# VIDYASAGAR UNIVERSITY

MIDNAPORE – 721102

**2014**

M.Sc. in Computer Science

## MSC SEMESTER – I

| Course Code | Paper | Teaching Scheme (Per Week) | | | Examination Scheme (Marks) | | Total (Marks) |
|---|---|---|---|---|---|---|---|
| | | Th. | Tu. | Pr. | Int. | Ext. | |
| CS/MSC/101 | Mathematical Computation | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/102 | Advanced Computer Architecture | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/103 | Computer Network | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/104 Module: I | Computer Graphics | 1 | 1 | 0 | 5 | 20 | 50 |
| CS/MSC/104 Module: II | Multimedia | 1 | 1 | 0 | 5 | 20 | |
| CS/MSC/105 | Network Lab | 0 | 1 | 5 | 10 | 40 | 50 |
| CS/MCA/106 | Computer Graphics Lab & Multimedia Lab | 0 | 1 | 5 | 10 | 40 | 50 |

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# MSC SEMESTER – II

| Course Code | Paper | Teaching Scheme (Per Week) | | | Examination Scheme (Marks) | | Total (Marks) |
|---|---|---|---|---|---|---|---|
| | | Th. | Tu. | Pr. | Int. | Ext. | |
| CS/MSC/201 | Advanced DBMS | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/202 Module: 1 | Theory of Computing | 2 | 1 | 0 | 5 | 20 | 50 |
| CS/MSC/202 Module: 2 | Compiler Design | 2 | 1 | 0 | 5 | 20 | |
| CS/MSC/203 | Design and Analysis of Algorithm | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/204 | Software Engineering | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/205 | Advanced DBMS Lab | 0 | 1 | 5 | 10 | 40 | 50 |
| CS/MSC/206 | Compiler Lab | 0 | 1 | 5 | 10 | 40 | 50 |

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# MSC SEMESTER – III

| Course Code | Paper | Teaching Scheme (Per Week) | | | Examination Scheme (Marks) | | Total (Marks) |
|---|---|---|---|---|---|---|---|
| | | Th. | Tu. | Pr. | Int. | Ext. | |
| CS/MSC/301 | Advanced Operating Sytem | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/302 Module 1 | Artificial Intelligence | 2 | 1 | 0 | 5 | 20 | 50 |
| CS/MSC/302 Module 2 | Soft Computing | 2 | 1 | | 5 | 20 | |
| CS/MSC/303 | Elective-I | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/304 | Wireless Network and Web Technology | 2 | 1 | 0 | 10 | 40 | 50 |
| CS/MSC/305 | AI Lab | 0 | 1 | 5 | 10 | 40 | 50 |
| CS/MSC/306 Module: I | Advanced Operating System Lab | 0 | 1 | 2 | 5 | 25 | 50 |
| CS/MSC/306 Module: II | Web Technology Lab | 0 | 1 | 2 | 5 | 25 | |

**ELECTIVE-I:**

1. Human Computer Interaction
2. Pattern Recognition
3. Natural Language Processing
4. Bioinformatics
5. Embedded System
6. Cloud Computing
7. Real Time System
8. Image Processing

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# MSC SEMESTER – IV

| Course Code | Paper | Teaching Scheme (Per Week) | | | Total (Marks) | | |
|---|---|---|---|---|---|---|---|
| | | Th. | Tu. | Pr. | Int. | Ext. | |
| CS/MSC/401 | Project /Masters Thesis | 0 | 0 | 0 | 0 | 200 | 200 |
| CS/MSC/402 | Seminar | 0 | 0 | 0 | 0 | 50 | 50 |
| CS/MSC/403 | Grand Viva | 0 | 0 | 0 | 0 | 50 | 50 |

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# DETAILED SYLLABUS of M.Sc. in COMPUTER SCIENCE

## CS/MSC/101 Mathematical Computation

Propositional logic: Syntax, semantics, valid, satisfiable and unsatisfiable formulas, encoding and examining the validity of some logical arguments.
Proof techniques: forward proof, proof by contradiction, contrapositive proofs, proof of necessity and sufficiency.
Sets, relations and functions: Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations, principles of mathematical induction.
Size of a set: Finite and infinite sets, countable and uncountable sets, Cantor's diagonal argument and the power set theorem, Schroeder-Bernstein theorem.
Introduction to counting: Basic counting techniques - inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating function.
Algebraic structures and morphisms: Algebraic structures with one binary operation - semigroups, monoids and groups, congruence relation and quotient structures. Free and cyclic monoids and groups, permutation groups, substructures, normal subgroups. Algebraic structures with two binary operations - rings, integral domains and fields. Boolean algebra and Boolean ring.
Introduction to graphs: Graphs and their basic properties - degree, path, cycle, subgraphs, isomorphism, Eulerian and Hamiltonian walks, graph coloring, planar graphs, trees.

References


1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill.
2. C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill.
3. Norman L. Biggs, Discrete Mathematics, Oxford University Press.
4. Kenneth Bogart, Clifford Stein and Robert L. Drysdale, Discrete Mathematics for Computer Science, Key College Publishing.
5. Thomas Koshy, Discrete Mathematics with Applications, Elsevier.
6. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, Asia.


## CS/MSC/102 Advanced Computer Architecture

Overview of von Neumann architecture: Instruction set architecture; The Arithmetic and Logic Unit, The Control Unit, Memory and I/O devices and their interfacing to the CPU; Measuring and reporting performance; CISC and RISC processors.
Pipelining: Basic concepts of pipelining, data hazards, control hazards, and structural hazards; Techniques for overcoming or reducing the effects of various hazards.
Hierarchical Memory Technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.
Instruction-level parallelism: Concepts of instruction-level parallelism (ILP), Techniques for increasing ILP; Superscalar, super-pipelined and VLIW processor architectures; Vector and symbolic processors; Case studies of contemporary microprocessors
Multiprocessor Architecture: Taxonomy of parallel architectures; Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks; Distributed shared-memory architecture, Cluster computers.
Non von Neumann Architectures: Data flow Computers, Reduction computer architectures, Systolic Architectures.


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References


1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.
2. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill.
3. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.
4. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.


## CS/MSC/103 Computer Networks

Introduction to networks and layered architecture. Data communication concepts, transmission media and topology, multiplexing. Circuit switching and packet switching, data link layer, layer 2 switches and ATM switches, SONET/SDH. Medium access control. CSMA CD, TDMA, FDMA, CDMA. Network layer and addressing, IP version 4 and 6. Routing algorithms. Transmission layer, TCP and UDP. Congestion control techniques. WAN, ATM. Internetworking. Wireless communications. Network management and security.

References


1. William Stallings, Data and Computer Communication, Prentice Hall of India.
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill.
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.
4. Douglas Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India.
5. W. Richard Stevens, TCP/IP Illustrated, Volume 1, Addison-Wesley.


## CS/MSC/104 Module I Computer Graphics

Graphics hardware and display devices; graphics primitives: drawing lines and curves; 2d and 3d transformations; segments and their applications; generating curves, surfaces and volumes in 3d, wire-frame models, Bezier and spline curves and surfaces; geometric modeling: elementary geometric algorithms for polygons, boundary representations, constructive solid geometry, spatial data structures; hidden surface and line elimination; rendering: shading, light models, realistic image synthesis techniques, textures and image-based rendering; video games and computer animation.
Laboratory: Programming for generating lines, curves and rendered surfaces. Interactive graphics programming: modeling and updating objects in an object hierarchy, video games, computer animation and realistic image synthesis.
Programming environments: OpenGL (or equivalent), Java graphics environments, X windows (or equivalents).

## CS/MSC/104 Module II Multimedia

Introduction to Multimedia System: Architecture and components, Multimedia distributed processing model, Synchronization, Orchestration and Quality of Service (QOS) architecture.
Audio and Speech: Data acquisition, Sampling and Quantization, Human Speech production mechanism, Digital model of speech production, Analysis and synthesis, Psycho-acoustics, low bit rate speech compression, MPEG audio compression.


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Images and Video: Image acquisition and representation, Composite video signal NTSC, PAL and SECAM video standards, Bilevel image compression standards: ITU (formerly CCITT) Group III and IV standards, JPEG image compression standards, MPEG video compression standards.
Multimedia Communication: Fundamentals of data communication and networking, Bandwidth requirements of different media, Real time constraints: Audio latency, Video data rate, multimedia over LAN and WAN, Multimedia conferencing.
Hypermedia presentation: Authoring and Publishing, Linear and non-linear presentation, Structuring Information, Different approaches of authoring hypermedia documents, Hyper-media data models and standards.
Multimedia Information Systems: Operating system support for continuous media applications: limitations is usual OS, New OS support, Media stream protocol, file system support for continuous media, data models for multimedia and hypermedia information, content based retrieval of unstructured data.

References


1. Ralf Steinmetz and Klara Nahrstedt, Multimedia Systems, Springer.
2. J. D. Gibson, Multimedia Communications: Directions and Innovations, Springer.
3. K. Sayood, Introduction to Data Compression, Morgan-Kaufmann.
A. Puri and T. Chen, Multimedia Systems, Standards, and Networks, Marcel Dekker.
4. Iain E.G. Richardson, H.264 and MPEG-4 Video Compression, John Wiley.
5. Borivoje Furht, Handbook of Multimedia Computing, CRC Press.


## CS/MSC/105 Network Lab

Problems and assignment based on Paper CS/MSC/103

## CS/MSC/106 Computer Graphics Lab & Multimedia Lab

Problems and assignment based on Paper CS/MSC/104 (Module – I and Module – II)

## CS/MSC/201 Advanced DBMS

Relational Databases: Integrity Constraints revisited: Functional, Multi-valued and Join Dependency, Template Algebraic, Inclusion and Generalized Functional Dependency, Chase Algorithms and Synthesis of Relational Schemes. Query Processing and Optimization: Evaluation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information. Deductive Databases: Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation. Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases. Case Studies: Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2. Parallel and Distributed Databases: Distributed Data Storage: Fragmentation and Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation. Advanced Transaction Processing: Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors. Active Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and


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Concurrency Control, Compensation and Databases Recovery. Real Time Databases: Temporal Constraints: Soft and Hard Constraints, Transaction Scheduling and Concurrency Control. Image and Multimedia Databases: Modeling and Storage of Image and Multimedia Data, Data Structures - R-tree, k-d tree, Quadtrees, Content Based Retrieval: Color Histograms, Textures etc, Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio and Handwritten Data, Geographic Information Systems (GIS). WEB Databases: Accessing Databases through WEB, WEB Servers, XML Databases, commercial Systems: Oracle xxi, DB2. Data Mining: Knowledge Representation Using Rules, Association and Classification Rules, Sequential Patterns, Algorithms for Rule Accessing.

References


1. Abraham Silberschatz, Henry Korth, and S. Sudarshan, Database System Concepts, McGraw-Hill.
2. Raghu Ramakrishnan, Database Management Systems, WCB/McGraw-Hill.
3. Bipin Desai, An Introduction to Database Systems, Galgotia.
4. J. D. Ullman, Principles of Database Systems, Galgotia.
5. R. Elmasri and S. Navathe, Fundamentals of Database Systems8, Addison-Wesley.
6. Serge Abiteboul, Richard Hull and Victor Vianu, Foundations of Databases. Addison-Wesley.


## CS/MSC/202 Module I Theory of Computing

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages.

References


1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill



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## CS/MSC/202 Module II Compiler Design

The aim is to learn how to design and implement a compiler and also to study the underlying theories. The main emphasis is for the imperative languages.
Introduction: Phases of compilation and overview.
Lexical Analysis (scanner): Regular language, finite automata, regular expression, from regular expression to finite automata, scanner generator (lex,flex).
Syntax Analysis (Parser): Context-free language and grammar, push-down automata, LL(1) grammar and top-down parsing, operator grammar, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc,bison)
Semantic Analysis: Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree.
Symbol Table: Its structure, symbol attributes and management.
Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.
Intermediate Code Generation: Translation of different language features, different types of intermediate forms.
Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc.
Register allocation and target code generation
Advanced topics: Type systems, data abstraction, compilation of object oriented features and non-imperative programming languages.

References


1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley.
2. Michael L. Scott, Programming Language Pragmatics, Elsevier.
3. Andrew W. Appel, Modern Compiler Implementation in C/Java, Cambridge University Press.
4. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier.
5. Allen I. Holob, Compiler Design in C, Prentice-Hall.
6. Steven S. Muchnik, Advanced Compiler Design and Implementation, Elsevier.
7. Randy Allen and Ken Kennedy, Optimizing Compilers for Modern Architectures, Elsevier.


## CS/MSC/203 Design and Analysis of Algorithms

Algorithmic paradigms: Dynamic Programming, Greedy, Branch-and-bound; Asymptotic complexity, Amortized analysis; Graph Algorithms: Shortest paths, Flow networks; NP-completeness; Approximation algorithms; Randomized algorithms; Linear programming; Special topics: Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations), Internet algorithms (text pattern matching, tries, information retrieval, data compression, Web caching).

References


1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001.



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2. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.
3. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
4. Udi Manber, Algorithms -- A Creative Approach, Addison-Wesley, Reading, MA, 1989.
5. Mark de Berg, Mark van Kreveld, Mark Overmars and Otfried Shwarzkopf (Cheong), Computational Geometry: Algorithms and Applications, Third edition, Springer-Verlag, 2008.
6. Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
7. Vijay V Vazirani, Approximation Algorithms, Springer-Verlag, 2001.
8. Dorit S Hochbaum (editor), Approximation Algorithms for NP-Hard Problems, PWS Publishing Co, 1997.

## CS/MSC/204 Software Engineering

Introduction, software life-cycle models, software requirements specification, formal requirements specification and verification - axiomatic and algebraic specifications, function-oriented software design, object-oriented design, UML, design patterns, user interface design, coding and unit testing, integration and systems testing, debugging techniques, software quality - SEI CMM and ISO-9001. Software reliability and fault-tolerance, software project planning, monitoring, and control, software maintenance, computer-aided software engineering (CASE), software reuse, component-based software development, extreme programming.

References

1. Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India.
2. Pankaj Jalote, An integrated approach to Software Engineering, Springer/Narosa.
3. Roger S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill.
4. Ian Sommerville, Software Engineering, Addison-Wesley.

## CS/MSC/205 Advanced DBMS Lab

Structured Query Language

1. Creating Database

Creating a Database
Creating a Table
Specifying Relational Data Types
Specifying Constraints
Creating Indexes
2. Table and Record Handling
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements
3. Retrieving Data from a Database
The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

Clause

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Using  Aggregate Functions
Combining Tables Using JOINS
Subqueries
4. Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE

Cursors in Oracle PL / SQL

Writing Oracle PL / SQL Stored Procedures

## CS/MSC/206 Compiler Lab

Problems and assignment based on Paper CS/MSC/202.

## CS/MSC/301 Advanced Operating System

Evolution of Operating Systems, Structural overview, Concept of process and Process synchronization, Process Management and Scheduling, Hardware requirements: protection, context switching, privileged mode; Threads and their Management; Tools and Constructs for Concurrency, Detection and Prevention of deadlocks, Dynamic Resource Allocation, Design of IO systems, File Management, Memory Management: paging, virtual memory management, Distributed and Multiprocessor Systems, Case Studies.

References


1. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India.
3. D. M. Dhamdhere, Operating Systems: A Concept-Based Approach, Tata McGraw-Hill.
4. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing.
5. Gary J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley.
6. Maurice Bach, Design of the Unix Operating Systems, Prentice-Hall of India.
7. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, O'Reilly and Associates.


## CS/MSC/302 Module I Artificial Intelligence

This course will cover basic ideas and techniques underlying the design of intelligent computer systems. Topics include:
Introduction to AI and intelligent agents.
Problem Solving: Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.
Game Playing: minimax, alpha-beta pruning.
Knowledge and Reasoning: Building a Knowledge Base: Propositional logic, first order
Logic, situation calculus. Theorem Proving in First Order Logic.
Planning, partial order planning.


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Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks.
Learning: Overview of different forms of learning, Learning Decision Trees, Neural Networks
Introduction to Natural Language Processing.

References

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall.
2. Nils J. Nilsson, Artificial Intelligence: A New Sythesis, Morgan-Kaufmann.

## CS/MSC/302 Module II Soft Computing

Artificial Neural Network
Basic concept of Soft Computing; Basic concept of neural networks, Mathematical model, Properties of neural network, Typical architectures: single layer, multilayer, competitive layer; Different learning methods: Supervised, Unsupervised & reinforced; Common activation functions; Feed forward, Feedback & recurrent N.N; Application of N.N; Neuron.
Pattern Recognition
Pattern Classification, Pattern Association, Clustering, Simple Clustering algorithm, k-means & k-medoid based algorithm.
Models Of Neural Network Architecture, Algorithm & Application of -- McCulloh-Pitts, Hebb Net, Perceptron ( with limitations & Perceptron learning rule Convergence theorem), Backpropagation NN, ADALINE, MADALINE, Discrete Hopfield net, BAM, Maxnet , Kohonen Self Organizing Maps, ART1,ART2.
Fuzzy Sets & Logic
Fuzzy versus Crisp; Fuzzy sets—membership function, linguistic variable, basic operators, properties; Fuzzy relations—Cartesian product, Operations on relations; Crisp logic—Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic—Quantifiers, Inference; Fuzzy Rule based system; Defuzzification methods; FAM;
Genetic Algorithm
Basic concept; role of GA in optimization, Fitness function, Selection of initial population, Cross over(different types), Mutation, Inversion, Deletion, Constraints Handling; Evolutionary Computation;
Genetic Programming; Schema theorem; Multiobjective & Multimodal optimization in GA; Application—
Travelling Salesman Problem, Graph Coloring problem; Course Structure and Syllabus for
Hybrid Systems
Hybrid systems, GA based BPNN (Weight determination, Application); Neuro Fuzzy Systems—Fuzzy BPNN--fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G.A;

References:

1. Neural Networks- A Comprehensive foundation, Simon Haykin, 2nd Ed; Pearson
2. Fuzzy Sets & Fuzzy Logic, Klir & Yuan, PHI
3. Genetic Algorithm – Melanie Mitchell, PHI
References:
4. Neural Networks, Fuzzy Logic & Genetic Algorithms – Synthesis & applications, T.S. Rajasekaran & G.A. Vijaylakshmi Pai, PHI
5. Genetic Algorithm & fuzzy Logic Systems - Sanchez, Takanori, Zadeh; World Scientific
6. Genetic Algorithm, Goldberg David E.; Pearson
7. Fuzzy Set Theory & Its Applications - Zimmermann H. J.; Allied Publishers Ltd.
8. Fundamentals of Neural Networks, architectures, algorithms & applications --- Laurence Fausett;

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Prentice Hall, Englewood Clifts.

## CS/MSC/303 Elective I

### Human Computer Interaction

HCI foundation and history; Usability life cycle and methods; Design rules and guidelines; Empirical research methods; Models in HCI - GOMS, Fitts' law and Hick-Hyman's law; Task analysis; Dialogue design; Cognitive architecture and HCI ; Graphic User Interfaces & aesthetics; Usability Testing; UML,OOP,OOM; Design Case Studies.

REFERENCES


1. Dix A., Finlay J., Abowd G. D. and Beale R. *Human Computer Interaction*, 3rd edition, Pearson Education, 2005.
2. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. *Human Computer Interaction*, Addison-Wesley, 1994.
3. Shneiderman; *Designing the User Interface*, Addison Wesley 2000 (Indian Reprint)


### Pattern Recognition

Introduction and mathematical preliminaries - What is pattern recognition?, Clustering vs. Classification; Applications; Linear Algebra, vector spaces, probability theory, estimation techniques.
Classification: Bayes decision rule, Error probability, Error rate, Minimum distance classifier, Mahalanobis distance; K-NN Classifier, Linear discriminant functions and Non-linear decision boundaries.
Fisher's LDA, Single and Multilayer perceptron, training set and test sets, standardization and normalization.
Clustering: Different distance functions and similarity measures, Minimum within cluster distance criterion, K-means clustering, single linkage and complete linkage clustering, MST, medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.
Feature selection: Problem statement and Uses, Probabilistic separability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, (l,r) algorithm.
Feature Extraction: PCA, Kernel PCA.
Recent advances in PR: Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy.

REFERENCES


1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
2. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.
3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.


### Natural Language Processing

Speech and Natural Language Processing: Introduction; Brief Review of Regular Expressions and Automata; Finite State Transducers; Word level Morphology and Computational Phonology; Basic Text to Speech; Introduction to HMMs and Speech Recognition. Indian language case studies; Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic


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Analysis; Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Natural Language Generation; Techniques of Machine Translation; Indian Language case studies.

REFERENCES

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Prentice-Hall.
2. Chris Manning and Hinrich Schuetze, Foundations of Statistical Natural Language Processing, MIT Press.

**Bioinformatics**

Sequence similarity, homology, and alignment. Pairwise alignment: scoring model, dynamic programming algorithms, heuristic alignment, and pairwise alignment using Hidden Markov Models. Multiple alignment: scoring model, local alignment gapped and ungapped global alignment. Motif finding: motif models, finding occurrence of known sites, discovering new sites. Gene Finding: predicting reading frames, maximal dependence decomposition. Analysis of DNA microarray data using hierarchical clustering, model-based clustering, expectation-maximization clustering, Bayesian model selection.

REFERENCES

1. O'Reilly, " Developing Bio informatics computer skills", Indian Edition's publication
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics concepts, skills & Applications", CBS Publishers
3. Rashidi, Hooman and Lukas K. Buehler, "Bioinformatics Basic Applications" CRC Press.
4. "Bioinformatics" , Addison Wesley
5. Stephen Misner & Stephen Krawetz, " Bioinformatics- Methods & Protocols"

**Embedded System**

Introduction to Embedded Systems - definitions and constraints; hardware and processor requirements; special purpose processors; input-output design and I/O communication protocols; design space exploration for constraint satisfaction; co-design approach; example system design; Formal approach to specification; specification languages; specification refinement and design; design validation; Real Time operating system issues with respect to embedded system applications; time constraints and performance analysis.

REFERENCES

1. Peter Marwedel, Embedded System Design, Kluwer.
2. Wayne Wolf, Computers as Components: Principles of Embedded Computing Systems Design, Morgan-Kaufmann.
3. Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley.

**Cloud Computing**

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

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Introduction to Cloud Technologies, Study of Hypervisors, Compare SOAP and REST, Webservices, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization
Multitenant software: Multi-entity support, Multi-schema approach, Multi tenance using cloud data stores, Data access control for enterprise applications

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable,
HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce, Features and comparisons among GFS,HDFS etc, Map-Reduce model

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control Identity management, Access control, Autonomic Security Cloud computing security challenges: Virtualization security management virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.

Issues in cloud computing, Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.
Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Cloud computing platforms, Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform,

REFERENCES


1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
2. Enterprise Cloud Computing by Gautam Shroff,Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4. Google Apps by Scott Granneman,Pearson
5. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY)
6. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,
7. Cloud Computing Bible by Barrie Sosinsky, Wiley India
8. Stefano Ferretti et.al., QoS–aware Clouds", 2010 IEEE 3rd International Conference on Cloud Computing


**Real Time System**

Introduction to real time system, embedded systems and reactive systems; Hard and soft real time systems; handling real time; specification and modeling; design methods; real time operating


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systems; validation and verification; real time process and applications; distributed real time systems.

REFERENCES

1. Resource Management in Real-time Systems and Networks, C. Siva Ram Murthy and G. Manimaran, MIT Press, March 2001.
2. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.
3.Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.
4. Krishna and Shin, "Real-Time Systems," Tata McGraw Hill. 1999.

**Image Processing**

Digital Image Fundamentals: A simple image model, Sampling and Quantization, Imaging Geometry, Digital Geometry, Image Acquisition Systems, Different types of digital images.
Bilevel Image Processing: Basic concepts of digital distances, distance transform, medial axis transform, component labeling, thinning, morphological processing, extension to grey scale morphology.
Binarization and Segmentation of Grey level images: Histogram of grey level images, Optimal thresholding using Bayesian classification, multilevel thresholding, Segmentation of grey level images, Water shade algorithm for segmenting grey level image.
Detection of edges and lines in 2D images: First order and second order edge operators, multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking.
Images Enhancement: Point processing, Spatial Filtering, Frequency domain filtering, multi-spectral image enhancement, image restoration.
Color Image Processing: Color Representation, Laws of color matching, chromaticity diagram, color enhancement, color image segmentation, color edge detection, color demosaicing.
Image Registration and depth estimation: Registration Algorithms, Setreo Imaging, Computation of disparity map.
Image compression: Lossy and lossless compression schemes, prediction based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

References

1. Gonzalez and Woods, Digital Image Processing, Prentice-Hall.

## CS/MSC/304 Wireless Network and Web Technology

Evolution of mobile radio communication fundamentals. Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model. Small scale fading & multi-path propagation and measurements, impulse response model and parameters of multi-path channels, types of fading, theory of multi-path shape factor for fading wireless channels.

Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum(FH-SS), performance of DS-SS, performance of FH-SS, modulation performance in fading and multi-path channels, fundamentals of equalization, equalizer in communication receiver, survey of equalization techniques, linear equalizer, linear equalizer, non-linear equalizations, diversity techniques, RAKE receiver.

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Characteristics of speech signals, quantisation techniques, vocoders, linear predictive coders, time division multiple access, space division multiple access, and frequency division multiple access.

Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.

References:

1. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson

Reference Books:

1. Willium C. Y. Lee, “Mobile communication Design and fundamentals”
2. D. R. Kamilo Fehar, “Wireless digital communication”
3. Haykin S & Moher M., “Modern wireless communication”, Pearson, 2005.
4. R. Pandya, “ Mobile and personal communication system”, PHI.

### CS/MSC/305 AI Lab

Problems and assignment based on Paper CS/MSC/302 (Module - I).

### CS/MSC/306 Module – I Advanced Operating System Lab

Problems and assignment based on Paper CS/MSC/301.

### CS/MSC/306 Module -II Web Technology Lab

Problems and assignment based on Paper CS/MSC/304.

### CS/MSC/401 Project/Masters Thesis

Industrial or Research work for a period of six months in an industry or academic Institution.

### CS/MSC/402 Seminar

Seminar Presentation on a given topic.

### CS/MSC/403 Grand Viva

Viva – voce on subject studied throughout the course.

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