NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (HP)-177005

Modified Teaching Scheme M.Tech., COMPUTER SCIENCE & ENGINEERING
(July 2010 onwards)

FIRST SEMESTER

S.No.	Course No.	Course Title	L	T	P	C
1.	CSE-511	Parallel Processing	3	0	0	3
2.	CSE-512	Theory of Computer Science	3	0	0	3
3.	CSE-513	Database Systems	3	0	2	4
4.	CSE-514	Operating System	3	0	2	4
5.	CSE-EL-1		3	0	0	3
6.	CSE-516	Laboratory – I	0	0	3	2
		Total	**15**	**0**	**7**	**19**

SECOND SEMESTER

S.No.	Course No.	Course Title	L	T	P	C
1.	CSE-521	Software Engineering	3	0	0	3
2.	CSE-522	Topics in Computer Networks	3	0	2	4
3.	CSE-523	Algorithm Analysis & Design	3	0	0	3
4.	CSE-El-2		3	0	0	3
5.	CSE-El-2		3	0	0	3
6.		Open Elective (from other Dept)	3	0	0	3
7.	CSE-524	Laboratory – II	0	0	3	2
		Total	**18**	**0**	**5**	**21**

THIRD SEMESTER

S.No.	Course No.	Course Title	L	T	P	C
1.	CSE-600	Seminar	0	0	3	4
2.	CSE–El-3		3	0	0	3
3.	CSE-700	Dissertation (also to be continued in the IV semester)	0	0	6	6
		Total	**3**	**0**	**9**	**13**

FOURTH SEMESTER

S.No.	Course No.	Course Title	L	T	P	C
1.	CSE-700	Dissertation (also to be continued in the III semester)	0	0	0	14
		Total	**0**	**0**	**0**	**14**

Elective-1	Elective-2	Elective-3	Open Elective
CSE-EI-1(a) Multimedia Technology	CSE-El-2(a) Computer Vision and Image Processing	CSE-El-3(a) Logic and Functional Programming	CSE-520(a) Database Management System
CSE-EI-1(b) Data Mining	CSE-El-2(b) Distributed Computing System	CSE-El-3(b) Machine Translation	
CSE-El-1(c) Computer Graphics	CSE-El-2(c) Mobile Computing	CSE-El-3(c) Knowledge Discovery	
CSE-El-1(d) Object Oriented Software Modeling	CSE-El-2(d) Soft Computing	CSE-El-3(d) Software Architecture	
CSE-El-1(e) Artificial Intelligence	CSE-El-2(e) Network Programming	CSE-El-3(e) Embedded System	
CSE-El-1(f) Topics in Internet Technologies	CSE-El-2(f) Cryptography/Computer Security	CSE-El-3(f) Natural Language Processing Semantics	
CSE-El-1(g) Simulation and Modeling	CSE-El-2(g) Electronic Commerce	CSE-El-3(g) Advanced Topics in Algorithms and data Structure	
	CSE-El-2(h) Topics in Database Systems		
	CSE-El-2(i) Multimedia Information System		
	CSE-El-2(j) Fault Tolerance Computing		
	CSE-El-2(k) Real Time Systems		
	CSE-El-2(l) Software Project Management		
	CSE-El-2(m) Natural Language Processing		
	CSE-El-2(n) CAD of Digital Systems		
	CSE-El-2(o) Algorithms in Coding		
	CSE-El-2(p) Intelligent Agents		

L	T	P	C
3	0	0	3

CSE-511 Parallel Processing

Parallel Computer Models: The state of computing, multiprocessors and multicomputers,multivector and SIMD computers, architectural development tracks.
Program and Network Properties: conditions of parallelism, program partitioning and scheduling, program flow mechanisms.
Processor architecture: pipelining, vector processing, superscalar processors, hardware and compiler support for branch prediction, out-of-order Instruction issue, speculative execution and other techniques for high-performance, Instruction and data cache organizations, multilevel caches, parallel memory systems, Support for virtual memory, Multiple processor systems, taxonomy, programming models, message passing systems, Interconnection networks, shared memory system, memory models, cache coherence, I/O system, parallel disk organizations, Introduction to advanced topics.
System Interconnect Architectures: Network properties and routing, static interconnection networks and dynamic interconnection networks.
Processors and Memory Hierarchy: Advanced processor technology- CISC, RISC, Superscalar,Vector, VLIW and symbolic processors, Memory hierarchy technology, Virtual memory technology. Multivector Multiprocessors and Data Flow Architecture.

Books and Referances

1. Kai Hwang “Advanced Computer Architecture”, MGH .
2. Hennessy, J.L., and Patterson, D.A., Computer Architecture, A quantitative Approach, Morgan Kaufmann.
3. J.P.Hayes “Computer Architecture and Organization”, MGH.
4. Harvey G. Cragon, “Memory Systems and Pipelined Processors”, Narosa Publication.
5. V. Rajaranam & C.S.R. Murthy, “Parallel Computers”, PHI.
6. R. K. Ghose, Rajan Moona & Phalguni Gupta, “Foundation of Parallel Processing”, Narosa Publications.
7. Kai Hwang and Zu, “Scalable Parallel Computers Architecture”, MGH.
8. Stalling W., “Computer Organization & Architecture”, PHI.
9. Stone, H.S., High-Performance Computer Architecture Addison-Wesley Current Literature

L	T	P	C
3	0	0	3

CSE-512 Theory of Computer Science

Machines
Basic machine, FSM , Transition graph, Transition matrix, Deterministic and non-deterministic FSM'S, Equivalence of DFA and NDFA, Mealy & Moore machines, minimization of finite automata, Two-way finite automata.

Regular Sets and Regular Grammars
Alphabet, words, Operations, Regular sets, Finite automata and regular expression, Pumping lemma and regular sets, Application of pumping lemma, closure properties of regular sets.

Formal Grammars & Languages
Basic definitions and examples of languages, Chomsky hierarchy, Regular grammars, context free & context sensitive grammars, context free languages, non-context free languages, Chomskey normal forms, binary operations on languages.

Turing Machines & Pushdown Automata
TM model, representation and languages acceptability of TM Design of TM, Universal TM & Other modification, composite & iterated TM, Pushdown automata , Acceptance by PDA.

Computability
Basic concepts, primitive & partial recursive function, Recursive function, Decidability, Kleen's theorem.

Undecidibility
Properties of recursive & recursively enumerable languages, Universal Turing machine and an undecidable problem, Rice's theorem & some more undecidable problems.

Computational complexity Theory
Definition, linear speed-up, tape compression & reduction in number of tapes, Hierarchy Theorem, Relation among complexity measures, Transition lemmas & non deterministic hierarchies, properties of general complexity measures, the gap, speed-up, union theorem, Automatic complexity theorem.

Text Book
1. John E. Hopcroft, Jeffery Ullman, Introduction to Automata theory, Langauges & computation, Narosa Publishers.

Reference Books
1. E.V. Krishnamurthy, Introductory Theory of computer science.
2. K.L.P. Mishra, Theory of computer Science, Prentice Hall of India Pvt. Ltd.

L	T	P	C
3	0	2	4

CSE-513 Database Systems

Basic concepts: database & database users, characteristics of the database, database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, data modeling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems.

Relational model, languages & systems: relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: date definition in SQL, view and queries in SQL, specifying constraints and indexes in sql, a relational database management systems, DB2. DB2 Architecture, Logical Data Structures Physical Data Structure, Instances, Table Spaces, Types of Table spaces, Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.

Relational data base design: function dependencies & normalization for relational databases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

Concurrency control & recovery techniques: concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures. Object-oriented Databases, Distributed and Parallel Databases, Multi-databases, Access Methods, Transaction Management, Query Processing, Deductive Databases, multimedia Databases, Real-Time Databases, Active Databases, Temporal Databases, Mobile Databases, Database Benchmarks, Database Security, Data Mining and Data Warehousing.

Books and References

1. Desai, B., “An introduction to database concepts”, Galgotia publications.
2. Readings in Database Systems edited by M. Stonebraker, Morgan Kaufmann, 2nd ed., 1994 Conference and Journal papers
3. Date, C. J. , “An introduction to database systems”, 7rd Edition, Addison Wesley.
4. Date, C. J. , “An introduction to database systems”, 3rd Edition, Narosa publishing house.
5. Elmsari and Navathe, “Fundamentals of database systems”, Addison Wesley.
6. Ullman, J. D., “Principals of database systems”, Galgotia publications.
7. DB2 Manuals

L	T	P	C
3	0	2	4

CSE-514 Operating Systems

Overview: Importance of Operating Systems; Basic Concepts and Terminology; An Operating System Resource Manager: Memory Management Functions, Processor Management Functions, Device Management Functions, Information Management Functions.

Process Management:

Processes: Concept, Job Scheduler, Process Scheduling, operation on process, Threads, Overview of Inter-process communication CPU Scheduling: Scheduling criteria, Scheduling Algorithms, Algorithm Evaluation

Process Synchronization: Synchronization Hardware, Semaphores, and Classical Problem of Synchronization, Monitors and Atomic Transaction

Deadlocks: System model, Deadlock Characterization, Deadlocks Prevention, Deadlocks Avoidance, Deadlocks Detection, Recovery from Deadlock

Storage Management:

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation and Segmentation with Paging

Virtual Memory: Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing, and Demand Segmentation

Information Management: Introduction; File Concept, Directory Structure, Protection, Overview of File-SystemStructure, Allocation Method, Free-Space Management, Directory Implementation

I/O Systems: I/O Hardware, Application of I/O interface, Overview of Kernel I/O Subsystem, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Reliability.

Selected topics in operating systems of topical interest: Design, implementation, correctness and performance related aspects. Past offerings included study of subsystems such as process, storage and network subsystems.

Books and Referances

1. Silberschatz and Galvin, “ Operating System Concepts”.
2. Tannenbaum, “Operating systems Concepts”, PHI.
3. Peterson, “Operating System”.
4. Madnick E., Donovan J., “Operating Systems”, Tata McGraw Hill.

L	T	P	C
3	0	0	3

CSE-521 Software Engineering

Introduction:
Problem domain, software engineering challenges, software engineering approach.

Software Processes:
Software process, characteristics of software process, software development process models, other processes.

Software Requirements analysis and specification:
Software requirements, problem analysis, requirements specification, functional specification with use cases, validation, matrices.

Software Architecture
Role of software architect, architecture views, component and connector view, architecture style for C & C view, discussion and evaluating architectures.

Planning a software project:
Effort estimation, project scheduling and staffing, software configuration management plan, quality assurance plan, risk management, project monitoring plan.

Function oriented design:
Design principles, module level concepts, design notation and specification, structured design methodology, verification, metrics.

Object oriented design:
OO concepts, design concept, Unified Modeling Language, design methodology, metrics.

Detailed Design, Software Measurements, metrics and Models:
Detailed design and PDL, verification, Metrics and their scope, Qualities of a good Software metrics, classification of metrics, Cost estimation models COCOMO, Quality attributes, SQA, Quality Standards, ISO 9000 and CMM.

Coding
Programming principles and guidelines, coding process, refactoring, verification, metrics.

Testing
Testing fundamentals, black-box testing, white-box testing, testing process, defect analysis and prevention, metrics - reliability estimation.

CASE Tools: Types of CASE tools, advantages and components of CASE tools, Unified Modelling Language (UML)

Text Books

1. An integrated approach to software engineering, Pankaj Jalote, 3rd edition, Narosa Publishing.
2. Pressman Roger R, "*Software Engineering: A Practitioner's Approach*", TMH

Reference Books

1. Fundamentals of Software Engineering Rajib Mall, Pretence Hall of India.
2. Software Engineering, Ian Sommerville , Addition- Wesley Publishing Company.
3. Tom Pender "*UML Bible*", Wiley Dreamtech
4. Ian Sommerville, "*Software Engineering*", 5th edition, Addison-Wesley
5. Wamman S Jawadkar, "*Software Engineering*", Tata McGraw-Hill.

L	T	P	C
3	0	2	4

CSE-522 Topics in Computer Networks

Introduction: Overview of computer networks, seven-layer architecture, TCP/IP suite of

protocols, etc. MAC protocols for high-speed LANS, MANs, and wireless LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless ethernet, etc.)Fast access technologies. (For example, ADSL, Cable Modem, etc.)

IPv6: Why IPv6, basic protcol, extensions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, routing. Changes to other protocols. Application Programming Interface for IPv6. 6bone.

Mobility in networks. Mobile IP. Security related issues. IP Multicasting. Multicast routing protocols, adderss assignments, session discovery, etc. TCP extensions for high-speed networks, transaction-oriented applications. Other new options in TCP.

Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, Keydistribution protocols. Digital signatures, digital certificates.

Books and References

1. W. R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley, 1994.
2. G. R. Wright. TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley,1995.
3. W. R. Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, andthe Unix Domain Protocols, Addison Wesley, 1996.
4. R. Handel, M. N. Huber, and S. Schroeder. ATM Networks: Concepts, Protocols,Applications, Addison Wesley, 1998.
5. W. Stallings. Cryptography and Network Security: Principles and Practice, 2nd Edition,Prentice Hall, 1998.
6. C. E. Perkins, B. Woolf, and S. R. Alpert. Mobile IP: Design Principles and Practices,Addison Wesley, 1997.

L	T	P	C
3	0	0	3

CSE-523 Algorithm Analysis and Design

Algorithms Introduction:
Algorithm Design paradigms- motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations.

Divide and Conquer approach:
Structure of divide-and-conquer algorithms: sets and disjoint sets: Union and Find algorithms, quick sort, Finding the maximum an minimum, Quick Sort, Merge sort, Heap and heap sort,.

Greedy Algorithms:
Optimal storage on tapes, Knapsack problem, Job sequencing with deadlines, Minimum Spanning trees: Prim's algorithm & Kruskal's algorithm, Huffman codes.

Graph Algorithms:
Representation of graphs, BFS, DFS, Topological sort, strongly connected components; single source shortest paths: Bellmen-Ford algorithm, Dijkstra's algorithm; All pairs shortest path: The Warshall's algorithm.

Dynamic programming: Overview, difference between dynamic programming and divide and conquer, Matrix chain multiplication, Traveling salesman Problem, longest Common sequence, 0/1 knapsack.

Backtracking: 8-Queen Problem, Sum of subsets, graph coloring, Hamiltonian cycles.

Branch and bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem

Computational Complexity: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

TEXT BOOKS

1. E.Horowitz And S.Sahni, Fundamentals Of Computer Algorithms, Galgotia.
2. T.H.Cormen, C.E. Leiserson, R.L. Rivest, Introduction To Algorithms, The MIT Press,Cambridge.

REFERENCE BOOKS

1. A.V. Aho, J.E. Hopcroft And J.D. Ullman, The Design And Analysis Of Computer Algorithms, Addison Wesley.

L	T	P	C
3	0	0	3

CSE-El-1(a) Multimedia Technology

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

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, hyper applications.

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 wok place, High Definition Television and desktop computing, HDTV standards, Knowledge based Multimedia systems, Anatomy of an Intelligent Multimedia system.

Books and Referances
1. John F. Koegel Buford, Multimedia Systems, Pearson Education.
2. Nalin K. Sharda, Multimedia Information Networking, Prentice Hall.

L	T	P	C
3	0	0	3

CSE-El-1(b) Data Mining

Introduction
Data mining – Data mining functionalities – kinds of patterns can be mined – classification – major issues. Data warehouse – A multidimensional data model – Data warehouse architecture – Data warehouse implementation – From data warehouse to data mining

Data Pre-Processing
Data cleaning – Data Integration and Transformation – Data Reduction – Discretization and concept hierarchy generation – Data mining primitives – Data mining Task – A data mining query language - Architecture of Data mining systems – Characterization and comparison

Association Rule Mining
Mining single dimensional Boolean association rules from transactional databases – mining multilevel association rules from transaction databases-mining multidimensional association rules from Relational databases and Data warehouses – From association mining to correlation analysis – constraint-based association mining

Classification and Prediction
Issues regarding classification and prediction – classification by decision Tree Induction – Bayesian Classification – Classification by Back propagation –classification based on concepts from association rule mining – other classification methods – prediction – classifier accuracy

Applications and Trends in Data Mining
Data mining system products and Research prototypes – Additional themes on Data mining – Social Impacts of Data Mining – Trends in Data mining – Realization to data mining using SQL Server, Case studies in building business environment, Application of data ware housing and Data mining in Government, National Data ware houses and case studies.

Text Book

1. Jiawei Han and Michelien Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann.

Reference Book

1. Alex Berson and Stephen Smith, Data Warehousing, Data mining and OLAP, McGraw Hill

L	T	P	C
3	0	0	3

CSE-El-1(c) Computer Graphics

Introduction to Computer Graphics
Overview of Graphics Systems, Display Devices, Hard copy Devices. Interactive Input Devices, Display Processors, The Graphical Kernel System, Output Primitives, Line drawing algorithms, Circle Generation algorithms, Character Generation.

Raster Scan Graphics
Line Drawing Algorithms, Circle Generation, General Function Rasterization, Scan Conversion- Generation of the display, Image Compression, Polygon Filling , Fundamentals of Antialiasing.

Two-Dimensional Geometric Transformation & Viewing
Basic Transformation, Translation, Rotation, Scaling, Other Transformation Reflection, Shear, Transformation functions, Window to viewport co-ordinate transformation, Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping.

Three- Dimensional Concepts & Object Representations
Three Dimensional Display Methods, Parallel Projection, Perspective Projection, Translation, Rotation, Scaling, Composite Transformation, Three dimensional Transformation function, Polygon Surfaces, Curved Lines and surfaces, Bezier Curves and surfaces, B-Spline Curves and surfaces.

Graphics hardware
Display technology, random scan, raster scan display processing, input devices for interaction.

Visible Lines and Visible Surfaces
Visual Realism, Hidden line and hidden surface removal : depth buffer algorithm, geometric computations, scan line coherence algorithms, area coherence algorithms, priority algorithm., shading and color models, Modeling methods.

Rendering
A simple illumination model, Transparency, Refraction effects in transparent materials, Simple Transparency Models, Z-Buffer Transparency, Shadows, Texture.

Text Books
1. D.F. ROGERS, Procedural Elements for Computer Graphics, McGraw Hill.
2. HEARN and BAKER, Computer graphics, PHI

Reference Books
1. S. HARRINGTON, Computer Graphics - A programming approach, McGraw Hill.
2. D.F. ROGERS, Mathematical Elements for Computer Graphics, McGraw Hill.

L	T	P	C
3	0	0	3

CSE-El-1(d) Object Oriented Software Modeling

Unified Modeling Language, (UML), Use case modeling , Methodologies for objectoriented analysis and design (OOAD), Design patterns, CASE tool support for OOAD and automatic code generation, Precise modeling (using OCL-Object Constraint Language) and analysis of software models, Model driven architecture (MDA), Modeling language design meta modeling , UML Profiles, Advanced Modeling topics: Aspect oriented modeling, Modeling non functional properties, round-trip engineering, modelbased testing, open research questions.

Books and references:
To be conveyed by the teacher

L	T	P	C
3	0	0	3

CSE-El-1(e) Artificial Intelligence

Introduction
Introduction to AI, AI techniques, level of model ,criteria for success, Turing test

Problems, Problem Spaces &Search
Defining problem as a space, search, production system, problem characteristics, production system characteristics, issues in the design of search programs.

Heuristics Search Strategies
Generate and test, Hill climbing, best first search(A^*), problem reduction(AO^*), constraint satisfaction,Means Ends analysis.

Knowledge Representation Issues
Representations and mappings, Approaches to knowledge representation, The frame problem, Semantic network, Frame representation.

Using Predicate Logic
Representing simple facts in logic, representing instance and is-a relationship, Computable functions and predicates, Resolution, Natural deduction.

Representing Knowledge Using Rules
Procedural Vs Declarative knowledge, Logic programming, Forward and Backward searching, Matching knowledge representation.

Game Playing and Search
Introduction, Min-Max algorithm, Alpha-Beta cut off, Example of Games.

Intelligent Systems
Learning Model, Types of Learning, Components of an Expert System, categories of Expert System, stages of Development of Expert System, Expert System Development Tools., Overview of fuzzy systems, ANN, Swarm Intelligent systems

Text Books

1. N.J. NILSSON, Principles of artificial Intelligence, Narosa Publishing House.
2. E. RICH AND KNIGHT, Artificial Intelligence, McGraw Hill International.

Reference Books

1. PETERSON, Artificial Intelligence, PHI Ltd.
2. R.FORSYTH, Expert systems, Principles and Case Studies, Chapman and Hill.
3. R. KELLER, Expert system Technology Development and Application, Yourdon Press.

L	T	P	C
3	0	0	3

CSE-El-1(f) Topics in Internet Technologies

Today the Internet is being used for myriad of applications – electronic publishing, electronic commerce, distance education, collaborative working, etc. This course intends to investigate the underlying principles and practices that support these applications.

Introduction to computer networks; Content preparation – HTML, DHTML, VRML, SGML, XML and other markup schemes; Images – compression, formats; Audiocompression, formats; content Delivery, - protocols-HTTP and variants, Internet servers, proxy servers; Search engines; Data on the web; Content Display – browsers, plugins, helper applications; Interactivity – Java, Active-X; Component technologies, Javabeans,

COBRA; Security. Electronic payment systems, Firewalls, Encryption, Watermarks; Performance, Benchmarking the web.

Books, References, Websites

1. www.w3.org
2. www.ietf.org
3. www.omg.org
4. www.xml.org
5. www.microsoft.com/com
6. java.sun.com
7. Research papers

L	T	P	C
3	0	0	3

CSE-El-1(g) Simulation and Modeling

Fundamentals

Definition and reasons for simulation, Continuous (time-oriented) and discrete (event) systems, Modeling/programming simple deterministic systems, Rates and system dynamics.

Concepts in Simulation

Stochastic variables; discrete vs continuous probability; algorithms for generating random numbers, their comparison with respect to speed and validity; continuous uniformly distributed random numbers; methods for generating non-uniform distributions.

Building Simulation Programming Models

Arrival patterns, service times, and queue formation. Formulating systems as events and entities (such as resources, queues, gates, and linkages). Congestion in systems; arrival patterns; Poisson arrivals; the exponential distribution; the coefficient of variation; service times; normal distribution; queuing disciplines; Measures for Queues; Analytic Solutions of Queuing Problems; Utilization as a Design Factor; Other factors like grade of service.

Discrete Event System Simulation

Discrete events; representation of time; queues and servers; generation of arrival patterns; resource seizing; departures simulation of a telephone system and computer networks; simulating components of an operating system; delayed calls; modeling policies; priority queues; tasks; gathering statistics; counters and summary statistics; measuring utilization and occupancy; recording distributions and transit times.

Introduction to a Simulation Languages

Simulation in C++, GPSS, Simulations Packages, Trends in simulation Software. SIMSCRIPT programs; SIMSCRIPT system concepts; organization of a SIMSCRIPT program; blocks, names, and labels; SIMSCRIPT statements; entities, events, and activities; defining the system; defining the system model; referencing variables; the procedural structures; arrival event; timing routine; disconnect event; closing event; execution, debugging and validation; interpreting outputs and system optimization via modification.

Books and Referances

1. Simulation Modeling and Analysis, Law and Kelton, McGraw-Hill, Third Edition 2000.
2. Discrete-Event System Simulation, (Second Edition), Banks, Prentice-Hall, 1996.
3. Getting Started in GPSS, Dunning, Engineering Press, San Jose, CA, 1985.
4. Simulation Model Design and Execution, Fishwick, Prentice-Hall, 1995.

L	T	P	C
3	0	0	3

CSE-El-2(a) Computer Vision and Image Processing

Introduction
Digital image representation, Fundamental steps in image processing, Elements of Digital Image processing systems, Elements of visual perception, Image model, Sampling and quantization, Relationship between pixels, Imaging geometry.

Image Enhancement
Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters, Frequency domain: Low-Pass, High-Pass, Homomorphic filtering.

Image Compression
Coding redundancy, Inter-pixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real-Time image transmission, JPEG and MPEG.

Image Segmentation
Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion in segmentation, Spatial techniques, Frequency domain techniques.

Spatial Operations and Transformations
Spatially dependent transform template and convolution, Window operations, 2-Dimensional geometric transformations.

Pattern Recognition
Classification and description, Structure of a pattern recognition system, feature extraction, Classifiers, Decision regions and boundaries, discriminent functions, Supervised and Unsupervised learning, PR-Approaches statistics, syntactic and neural.

Statistical Pattern Recognition
Statistical PR, Classifier Gaussian Model, Classifier performance, Risk and error, Maximum likelihood estimation, Bayessian parameter estimation approach, Clustering for unsupervised learning and classifiers.

Text Books

1. R. GONZALEZ and R. E. WOOD, Digital Image Processing, Prentice Hall of India.
2. ANDRIAN LOW, Introductory Computer Vision and Image Procession, McGraw Hill CO.
3. ROBERT SCHOLKOFF and JOHN WILLEY & SONS, Pattern Recognition-Statistical, Structural and neural approach.

Reference Books

1. W.K. PRATT, Digital Image Processing, McGraw Hill.
2. A. K. JAIN, Fundamentals of Image Processing.

L	T	P	C
3	0	0	3

CSE-El-2(b) Distributed Computing Systems

Introduction to Distributed System
Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems.

Communication
Layered protocols, Remote procedures call, Remote object invocation, Message-oriented communication, Stream-oriented communication.

Processes
Threads, Clients, Servers, Code Migration, Software agent.

Naming
Naming entities, Locating mobile entities, Removing un-referenced entities.

Synchronization
Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions.

Consistency and Replication
Introduction, Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols.

Fault Tolerance
Introduction, Process resilience, Reliable client server communication, Reliable group communication. Distributed commit, Recovery.

Security
Introduction, Secure channels, Access control, Security management.

Distributed File System
Sun network file system, CODA files system.

Case Study
CORBA, Distributed COM, Globe, Comparison of CORBA, DCOM, and Globe.

Text Books
1. G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts and Design, Pearson Education
2. Taunenbaum, Distributed Systems: Principles and Paradigms, PHI.

Reference Book
1. M. Singhal & N. Shivaratri, Advanced Concepts in Operating Systems, TMH.

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CSE-El-2(c) Mobile Computing

Introduction : Challenges in mobile computing, coping with uncertainties, resource poorness, bandwidth, etc. Cellular architecture, co-channel interference, frequency reuse, capacity increase by cell splitting.
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.
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 .
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.
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 .
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 .
Data Dissemination and Management: Challenges, Data dissemination, Mobile data replication, Mobile data caching, Mobile cache maintenance, mobile web caching, caching in ad hoc networks.
Context Aware Computing: Ubiquitous computing, concept of context, context aware computing and applications, middleware support.
Mobile Middleware: Service discovery, adaptation, mobile agents.
Wireless security: Traditional security issues, mobile and wireless security issues, Problems in ad hoc networks.

Text Books

1. *Frank Adelstein, S.K.S. Gupta, Golden G. Richard III* and *Loren Schwiebert,* Fundamentals of Mobile and Pervasive Computing, McGraw-Hill Professional.
2. D.P. Agrawal and Q.-A. Zeng, Introduction to Wireless and Mobile Systems, Thomson Brooks/Cole.

Reference Books

1. K. Pahlavan and P. Krishnamurthy, Principles of Wireless Networks, Prentice Hall.
2. Siva Ram Murthy and B.S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Pearson.

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CSE–EI–2(d) Soft Computing

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

Fuzzy Logic:
Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information:
Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Introduction of Neuro-Fuzzy Systems: Architecture of Neuro Fuzzy Networks.

Application of Fuzzy Logic: Medicine, Economics etc.

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

Swarm Intelligence: Ant Colony system, PSO system.

Text Books

1. Anderson J.A., “An Introduction to Neural Networks”, PHI,
2. Hertz J. Krogh, R.G. Palmer, “Introduction to the Theory of Neural Computation”, Addison-Wesley,
3. G.J. Klir & B. Yuan, “Fuzzy Sets & Fuzzy Logic”, PHI,
4. Melanie Mitchell , “An Introduction to Genetic Algorithm”, PHI,

Reference Book

1. Freeman J.A. & D.M. Skapura, “Neural Networks: Algorithms, Applications and Programming Techniques”, Addison Wesley

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CSE-El-2(e) Network Programming

Inter-process communication, socket programming, pseudo terminals; TCP/IP stack;

Application Protocols, with example implementations: SMTP, HTTP, FTP; Algorithms and protocols for routing and forwarding; Network information discovery and retrieval, web servers, robots and search engines, security issues, firewalls and encryption; XML technologies.

Books

1. Stevens, Unix Network Programming, Vol. 1. Second edition, Prentice-Hall, 1999
2. Stevens, Unix Network Programming, Vol. 2, Second edition, Prentice-Hall, 1999
3. Current on-line literature

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CSE-El-2(f) Cryptography/Computer Security

Introduction

Introduction to OSI Network Security Architectures, Services, Mechanisms and Attacks, Classical Encryption Techniques, Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

Block Cipher and Data Encryption standards

Classical Encryption Techniques, Introduction to DES, differential and Linear Cryptanalysis, Block Cipher Cryptography, Triple DES Algorithm, International Data Encryption Algorithm (IDEA), Blowfish Algorithm, RC-x Algorithms, CAST-x Algorithms, Symmetric Block Cipher Schemes, Encryption Function Placement and Confidentiality problems.

Public-Key Cryptography and Message Authentication

The Key Distribution Problem, Random Number Generation, The Public-Key Cryptosystems, The RSA Algorithm, The Key Management riddle, The Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Introduction to Message Authentication, requirements and functions, Message Authentication Codes, Hash Functions, their Security and other considerations

Authentication Applications

The Message Digest (MD5) Algorithm, The Secure Hash Algorithm (SHA-1), RIPEMD-x and HMAC fundamentals, Digital Signature basics, Authentication Protocols, The Digital Signature Standard, Introduction to the Kerberos Authentication scheme, The X.319 Directory Authentication scheme.

Electronic Mail and IP Security

Fundamentals of the E-mail security, PGP, The S/MIME Standard, The IP Security Framework, The Authentication Header scheme, The ESP scheme, Hybrid schemes and Key Management problems

Web Security and network management

Web-based Security frameworks, requirements, The SSL and TLS frameworks, A review of Web-security solutions, Introduction to Intrusion Detection, On the Virus, Worm and similar security threats, Introduction to Firewall Systems, On the Trusted Systems, A Case-study / Design of an Internet Security System.

Books and References

1. William Stallings, Cryptography and Network Security: Principles and Practice, Third Edition, Pearson Education, New Delhi, 2001.
2. C. Kaufman, R. Perlman and M. Spenser, Network Security, Second Edition, Prentice-Hall, Englewood Cliffs, 2002.
3. S. Bellovin and W. Chesvick, Internet Security and Firewalls, Second Edition, Addison-Wesley, Reading, 1998

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CSE-El-2(g) Electronic Commerce

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

Consumer Oriented Electronic commerce - Mercantile Process models.

Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

Inter Organizational Commerce - EDI, EDI Implementation, Value added networks.

Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.

Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processings, Desktop video conferencing.

Text Books

1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

Reference Books

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.
3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
4. Electronic Commerce – Gary P.Schneider – Thomson.
5. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico Traver.

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CSE- El-2(h) Topics in Database Systems

Overview of database management
Traditional database models, relational model, relational languages, SQL and Embedded SQL.

Conceptual database design
Conceptual database design process, ER model, generalization, specialization and aggregation, conventions, ternary and higher order relationships and concept of cardinalities in such relationships.

Logical database design
Relational Database design and update anomalies, structures, guidelines for relational schema, normalization, dependencies, transformation of entity relationship model into relational schema.

Physical database design
Database performance, tables using operating system files, multi-table files and table fragmentation clustered table organization, page organization, indexing, B-Tree, B+ Tree, B-tree organizations, ISAM organization, clustered and non clustered indexes, hashing, static and dynamic hashing, buffer management, physical design features .

Query processing
Query processing stages, query Interpretation, query resource utilization, query execution, estimation of query processing cost, table scants, simple index access, fill factor, multiple index access, methods for join tables, (nested loop, merge join, hybrid join, multiple table join); structure of query optimizer, examples from one or two actual contemporary database management software.

Transaction Processing
Types of Failures of applications, transaction, properties, schedules and recoverability, serializability of schedules, levels of transaction, consistency, deadlocks, transaction performance, bench marking, transaction in contemporary database management systems.

Crash Recovery
Failure classification, recovery concepts based on deferred update, recovery concepts based on intermediate update, shadow paging, check points, on-line backup during database updates, case study from contemporary database management software.

Concurrency Control
Techniques based on time stamp ordering, multi-version techniques, optimistic techniques, multiple granularity, case studies Distributed Databases, distributed database concepts, architecture and design of distributed database, query processing, recovery, federated databases, asynchronous replication concepts, distributed database features in contemporary database management systems.

Client/Server Databases

Client/Server concepts, approach, Client/Server environments, characterization of Client/Server computing, application partitioning, the two-layer, and the Three layer architecture, Client/Server communication, APIs in Client/Server computing, middleware technology, application developments, design concepts, Client application development tools, and database servers.

Integrity, Security and Repositories
Needs for database integrity, integrity constraints, non-procedural integrity constraints, integrity constraints specifications in SQL, introduction to database security mechanism, security specification in SQL, system catalogues.

Emerging Database Trends
Object-Oriented databases, active databases, deductive databases, concept of next generation databases, data warehouses and executive information system, data mining, parallel query processing: multi-media databases.

Text Books
1. H Korth, A Silberschatz, "*Database System Concepts*", McGraw-Hill
2. R Elmasri, S Navathe, "*Fundamentals of database Systems*", Benjamin Cummings
3. Bipin Desai, "*An introduction to database Systems*", Galgotra Publications, West Publishing

Reference Books
1. Peter Rob, Carlos Coronel, "*Database Design and Implementation and Management*", Wadsworth Publishing Company
2. C J Date, "*An introduction to Database Systems, Volume I*", Addison-Wesley.

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CSE-El-2(i) Multimedia Information Systems

Multimedia Information, Delay-sensitive and Time-based Media data Modeling, Multimedia storage and retrieval techniques, Multimedia Communications: Synchronization, delay compensation, QoS negotiation protocols, Architectures and Issues for Distributed Multimedia Systems, Prototype Multimedia systems: Video-on-Demand, Video conferencing.

Books:

1. Grosky WI, Jain R, and Mehrotra R, The Hand Book of Multimedia Information Management, Prentice-Hall1997.
2. Koegel Buford JF, Multimedia Systems, Addison-Wesley, 1994.
3. Relevant Research Papers from the Journals/Conferences.

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CSE-El-2(j) Fault Tolerant Computing

Redundancy techniques, `Fault Coverage, Computational integrity, Fault detection methods Fault identification algorithms, Exception handling, Damage assessment and confinement, System diagnosability, Diagnosis algorithms, System recovery and distribution, Reconfiguration techniques, Repairable Systems, algorithms based fault tolerance testing techniques, Test scheduling, Test pattern generation, Fault tolerant computer communication networks, Fault tolerance of Software.

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CSE-El-2(k) Real Time Systems

Introduction
Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Real Time Scheduling
Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Resources Access Control
Effect of Resource Contention and Resource Access Control (RAC), Nonpreemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

Multiprocessor System Environment
Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.

Real Time Communication
Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.

Text Books
1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Real-Time Systems: Scheduling, Analysis, and Verification by Prof. Albert M. K. Cheng, John Wiley and Sons Publications.

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CSE-E1-2(l) Software Projects Management.

Managing Software Projects, Processes and Project Management, Project Management and the CMM, Overview of the CMM, KPAs for Project Management, The Project Management Process.

Process Planning. The Standard Process, Process Tailoring, Tailoring for Short Duration Projects, Requirement Change Management, The Change Management Process.

Effort Estimation and Scheduling. Estimation and Scheduling Concepts, Effort Estimation Models. Estimating Schedule, Effort Estimation, the Use Case Points Approach. Effectiveness of the Overall Approach, Effort Estimate of the ACIC Project, Scheduling, Overall Scheduling, The Effectiveness of the Approach,Detailed Scheduling.

Quality Planning, Quality Concepts, Procedural Approach to Quality Management, Quantitative Approaches to Quality Management, Quantitative Quality Management Planning, Setting the Quality Goal, Estimating Defects for Other Stages, Quality Process Planning, Defect Prevention Planning.

Risk Management. Concepts of Risks and Risk Management, Risk Assessment, Risk Identification, Risk Prioritization, Risk Control, Risk Management Planning, Risk Monitoring and Tracking.

Measurement and Tracking Planning, Concepts in Measurement, Metrics and Measurements, process Monitoring through Statistical Process Control, Measurements, Collecting Effort Data, Logging and Tracking Defects, Measuring Schedule, Measuring Size, Project Tracking.

The Project Management Plan. Team Management, Team Structure, Communication, Team development, Customer Communication and Issue Resolution, The Structure of the Project management Plan.

Configuration Management, Concepts in Configuration Management, The configuration management Process, planning and Setting Up Configuration Management,
Perform Configuration Control, Status Monitoring and Audits.

Reviews. The Review Process, Planning, Overview and Preparation, Group Review Meeting, Rework and Follow-up, one person Review, Guidelines for Reviews in Projects.

Project Monitoring and Control, Project Tracking, Activities Tracking, Defect Tracking, Issues Status Reports, Milestone analysis.

Project Closure. Project Closure Analysis, The Role of Closure Analysis, Performing Closure Analysis, Closure Analysis Report.

Books:

1. Software Project Management in Practice By Pankaj Jalote, Published by Addison Wesley Professional.

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CSE-El-2(m) Natural Language Processing

A computational framework for natural language. A framework such as LEG, GPSG or panlm in some depth. Partial description of English or an Indian language in the frame work, lexicon, algorithms and data structures for implementation of the framework.
Introduction to semantics and knowledge representation. Some applications like machine translation, database interface.

Books and References:

1. Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, NLP:A Paninian Perspective, Prentice Hall, New Delhi, 1994.
2. T.winograd. Language as a cognitive Process, Addison-Wesley, 1983.

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CSE-El-2(n) CAD of Digital Systems

Introduction
Hierarchical and Structural Design , Analog stages in CAD of Digital Systems, Y-Chart-Levels and Domains of description, Design flow and Synthesis of Taxonomy, Single Component Tools, Layout Editor, Symbolic Layout Editor, Semi-custom design approach, Schematic Editor approach, Module generator to generate specific layout.

Design Using VHDL
Existing hardware description languages, Design in VHDL, Design description, Description of component using sequence detector, Basic concepts in VHDL, Signals and variables, Timing and Control, Concurrent and sequential assignment, Library support, Block structure, structural description, Subprogram, type declaration and usage.

High Level Synthesis
Introduction to design space and constraints, High level synthesis tasks, Internal representation, Synthesis of the register transfer level structure, Scheduling: Resource constrained scheduling, Force directed scheduling, Path based scheduling, Scheduling for pipelining design, Allocation and binding, General algorithm: Clique-partitioning, Left-edge Algorithm, Bipartite Graph, Weighted bipartite Graph, Binding after allocation, Bus allocation and binding, Allocation after Scheduling, Comparison of various schemes.

Register Level Synthesis
Data path synthesis, Optimization strategies, Retiming and Resynthesis, Resource allocation and assignment, Control Synthesis, State assignment for controllers, State assignments for single PLA Controllers.

Logic Level Synthesis
Preliminaries and definitions, Two-level minimization Algorithm, ESPRESSO, Multi level logic minimization method, Sequential circuits and state assignments, Multi-level logic and state assignment, Mustang Algorithm.

Technology Mapping
Abstraction of technology, Tree, DAG, Look up tables.

Field Programmable Gate Arrays (FPGA)
FPGA, CAD system for FPGA, classification of FPGA, Programming technologies, Static RAM, Anti-fuse, EPROM, Advantages and disadvantages of FPGA, Applications of FPGA.

Text Books
1. P. Michel, U. Lauther, P. Duzy , The Synthesis Approach to digital System design, Kluwer Academic
2. Z. Navabi, VHDL –Analysis & Modelling of Digital systems, McGraw Hill.

Reference Books
1. D. Gajski, N. Dutt, A. Wu, S. Lin, High Level Syntheis, Kluwer Academic Publisher.
2. J.Bhaskar, " A VHDL Primer", Addison Wesley
3. Doglas Perry, "VHDL", MGH

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CSE–EI–2(O) Algorithms in Coding

Groups, rings, vector spaces, Galois fields, polynomial rings,Channel models, Block and convolutional codes, algebraic and finite state descriptions. Linear and nonlinear codes, BCH, Reed-Solomon and Goppa codes. The Berlekamp-Massey and Fuelid decoding algorithms. Decoding algorithms for convolutional codes, the Viterbi, Stael and Fano algorithms. Decoding beyond the minimum distance diameter. Combinatorial descriptions of block and convolutional codes. Algorithms for the construcion of minimal and tail biting trellises. Soft decision decoding algorithms. Suboptimal decoding algorithms. Iterative decoding algorithms, turbo decoding. The two way algorithm

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CSE-EI-2(p) Intelligent Agents

Introduction
Definitions of agency; properties of agents; agents and objects; comparison between agents and other softwares, agents and expert systems; agents and distributed systems; typical application areas for agent systems.

Agent Architectures
Reactive/deliberative/hybrid agents; BDI and practical reasoning agents; deductive reasoning agents, Rational Reasoning: decision-theoretic/game-theoretic foundations; bounded rationality; means-ends reasoning. the design of intelligent agents - reasoning agents (eg AgentO), agents as reactive systems (eg subsumption architecture); hybrid agents (eg PRS); layered agents (eg Interrap) a contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM! system).

Multi-Agent Systems
Designing multi agent society, Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; cooperation,- the Prisoner's dilema and Axelrod's experiments;

Interactions between self-interested agents
Auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination; Interaction languages and protocols: speech acts, KQML/KIF, the FIPA framework.

Agent coordination
Distributed problem solving, planning and task sharing; teamwork and coalition formation; negotiation (game-theoretic/heuristic/argumentation-based); matchmaking and brokering. distributed search/distributed constraint satisfaction; multiagent learning; agent-oriented software engineering; trust/norms/institutions, organisational approaches.

Text Books

1. Michael J. Wooldridge. An Introduction to Multiagent Systems, John Wiley and Sons.
2. G. Weiss (ed.). Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence, MIT Press.

Reference Books

1. Singh, M. and Huhns, M., “Readings in Agents”, Morgan Kaufmann.
2. Ferber, J., “Multi-Agent Systems”, Addison Wesley.

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CSE-El-3(a) Logic and Functional Programming

ML (CAML dialect); Lambda-calculus and combinators; abstraction and higher order functions; lazy and eager evaluation; types, polymorphism and type inference; Equations and pattern matching; SECD machine; denotational semantics of functional languages; implementing functional languages.

Introduction CAD of Digital System, Analog stages in CAD of Digital Systems, Y-Chart-Levels and Domains of description, Design flow and Synthesis of Taxonomy, Single Component Tools, Layout Editor, Symbolic Layout Editor, Semi-custom design approach, Schematic Editor approach, Module generator to generate specific layout.

Design Using VHLD
Existing hardware description languages, Design in VHLD, Design description, Description of component using sequence detector, Basic concepts in VHLD, Signals and variables, Timing and Control, Concurrent and sequential assignment, Library support, Block structure, structural description, Subprogram, type declaration and usage.

High Level Synthesis
Introduction to design space and constraints, High level synthesis tasks, Internal representation, Synthesis of the register transfer level structure,

Scheduling: Resource constrained scheduling, Force directed scheduling, Path based scheduling, Scheduling for pipelining design, Allocation and binding, General algorithm: Clique-partitioning, Leftedge Algorithm, Bipartite Graph, Weighted bipartite Graph, Binding after allocation, Bus allocation and binding, Allocation after Scheduling, Comparison of various schemes.

Register Level Synthesis
Data path synthesis, Optimization strategies, Retiming and Resynthesis, Resource allocation and assignment, Control Synthesis, State assignment for controllers, State assignments for single PLA Controllers.

Logic Level Synthesis Preliminaries and definitions, Two-level minimization Algorithm, ESPRESSO, Multi level logic minimization method, Sequential circuits and state assignments, Multi-level logic and state assignment, Mustang Algorithm.
Technology Mapping
Abstraction of technology, Tree, DAG, Look up tables.
Field Programmable Gate Arrays (Fpga)
FPGA, CAD system for FPGA, classification of FPGA, Programming technologies, Static RAM, Anti-fuse, EPROM, Advantages and disadvantages of FPGA, Aplications of FPGA.

TEXT BOOKS

1. P. Michel, U. Lauther, P. Duzy , The Synthesis Approach to digital System design, Kluwer Academic Publisher.
2. Z. Navabi, VHLD –Analysis & Modelling of Digital systems, McGraw Hill.

REFERENCE BOOKS

1. D. Gajski, N. Dutt, A. Wu, S. Lin, High Level Syntheis, Kluwer Academic Publisher.

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CSE-EI-3(b) Machine Translation

Overview of Natural Language Processing, Syntax,Semantics,Context and world of knowledge, Strategies for machine translation, Direct, Transfer and Interlingua approaches; Rule-based, Example based on Hybrid Methodologies; Construction of lexical database, Text generation, machine –aided translation, user interfaces; Example of English Hindi and Hindi English Machine Translation

Books and References :
To be Announced by the instructor.

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CSE-EI-3(c) Knowledge Discovery

This course will explore different machine learning, , knowledge discovery and data mining approaches and techniques: Concepts Learning, Decision, Tree Learning, Clustering and instance based learning, Rule induction and inductive learning.
Bayesian networks and causality, Neural networks, Genetic algorithms, Reinforcement learning, Analytical learning.

Books & References:

1. Heikki Mannila, Padhraic Smyth, Dvaid Hand. Principles of Data Mining, MIT
2. Press 2001
3. T Hastie, R Tibshirani, J H Friedman. The Elements of Statistical Learning: Data
4. Mining Inference, and Prediction, Springer Verlag, 2001
5. Jensen, F. An Introduction to Bayesian Networks. UCL Press, London 1996
6. Pearl, J.. Probabilistic Reasoning in Intelligent Systems: Networks of Plausible

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CSE-El-3(d) Software Architecture

Software process and the role of modeling and analysis, software architecture and software design, software Modeling and Analysis; analysis modeling and best practices, traditional best practice diagrams such as DFD and ERDs, UML, diagrams and UML analysis modeling, analysis case studies, analysis tools, analysis patterns.
Software Architecture: architectural styles, architectural patterns, analysis of architectures, formal descriptions of software architectures, architectural description languages and tools, scalability and interoperability issues, web application architectures, case studies.
Software design: design best practices, design patterns, extreme programming, design case studies, component technology, object oriented frameworks, distributed objects, object request brokers, case studies.

Books and References:

1. Booch,G.Rumbough, J., Jacobson, I., The Unified Modeling Language User Guide,
2. Addison-Wesley, 1999.
3. Gamma,E.,Helm, R.Johnson,R.Vissides, J., Design Patterns, Elements of Reusable
4. Object-oriented Software, Addison-Wesley, 1995.
5. Frank Buschmann et.al.Pattern Oriented Software Architecture, Volume 1: A System of Patterns, John Wiley and Sons, 1996.
6. Shaw, M.,and Garlan, D., Software Architecture: Perspectives on an Emerging Discipline, Prentice Hall, 1996.
7. Len Bass et.al.Software Architecture in Practice. Addison Wesley, 1998

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CSE-El-3(e) Embedded Systems

Introduction to Embedded Systems

Architecture of Embedded Systems - Hardware Architecture, Software Architecture, Communication Software, Development/Testing Tools

Programming for Embedded Systems

The Process of Embedded System Development - Design Trade offs, Hardware Software co-design, Implementation, Integration and Testing Hardware Platforms, Communication Interfaces

Embedded/Real-time Operating Systems Concepts - Representative Embedded Systems, Programming in RT-Linux Embedded Database Application Mobile Java Applications Embedded Software Development on 8051 Micro-controller Platform

DSP-based Embedded Systems - Implementation of Embedded Systems with VHDL, FPGA and CPLD Embedded Systems Applications using Strong ARM Platform

Text Books

1. Embedded/Real-time Systems: Concepts, Design and Programming – Dr. K.V.K.K.Prasad, Dreamtech press.
2. Proramming for Embedded Systems – Dreamtech Software team, Willey - dreamtech

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CSE-El-3(f) Natural Language Processing Semantics

Introduction to semantics, semantic interpretation, knowledge representation, contest and world knowledge, plans and actions, discourse structure, belief models, speech acts, Selected applications.

Books and References:

1. G.Chirchia and S.McConnell Ginet.Meaning and Grammer, MIT Press, 1990.
2. James Allen. Natural language Understanding, Benjamin-Cummins, 1987.

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CSE-El-3(g) Advanced Topic in Algorithms and Data Structure

The course intends to deal with advanced aspects of algorithms: design and analysis including data structures, analysis and lower bound proofs, amortized complexity of algorithms.
Fibonacci heaps and self-adjusting search trees, Splay trees, linking and cutting trees.
State-of-the-art algorithms for minimum spanning trees, shorted path problem
Network flows- preflow-push algorithms, max flow algorithm and sealing algorithms. Matching, blossoms, Micali-Vazirani algorithms. Lower bound thory for parallel computations.

Books and Reference

1. R.E.Tarjan. Data structures and Network Algorithms, SHAM Press, 1983
2. J.H.Hastad. Computational Limitations for Small Depth Circuits, MIT Press,
3. 1987.
4. K.Melhorn.Data Structures and Algorithms, Vol.i:Sorting and Searching, Springer Verlag.
5. K.Melhorn.Data Structures and Algorithms, Vol.3:Multi-dimensional Searching and Computational Geometry, Springer Verlag, 1981.
6. Research papers.

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CSE-520(a) Database Management System

Basic concepts: database & database users, characteristics of the database, database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, data modeling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems.
Relational model, languages & systems: relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: date definition in SQL, view and queries in SQL, specifying constraints and indexes in sql, a relational database management systems, DB2. DB2 Architecture, Logical Data Structures Physical Data Structure, Instances, Table Spaces, Types of Table spaces, Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.
Relational data base design: function dependencies & normalization for relational databases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.
Concurrency control & recovery techniques: concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures. Object-oriented Databases, Distributed and Parallel Databases, Multi-databases, Access Methods, Transaction Management, Query Processing, Deductive Databases, multimedia Databases, Real-Time Databases, Active Databases, Temporal Databases, Mobile Databases, Database Benchmarks, Database Security, Data Mining and Data Warehousing.

Books and Referances

1. Desai, B., “An introduction to database concepts”, Galgotia publications.
2. Readings in Database Systems edited by M. Stonebraker, Morgan Kaufmann, 2nd ed., 1994 Conference and Journal papers
3. Date, C. J. , “An introduction to database systems”, 7rd Edition, Addison Wesley.
4. Date, C. J. , “An introduction to database systems”, 3rd Edition, Narosa publishing house.
5. Elmsari and Navathe, “Fundamentals of database systems”, Addison Wesley.
6. Ullman, J. D., “Principals of database systems”, Galgotia publications.
7. DB2 Manuals