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UNIVERSITY OF MUMBAI
No.UG/ 77 of 2004

CIRCULAR :

Attention of the Principal of the affiliated colleges in the faculty of Science, the Head, University Department of Computer Science and the Director/Heads of recognized institutions is hereby invited to this office Circular No.UG/193 dated 6th May, 2002 and are hereby informed that the recommendation made by the ad-hoc Board of Studies in B.Sc. and M.Sc. Computer Science at its meeting held on 4th December, 2003 has been approved by the Academic Council at its meeting held on 3rd January, 2004 vide item No.4.39 and that in accordance therewith the syllabus in the subject of Computer Science at the M.Sc. (Parts I and II) degree course examinations has been revised as per Appendix and that the same will be brought into force with effect from the academic year 2004-2005 and 2005-2006 respectively.

Mumbai 400 032
3rd March, 2004

for REGISTRAR.

To,
Principals of the affiliated colleges in the faculty of Science, the Head, University Department of Computer Science and the Director/Heads of the recognized institutions.

A.C.4.39/03.01.2004

No.UG/ 77-A of 2004

3rd March, 2004

Copy forwarded with compliments to the Dean, Faculty of Science, for information.

for REGISTRAR.

Copy to :

The Director, Board of College and University Development, the Controller of Examinations, the Deputy Registrar (Eligibility & Migration Section) the Director of Students Welfare, the Personal Assistants to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-centre, Ratnagiri, for information.

The Controller of Examinations (10 copies), F. & A.O. (Accounts Section), Fort (2 copies), Record Section (5 copies), Publication Section (5 copies), D.R. (Enrolment, Eligibility & Migration Section - 3 copies), D.R. (Statistical Unit) (2 copies), D.R. (Accounts Section) (2 copies), D.R. (Affiliation Section) (2 copies), D.R. (U.G. & P.G. Unit) (2 copies), A.R., A.A. Unit (2 copies) He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council/Management Council referred to in the above Circular and that no separate Action Taken Report will be sent in this connection. A.R., ONCOL (2 copies), BUCTU (1 copy), Dy.Acct. (Unit V) (1 copy), In-charge, C.C.F. (1 copy), Receptionist (1 copy), Telephone Operator (1 copy), Secretary, MUASA (1 copy), Supdt., P.G. Section (2 copies).

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UNIVERSITY OF MUMBAI



Revised Syllabus for M.Sc. Computer Science

Part I
(2004-2005)

Part II
(2005-2006)

M. Sc. Computer Science - First Year

Subjects	Lect/ Week	Pract/ Week	Paper		Pract	Total
			Hours	Marks		
I Year – I Term						
1 Principles of Compiler Design Part I	4	4	3	100	50	150
I Year – II Term						
Principles of Compiler Design Part II	4	4	3	100	50	150
I Year – I Term						
2 Digital Signal Processing Part I	4	4	3	100	50	150
I Year – II Term						
Digital Signal Processing Part II	4	4	3	100	50	150
I Year – I Term						
3 Mobile Computing	4	4	3	100	50	150
I Year – II Term						
Computer Simulation and Modeling	4	4	3	100	50	150
I Year – I Term						
4 Data Warehousing and Mining	4	4	3	100	50	150
I Year – II Term						
Advanced Database Systems	4	4	3	100	50	150
Total , I Year – I Term	16	16	-	400	200	600
Total , I Year – II Term	16	16	-	400	200	600

M. Sc. Computer Science - Second Year

Subjects	Lect/ Week	Pract/ Week	Paper		Pract	Total
			Hours	Marks		
II Year – I Term						
1 Artificial Intelligence	4	4	3	100	--	100
II Year – II Term						
Image Processing	4	4	3	100	50	150
II Year – I Term						
2 Distributed Computing	4	4	3	100	--	100
II Year – II Term						
Embedded Systems	4	4	3	100	50	150
II Year – I Term						
3 Elective I						
I Term	4	4		100	50	150
II Term	4	4		100	--	100
4 Elective II						
I Term	4	4		100	50	150
II Term	4	4		100	--	100
5 Project, I Term	-		-	-	100	100
Project, II Term	-		-	-	100	100
Total , II Year – I Term	16	16	-	400	200	600
Total , II Year – II Term	16	16	-	400	200	600

Elective-I	
1	Parallel Processing, (I Term)
	Advanced Computer Networks, (II Term)
2	System Security (I Term)
	Internet security (II Term)
3	Enterprise Networking (I Term)
	Satellite Communications, (II Term)
4	Fuzzy Logic and Neural networks (I Term)
	Multimedia systems and convergence of technologies (II Term)

Elective-II	
1	Pattern Recognition, (I Term)
	Computer Vision, (II Term)
2	Virtual Reality and Virtual Environment (I Term)
	Java Technology (II Term)
3	Bio Informatics (I Term)
	Intelligent Systems (II Term)
4	Optimization Techniques (I Term)
	Customer Relations Management (II Term)

CLASS: M. Sc (Computer Science)		Year I'	
SUBJECT: PRINCIPLES OF COMPILER DESIGN, Paper I, Term I			
Periods per week	Lecture	4	
	TW/Tutorial/Practical	4	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	TW/Practical	--	50

Term I

- Introduction to Compilers
 - Compilers and translators
 - Why do we need translators?
 - The structure of a compiler
 - Lexical analysis
 - Syntax analysis
 - Intermediate code generation
 - Optimization
 - Code generation
 - Book keeping
 - Error handling
 - Compiler writing tools
 - Getting started
- Programming languages
 - High-level programming languages
 - Definitions of programming languages
 - The lexical and syntactic structure of a language
 - Data elements
 - Data structures
 - Operators
 - Assignment
 - Statements
 - Program units
 - Data environments
 - Parameter transmission
 - Storage management
- Finite automata and lexical analysis
 - The role of the lexical analyzer
 - A simple approach to the design of lexical analyzers
 - Regular expressions
 - Finite automata
 - From regular expressions to finite automata
 - Minimizing the number of states of a DFA
 - A language for specifying lexical analyzers
 - Implementation of a lexical analyzer
 - The scanner generator as Swiss army knife

- The syntactic specification of Programming Languages
 - Context-free grammars
 - Derivations and parse trees
 - Capabilities of context-free grammars
- Basic Parsing Techniques
 - Parsers
 - Shift-reduce parsing
 - Operator-precedence parsing
 - Top-down parsing
 - Predictive parsers
- Automatic Construction of Efficient Parsers
 - LR parsers
 - The canonical collection of LR(0) items
 - Constructing SLR parsing tables
 - Constructing canonical LR parsing tables
 - Constructing LALR parsing tables
 - Using ambiguous grammars
 - An automatic parser generator
 - Implementation of LR parsing tables
 - Constructing LALR sets of items

SUBJECT: PRINCIPLES OF COMPILER DESIGN, Paper I, Term II

- Syntax-Directed Translation
 - Syntax-directed translation schemes
 - Implementation of syntax-directed translators
 - Intermediate code
 - Postfix notation
 - Parse trees and syntax trees
 - Three-address code, quadruples, and triples
 - Translation of assignment statements
 - Boolean expressions
 - Statements that alter the flow of control
 - Postfix translations
 - Translation with a top-down parser
- More about Translation
 - Array references in arithmetic expressions
 - Procedure calls
 - Declarations
 - Case statements
 - Record structures
 - PL/I-style structures
- Symbol Tables
 - The contents of a symbol table
 - Data structures for symbol tables
 - Representing scope information
- Symbol tables
 - Implementation of a simple stack allocation scheme
 - Implementation of block-structured languages

- Storage allocation in FORTRAN
 - Storage allocation in block-structured languages
- Error detection and recovery
 - Errors
 - Lexical-phase errors
 - Syntactic-phase errors
 - Semantic errors
- Introduction to code optimization
 - The principle sources of optimization
 - Loop optimization
 - The DAG representation of basic blocks
 - Value numbers and algebraic laws
 - Global data-flow analysis
- More about loop optimization
 - Dominators
 - Reducible flow graphs
 - Depth-first search
 - Loop-invariant computations
 - Induction variable elimination
 - Some other loop optimizations
- More about data-flow analysis
 - Reaching definitions again
 - Available expressions
 - Copy propagation
 - Backward flow problems
 - Very busy expressions and code hoisting
 - The four kinds of data-flow analysis problems
 - Handling pointers
 - Interprocedural data-flow analysis
 - Putting it all together
- Code generation
 - Object programs
 - Problems in code generation
 - A machine model
 - A simple code generator
 - Register allocation and assignment
 - Code generation from DAG's
 - Peephole optimization

Practical

- Debug C++ / JAVA Programs using debugger provided by different vendors along with IDE
- Make a comparative study of Different features of at least two Integrated Development Environment(IDE) and compilers
- Manipulation of IDE's and restoring the original setting

CLASS: M. Sc (Computer Science)		Year I	
SUBJECT: Digital Signal Processing , Paper II, Term I			
Periods per week	Lecture	4	
	TW/Tutorial/Practical	4	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	TW/Practical	--	50

Term I

Sequences-Representation of arbitrary sequences-Linear time variant systems-causality, stability- difference equations-frequency response-first order systems-second order systems-Discrete Fourier series-relation between continuous and discrete Systems. The z Transform-the Relation between the z Transform and the Fourier transform of a sequence-Solution of differences equation using one-sided transform-geometric evaluation of the Fourier Transform-Digital Filter Realizations-structures for all zero filters-the discrete Fourier transform – convolution of sequences-linear convolution of finite duration sequences-the discrete Hilbert transform.

The Theory and approximation of finite duration impulse response digital filters-issues in Filter design-FIR filters Design techniques for Linear phase FIR filters-windowing-issues with windowing-frequency sampling-solution for optimization-linear programming-linear phase filters-Maximal ripple FIR Filters –Remez exchange algorithm- Multiple band optimal FIR Filters-Design of filters with simultaneous constraints on the time and frequency response.

Theory and approximation of infinite impulse response digital filters- IIR filters-filter coefficient-Digital Filter Design –Mapping of differentials-Transformations-Direct design of digital filters-comparison between FIR filters and IIR filters

Finite word length effects in digital filters-analog to digital conversions-digital to analog conversions-types of Arithmetic in digital systems. Types of quantization in digital filters-Dynamic range Constraints-Realizations-ordering and pairing in cascade realizations-round off noise-fixed point analysis-Coefficient quantization – Limit cycle oscillations

Spectrum analysis and the fast fourier Trans form-introduction to Radix-2 FFT's-data shuffling and bit reversal-FFT computer programming-Decimation –in-Frequency Algorithm –Computing an Inverse DFT by doing a Direct DFT-Radix2 Algorithm-Spectrum analysis at a single point in the z plane-spectrum analysis in FFT Analysis-Windows in spectrum Analysis-Bluestein's Algorithm-The chirp z transform algorithm- convolution and correlation using number theoretic transforms.

SUBJECT: Digital Signal Processing , Paper II, Term II

An introduction to the theory of two dimensional signal processing-Two-dimensional signals-systems-causality- separability -stability-difference equations-Frequency Domain Techniques- Z Transforms-finite sequences-Two dimensional DFT-Two dimensional windows-Frequency sampling filters- frequency transformations from one to two dimensions.

Introduction to Digital hardware-design procedure for Digital Signal Processing Hardware- the major logic families- commercial logic packages- gates, multiplexers and decoders- Flip-Flops-arithmetic Units- dividers and floating point hardware. Special purpose hardware for digital filtering and signal generation-direct form FIR hardware- parallelism for direct form FIR- Cascade FIR filters-IIR filters- Digital Touch Tone Receiver (TTR) - Digital time Division Multiplexing (TDM) to Frequency Division Multiplexing (FDM) translator partitioning of digital filters for IC Realization- Hardware realization of a Digital Frequency Synthesizer

Special purpose hardware for FFT- FFT indexing- bit reversal and digit reversal for fixed radices- Comparison of computations for radices- introduction to quantization effects in FFT Algorithms. Hardware for Radix 2 Algorithm- FFT Computation using Fast Scratch Memory
Radix 2 and Radix 4 Parallel structures using RAM's- Pipeline FFT- Comparison of Pipe line FFT's- overlapped FFT with random access memory-real time convolution via FFT using a single Ram and one AE

General Purpose hardware for signal Processing facilities- special and general purpose computers- input output problems for real time processing- methods of improving computer speed – parallel operations of memories, Arithmetic, control and instruction fetches- the Linco Laboratory Fast Digital Processor(FDP). Doing FFT in FDP- LSP2

Application of Digital signal processing to speech- models of speech production- Short time spectrum analysis- speech analysis-synthesis System based on short time spectrum analysis- channel vocoder- analyzers-synthesizers- pitch detection and voiced unvoiced detections- homomorphic processing of speech, vocoder-formant Synthesis- Voiced –Unvoiced Detection- Voiced Fricative excitation

network- Linear prediction of speech- Computer Voice Response system
Applications to radar- Radar principle and application radar systems and parameter- Signal design and ambiguity functions- Airborne Surveillance Radar for Air Traffic Control – Digital matched Filter for a high performance Radar.

Reference

Theory and application of Digital signal processing Lawrence R. Rabiner Bernard Gold- prentice hall of India

Practical

Hands on experience in using commercial software packages for digital signal processing

Developing academic exercise programs for Filter design and FFT analysis for real time applications

CLASS: M. Sc (Computer Science)

SUBJECT: MOBILE COMPUTING, Paper III, Term I

Lectures: 4 Hrs per week
Practical: 4 Hrs per week

Theory: 100 Marks
Term work / Practical: 50 Marks

Objective: Recent developments in portable devices and high-bandwidth, ubiquitous wireless networks has made mobile computing a reality. Indeed, it is widely predicted that within the next few years' access to Internet services will be primarily from wireless devices, with desktop browsing the exception. Such predictions are based on the huge growth in the wireless phone market and the success of wireless data services. This course will help in understanding fundamental concepts, current developments in mobile communication systems and wireless computer networks.

DETAILED SYLLABUS

1. **Introduction:** Applications, A short history of wireless communication
2. **Wireless Transmission:** Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems.
3. **Medium Access Control:** Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.
4. **Telecommunication Systems:** GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, Security, New data services; DECT: System architecture, Protocol architecture; TETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA FDD mode, UTRA TDD mode
5. **Satellite Systems:** History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover, Examples
6. **Broadcast Systems:** Overview, Cyclic repetition of data, Digital audio broadcasting: Multimedia object transfer protocol; Digital video broadcasting
7. **Wireless LAN:** Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control. Sublayer, Medium access control Sublayer, Information bases And Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking. Security, Link management.
8. **Wireless ATM:** Motivation for WATM, Wireless ATM working group, WATM services, Reference model: Example configurations, Generic reference model; Functions: Wireless mobile terminal side, Mobility supporting network side; Radio access layer: Requirements, BRAN; Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios,

Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol

9. **Mobile Network Layer:** Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics
10. **Mobile Transport Layer:** Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP
11. **Support for Mobility:** File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Hypertext markup language, Some approaches that might help wireless access, System architectures; Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML script, Wireless telephony application, Examples Stacks with Wap, Mobile databases, Mobile agents

Text Books:

1. Jochen Schiller, "*Mobile communications*", Addison wisely, Pearson Education
2. William Stallings, "*Wireless Communications and Networks*"

References :

1. Rappaort, "*Wireless Communications Principals and Practices*"
2. YI Bing Lin, "*Wireless and Mobile Network Architectures*", John Wiley
3. P. Nicopolitidis, "*Wireless Networks*", John Wiley
4. K Pahlavan, P. Krishnamurthy, "*Principles of Wireless Networks*"
5. M. Richharia, "*Mobile Satellite Communication: Principles and Trends*", Pearson Education

TERM WORK

1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)

SUBJECT: COMPUTER SIMULATION AND MODELING, Paper III, Term II

Lectures: 4 Hrs per week

Practical: 4 Hrs per week

Theory: 100 Marks

Term Work / Practical: 50 Marks

Objective: In the last five decades digital computer simulation has developed from infancy to a full-fledged discipline. The field of modeling and simulation is as diverse as of man. The application of simulation continues to expand, both in terms of extent to which simulation is used and the range of applications. This course gives a comprehensive and state of art treatment of all the important aspects of a simulation study, including modeling, simulation software, model verification and validation, input modeling.

DETAILED SYLLABUS

1. **Introduction to Simulation:** System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation.
2. **Simulation Examples:** Simulation of Queueing systems, Other examples of simulation.
3. **General Principles:** Concepts of discrete event simulation, List processing,
4. **Simulation Software:** History of simulation software, Desirable software features, General-purpose simulation packages, Object oriented simulation, Trends in simulation software.
5. **Statistical Models in Simulation:** Useful statistical model, Discrete distribution, Continuous distribution, Poisson process, Empirical distribution.
6. **Queueing Models:** Characteristics of Queueing systems, Queueing notations, Long run measures of performance of Queueing systems, Steady state behavior of infinite population Markovian models, Steady state behavior finite population model, Network of Queues.
7. **Random Number Generation:** Properties of random numbers, Generation of pseudo random numbers, Techniques for generating random numbers, Tests for random numbers.
8. **Random Variate Generation:** Inverse transform technique, Convolution method, Acceptance rejection techniques
9. **Input Modeling:** Data Collection, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models.
10. **Verification and Validation of Simulation Model:** Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models.
11. **Output Analysis for a Single Model:** Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation
12. **Comparison and Evaluation of Alternative System Design:** Comparison of two system design, Comparison of several system design, Meta modeling, Optimization via simulation.

13. Case Studies: Simulation of manufacturing systems, Simulation of computer systems, Simulation of super market, Simulation of pert network

Text Books:

1. Jerry Banks, John Carson, Barry Nelson, David Nicol, "*Discrete Event System Simulation*"
2. Averill Law, W. David Kelton, "*Simulation Modeling and Analysis*", McGRAW-HILL

References:

1. Geffery Gordon, "*System Simulation*", PHI
2. Bernard Zeigler, Herbert Praehofer, Tag Gon Kim, "*Theory of Modeling and Simulation*", Academic Press
3. Narsing Deo, "*System Simulation with Digital Computer*", PHI
4. Donald W. Body, "*System Analysis and Modeling*", Academic Press Harcourt India
5. W David Kelton, Randall Sadowski, Deborah Sadowski, "*Simulation with Arena*", McGRAW-HILL.

TERM WORK

2. Term work should consist of at least 10 practical experiments/Assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)

SUBJECT: DATA WAREHOUSING AND MINING, Paper IV, Term I

Lectures: 4 Hrs per week
Practical: 4 Hrs per week

Theory: 100 Marks
Term work/Practical: 50 Marks

Objectives of the course: The data warehousing part of module aims to give students a good overview of the ideas and techniques which are behind recent development in the data warehousing and online analytical processing (OLAP) fields, in terms of data models, query language, conceptual design methodologies, and storage techniques. Data mining part of the model aims to motivate, define and characterize data mining as process; to motivate, define and characterize data mining applications.

DETAILED SYLLABUS

Data Warehousing:

1. **Overview And Concepts:** Need for data warehousing, Basic elements of data warehousing, Trends in data warehousing.
2. **Planning And Requirements:** Project planning and management, Collecting the requirements.
3. **Architecture And Infrastructure:** Architectural components, Infrastructure and metadata.
4. **Data Design And Data Representation:** Principles of dimensional modeling, Dimensional modeling advanced topics, data extraction, transformation and loading, data quality.
5. **Information Access And Delivery:** Matching information to classes of users, OLAP in data warehouse, Data warehousing and the web.
6. **Implementation And Maintenance:** Physical design process, data warehouse deployment, growth and maintenance.

Data Mining:

1. **Introduction:** Basics of data mining, related concepts, Data mining techniques.
2. **Data Mining Algorithms:** Classification, Clustering, Association rules.
3. **Knowledge Discovery :** KDD Process
4. **Web Mining:** Web Content Mining, Web Structure Mining, Web Usage mining.
5. **Advanced Topics:** Spatial mining, Temporal mining.
6. **Visualisation :** Data generalization and summarization-based characterization, Analytical characterization: analysis of attribute relevance, Mining class comparisons: Discriminating between different classes, Mining descriptive statistical measures in large databases
7. **Data Mining Primitives, Languages, and System Architectures:** Data mining primitives, Query language, Designing GUI based on a data mining query language, Architectures of data mining systems
8. **Application and Trends in Data Mining:** Applications, Systems products and research prototypes, Additional themes in data mining, Trends in data mining

Text Books:

1. Paulraj Ponnian, "*Data Warehousing Fundamentals*", John Wiley.
2. M.H. Dunham, "*Data Mining Introductory and Advanced Topics*", Pearson Education.
3. Han, Kamber, "*Data Mining Concepts and Techniques*", Morgan Kaufmann

References:

1. Ralph Kimball, "*The Data Warehouse Lifecycle toolkit*", John Wiley.
2. M Berry and G. Linoff, "*Mastering Data Mining*", John Wiley.
3. W.H. Inmon, "*Building the Data Warehouses*", Wiley Dreamtech.
4. R. Kimpall, "*The Data Warehouse Toolkit*", John Wiley.
5. E.G. Mallach, "*Decision Support and Data Warehouse systems*", TMH.

TERM WORK

3. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)

SUBJECT: ADVANCED DATABASE SYSTEMS, Paper IV, Term II

Lectures: 4 Hrs per week

Practical: 4 Hrs per week

Theory: 100 Marks

Term work/ Practical: 50 Marks

Objectives: To study the further database techniques beyond which covered in the second year, and thus to acquaint the students with some relatively advanced issues. At the end of the course students should be able to: gain an awareness of the basic issues in objected oriented data models, learn about the Web-DBMS integration technology and XML for Internet database applications, familiarize with the data-warehousing and data-mining techniques and other advanced topics, apply the knowledge acquired to solve simple problems

DETAILED SYLLABUS

1. **The Extended Entity Relationship Model and Object Model:** The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two.
2. **Object-Oriented Databases:** Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming languages; OODBMS architecture and storage issues; Transactions and Concurrency control, Example of ODBMS
3. **Object Relational and Extended Relational Databases:** Database design for an ORDBMS - Nested relations and collections; Storage and access methods, Query processing and Optimization; An overview of SQL3, Implementation issues for extended type; Systems comparison of RDBMS, OODBMS, ORDBMS
4. **Parallel and Distributed Databases and Client-Server Architecture:** Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases. An overview of Client-Server architecture
5. **Databases on the Web and Semi Structured Data:** Web interfaces to the Web, Overview of XML; Structure of XML data, Document schema, Querying XML data; Storage of XML data, XML applications; The semi structured data model, Implementation issues, Indexes for text data
6. **Enhanced Data Models for Advanced Applications:** Active database concepts. Temporal database concepts.; Spatial databases, Concepts and architecture; Deductive databases and Query processing; Mobile databases, Geographic information systems.

Text Books:

1. Elmasri and Navathe, "*Fundamentals of Database Systems*", Pearson Education
2. Raghu Ramakrishnan, Johannes Gehrke, "*Database Management Systems*", McGraw-Hill

References:

1. Korth, Silberchatz, Sudarshan , "*Database System Concepts*", McGraw-Hill.
2. Peter Rob and Coronel, "*Database Systems, Design, Implementation and Management*", Thomson Learning.
3. C.J.Date, Longman, "*Introduction To Database Systems*", Pearson Education

TERM WORK

4. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)	
SUBJECT: PARALLEL PROCESSING (Elective)	
Lectures: 4 Hrs per week Practical: 4 Hrs per week	Theory: 100 Marks Term Work/Practical : 50 Marks
Objective: Upon completion of this course students will be able to understand and employ the fundamental concepts and mechanisms which form the basis of the design of parallel computation models and algorithms, recognize problems and limitations to parallel systems, as well as possible solutions	
DETAILED SYLLABUS	
1. Introduction: Parallel Processing Architectures: Parallelism in sequential machines, Abstract model of parallel computer, Multiprocessor architecture, Pipelining, Array processors. 2. Programmability Issues: An overview, Operating system support, Types of operating systems, Parallel programming models, Software tools 3. Data Dependency Analysis: Types of dependencies loop and array dependences, Loop dependence analysis, Solving diophantine equations, Program transformations 4. Shared Memory Programming: General model of shared memory programming, Process model under UNIX 5. Algorithms for Parallel Machines: Speedup, Complexity and cost, Histogram computation, Parallel reduction, Quadrature problem, Matrix multiplication, Parallel sorting algorithms, Solving linear systems, Probabilistic algorithms 6. Message Passing Programming: Introduction, Model, Interface, Circuit satisfiability, Introducing collective, Benchmarking parallel performance 7. Parallel Programming languages: Fortran90, nCUBE C, Occam, C-Linda 8. Debugging Parallel Programs: Debugging techniques, Debugging message passing parallel programs, Debugging shared memory parallel programs 9. Memory and I/O Subsystems: Hierarchical memory structure, Virtual memory system, Memory allocation and management, Cache allocation and management, Cache memories and management, Input output subsystems 10. Other Parallelism Paradigms: Data flow computing, Systolic architectures, Functional and logic paradigms, Distributed shared memory 11. Performance of Parallel Processors: Speedup and efficiency, Amdahl's law, Gustafson-Barsis's law, Karf-Flatt metric, Isoefficiency metric	
Text Books:	
1. Hawang Kai and Briggs F. A., "Computer Architecture and Parallel Processing", McGraw Hill 2. Jorden H. F. and Alaghaband G., "Fundamentals of Parallel Processing" 3. M.J. Quinn, "Parallel Programming", TMH	
References:	
1. Shasikumar M., "Introduction to Parallel Processing", PHI 2. Wilson G.V., "Practical Parallel Programming", PHI	

3. D. E. Culler, J.P. Singh, A. Gupta, "*Parallel Computer Architecture*", Morgan Kaufman

TERM WORK

Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)

SUBJECT: ADVANCED COMPUTER NETWORKS (ELECTIVE)

Lectures: 4 Hrs per week
Practical: 4 Hrs per week

Theory: 100 Marks
Term work/Practical: 50 Marks

Objectives: In first part, Advanced technologies like High speed Devices etc. are to be considered. Second part Network programming is to be studied. Not just SOCKETS but also protocols, Drivers, Simulation Programming. In third part we should study Network Design, Protocols designs and analysis considering deterministic and non-deterministic approach. We expect natural thinking from student. For example he should able to consider different constraints and assume suitable data and solve the problems.

DETAILED SYLLABUS

1. **Data Communications:** Business Drivers and Networking Directions : Data communication Past and future.
2. **Understanding the standards and their maker:** Creating standards: players and Process, Current forums, Standard protocols, Layered reference models: The OSI RM, Standard computer architectures.
3. **Introduction to Transmission Technologies:** Hardware selection in the design process.
4. **Optical Networking:** SONET/SDH standards, Dense wavelength division multiplexing (DWDM), Performance and Design considerations.
5. **Physical Layer Protocols and Access Technologies:** Physical Layer Protocols and Interfaces, Accessing the Network, Copper access technologies, Cable Access Technologies, Fiber Access Technologies, Air Access Technologies.
6. **Common Protocols and Interfaces in the LAN environment:** Data link layers protocols, LLC and MAC sub layer protocol, Ethernet, Token Ring, Token Bus and FDDI, Bridge protocols, Switching in the LAN environment.
7. **Frame Relay:** FR specification and design, VoFR: Performance and Design considerations, Advantages and disadvantages of FR.
8. **Common WAN Protocol:** ATM: Many faces of ATM, ATM protocol operation (ATM cell and Transmission), ATM networking basics, Theory of operations, B-ISDN protocol reference model, PHY layer, ATM layer (Protocol model), ATM layer and cell (Definition), Traffic descriptors and parameters, Traffic and Congestion control defined, AAL Protocol model, Traffic contract and QoS, User plane overview, Control plane AAL, Management plane, Sub-DS3 ATM, ATM public services.
9. **Common Protocols and Interfaces in the Upper Layers(TCP/IP):** Background (Routing protocols), TCP/IP suite, Network layer (Internetwork layer), Transport layer, Application layer, Addressing and routing design.
10. **Mature Packet Switched Protocol:** ITU Recommendation X.25, User connectivity, Theory of Operation, Network layer functions, X.75 Internetworking protocol, switched multimegabit data service (SMDS), SMDS and IEEE 802.6, Subscriber Interface and Access protocol, Addressing and Traffic control.

11. **Requirements Definition:** User requirements, Traffic sizing, Traffic characteristics, Protocols, Time and Delay considerations, Connectivity, Availability, Reliability and Maintainability, Service aspects, Budget constraints,.
12. **Traffic Engineering and Capacity planning:** Background (Throughput calculations) , Traffic engineering basics (Traffic characteristics), Traditional Traffic engineering, Queued data and packet switched traffic modeling, Designing for peaks, Delay or Latency, Availability and reliability, Network performance modeling, Creating the traffic matrix, Capacity planning and Network vision, Design tool, Categories of tools, Classes of design tool, Components of design projects, Types of design projects.
13. **Technology Comparisons:** Circuits-message-packet and cell switching methods, Packet switching service aspects, Generic packet switching network characteristics, Private versus public networking, Public network service selection, Business aspects of Packet-Frame and cell switching services, High speed LAN protocols comparisons, Application performance needs.
14. **Access Network Design:** Network design layers, Access layer design, Access network capacity, network topology and hardware, completing the access network design.
15. **Backbone Network Design:** Backbone requirements, Network capacities, Topologies, Topologies strategies, Tuning the network.

Text Books:

1. Darren L Spohn, "Data Network Design", TMH
2. D. Bertsekas, R. Gallager, "Data Networks", PHI

References:

1. W.R. Stevens, "Unix Network Programming", Vol.1, Pearson Education
2. J.Walrand, P. Varaiya, "High Performance Communication Networks", Morgan Kaufmann
3. Y. Zheng, S. Akhtar, "Networks for Computer Scientists and Engineers", Oxford
4. A.S. Tanenbaum, "Computer Networks"
5. Peterson & Davie, "Computer Networks", Harcourt Asia.
6. James D. McCabe , "Practical Computer Analysis and Design", Harcourt Asia.

TERM WORK

5. Term work should consist of at least 10 practical experiments and two assignments covering all the topics of the syllabus.

CLASS: M. Sc (Computer Science)	
SUBJECT: SYSTEM SECURITY (Elective)	
Lectures: 4 Hrs per week Practical: 4 Hrs per week	Theory: 100 Marks Term work/Practical: 50 Marks
Objectives of the course: Learn about the threats in computer security. Understand what puts you at a risk and how to control it. Controlling a risk is not eliminating the risk but to bring it to a tolerable level.	
DETAILED SYLLABUS	
1. Introduction: Security, Attacks, Computer criminals, Method of defense 2. Cryptography: Basic Cryptography: Classical Cryptosystems, Public key Cryptography, Cryptographic checksum, Key Management: Key exchange, Key generation, Cryptographic key infrastructure, Storing and revoking keys, Hash algorithm, Digital signature, Cipher Techniques: Problems, Stream and block ciphers: AES, DES, RC4. 3. Program Security: Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats 4. Operating System Security: Protected objects and methods of protection, Memory address protection, Control of access to general objects, File protection mechanism, Authentication: Authentication basics, Password, Challenge-response, Biometrics. 5. Database Security: Security requirements, Reliability and integrity, Sensitive data, Interface, Multilevel database, Proposals for multilevel security 6. Security in Networks: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec 7. Administrating Security: Security planning, Risk analysis, Organizational security policies, Physical security. 8. Legal, Privacy, and Ethical Issues in Computer Security: Protecting programs and data, Information and law, Rights of employees and employers, Software failures, Computer crime, Privacy, Ethical issues in computer society, Case studies of ethics	
Text Books:	
1. Stallings, "<i>Cryptography And Network Security: Principles and practice</i>" 2. C. P. Pfleeger, and S. L. Pfleeger, "<i>Security in Computing</i>", Pearson Education. 3. Matt Bishop, "<i>Computer Security: Art and Science</i>", Pearson Education.	
References :	
1. Kaufman, Perlman, Speciner, "<i>Network Security</i>" 2. Eric Maiwald, "<i>Network Security : A Beginner's Guide</i>", TMH 3. Bruce Schneier, "<i>Applied Cryptography</i>", John Wiley. 4. Macro Pistoia, "<i>Java network security</i>", Pearson Education 5. Whitman, Mattord, "<i>Principles of information security</i>", Thomson	

CLASS: M. Sc (Computer Science)	
SUBJECT: INFORMATION SECURITY (Elective)	
Lectures: 4 Hrs per week Practical: 4 Hrs per week	Theory: 100 Marks Term Work/Practical: 50 Marks
Objectives of the course: Learn about the threats in computer security. Understand what puts you at a risk and how to control it. Controlling a risk is not eliminating the risk but to bring it to a tolerable level.	
DETAILED SYLLABUS	
9. Introduction: Security, Attacks, Computer criminals, Method of defense 10. Program Security: Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats 11. Operating System Security: Protected objects and methods of protection, Memory address protection, Control of access to general objects, File protection mechanism, Authentication: Authentication basics, Password, Challenge-response, Biometrics. 12. Database Security: Security requirements, Reliability and integrity, Sensitive data, Interface, Multilevel database, Proposals for multilevel security 13. Security in Networks: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec 14. Administrating Security: Security planning, Risk analysis, Organizational security policies, Physical security. 15. Legal, Privacy, and Ethical Issues in Computer Security: Protecting programs and data, Information and law, Rights of employees and employers, Software failures, Computer crime, Privacy, Ethical issues in computer society, Case studies of ethics	
Text Books:	
4. C. P. Pfleeger, and S. L. Pfleeger, "<i>Security in Computing</i>", Pearson Education. 5. Matt Bishop, "<i>Computer Security: Art and Science</i>", Pearson Education.	
References :	
6. Stallings, "<i>Cryptography And Network Security: Principles and practice</i>" 7. Kaufman, Perlman, Speciner, "<i>Network Security</i>" 8. Eric Maiwald, "<i>Network Security : A Beginner's Guide</i>", TMH 9. Macro Pistoia, "<i>Java Network Security</i>", Pearson Education 10. Whitman, Mattord, "<i>Principles of information security</i>", Thomson	
Assignments: 10 assignments covering the syllabus has to be submitted	

CLASS: M. Sc (Computer Science)	
SUBJECT: Enterprise Networking (Elective)	
Lectures: 4 Hrs per week Practical: 4 Hrs per week	Theory: 100 Marks Term Work/Practical: 25 Marks

Introduction

Growth of Computer Networking, Complexity in Network Systems, Mastering the Complexity, Resource Sharing, Growth of the Internet, Probing the Internet, Interpreting A Ping Response

PART I DATA TRANSMISSION

Transmission Media

Copper Wires, Glass Fibers, Radio, Satellites, Geosynchronous Satellites, Low Earth Orbit Satellites, Low Earth Orbit Satellite Arrays, Microwave, Infrared, Light Form a Laser

Local Asynchronous Communication

The Need for Asynchronous Communication, Using Electric Current to Send Bits, Standards for Communication, Baud Rate, Framing, and Errors, Full Duplex Asynchronous Communication, Limitations of Real Hardware, Hardware Bandwidth and the Transmission of Bits, The Effect of Noise On Communication, Significance for Data Networking

Long-Distance Communication (Carriers, Modulation and Modems)

Sending Signals across Long Distances, Modem Hardware Used for Modulation and Demodulation, Leased Analog Data Circuits, Optical, Radio Frequency, And Dialup Modems, Carrier Frequencies and Multiplexing, Base band And Broadband Technologies

Wave Division Multiplexing, Spread Spectrum, Time Division Multiplexing

PART II PACKET TRANSMISSION

Packets, Frames and Error Detection

The Concept of Packets, Packets and Time-Division Multiplexing, Packets and Hardware Frames, Byte Stuffing, Transmission Errors, Parity Bits and Parity Checking, Probability, Mathematics And Error Detection, Detecting Errors With Checksums, Detecting Errors With Cyclic Redundancy Checks, Combining Building Blocks, Burst Errors, Frame format And Error Detection Mechanisms

LAN Technologies and Network Topology

Direct Point-To-Point Communication, Shared Communication Channels, Significance of LANs and Locality of Reference, LAN Topologies, Bus Network: Ethernet Carrier Sense on Multi-Access Networks (CSMA), Collision Detection and Back off With CSMA/CD, Wireless LANs And CSMA/CA, Bus Network: Local Talk

Hardware Addressing and Frame Type Identification

Specifying a Recipient, How LAN Hardware Uses Addresses to Filter Packets
Format of a Physical Address, Broadcasting, Multicasting, Multicast Addressing,
Identifying Packet Contents, Frame Headers And Frame Format, Using Networks
That Do Not Have Self-Identifying Frames, Network Analyzers

LAN Wiring, Physical Topology, and Interface Hardware

Speeds of LANs and Computers, Network Interface Hardware, the Connection
between A NIC and A Network, Original Thick Ethernet Wiring, Connection
Multiplexing, Thin Ethernet Wiring
Twisted Pair Ethernet, the Topology Paradox, Network Interface Cards and Wiring
Schemes,

Extending LANs: Fiber Modems, Repeaters, Bridges and Switches

Distance Limitation and LAN Design, Fiber Optic Extensions, Repeaters, Bridges,
Frame Filtering
Startup and Steady State Behavior of Bridged Networks, Planning a Bridged
Network, Bridging Between Buildings, Bridging Across Longer Distances, A Cycle Of
Bridges, Distributed Spanning Tree, Switching, Combining Switches And Hubs,
Bridging And Switching With Other Technologies

Long-Distance Digital Connection Technologies

Digital Telephony, Synchronous Communication, Digital Circuits and DSU,
Telephone Standards
DS Terminology and Data Rates, Lower Capacity Circuits, Intermediate Capacity
Digital Circuits
Highest Capacity Circuits, Optical Carrier Standards, the C Suffix, Synchronous
Optical Network (SONET), the Local Subscriber Loop, ISDN, Asymmetric Digital
Subscriber Line Technology
Other DSL Technologies, Cable Modem Technology, Upstream Communication,
Hybrid Fiber Coax

Wan Technologies and Routing

Large Networks and Wide Areas, Packet Switches, Forming A WAN, Store and
Forward Physical Addressing In A WAN, Next-Hop Forwarding, Source
Independence, Relationship of Hierarchical Addresses to Routing, Routing In A
WAN, Use of Defaults Routes, Routing Table Computation, Shortest Path
Computation in a Graph, Distributed Route Computation, Distance Vector Routing

Network Ownership, Service Paradigm, and Performance

Network Ownership, Virtual Private Networks, Service Paradigm, Connection
Duration and Persistence, Examples of Service Paradigms, Addresses and
Connection Identifiers, Network Performance Characteristics

Protocols and Layering

The Need for Protocols, Protocol Suites, A Plan for Protocol Design, the Seven
Layers, Stacks: Layered Software, How Layered Software Works, Multiple, Nested
Headers, the Scientific Basis for Layering,

TERM WORK

Term work should consist of at least 10 assignments from the aforementioned topics.
A Seminar to be presented by each student as part of term works carrying 15 marks.

REFERENCE

Computer Network, Tuekeun, PHI

Networking Technology, Jaiswal, Galgotia.

Data Networking, Bertsekas, PHI

Computer Networks and Internets, Douglas E. Comer Pearson Education Asia

CLASS: M. Sc (Computer Science)			
Sub: Satellite Communications (Elective)			
Periods per week	Lecture	4	
	Practical	4	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Term Work / Practical	--	50
Detailed Syllabus			

- 1. Introduction:**
General background, frequency allocations for satellite services, basic satellite system, system design considerations, applications.
- 2. Satellite Orbits:**
Introduction, laws governing satellite motion, orbital parameters, orbital perturbations, Doppler effects, geostationary orbit, antenna look angles, antenna mount, limits of visibility, Earth eclipse of satellite, sun transit outage, inclined orbits, sun-synchronous orbit, launching of geostationary satellites.
- 3. Wave Propagation and Polarization:**
Introduction, atmospheric losses, ionospheric effects, rain attenuation, other impairments, antenna polarization, polarization of satellite signals, cross polarization discrimination, ionospheric depolarization, rain depolarization, ice depolarization.
- 4. Satellite Antenna:**
Antenna basics, aperture antennas, parabolic reflectors, offset feed, double reflector antennas, shaped reflector systems.
- 5. Link Design:**
Introduction, transmission losses, link power budget equation, system noise, carrier to noise ratio for uplink and downlink, combined uplink and downlink carrier to noise ratio, inter modulation noise
- 6. Communication Satellites:**
Introduction, design considerations, lifetime and reliability, spacecraft sub systems, spacecraft mass and power estimations, space segment cost estimates.
- 7. Earth Stations:**
Introduction, design considerations, general configuration and characteristics.
- 8. Multiple Access Techniques:**
Introduction, FDMA, TDMA, FDMA/TDMA, operation in a multiple beam environment, CDMA, multiple access examples

9. **Non Geostationary Orbit Satellite Systems:**
Introduction, reasons, design considerations, case study, example of systems.

Term Work:

Assignments covering the entire syllabus

Text Books:

1. Satellite Communications – Dennis Roddy – 3rd edition,
Mc-Graw Hill publication
2. Satellite Communications systems – M. Richharia – 2nd edition
Mc Millan publication.

CLASS: M. Sc (Computer Science)

SUBJECT: NEURAL NETWORKS & FUZZY SYSTEMS (Elective)

Lectures: 4 Hrs per week
Practical: 4 Hrs per week

Theory: 100 Marks
Term Work/Practical: 50 Marks

Objective: This course covers basic concepts of artificial neural networks, fuzzy logic systems and their applications. Its focus will be on the introduction of basic theory, algorithm formulation and ways to apply these techniques to solve real world problems.

DETAILED SYLLABUS

1. **Introduction:** Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Knowledge representation. Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules.
2. **Single Layer Perceptron:** Perceptron convergence theorem, Method of steepest descent - least mean square algorithms.
3. **Multilayer Perceptron:** Derivation of the back-propagation algorithm, Learning Factors.
4. **Radial Basis and Recurrent Neural Networks:** RBF network structure, theorem and the reparability of patterns, RBF learning strategies, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance .
5. **Simulated Annealing:** The Boltzmann machine, Boltzmann learning rule, Bidirectional Associative Memory.
6. **Fuzzy logic:** Fuzzy sets, Properties, Operations on fuzzy sets, Fuzzy relations, Operations on fuzzy relations, The extension principle, Fuzzy measures, Membership functions, Fuzzification and defuzzification methods, Fuzzy controllers.

Text Books:

1. Simon Haykin, "*Neural Network a - Comprehensive Foundation*", Pearson Education
2. Zurada J.M., "*Introduction to Artificial Neural Systems*", Jaico publishers
3. Timothy J. Ross, "*Fuzzy Logic with Engineering Applications*", McGraw Hill
4. Ahmad Ibrahim, "*Introduction to Applied Fuzzy Electronics*", PHI

References:

1. Yegnanarayana B., "*Artificial Neural Networks*", PHI
2. Driankov D., Hellendoorn H. & Reinfrank M., "*An Introduction to Fuzzy Control*", Norosa Publishing House
3. Berkan R.C., and Trubatch S.L., "*Fuzzy Systems Design Principles*", IEEE Press

TERM WORK

6. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)	
Subject: Multimedia systems and convergence of Technologies (Elective)	
Lectures: 4 Hrs per week	Theory: 100 Marks Term work/Practical: 50 Marks
Practical: 4 Hrs per week	

Multimedia systems and convergence of technologies

Defining the scope of multimedia, Hypertext and Collaborative research, Multimedia and personalised computing, Multimedia on the map, Emerging applications, The challenges

The convergence of computers, Communications, and entertainment products

The technology trends, Multimedia appliances, Hybrid Devices, Designers perspective, industry perspective of the future, Key challenges ahead, Technical, regulatory, Social

Architectures and issues for Distributed Multimedia systems

Distributed Multimedia systems, Synchronization, and QOS Architecture, The role of Standards, A frame work for Multimedia systems

Digital Audio Representation and processing

Uses of Audio in Computer Applications, Psychoacoustics, Digital representation of sound, transmission of digital sound, Digital Audio signal processing, Digital music making, Speech recognition and generation, digital audio and the computers

Video Technology

Raster Scanning Principles, Sensors for TV Cameras, Colour Fundamentals, Colour Video, Video performance Measurements, Analog video Artifacts, video equipments, World wide television standards

Digital Video and Image Compression

Video compression techniques, standardization of Algorithm, The JPEG Image Compression Standard, ITU-T Recommendations, The EPEG Motion Video Compression Standard, DVI Technology

Operating System Support for Continuous Media Applications

Limitation of Work station Operating system, New OS support, Experiments Using Real Time Mach

Middleware System Services Architecture

Goals of Multimedia System services, Multimedia system services Architecture, Media stream protocol

Multimedia Devices, Presentation Services, and the User Interface

Client control of continuous multimedia, Device control, Temporal coordination and composition, toolkits, hyperapplications

Multimedia File systems and Information Models

The case for multimedia information systems, The file system support for continuous Media, Data models for multimedia and Hypermedia information, Content- based Retrieval of Unstructured Data

Multimedia presentation and Authoring

Design paradigms and User interface, barriers to wide spread use, research trends

Multimedia Services over the Public Networks

Requirements, Architecture, and protocols, Net work services, applications

Multimedia Interchange

Quick time Movie File Format, QMFI, MHEG (Multimedia and Hypermedia Information Encoding Expert Group), Format Function and representation, Track model and Object model, Real Time Interchange

Multimedia conferencing

Teleconferencing Systems, Requirements of Multimedia Communications, Shared Application Architecture and embedded Distributed objects, Multimedia Conferencing Architecture

Multimedia Groupware

Computer and Video fusion approach to open shared work place, High Definition Television and desktop computing, HDTV standards, Knowledge based Multimedia systems, Anatomy of an Intelligent Multimedia system

Text Book

Multimedia Systems by John F. Koegel Buford- Pearson Education

CLASS: M. Sc (Computer Science)	
SUBJECT: Artificial Intelligence	
Lectures: 4 Hrs per week Practical: 4 Hrs per week	Theory: 100 Marks Term Work / Practical: 50 Marks

1 AI and Internal Representation

Artificial Intelligence and the World, Representation in AI, Properties of Internal Representation, The Predicate Calculus, Predicates and Arguments, Connectives Variables and Quantification, How to Use the Predicate Calculus, Other Kinds of Inference Indexing, Pointers and Alternative Notations, Indexing, The Isa Hierarchy, Slot-Assertion Notation, Frame Notation

2 Lisps

Lisps, Typing at Lisp, Defining Programs, Basic Flow of Control in Lisp, Lisp Style, Atoms and Lists, Basic Debugging, Building Up List Structure, More on Predicates, Properties, Pointers, Cell Notation and the Internals (Almost) of Lisp, Destructive Modification of Lists, The for Function, Recursion, Scope of Variables, Input/Output, Macros

3. Neural Networks and Fuzzy systems

Neural and fuzzy machine Intelligence, Fuzziness as Multivalence, The Dynamical Systems approach to Machine Intelligence, The brain as a dynamical system, Neural and fuzzy systems as function Estimators, Neural Networks as trainable Dynamical system, Fuzzy systems and applications, Intelligent Behavior as Adaptive Model free Estimation, Generalization and creativity, Learning as change, Symbol vs Numbers, Rules vs Principles, Expert system Knowledge as rule trees, Symbolic vs Numeric Processing, Fuzzy systems as Structured Numerical estimators, Generating Fuzzy rules with product space Clustering, Fuzzy Systems as Parallel associators, Fuzzy systems as Principle based Systems

Neural Network Theory

Neuronal Dynamics: Activations and signals, Neurons as functions, signal monotonicity, Biological Activations and signals, Neuron Fields, Neuron Dynamical Systems, Common signal functions, Pulse-Coded Signal functions

Genetic Algorithms

A simple genetic algorithm, A simulation by hands, similarity templates(Schemata), Mathematical foundations, Schema Processing at work, The two- armed and k-armed Bandit Problem, The building block hypothesis, The minimal Deceptive Problem

Computer implementation of Genetic algorithm, Data Structures, Reproduction, Cross over and Mutation, Time to reproduce and time to Cross Mapping objective function to fitness form, Fitness scaling

Applications of genetic algorithm, De Jong and Function Optimization, Improvement in basic techniques, Introduction to Genetics based machine learning, applications of genetic based machine leaning

1. Data Mining

Introduction to Data Mining, Computer systems that can learn, Machine learning and methodology of science, Concept learning, Data ware house, designing decision support systems, Client server and data warehousing, Knowledge Discovery Process, Visualization Techniques, K- nearest neighbor, Decision trees, OLAP tools, Neural networks, Genetic algorithm, Setting up a KDD environment, Real life applications, Customer profiling, Discovering foreign key relationships

Assignments

10 assignments covering the syllabus has to be submitted

Text book

1. Introduction to Artificial Intelligence By Eugene Charniak, Drew McDermott- Addison Wesley
2. Neural Networks and fuzzy systems A dynamical systems approach to machine Intelligence by Bart Kosko- PHI
3. Genetic Algorithms in search, Optimization & Machine Learning by David E Goldberg-Addison wesley
4. Data Mining by Pieter Adriaans and Dolf Zantinge – Pearson Education Asia
5. Data Warehousing in the Real World by Sam Anahory and Dennis Murray, Addison -Wesley

CLASS: M. Sc (Computer Science)

SUBJECT: IMAGE PROCESSING

Lectures: 4 Hrs per week
Practical: 4 Hrs per week

Theory: 100 Marks
Term Work/Practical: 50 Marks

Objective: Digital Image Processing is a rapidly evolving field with growing applications in science and engineering. Image processing holds the possibility of developing the ultimate machine that could perform the visual functions of all living beings. There is an abundance of image processing applications that can serve mankind with the available and anticipated technology in the near future.

DETAILED SYLLABUS

1. **Digital Image Processing Systems:** Introduction, Structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, Storage, Processing, Communication, Display. Image sampling and quantization, Basic relationships between pixels
2. **Image Transforms (Implementation):** Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen - Loeve (Hotelling) transform.
3. **Image Enhancement in the Spatial Domain:** Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters
4. **Image Enhancement in the Frequency Domain:** Frequency domain filters: Smoothing and Sharpening filters, Homomorphic filtering
5. **Wavelets and Multiresolution Processing:** Image pyramids, Subband coding, Haar transform, Series expansion, Scaling functions, Wavelet functions, Discrete wavelet transforms in one dimensions, Fast wavelet transform, Wavelet transforms in two dimensions
6. **Image Data Compression:** Fundamentals, Redundancies: Coding, Interpixel, Psycho-visual, Fidelity criteria, Image compression models, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone still image compression standards, Video compression standards.
7. **Morphological Image Processing:** Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images
8. **Image Segmentation:** Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Region based segmentation
9. **Image Representation and Description:** Representation schemes, Boundary descriptors, Regional descriptors

Text Books:

1. R.C.Gonsales R.E.Woods, "*Digital Image Processing*", Second Edition, Pearson Education
2. Anil K.Jain, "*Fundamentals of Image Processing*", PHI

References:

1. William Pratt, "*Digital Image Processing*", John Wiley
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, "*Image Processing, Analysis, and Machine Vision*" Thomson Learning
2. N Ahmed & K.R. Rao, "*Orthogonal Transforms for Digital Signal Processing*" Springer
3. B. Chanda, D. Dutta Majumder, "*Digital Image Processing and Analysis*", PHI.

TERM WORK

7. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)	
SUBJECT: DISTRIBUTED COMPUTING	
Lectures: 4 Hrs per week Practical: 4 Hrs per week	Theory: 100 Marks Term work: 25 Marks
Objective: This course aims to build concepts regarding the fundamental principles of distributed systems. The design issues and distributed operating system concepts are covered.	
DETAILED SYLLABUS	
1. Introduction to Distributed System: Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems. 2. Communication: Layered protocols, Remote procedures call, Remote object invocation, Message-oriented communication, Stream-oriented communication. 3. Processes: Threads, Clients, Servers, Code Migration, Software agent. 4. Naming: Naming entities, Locating mobile entities, Removing un-referenced entities. 5. Synchronization: Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions. 6. Consistency and Replication: Introduction, Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols. 7. Fault Tolerance: Introduction, Process resilience, Reliable client server communication, Reliable group communication. Distributed commit, Recovery. 8. Security: Introduction, Secure channels, Access control, Security management. 9. Distributed File System: Sun network file system, CODA files system. 10. Case Study: CORBA, Distributed COM, Globe, Comparison of CORBA, DCOM, and Globe.	
Text Books:	
1. A. Taunenbaum, "<i>Distributed Systems: Principles and Paradigms</i>" 2. G. Coulouris, J. Dollimore, and T. Kindberg, "<i>Distributed Systems: Concepts and Design</i>", Pearson Education	
References:	
1. M. Singhal, N. Shivaratri, "<i>Advanced Concepts in Operating Systems</i>", TMH	
TERM WORK	
8. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.	

CLASS: M. Sc (Computer Science)

SUBJECT: EMBEDDED SYSTEMS

Lectures: 4 Hrs per week
Practical: 4 Hrs per week

Theory: 100 Marks
Term Work/Practical: 50 Marks

Objective: Embedded system tools and products are evolving rapidly. This course deals with various approaches to building embedded systems. It introduces unified view of hardware and software. The aim of this course is to make the students aware of the various applications of embedded systems.

DETAILED SYLLABUS

1. **An overview of embedded systems:** Introduction to embedded systems, Categories and requirements of embedded systems, Challenges and issues related to embedded software development, Hardware/Software co-design, Introduction to IC technology, Introduction to design technology
2. **Embedded Software development:** Concepts of concurrency, processes, threads, mutual exclusion and inter-process communication, Models and languages for embedded software, Synchronous approach to embedded system design, Scheduling paradigms, Scheduling algorithms, Introduction to RTOS, Basic design using RTOS
3. **Embedded C Language:** Real time methods, Mixing C and Assembly, Standard I/O functions, Preprocessor directives, Study of C compilers and IDE, Programming the target device
4. **Hardware for embedded systems:** Various interface standards, Various methods of interfacing, Parallel I/O interface, Binary counting synchronization and Gadget Busy waiting, Parallel port interfacing with switches, keypads and display units, Memory and high speed interfacing, Interfacing of data acquisition systems, Interfacing of controllers, Serial communication interface, Implementation of above concepts using C language
5. **Study of ATMEL RISC Processor:** Architecture, Memory, Reset and interrupt, functions, Parallel I/O ports, Timers/Counters, Serial communication, Analog interfaces, Implementation of above concepts using C language, Implementation of above concepts using C language
6. **Case studies and Applications of embedded systems:** Applications to: Communication, Networking, Database, Process Control, Case Studies of: Digital Camera, Network Router, RTLinux

Text Books:

1. Raj Kamal, "Embedded Systems", TMH
2. David E. Simon, "An Embedded Software Primer", Pearson Education
3. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education

References:

1. Frank Vahid, Tony Givargis, "*Embedded System Design: A Unified Hardware/Software Introduction*", John Wiley
2. Craig Hollabaugh, "*Embedded Linux*", Pearson Education
3. Daniel Lewis, "*Fundamentals of Embedded Software*", Pearson Education.
4. Barnett, Cox, O'Cull, "*Embedded C Programming and the Atmel AVR*", Thomson Learning
5. Myke Predko, "*Programming and Customizing the 8051 Microcontroller*", TMH

TERM WORK

9. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
 - Four experiments on micro controller based systems.
 - Four experiments using cross C compiler and Linux.
 - Two experiments using developments tools like logic analyzer, emulator and simulator.
 - Two experiments on case study of advanced embedded systems

CLASS: M. Sc (Computer Science)	
SUBJECT: PATTERN RECOGNITION (Elective)	
Lectures: 4 Hrs per week Practical: --	Theory: 100 Marks Term Work/Practical: -- Marks
Objective: This course teaches the fundamentals of techniques for classifying multi-dimensional data, to be utilized for problem-solving in a wide variety of applications, such as engineering system design, manufacturing, technical and medical diagnostics, image processing, economics, psychology.	
DETAILED SYLLABUS	
1. Introduction: Machine perception, Pattern recognition systems, Design cycle, Learning and Adaptation 2. Bayesian Decision Theory: Bayesian decision theory: Continuous features, Minimum-error rate classification, classification, Classifiers, Discriminant functions and Decision surfaces, Normal density, Discriminant functions for normal density, Bayes Decision theory: discrete features 3. Maximum-Likelihood and Bayesian Parameter Estimation: Maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation: Gaussian case and General theory, Problems of dimensionality, Hidden Markov Model 4. Nonparametric Techniques: Density estimation, Parzen windows, k_n-Nearest-Neighbor estimation, Nearest-Neighbor rule, Matrices and Nearest-Neighbor classification 5. Linear Discriminant Functions: Linear discriminant functions and decision surfaces, Generalised linear discriminant functions, 2-Category linearly separable case, Minimising the Perceptron criterion function, Relaxation procedure, Non-separable behavior, Minimum squared error procedure, Ho-Kashyap procedures, Multicategory generalizations 6. Nonmetric Methods: Decision tree, CART, ID3, C4.5, Grammatical methods, Grammatical interfaces 7. Algorithm Independent Machine Learning: Lack of inherent superiority of any classifier, Bias and Variance, Resampling for estimating statistic, Resampling for classifier design, Estimating and comparing classifiers, Combining classifiers 8. Unsupervised Learning and Clustering: Mixture densities and Identifiability, Maximum-Likelihood estimations, Application to normal mixtures, Unsupervised Bayesian learning, Data description and clustering criterion function for clustering, Hierarchical clustering 9. Applications of Pattern Recognition	
Text Books:	
1. Duda, Hart, and Stock, "<i>Pattern Classification</i>", John Wiley and Sons. 2. Gose, Johnsonbaugh and Jost, "<i>Pattern Recognition and Image analysis</i>", PHI	

TERM WORK

10. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)	
SUBJECT: COMPUTER VISION (Elective)	
Lectures: 4 Hrs per week Practical: --	Theory: 100 Marks Term Work/Practical: -- Marks
Objective: To introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving	
DETAILED SYLLABUS	
1. Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, Matching. Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components. 2. Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchical segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation. 3. Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting). 4. Region Analysis: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. 5. Facet Model Recognition: Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consistent labeling problem, Back-tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry – from 2D to 3D, Image matching : Intensity matching of 1D signals, Matching of 2D image, Hierarchical image matching. 6. Object Models And Matching: 2D representation, Global vs. Local features. 7. General Frame Works For Matching: Distance relational approach, Ordered-structural matching, View class matching, Models database organization. 8. General Frame Works: Distance –relational approach, Ordered –Structural matching, View class matching, Models database organization. 9. Knowledge Based Vision: Knowledge representation, Control-strategies, Information integration.	
Text Books:	
1. David A. Forsyth, Jean Ponce, <i>"Computer Vision: A Modern Approach"</i> 2. R. Jain, R. Kasturi, and B. G. Schunk, <i>"Machine Vision"</i>, McGraw-Hill.	
References:	
1. Milan Sonka, Vaclav Hlavac, Roger Boyle, <i>"Image Processing, Analysis, and Machine Vision"</i> Thomson Learning 2. Robert Haralick and Linda Shapiro, <i>"Computer and Robot Vision"</i>, Vol I, II, Addison-Wesley, 1993.	

TERM WORK

11. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)	
Subject: Virtual Reality and Virtual Environment (Elective)	
Lectures: 4 Hrs per week Practical: --	Theory: 100 Marks Term work/Practical: -- Marks

Real time computer graphics, Flight simulation, virtual environment, Benefits of virtual reality, Evolution of Virtual Reality, Historical perspective, scientific land marks

3D Computer graphics

The virtual world space, positioning the virtual observer, the perspective projection, Human vision, Stereo perspective projection, 3D clipping, colour theory, simple 3D modelling, illumination models, shading algorithms, radiosity, hiddensurface removal, realism, stereographic images

Geometric modelling

From 2D to 3D, 3D space curves, 3D boundary representation,

Geometrical Transformations

Frames of reference, Modelling transformations, instances, picking flying, Scaling the VE, Collision detection

A generic VR Systems

The virtual Environment, The computer environment, VR Technology, Modes of Interaction, VR systems

Animating the Virtual Environment

Dynamics of numbers, the animation of objects, shape and object inbetweening, free-form deformation, particle systems

Physical Simulation

Objects falling in a gravitational field, rotating wheels, Elastic collisions, Projectiles, simple pendulums, springs, flight dynamics of an aircraft

Human factors

The eye, The ear, the somatic senses, Equilibrium

Virtual Reality Hardware

Sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR Systems

Virtual Reality Software

Modelling Virtual worlds, Physical simulation, VR tool kits

Virtual Reality Applications

Engineering, Entertainment, science, Education, training, Future Virtual
environment, Modes of Interaction

Text Books

Virtual Reality Systems John Vince- Pearson Education Asia

CLASS: M. Sc (Computer Science)	
SUBJECT: Java Technology (Elective)	
Lectures: 4 Hrs per week Practical: --	Theory: 100 Marks Term work/Practical: -- Marks

Java Programming

Object oriented programming revisited, JDK, Java Virtual machine-Platform independent-portability-scalability Operators and expressions-decision making, branching, looping, Classes, Objects and methods, Arrays Strings and Vectors, Interfaces, Packages, Multi-Threading, managing errors and exceptions, Applet programming, Managing files and streams

Java Technology for Active Web Documents

An Early Form of Continuous Update, Active Documents and Server Overhead, Active Document Representation and Translation, Java Technology, the Java Run-Time Environment, The Java Library

A Graphics Toolkit, Using Java Graphics on a Particular Computer, Java Interpreters and Browsers

Compiling a Java Program, Invoking an Applet, Example of Interaction with a Browser

RPC and Middleware

Programming Clients and Servers, Remote Procedure Call Paradigm, RPC Paradigm, Communication Stubs, External Data Representation, Middleware and Object-Oriented Middleware

Network Management (SNMP)

Managing an Internet, The Danger of Hidden Features, Network Management Software, Clients, Servers, Managers and Agents, Simple Network Management Protocol, Fetch-Store Paradigm, The MIP and Object Names, The Variety of MIB Variables, MIB variables that correspond to arrays

Java technologies

Graphics, JFC-JAVA foundation classes, swing, images, java 2d graphics, internationalization, Communication and Networking, TCP Sockets, UDP Sockets, **java.net**, java security, Object serialization, Remote method serialization, JDBC: Java Data Base Connectivity, Java beans, Java interface to CORBA, JAVA- COM Integration, Java Media Framework, commerce and java wallet, Data structures and java utilities, JavaScript, Servlets

TERM WORK

Term work should consist of at least 06 assignments including debugged java source code for the applications from the aforementioned topics. A Seminar to be presented by each student as part of term work carrying 15 marks.

REFERENCE

Using JAVA 2, Joseph L weber, PHI
JAVA 2 complete, Sybex, BPB
Java2 The complete Reference, Patrick Naughton, T M H
Computing concepts With JAVA2, Cay Horstmann, WILEY
JSP Java Server Pages, Barry Burd, IDG Books India(p) Ltd
Java2 Programming Bible, Aaron Walsh, IDG Books India(p) Ltd
Java2, swing, servlets, JDBC & JAVA Beans Programming Black Book Steven
Holzner dreamtech press

CLASS: M. Sc (Computer Science)		Year II	
SUBJECT: Bioinformatics (Elective)			
Periods per week 1Period is 50 minutes	Lecture	4	
	TW/Practical	--	
Evaluation System		Hours	Marks
	Theory Examination	3	100
	TW/Tutorial/Practical	--	--

Overview

Information networks- Protein information resources-Genome Information resources-DNA Sequence analysis- pair wise alignment techniques-multiple sequence alignment-Secondary database searching-building a sequence search protocol Introduction

The biological sequence structure deficit- Genome Projects-pattern recognition and prediction –the role of chaperones-sequence Analysis-Homology and analogy.

Information Networks

Review of computer communication networks-the European molecular biology network- EMBnet-National Center for Biotechnology Information-NCBI- virtual tourism.

Protein Information resources

Biological Data Bases-Primary sequence Databases-Composite Protein sequence databases-Secondary databases- Composite Protein pattern databases-structure classification databases-web addresses

Genome Information resources

DNA Sequence Analysis

Pairwise alignment Techniques

Multiple sequence alignment

Secondary database searching

Building a sequence search Protocol

Analysis packages

Term Work

10 assignments covering the entire syllabus

CLASS: M. Sc (Computer Science)

SUBJECT: INTELLIGENT SYSTEMS (Elective)

Lectures: 4 Hrs per week

Practical: --

Theory: 100 Marks

Term Work/Practical: -- Marks

Objectives: To understand and apply principles, methodologies and techniques in design and implementation of intelligent system.

DETAILED SYLLABUS

1. **Artificial Intelligence:** An overview, Intelligent Systems: Evolution of the concept.
2. **Intelligent Agents:** How agent should act, Structure of intelligent agents, Environments
3. **Problem Solving:** Solving problems by searching, Informed search methods, Game playing
4. **Knowledge and Reasoning:** A knowledge based agent, The wumpus world environment, Representation, Reasoning, Logic, Propositional logic, First order logic: Syntax and Semantics, Extensions and Notational variation, Using first order logic
5. **Building a Knowledge Base:** Properties of good and bad knowledge base, Knowledge engineering, General ontology
6. **Interfacing First Order Logic:** Interface rules involving quantifiers, An example proof, Forward and backward chaining, Completeness
7. **Acting Logically:** Planning, Practical planning: Practical planners, Hierarchical decomposition, Conditional planning
8. **Uncertain Knowledge and Reasoning:** Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief networks, Inference in belief networks
9. **Learning:** Learning from observations: General model of learning agents, Inductive learning, learning decision trees, Learning in neural and belief networks: Introduction to neural networks, Perceptrons, Multilayer feed-forward network, Application of ANN, Reinforcement learning: Passive learning in a known environment, Generalization in reinforcement learning, Genetic algorithms
10. **Agents that Communicate:** Communication as action, Types of communicating agents, A formal grammar for a subset of English
11. **Expert system:** Introduction to expert system, Representing and using domain knowledge, Expert system shells, Explanation, Knowledge acquisition
12. **Applications:** Natural language processing, Perception, Robotics

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach"
2. George F. Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education

References:

1. Nils J. Nilsson, "*Artificial Intelligence: A New Synthesis*", Harcourt Asia
2. Elaine Rich and Kevin Knight, "*Artificial Intelligence*", TMH
3. Patrick Winston, "*Artificial Intelligence*", Pearson Education
4. Ivan Brakto, "*Prolog Programming for Artificial Intelligence*", Pearson Education
5. Efraim Turban Jay E. Aronson, "*Decision Support Systems and Intelligent Systems*"
6. Ed. M. Sasikumar and Others, "*Artificial Intelligence : Theory and Practice*"
Proceedings of the International Conference KBCS-2002, Vikas Publishing House

TERM WORK

12. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)			
OPTIMIZATION (Elective)			
Periods per week	Lecture	4	
	Practical	--	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Terwork / Practical	--	--
Detailed Syllabus			

INTRODUCTION

Need for optimization and historical development classification and formulation of optimization problem, Classical optimization methods, Calculus based methods, Enumerative schemes, Random search algorithms, Evolutionary algorithms.

Formulation of Primary and Subsidiary design equations, Limit equations and Normal redundant and incompatible specification.

Exact and Interactive techniques. Optimal design of elements and systems, shafts, gears, bearings, High-speed machinery, cams etc.

Linear Programming model

Formulation, objective function, constraints, decision variables, canonical and standard forms, parameters and variables, classical problems such as crew scheduling, Knap sack, napkin/caterer, product mix etc.

Graphical method for two variable problems, simplex algorithm and tabular representation, types of solution such as feasible / non feasible, degenerate / non degenerate, optimal / sub optimal, unique / alternate / infinite optimal, bounded / unbounded value and solution and their interpretations from simplex table, cycling phenomena, mutual solution of problems involving upto three iterations.

Duality concept, dual problem formulation, dual simplex method, primal sub optimal - dual not feasible, and other primal - dual relations, interpretation of dual variables.

Duality Properties, sensitivity analysis for variation of parameter at a time.

Transportation, Transshipment and Assignment models.

As special cases of LP model, Problem formulation and optimality conditions in Vogel's penalty and Hungarian methods of solution. traveling salesman problem as a special case of assignment problem, sensitivity analysis manual solution of problems involving upto three iterations.

Integer LP Models .

Gomary's Cutting plane algorithms, branch and bound technique for integer programming

Simulation Models

Monte Carlo or experimenting method based on Probabilistic behavior data and random numbers, application in Probabilistic real life problems

TERM WORK:

10 Assignments covering the entire syllabus.

TEXT BOOKS:

1. Optimization Theory and application by S..S Rao.

REFERENCE BOOKS:

1. Optimization for Engineering Design by Deb & Kalyanway.
2. Optimization Methods by Mital K.V
3. Operation Research - An Introduction by H.A. Taha.
4. Statistical Distribution in Engineering by Karl Bury.
5. Artificial Intelligence Through Simulated Evolution by Foged, Owence and Walsh.
6. Conference proceedings – Annual conference on Evolution programming

CLASS: M. Sc (Computer Science)			
SUBJECT: CRM (Customer Relations Management) (Elective)			
Periods per week	Lecture	4	
	TW/Practical	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	TW/Practical	--	--

1. **Introduction to CRM** : what is a customer? How do we define CRM? CRM technology, CRM technology components, customer life style, customer interaction.
2. **Introduction to eCRM** : difference between CRM & eCRM, features of eCRM.
3. **Sales Force Automation(SFA)** : definition & need of SFA, barriers to successful SFA, SFA: functionality , technological aspect of SFA: data synchronization , flexibility & performance , reporting tools.
4. **Enterprise Marketing Automation (EMA)**: components of EMA, marketing camping, camping, planning & management, business analytic tools, EMA components (promotions, events, loyalty & retention programs), response mgmt.
5. **Call Centers Mean Customer Interaction**: the functionality, technological implementation, what is ACD(automatic call distribution),IVR(interactive voice response), CTI(computer telephony integration),web enabling the call center, automated intelligent call routing, logging & monitoring.
6. **Implementing CRM**: pre implementation, kick off meeting, requirements gathering, prototyping & detailed proposal generation, development of customization, Power User Beta Test & Data import, training, roll out & system hand off, ongoing support , system optimization, follow up.
7. **Introduction to ASP(application service provider)**: who are ASP's?, their role & function, advantages & disadvantages of implementing ASP.

References:

- 1.CRM at the speed of light by Paul Greenberg,TMH.
2. Customer R elations Management by Kristin Anderson & Carol Kerr. TMH.

Term work

10 assignments covering the entire syllabus.

CLASS: M. Sc (Computer Science)			
Project I (I year) and II (II Year)			
Periods per week	Lecture	--	
	Practical	4	
	Tutorial	--	
		Hours	Marks
Evaluation System	Project	--	50
	Examination	--	50

Guidelines for submission of report of Project I and II

Body of Project

Introduction
 Literature Survey
 Objective
 Methodology
 Feasibility study
 Design/synthesis/Analysis
 Fabrication and Details
 Drawings
 Test set up and Tests
 Results
 Case Study
 Results / Discussion
 Conclusion
 Future work
 References

Appendix

This should contain Drawings, Graphs, coding used etc.