignments, session discovery, etc. IPsec protected channel service, virtual private network service, multiprotocol label switching, MPLS VPN

Traffic Types, TCP extensions for high-speed networks, transaction-oriented applications. Other improvements in TCP, Performance issues, TCP Congestion Control – fairness, scheduling and Delay modeling, QoS issues, differentiated services.

Unit 4

Network security at various layers. Security related issues in mobility. Secure-HTTP, SSL, Message digests, Key distribution protocols. Digital signatures, and digital certificates.

Books and References:

1. W. R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley, 1994.
2. G. R. Wright. TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley, 1995.
3. W. R. Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, and the Unix Domain Protocols, Addison Wesley, 1996.
4. W. Stallings. Cryptography and Network Security: Principles and Practice, 2nd Edition, Prentice Hall, 1998.
5. C. E. Perkins, B. Woolf, and S. R. Alpert. Mobile IP: Design Principles and Practices, Addison Wesley, 1997.
6. J.F. Kurose and K.W. Ross, Computer Networking – A Top-down Approach Featuring the Internet, Pearson Education, New Delhi, 2004.
7. N. Olifer & V. Olifer, Computer Networks: Principles, Technologies, and Protocols for network Design, Wiley-Dreamtech Low Price, New Delhi

MTCOE-105 Algorithm Analysis and Design

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**

Final Theory paper: 60 Marks; Time: 3 Hrs
Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction

Algorithm concepts, Analyzing and design, Pseudocode conventions, asymptotic efficiency of algorithms, asymptotic notations and their properties.

Analysis Techniques:

Growth Functions, Recurrences and Solution of Recurrence equation-, Amortized Analysis, Aggregate, Accounting and Potential Methods, Probabilistic analysis concepts, hiring problem and its probabilistic analysis, String Matching: naive string Matching, Rabin Karp, and String matching with finite Automata, KW and Boyer – Moore algorithm.

Unit 2

Number Theoretic Algorithms

Elementary notions, GCD, Modular Arithmetic, Solving modular linear equations, The chines remainder theorem, Powers of an element, RSA cryptosystem, Primality testing, Integer factorization, Polynomials. Huffman Codes: Concepts, construction, correctness of Huffman's algorithms; Representation of polynomials, DFT, FFT, Efficient implementation of FFT, Graph Algorithm, Bellman Ford Algorithm, Single source shortest paths in a DAG Johnson's Algorithm for sparse graph, Flow networks & Ford fulkerson Algorithm, Maximum bipartite matching.

Unit 3

Computational Geometry

Geometric structures using C++: Vectors, points, Polygons, Edges: Geometric Objects in space: Finding the intersection of a line & triangle, Finding star shaped polygons and convex hull using incremental insertion.

Unit 4

NP-completeness Concepts

Polynomial time verification, NP-completeness and reducibility, showing problems to be NP-complete like Clique problem, vertex cover problem etc. Approximation algorithms of these problems.

Reference Books

1. T. H Cormen, C E Leiserson. R L Rivest & C Stein, "Introduction to algorithms", 2nd Edition, PHI.
2. Michael J Laszio, "Computational Geometry and Computer Graphics in C++", PHI. India 1996.
3. Brassard, Bratley, "Fundamentals of algorithms", Prentice Hall of India.
4. Knuth, "The Art of Computer Programming", Vol I-III, Pearson Education.

MTCOE-107 Distributed Operating System

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**

Final Theory paper: 60 Marks; Time: 3 Hrs

Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction

Distributed system, goals, Hardware and Software concepts, Fundamental Issues in Distributed Systems, Distributed System Models and Architectures.

Communication in distributed systems: Layered protocols, client-server model. RPC, Group communication.

Unit 2

Synchronization in distributed Systems

Clock synchronization, Clock synchronization Algorithms, Mutual Exclusion and its algorithms, Election algorithms: Bully algorithm, Ring algorithm, Atomic transactions, Transaction models, Deadlocks: Distributed deadlock detection and prevention.

Unit 3

Process management

Threads, System models, processor allocation, scheduling algorithms, fault tolerance, real-time distributed systems

Distributed File System

Design and implementation of distributed file system, scalability and mobility issues, fault tolerance.

Unit 4

Distributed Shared Memory

Shared memory, consistency models, Page-based distributed shared memory

Case Studies

AMOEBA,MACH

1. Distributed Operating Systems; Andrew S Tanenbaum, Pearson Ed. .
2. Distributed Systems :Concepts and Design; G Colouris, J Dollimore, T Kindberg 3/e Pearson Ed. 2002.
3. Principles of Distributed Systems, VK Garg, Kluwer Academic Publishers, 1996.
4. Distributed Systems and Algorithmic Approach by Su Kumar Boss, Chamal & Hall.
5. Principles of Distributed Computing by V K Garg, IEEE Press.
6. Distributed Computing by A D Kshem Kalyani & Mukesh Singha.
7. Distributed Algorithms by Nancy Lynch, Morgan Kaufmann Press.
8. Introduction to Distributed Algorithms by G Tel, Cambridge University.

MTCOE-109 Laboratory I

A set of fifteen programs will be designed to develop skills and familiarity with the majority of the following and the students will have to execute at least twelve programs out of them:
make, Lex, Yacc, Perl, Awk and other scripting languages, sockets and RPCs, XML, C#, Designing, testing and validation using Rational Suite.

Syllabus –II semester

MTCOE-202 Advanced Database Design

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**
Final Theory paper: 60 Marks; Time: 3 Hrs
Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction:
Overview of DBMS and its internal Architectural, Data Storage and representation in DBMS: Memory Hierarchy, Secondary storage mechanism and reliability improvement through mirroring and RAID, Recovery from disk crashes, Representing Relational data elements with records (fixed and variable) use of page and block formats, Heap, sorted and clustered file organization.

Unit 2

Indexing in DBMS:
Clustered, primary, secondary, dense and Sparse indexing, Hash and Tree based index structures, ISA and B+ tree data structures, bit map indexing, R-indexing.
Database Design:
Three steps of Conceptual, logical and Physical design, and methodology for design, Overview of E-R and Extended E-R Modeling and conversion to logical tables and normalization, Physical database design and tuning – overview of tasks involved and methodology, Guidelines for index selection, Clustering, Demoralization and view definitions, Tuning of Queries with Explain PLAN.

Unit 3

Query Processing and Transaction management in DBMS:
Query processing architecture in DBMS, relational operations and implementation techniques, Algorithms for Selection, Projection and Join, Query optimization, Query tree and optimization using Relational equivalences, Transaction Management DBMS:Transaction and ACID Properties, schedules and serializability, Concurrency control techniques – locking timestamps and Optimistic Concurrency control, Concept of Recovery management, Buffer and Recovery management structures in DBMS, Deferred update and ARIES algorithm for recovery with an example.

Unit 4

Database Security:
Access Control mechanisms in DBMS, GRANT and REVOKE of VIEWS, Security for Internet applications through Encryption Firewalls, proxy servers, SSL and digital signatures.

Reference Books

1. Gracia-Mlina, Ullman and Widom, “Database System Implementation”,(2001)-Pearson Education.
2. Connolly & Begg, “Database Systems”, Third Edition (2002)- Pearson Publication.
3. Raghu Ramkrishnan & Gehrke, “Database Management Systems”, Third Edition McGraw Hill Publications (2003).

MTCOE-204 Object Oriented S/W System Design

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**

Final Theory paper: 60 Marks; Time: 3 Hrs

Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction: Object-oriented Concepts, Object-oriented domain analysis, software reuse, software life cycle models, unified modeling language (UML).

Object-oriented methods (OOM): Overview, Goals, Concepts: Object analysis model, Information model. Behavior model, Process model, Requirements definition model, benefits and weaknesses.

Unit 2

Object-oriented software development methods: ObjectOry: System development and analysis, use cases, entities, interface objects, services and system design, advantages, Introduction to Object-oriented structured design and application examples.

Object-oriented Methodologies: Classification, Rumbaugh methodology, Jacobson methodology, Booch methodology, Responsibility-Driven design, Pun and Winder methodology, Shlaer/Mellor methodology.

Unit 3

Object-Oriented Design: Representation of design model, Identification o components, classes, inheritance and objects, Identification of software behavior, Suitability of Methodology for Object-Oriented Design (MOOD), Context of MOOD, A CASE environment for MOOD, MOOD tools.

Reusability and Life Cycle Issues: Reusability during Object-Oriented design, Object-Oriented software life cycle model, Software life cycle issues.

Unit 4

Software maintenance concepts: S/W maintenance process, Reverse engineering environment, Documentation for S/W maintenance, S/W configuration management and S/W maintenance models.

Object-Oriented Programming Languages: Simula, SmallTalk, Ada95, Object COBOL.

Books and References:

1. Object-Oriented Methods for Software Development, Jag Sodhi, Prince Sodhi, McGraw-Hill.
2. Object-Oriented Software: Design and Maintenance, Luiz Fernando Capretz, Miriam A M Captrez, World Scientific.
3. Ali Bahrami, Object Oriented Systems Development ,:McGraw Hill, 1999
.
4. Rumbaugh et.al.,Object Oriented Modeling and Design, PHI, 1997
.
5. Forouzan, Coombs and Fegan: Introduction to data Communications and Networks TMH,

   1999.

6. William Stallings: Data and Computer Communications 5/e, PHI.

MTCOE-206 Mobile Ad hoc and Wireless Sensor Networks

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**
Final Theory paper: 60 Marks; Time: 3 Hrs
Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Mobile Ad hoc Networks (MANET) – Mobility Management, modeling distributed applications for MANET, MAC mechanisms and protocols.

Unit 2

MANET Routing Protocols: Ad hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, OLSR & TORA routing, location aided routing, zonal routing algorithm.

Unit 3

Ad hoc network security – Link layer, Network layer, Trust and key management.

Self policing MANET – Node Misbehaviour, secure routing, reputation systems.

Wireless Sensor Networks (WSN) – Design Issues, Clustering, Applications of WSN.

Unit 4

MAC layer and routing protocols in WSN

Data Retrieval Techniques in WSN – Sensor databases, distributed query processing, Data dissemination and aggregation schemes, Operating Systems for WSN, Security issues in WSN.

Books and References:

1. C. Siva Ram Murthy & B.S. Manoj, Mobile Ad hoc Networks – Architectures & Protocols, Pearson Education, New Delhi, 2004
2. C M Cordeiro & D.P. Agrawal, Adhoc & Sensor Networks – Theory and Applications, ISBN 981-256-682-1, World Scientific Singapore, 2006
3. C. S. Raghvendra, Wireless Sensor Networks, Springer-Verlag, 2006 (Available as E-Book at NIT Kurukshetra Purchased in 2006)

MTCOE-230 Probability, Random Variables and Stochastic Processes

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**
Final Theory paper: 60 Marks; Time: 3 Hrs
Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Probability Introduction: Introduction, Probability and Induction, Set Theory, Probability Space, Conditional Probability, Bernoulli Trials, Bernoulli's Theorem and Games of Chance.

Unit 2

The Concept of a Random Variable: Introduction, Distribution and Density Functions, Specific Random Variables, Conditional Distributions, Asymptotic Approximations for Binomial Random Variable, The Random Variable $g(\mathbf{x})$, The Distribution of $g(\mathbf{x})$, Mean and Variance, Moments, Characteristic Functions, Bivariate Distributions, One Function of Two Random Variables, Two Functions of Two Random Variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values Mean Square Estimation Stochastic Convergence and Limit Theorems.

Unit 3

Stochastic Processes: Definitions, Systems with Stochastic Inputs, The Power Spectrum, Discrete-Time Processes, Random Walks, Poisson Points and Shot Noise, Modulation, Cyclostationary Processes, Bandlimited Processes and Sampling Theory.

Unit 4

Markov Chains and Queuing Theory: Introduction, Higher Transition Probabilities and the

Chapman–Kolmogorov Equation, Classification of States, Stationary Distributions and Limiting Probabilities, Transient States and Absorption Probabilities, Markov Processes, Queueing Theory, Networks of Queues / Problems.

Books

- Probability and Statistics with Reliability, Queuing, and Computer Science Applications, Trivedi Kishor Shridharbhai ,John Wiley and Sons.
- Probability, Random Variables and Stochastic Processes, A. Papoulis and S. Pillai, TMH.
- Probability & Statistics – for Engineers & Scientists, R. Walpole, R. Myers, S. Myers and K. Ye.

MTCOE-232 Embedded Systems

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**
Final Theory paper: 60 Marks; Time: 3 Hrs
Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction to embedded systems: Background and History of Embedded Systems, definition and Classification, Programming languages for embedded systems: desirable characteristics of programming languages for embedded systems, low-level versus high-level languages, main language implementation issues: control, typing. Major programming languages for embedded systems. Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

Unit 2

Processor and Memory Organization: Structural units in processor, Processor selection for an embedded system, Memory devices, Memory selection, Allocation for memory to program segments and blocks and memory map of a system, DMA, Interfacing processor. I/O Devices - Device I/O Types and Examples ? Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Device.

Unit 3

Microcontroller: Introduction to Microcontrollers, Evolution, Microprocessors vs. Microcontrollers, MCS-51 Family Overview, Important Features, Architecture. 8051 Pin Functions, Architecture, Addressing Modes, Instruction Set, Instruction Types.
Programming: Assembly Programming. Timer Registers, Timer Modes, Overflow Flags, Clocking Sources, Timer Counter Interrupts, Baud Rate Generation. Serial Port Register, Modes of Operation, Initialization, Accessing, Multiprocessor Communications, Serial Port Baud Rate.

Unit 4

Interrupts: Interrupt Organization, Processing Interrupts, Serial Port Interrupts, External Interrupts, Interrupt Service Routines. Microcontroller Specification, Microcontroller Design, Testing, Timing Subroutines, Look-up Tables, Serial Data Transmission.
Applications: Interfacing Keyboards, Interfacing Displays, Interfacing A/D and D/A Converters, Pulse Measurement, Loudspeaker Interface, Memory Interface.

Books and References:

1. John Catsoulis, “Designing Embedded Hardware”, O’reilly
2. An Embedded Software Primer”, David E. Simon, Pearson Education
3. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley & Sons, Inc
4. Karim Yaghmour, “Building Embedded Linux Systems”, O’reilly
5. Michael Barr, “Programming Embedded Systems”, O’reilly
6. Alan C. Shaw, “Real-time systems & software”, John Wiley & sons, Inc.
7. Wayne Wolf, “ Computers as Components”, Harcourt India Pvt. Ltd.

MTCOE-234 Data Mining

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**
Final Theory paper: 60 Marks; Time: 3 Hrs
Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction

Data Mining, Functionalities, Data Mining Systems classification, Integration with Data Warehouse System, Data summarization, data cleaning, data integration and transformation, data reduction.

Data Warehouse
Need for Data Warehousing , Paradigm Shift, Business Problem Definition, Operational and Information Data Stores, Data Warehouse Definition and Characteristics, Data Warehouse Architecture and Implementation, OLAP.

Unit 2

Data Mining Primitives, Query Language and System Architecture, Concept Description, Data generalization, Analysis of attribute relevance, Mining descriptive statistical measures in large databases.

Unit 3

Mining association rules in large databases: Association rule mining, Mining single dimensional boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Relational databases and data warehouses, correlation analysis, classification and prediction.

Unit 4

Introduction to cluster analysis, Mining complex type of data: Multidimensional analysis and descriptive mining of complex data objects, Spatial databases, Multimedia databases, Mining time series and sequence data, Mining text databases, Mining the World Wide Web, Applications and trends in data mining.

Books and References:

1. Data Mining : Concepts and Techniques; Jiawei Han and Micheline Kamber; Elsevier.
2. “Mastering Data Mining: The Art and Science of Customer Relationship Management”, by Berry and Lin off, John Wiley and Sons, 2001.
3. “Data Ware housing: Concepts, Techniques, Products and Applications”, by C.S.R. Prabhu, Prentice Hall of India, 2001.
4. “Data Mining: Concepts and Techniques”, J.Han, M.Kamber, Academic Press, Morgan Kanfman Publishers, 2001.
5. “Data Mining”, by Pieter Adrians, Dolf Zantinge, Addison Wesley 2000.
6. “Data Mining with Microsoft SQL Server”, by Seidman, Prentice Hall of India,2001.

Syllabus –III semester

MTCOE-301 Digital Image Processing

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**
Final Theory paper: 60 Marks; Time: 3 Hrs
Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction And Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Unit 2

Image Enhancement in the Spatial Domain:
Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering.

Unit 3

Image Restoration:A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Pereodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invarient Dedradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.
Image Compression: Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards.

Unit 4

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.
Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.
Object Recoginition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

Text Books:

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education, 2004.
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003.

Reference Books:

1. Rosefield Kak, "Digital Picture Processing", 1999.
2. W.K. Pratt, "Digital Image Processing", 2000.

MTCOE-331 Soft Computing

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**

Final Theory paper: 60 Marks; Time: 3 Hrs

Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit 2

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations, Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations, Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, Applications.

Unit 3

Regression and Optimization : Least-Squares Methods for System Identification - System Identification: An Introduction, Basics of Matrix Manipulation and Calculus, Least-Squares Estimator, Geometric Interpretation of LSE, Recursive Least-Squares Estimator, Recursive LSE for Time-Varying Systems, An introduction to LSE for Nonlinear Models, Derivative-based Optimization-Descent Methods, The Method of Steepest Descent, Newton's Methods, Step Size Determination, Conjugate Gradient Methods, Analysis of Quadratic Case, Nonlinear Least-squares Problems, Incorporation of Stochastic Mechanisms, Derivative-Free Optimization.

Unit 4

Genetic Algorithm: An Overview of GA, GA operators, GA in problem solving, Implementation of

GA.

Text Books:

1. "Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
2. "Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI, 1995.
3. "Neuro-fuzzy and Soft Computing", by J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI.
4. "An Introduction to Genetic Algorithm", Melanie Mitchell, PHI, 1998.
5. "Soft computing and Intelligent System Design", F. O. Karray and C. de Silva, Pearson, 2009.

Reference:

1. "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
2. "Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

MTCOE-333 Remote Sensing and GIS

Lecture- 4 hrs **Total Marks: 100.** **Total credits- 4**

Final Theory paper: 60 Marks; Time: 3 Hrs

Sessionals: 40 marks (Attendance: 15 marks + Class performance/Behaviour: 10 + Average of two best sessionals 15 marks: I sessional-15 marks; II sessional-15 marks; III sessional-15 Marks) Time: 1 hr for each sessional.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit 1

Introduction: Electromagnetic (EM) Spectrum, Interaction of EM radiations with earth's surface and atmosphere, special signatures, remote sensing platforms. Aerial photographs; types of aerial photographs, stereoscopic vision, stereoscopic parallax, measurement of height difference, vertical exaggeration, image distortion. Photo elements, geotechnical elements, photocharacteristics of different rock types and structures, photo-mosaic, rectification. Plotting instruments.

Unit 2

Satellite Imagery: Imagery vis a vis aerial photograph, active and passive sensors, MSS, LISS, CCD, Infrared and thermal scanners, different satellite programmes, microwave sensors, Remote sensing data products, fundamentals of image interpretations and analysis, visual interpretation of remote sensing data; false colour composite, Concept of digital image analysis, image restoration, image enhancement and information extraction. Supervised and unsupervised classification. Map accuracy assessment.

Unit 3

Applications: Interpretation and analysis of aerial photographs and images for identification of different rock types, structures, lineaments and preparation of geological map. Recognition of landforms, drainage pattern and preparation of geomorphological map; applications in engineering projects (dam reservoir, tunnel alignment, route location etc), ground water prospecting, exploration for minerals and oil, geoenvironmental studies (soil conservation, land degradation etc), Disaster management (flood, landslide etc) and monitoring of atmospheric pollution.

Unit 4

Introduction to Geographical Information System (GIS), components of GIS, data structures, Concept of raster and vector data, digitization, editing, attribute attachment etc, creation of layers, Data Integration, vector to raster conversion and vice –versa. Introduction to Global Position System (GPS) and its uses.

Recommended Books:

1. Remote Sensing Geology (Springer Verlag). R.P. Gupta
2. Remote Sensing in Geology (John Wiley & sons). B.S. Siegel and A.R. Gillespie
3. Remote Sensing and image interpretation (John Wiley & sons). T.M. Lillesand and R.W. Kiefer
4. Remote Sensing Principles and interpretation (WH Freeman Company. F.F. Reeds
5. Remote Sensing fro Earth Resources (AEG publication), D.P. Rao
6. Principles of Remote sensing (ELBS London). P. J. Kuran
7. Advances in Geophysics Vol. 1 and 13 (Academic press) H.E. Landesberg

MTCOE-335 Knowledge Based Systems & Robotics

Unit 1