Course Structure and Syllabus

Of

M Tech (IT)

Department of Computer Sciences & Engineering

School of Engineering

Tezpur University
Course Structure

Time Duration:

Minimum duration: 2 years (4 semesters)
Maximum duration: 4 years (8 semesters)

Credit Requirements:

Minimum Credit requirement : 64
Core Courses : 43
Electives : 12
IDC : 09
# COURSE STRUCTURE

## Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credit Structure</th>
<th>Total Credit</th>
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<tr>
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<td>L-T-P</td>
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<tr>
<td>1st Semester</td>
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<tr>
<td>CS 531</td>
<td>Object Oriented Programming &amp; Design</td>
<td>3 1 1 1</td>
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<tr>
<td>IT 611</td>
<td>Distributed Systems</td>
<td>3 0 0 0</td>
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<tr>
<td>CS 634</td>
<td>Selected Topics in Computer Networks</td>
<td>3 0 1 1</td>
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<td>Elective 1</td>
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<td>IDC</td>
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<td>2nd Semester</td>
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<tr>
<td>CS 601</td>
<td>Design Analysis of Algorithms</td>
<td>3 0 0 0</td>
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<td>IT 610</td>
<td>Advanced Database System</td>
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<td>Elective 2</td>
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<td>Elective 3</td>
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<td>3rd Semester</td>
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<tr>
<td>IT 604</td>
<td>Term Project I</td>
<td>0 0 8 8</td>
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<td>Elective 4</td>
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<td>4th Semester</td>
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<tr>
<td>IT 605</td>
<td>Term Project II</td>
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## Elective Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credit Structure</th>
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<tr>
<td>CS 509</td>
<td>Data Communication</td>
<td>3-0-1</td>
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<tr>
<td>CS 505</td>
<td>Software Engineering</td>
<td>3-0-1</td>
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<td>CS 525</td>
<td>Artificial Intelligence</td>
<td>3-0-0</td>
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<td>CS 424</td>
<td>Formal Language and Automata</td>
<td>3-0-0</td>
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<tr>
<td>IT 518</td>
<td>Graph Theory</td>
<td>3-0-0</td>
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<td>CS 529</td>
<td>Embedded Systems</td>
<td>3-0-1</td>
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<td>CS 621</td>
<td>Mobile Computing</td>
<td>4-0-0  4</td>
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<td>CS 625</td>
<td>Web Technology</td>
<td>3-0-1  4</td>
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<td>IT 517</td>
<td>Pattern Recognition</td>
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<tr>
<td>IT 509</td>
<td>Data Mining &amp; Data Warehousing</td>
<td>3-0-1  4</td>
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<td>IT 507</td>
<td>Computer Security &amp; Cryptography</td>
<td>3-0-0  3</td>
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<td>CS 606</td>
<td>Computer Architecture and Parallel Processing</td>
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<td>CO 504</td>
<td>Natural Language Processing</td>
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<td>CS 610</td>
<td>Bioinformatics</td>
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<td>CS 725</td>
<td>Knowledge Representation and Reasoning</td>
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<td>CS 731</td>
<td>Data Mining in Security</td>
<td>3-0-1  4</td>
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<td>CS 538</td>
<td>Computational Geometry</td>
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<td>CO 503</td>
<td>Fuzzy Logic and Neural Networks</td>
<td>3-0-0  3</td>
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<tr>
<td>IT 523</td>
<td>Discrete Mathematics</td>
<td>3-0-0  3</td>
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<td>CS 522</td>
<td>Computer Graphics</td>
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<td>CS 523</td>
<td>Enterprise Resource Planning</td>
<td>3-0-0  3</td>
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<tr>
<td>CS 524</td>
<td>Theory of Computation</td>
<td>3-0-0  3</td>
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<td>CS 502</td>
<td>System Software</td>
<td>2-0-2  3</td>
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<td>CS 507</td>
<td>Computer Networks</td>
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<td>CS 508</td>
<td>Database Management Systems</td>
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<td>IT 503</td>
<td>Multimedia Systems</td>
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<td>IT 504</td>
<td>E-Commerce</td>
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<tr>
<td>IT 506</td>
<td>Logic Programming</td>
<td>3-0-0  3</td>
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<tr>
<td>IT 510</td>
<td>Advanced Operating Systems</td>
<td>3-0-1  4</td>
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<tr>
<td>CS 532</td>
<td>Compiler Design</td>
<td>3-0-1  4</td>
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<tr>
<td>CS 602</td>
<td>Image Processing</td>
<td>3-0-0  3</td>
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<tr>
<td>CS 607</td>
<td>Optimization Technique</td>
<td>3-0-0  3</td>
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Detailed Syllabi

<table>
<thead>
<tr>
<th>CS 531</th>
<th>Object Oriented Programming and Design</th>
<th>3-1-1</th>
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</thead>
</table>

Part I : Object Oriented Programming
Structured Programming and Object Oriented Programming paradigms.
Key Concepts :
Data Abstraction : Class, object, constructors, destructors, memory allocations for objects, member functions, friend functions, templates.
Inheritance : Single & multiple inheritance, virtual base class.
Polymorphism : Compile time polymorphism : operator overloading, function overloading, static binding.
Run-time polymorphism : Virtual function, pure virtual function, abstract class, dynamic binding.
Exception handling.
Part - II Object Oriented Design
Object Oriented Design Approaches: Object Model, Dynamic Model, and Functional Model.
(Objet Diagram, State Diagram, and DFD).

Books/References:
2. Bjarne Stroustrup: The C++ Programming Language, Addison Wesley

<table>
<thead>
<tr>
<th>IT 611</th>
<th>Distributed System</th>
<th>3-0-0</th>
<th>3</th>
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</thead>
</table>

Characterization of Distributed Systems, Design issues and user requirements. Interprocess Communication-Synchronous and Asynchronous, Client-server communication, Group communication.

Books/References:
Coulouris, Dollimore and Kindberg, Distributed Systems-Concepts and Design, Pearson Education Asia
Singhal and Shivaratri, Advanced Concepts in Operating Systems, TMH
Tanenbaum, Distributed Systems: Principles and Paradigms, Pearson Education
Selected Topics in Computer Networks

General congestion Control & Queuing, TCP Congestion Control, Random Early detection(RED) Gateways for Congestion Avoidance, Tuning RED for Web Traffic, Core Stateless Fair Queuing, The war between Mice & Elephants, Promoting the Use of End-to-End Congestion Control in the Internet, A study of Active Queue Management for Congestion Control, Analysis and Design of an Adaptive Virtual Queue (AVQ) Algorithm for Active Queue Management, Congestion Control for High bandwidth-Delay Product Networks, Improving the Performance of Reliable Transport protocols in Mobile Computing Environments, End-to-End Bandwidth Estimation in TCP to Improve Wireless Link Utilization, Discriminating Congestion Losses from Wireless Losses using Inter-Arrival Times at the Receiver.

SCTP — Multi-homing, Multi-streaming features, Application in High Availability, Mobility, Multimedia and Web Data Transport, Congestion Control and Security Issues.


Security issues in different networks.

Books/References:


Design and Analysis of Algorithms

Review of basic data structures such as stack, queue, linked list, trees and graphs. Concepts in algorithm analysis, Asymptotic complexity. Domain independent algorithm design techniques such as divide and conquer, greedy method, dynamic programming, back tracking, branch and bound. Basic ideas about neural network, genetic algorithms and simulated annealing. Example algorithms for sets, graphs, text processing, internal and external sorting, height balanced trees, B-trees, hashing, dynamic storage allocation, garbage collection. Lower bound theory and NP-hard problems.

Books/References:

Review of ER/EER and other semantic data models; Network, Hierarchical and Relational Data Models.

Query Processing: Various Operations such as Join, Selection, sorting, expression evaluation, etc.

Concurrency Control Mechanism: Protocols, Multiple Granularity, Multi-version schemes, Deadlock handling,

Recovery: Recovery and atomicity, various techniques, buffer management, Advanced Recovery Techniques;

Database Security: Authentication, Various Access Control Mechanisms, etc

Distributed Databases: Distributed Query Processing, Transaction Model, deadlock handling, multi-database systems;

Object Oriented Database: OO Data Model e.g. UML, OO DBMS architectures, Client-Server Approach, Query Processing, Object Relational Databases

Spatial Databases: Data Models, various representation schemes, architectures, Query Processing, Storage Structures; Image and Multimedia Databases

Books/References:

1. Silberschatz and Korth, Database system concepts, McGraw Hill.
2. Elmasri and Navathe, Fundamentals of database systems; Narosa Publishing Co.
3. John G Hughes, Object Oriented Databases; Prentice Hall Int nl Series in Computer Science
5. R Raghuramakrishnan & J Gehrke, Database Management System
6. Alhir, UML: In A Nutshell, O Reilly
Introduction to software engineering, concept of a software project, size factor, quality and productivity factor, different phase of a software development life cycle, managerial issues.

Software project planning: Problem definition, development of a solution strategy, development process planning, software development models and their comparative study; Organizational structure planning, project formats and team structures; Planning for quality assurance and configuration management; Planning for verification and validation.

Software economics: Cost estimation and evaluation techniques, cost estimation based on COCOMO model and Raleigh model.

Software requirements analysis and specifications techniques - their notations & languages.

Software design: Concept of fundamental design; Design approaches - top-down & bottom-up, structured, object-based & object oriented design; Design specification and notations.

Software implementation: Structured coding techniques, coding styles, and standards; Guidelines for coding and documentation.

Software verification and validation: Theoretical foundation, black box and white box approaches; Integration and system testing.

Software reliability: Definition and concept of reliability, software faults, errors, repair and availability, reliability and availability models.

Case studies.

Books/References:


Introduction: AI problem; AI techniques, problem as a state space search, Production Systems, Issues in design of search programs.

Heuristic Search Techniques: Generate and test, Hill Climbing, Best-First Search, Problem reduction, Means-Ends analysis.


Natural Language Processing: Syntactic processing, semantic analysis, Discourse and pragmatic processing.


Books/References:

CS 424  
**Formal Language and Automata**  

Alphabets, Languages, Grammars.  
Finite automata: regular expressions, regular languages.  
Context free languages: pushdown automata, DCFLs, LL(k) and LALR grammars.  
Context sensitive languages: linear bound automata.  
Turing machines: recursively enumerable languages.  
Operations on formal languages and their properties.  
Decision questions on languages, Undecidable problems.  

**Books/References:**  

IT 518  
**Graph Theory**  

Graph: Incidence and degree; Handshaking Lemma; Isomorphism; Subgraphs and Union of graphs; Connectedness; Walks, Paths and Circuits; Components and Connectednes; Walks, Walks, Paths and Circuits; Components and Connectednes algorithms; Shortest Path Algorithms, Eulerian graph, Fleury s algorithm and Chinese postman problem; Hamiltonian graph - necessary and sufficient conditions; Traveling salesman; Bipartite graph.  
Tree: Properties of trees; Pedant vertices in a tree; Center of a tree; Rooted binary trees; Spanning trees - Spanning tree algorithms; Fundamental circuits; Spanning trees of a weighted graph; cut-sets and cut-vertices; Fundamental cut-sets; Connectivity and separativity; network flow; max-flow min-cut theorem.  
Planner graph: Combinatorial and geometric dual; Kuratowski s graph; detection of planarity; Thickness and crossings.  
Matrix representations of graph: Incidence; Adjacency; matrices and their properties.  
Colourings: Chromatic number : Chromatic polynomial; The six and five colour theorems; The four colour problem.  
Directed graphs: Binary relations; Directed graphs and connectedness; directed trees; Aborecence; Polish method; Tournaments.  
Counting of labeled trees: Cayley s theorem; Counting methods; Polya theory.  
Application of graphs in computer science.  

**Books/References:**  
1. Deo, N.: Graph Theory with Applications to Engineering and Computer Science.  
2. Harary : Graph Theory, PHI (EEE)
Introduction: Characteristics of embedded systems; Applications; Concept of real time systems; Challenges in embedded system design.

Embedded Processors: Review of structure of a basic computer system: CPU, memory, I/O devices on a bus; Memory System Mechanisms – Caches, Memory Management Units and Address Translation; I/O subsystem – input and output devices, busy-wait I/O, interrupt driven I/O; Interrupts – Basics, interrupt latency; Co-processors; Processor Performance Enhancement – Pipelining, Superscalar execution, caching.

The Embedded Computing Platform: Board Buses – Bus Arbitration and Timing; The CPU Bus; Memory Devices and their Characteristics – Random-Access memories, Read-Only memories; I/O devices – Timers and Counters, Watchdog timers, GPIO, A/D, D/A, Displays, Keyboards; Component Interfacing – Memory interfacing, device interfacing, interfacing protocols; Designing with processors – System architecture, Hardware design; Target Devices – FPGA, CPLD.

Embedded Software Architectures: Round-Robin; Round-Robin with Interrupts; Function-Queue-Scheduling Architectures; Real-Time Operating System Architecture; Selecting an Architecture.

Real-time operating systems: Tasks and Task States; Tasks and Data; Context Switching – Cooperative multitasking, Preemptive multitasking; Scheduling Policies – Rate-Monotonic scheduling, Earliest-Deadline-First scheduling, RMS versus EDF; Semaphores and Shared Data; Message Queues; Timer Functions; Events; Memory Management; Priority Inversion; Interrupt Routines in an RTOS Environment.

Low-power computing: Sources of energy consumption: toggling, leakage - Instruction-level strategies for power-management: functional unit management - Memory system power consumption: caches, off-chip memory - Power consumption with multiple processes - System-level power management: deterministic, probabilistic methods.


Networked embedded systems: Why networked embedded systems - Example networked embedded systems: automobiles, factory automation systems - Types of network fabrics - Network performance analysis - Internet-enabled embedded systems.


Text Books:
2. Embedded Software Primer, David E. Simon, Addison Wesley Professional.

References:

2. Designing Embedded Hardware ï John Catsoulis
4. The 8051 Microcontroller and Embedded Systems ï Mazidi, Mazidi, and McKinlay; Pearson Education.
5. ARM manuals 
6. Suggested Readings as mentioned in Lesson Plan.

CS 621 Mobile Computing 4-0-0 4

Introduction: Cellular networks, wireless LANs, application adaptation.
Cellular Overview: Cellular concepts, location management, handoffs.
Wireless LAN overview: MAC issues, mobile IP, ad hoc networks, TCP issues.
Applications overview: wireless applications, disconnected operations, data broadcasting, mobile agents.
GSM: Air-interface, channel structure, timing, architecture.
WAP: Architecture, protocol stack, application environment.
TCP: Asymmetric links, wireless errors, handoffs; i-tcp, snoop, link rxmit, m-tcp.
Ad hoc networks: MAC, routing, transport.
Routing: Virtual backbone, Kelpi, mobile-IP.
Data broadcasting: Push-pull, consistency.
Location management: HLR-VLR, hierarchical.
Access Technologies: Blue Tooth, GPRS, IEEE 802.11, CDMA.
QoS in Wireless

Books/References:

1. Schiller, Mobile Communications, Addison Wesley, 2003
5. Charles Perkins, Ad hoc Networks, Addison Wesley, 2000

CS 625 Web Technology 3-0-1 4

Basics Of Internet
Markup Languages And Their Grammers: SGML, DTD Resource; HTML, CSS; XML, XSL, Query Languages for XML W3schools xml validator script
Web Browser: Browser Architecture, Configuration of Netscape and IE
Web Server Apache Architecture: Web Server Architecture, Server Features, Configuration of Apache and IIS.
Protocols: HTTP, FTP, SMTP, POP; JAVASCRIPT CGI PROGRAMMING JAVA
Overview of Java, JAVA Applet, JAVA Servlet;
ASP & JSP Search Engines; Web Database Connectivity;
CGI interface to Database, JDBC interface to Database.

Distributed Object Models: CORBA, DCOM, EJB.

Books/References:

3. Robert Niles et.al., CGI by Examples , Que, 1996.
4. Scot Johnson et.al., Using Active Server Pages , Que., Information Technology.
5. Web Technologies by Achyut S Godbole and Atul Kahat

IT 517  
Pattern Recognition  4-0-0  4

Unit 1 : Bayes Decision Rules for two Class problem, Bayes maximum likelihood rule, minimum distance classifier, error probabilities for classifier, Mahalanobis distance, Bound for error probabilities, Estimation of parameters, Learning.
Unit 2 : Single layer perceptron
Unit 3 : Clustering, Minimum within cluster distance critewrion, k-menas algorithm single linkage, complete linkage and average linkage algorithms, Isodata algorithm etc.
Unit 4 : Feature Selection
Algorithms for feature selection such as Branch and Bound, Sequential forward and backward selections, GSFS and GSBS, (L, R) algorithm.
Criterion function: Probabilistic Separability criterion, error probability based criterion, entropy based criterion, minimum within class distance based criterion, probabilistic independence.
Principal Component Analysis
Unit 5 : Fuzzy Set-theoretic Pattern Recognition
Usual Fuzzy set theoretic operations union, intersection etc.
Multiivalued Logic: Zade Compositional Rule of inference
Fuzzy C-means algorithm
Supervised Classification: Multiivalued Recognition System
Fuzzy set theoretic based feature selection criteria
Unit 6 : Applications will be dealt with appropirating classification errors such as commission and Omission.

Books/References:

1. Duda and Hart, Pattern Classification ad Scene Analysis , John Willey, 1990

**IT 509**  
**Data Mining & Data Warehousing**  
3-0-1  
4

Data Warehousing  
Concept of Data Warehouse, Differences between Operational Databases and Date Warehouse, Multi-dimensional Data Model, Schemas for Multi-dimensional Databases, Data Cube Representations, Data Warehouse Architecture, OLTP vs OLAP, Efficient Query Processing in data Warehouses, Indexing of OLAP data, Materialization concept;  
Data Mining  
Data Clustering: Partitioning, Hierarchical, Density-based, Grod Based and Model Based Methods;  
Classification & Prediction: Decision Tree Techniques, Back-Propagation Method, Bayesian Method  
Association Rule Mining Techniques: Frequent Itemset Generation, Apriori, Horizontal Method, Sampling Approach, Hashing Approach; Dynamic Association Rule Mining;  
Mining of Complex Types of Data: Mining of Spatial Databases, Multimedia Databases, Time-series and sequence Data, Text Databases, WWW Data;

**Books/References:**

1. Jiawei Han and Micheline Kamber, *Data Mining: Concepts and Techniques*, Morgan Kaufmann, India  
2. A K Pujari, *Data Mining Techniques*, University Press, India  
3. Han, Manilla and Smyth, *Principles of Data Mining* PHI, India

**IT 507**  
**Computer Security & Cryptography**  
3-0-0  
3

Introduction to Cryptography, Mathematical Foundation of Cryptography : Information Theory, Complexity Theory, Number Theory, Probability Theory;  
Secret Key Cryptosystem : Stream and Block Ciphers; Pseudo-random pattern generators, LFSR based stream ciphers, other stream ciphers; Correlation attacks and other relevant attacks for steam ciphers; DES and Its Security, other Block Ciphers; Differential Cryptanalysis, Attacks on Block Ciphers;  
One-Way Hash Functions and Data Integrity: Snefru, MD4, MD5, SHA, HAVAL; Cryptanalysis of hash functions;  
Public Key Cryptography: Mathematical Foundation, RSA, Security Analysis of RSA  
Key Establishment Protocols: Symmetric key based and Asymmetric Key based protocols, KERBEROS, EKE, DH-EKE, PAKE, etc; Secret Sharing;  
Digital Signature Schemes: RSA and other related signature schemes, Possible Attacks, DSA and other related signature schemes;

**Books/References:**

1. Manezes, Oorschot and Vanstone, Handbook of Applied Cryptography, CRC Press
CS 606  Computer Architecture and Parallel Processing  3-0-0  3

Classification of Computer Architectures - Flynn's Classification - Classification of Parallel Architectures.
Instruction Level Parallel (ILP) Processors - Pipelined, VLIW, Super Scalar Processors - Instruction Dependencies, their Effect on Performance and Techniques to overcome them.
Basic Concepts and Techniques in Vector, Systolic and Dataflow architectures.
Multiprocessor Architectures - Synchronization and Cache Coherence Issues.
Multicomputer Architectures - Interconnection Networks, Routing and Data Communication Algorithms.

Books/References:

CO 504  Natural Language Processing  3-0-0  3

Introduction- Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications.
Text representation in computers, encoding schemes.
Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML, Management of linguistic data with the help of GATE, NLTK.
Regular expressions, Finite State Automata, word recognition, lexicon.
Morphology, acquisition models, Finite State Transducer.
N-grams, smoothing, entropy, HMM, ME, SVM, CRF.
Part of Speech tagging- Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions.
A survey on natural language grammars, lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax.
Parsing- Unification, probabilistic parsing, TreeBank.
Semantics- Meaning representation, semantic analysis, lexical semantics, WordNet
Word Sense Disambiguation- Selectional restriction, machine learning approaches, dictionary based approaches.
Discourse- Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure.
Applications of NLP- Spell-checking, Summarization
Information Retrieval- Vector space model, term weighting, homonymy, polysemy, synonymy, improving user queries.
Machine Translation - Overview.

Books/References:

1. Genes VII by Bonjamin Lewin.
7. Introduction to Bioinformatics Aurther M. Lesk, Oxford University Press
8. Fundamental Concepts of Bioinformatics Krane and Raymer, Pearson Education
9. Bioinformatics (Sequence and Genome Analysis) David W. Mount, Gold Spring Harbour Laboratory Press

Review of logical foundations of knowledge representation including key properties of formal systems (such as soundness, completeness, expressiveness and tractability). Principles of Logic Programming.
Representing and reasoning about time and actions and physical changes (e.g., interval calculus, event calculus). Representing space and physical situations (topology, orientation, physical objects).
Automated inference techniques (e.g., refinements of resolution, relational composition, non-monotonic reasoning).
Formalisms for representing other aspects of knowledge e.g., vagueness, uncertainty, belief, desire. Description logics. Defaults. Probabilities. Explanation and diagnosis; Ontology representation languages and tools. Semantic web applications.

TextBook:


References:


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<thead>
<tr>
<th>CS 731</th>
<th>Data Mining in Security</th>
<th>3-0-1</th>
<th>4</th>
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Data mining fundamentals
Cluster Analysis, data types and proximity measures; various clustering approaches: Partitioning, Hierarchical, Density based, Model based, Grid based, distributed, ensemble, soft computing based; Cluster validity measures
Association mining: Frequent item set generation techniques; Rule generation techniques
DM in Privacy Preserving
Heuristic approaches: randomization, k-anonymity, l-diversity, t-closeness and (n,t)-closeness; Cryptographic approaches; Validity measures
Wired network security; IDS Fundamental; Generic architecture, Host based and Network based IDSs; DM in NIDS development: supervised, semi-supervised and unsupervised NIDSs
Signature/Rule based NIDS
Anomaly based NIDS development
Performance evaluation metrics for NIDS
Wireless network security; Development of security applications
Privacy preserving data clustering; privacy preserving association mining

References:


<table>
<thead>
<tr>
<th>CS 538</th>
<th>Computational Geometry</th>
<th>3-0-0</th>
<th>3</th>
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Geometric and Algorithm Basics: Fundamentals of Euclidean and Affine Geometry, Convexity; Basic concepts of Algorithms and its complexity, correctness proofs of algorithms; Paradigms of computational geometric algorithms; Degeneracies in Computational Geometry.
Convex Hulls Planar convex hulls definition, deterministic, randomized, output-sensitive and dynamic algorithms; applications of convex hull.
Intersection: Plane sweep algorithm for line segment intersection.
Geometric searching: Segment tree, Interval tree and Priority search tree; Point location query; Range searching -- Kd tree, range tree, fractional cascading; Proximity queries -- Nearest neighbor, closest pair; persistent data structure (if possible)
Triangulation and Partitioning: Polygon triangulation -- existence and algorithms, Art Gallery Theorem.
Voronoi Diagram and Delaunay Triangulation: Voronoi diagram, Delaunay triangulation and their dual relations; algorithms for computing Voronoi diagram and Delaunay triangulation.
Duality and Arrangement: Duality relation between points and lines; Arrangements and their applications.
Basics of Combinatorial Geometry: Unit distance problem, Point line incidences.

**Text Book:**


**Reference Books:**


| CO 503 | Fuzzy Logic and Neural Networks | 3 - 0 - 0 | 3 |

**Overview of Crisp Sets and Fuzzy Sets:**
Basic concepts of crisp sets and fuzzy sets. Types of fuzzy sets, Operation on fuzzy sets.

**Fuzzy relations and fuzzy logic:**
Crisp vs fuzzy relations, binary relations, equivalence relations, tolerance relations, composition of relations, fuzzy relational equations, fuzzy measure and possibility theory, classical logic and multivalued logic, fuzzy propositions and approximate reasoning.

**Introduction to neural networks:**
Biological and Artificial neurons, Learning in ANNs, Perceptrons ï classification and linear separability, XOR problem, Network architectures, Multilayer feed forward networks and recurrent networks, Generalized delta rule.

**Multilayer networks:**
Back propagation (BP) network, BP training algorithm, Radial basis function (RBF) networks, Applications of BP and RBF networks.
Recurrent networks and unsupervised learning, Hopfiled network - energy, stability, capacity; Application to optimization problems, Counter back propagation network, Bolzman machine, Kohonenâ€™s self organizing feature maps, Adaptive resonance theory.

**Associative memory:**
Matrix associative memory, Auto associative memories, hetero associative memories, Bi-directional associative memory, applications of associative memories.
Fuzzy Systems and Neuro fuzzy systems:
Relevance of Integration between fuzzy sets and neural network, Fuzzy neural network, Neuro fuzzy systems, Fuzzy associative memories.

Application of Fuzzy sets and Neural networks:
Application in pattern recognition, Image processing and computer vision, Application in control: Fuzzy controllers, neuro controllers and fuzzy neuro controllers, applications in expert systems and decision making systems, application in real world computing.

Reference books:
2. Limin Fu, Neural Networks in computer intelligence, McGraw hill Intl.
3. T Ross, Fuzzy logic with Engineering applications.
4. G Klir, B Yuan, Fuzzy sets and fuzzy logic : Theory and application, PHI.

IT 523 Discrete Mathematics 3-0-0 3
Part - I : Set, relation and functions :
- Set, relations, equivalence relations; mappings-one-one and on to ;
- Definition of an algebraic structure;
- Introduction to groups, subgroups, normal subgroups, isomorphism, homeomorphism; automorphism of groups; semigroups, monoids, rings, vector space.
Part - II : Logic :
- Logic operators, Truth table, Normal forms
- Theory of inference and deduction.
- Mathematical induction.
- Predicate calculus; predicates and quantifiers.
- Boolean algebra.
- Lattice.
Part - III : Combinatorics :
- Basic counting techniques.
- Recurrence relations and their solutions.
- Generating functions.
Part - IV : Modular Arithmetic :
- Congruence modulo, Fermat’s Theorem, Euler’s Theorem, Multiplicative Inverse, Reminder Theorem, FFT, Discrete Logarithm.

Books/References:

CS 522 Computer Graphics 3-0-2 4
Display Devices : Line and point plotting systems; raster, vector, pixel and plotters, Continual refresh and storage displays, Digital frame buffer, Plasma panel displays, Very high resolution
devices, High-speed drawing, Display processors, Character generators, Colour-display techniques (Shadow-mask and penetration CRT, colour look-up tables. analog false colours, hard-copy colour printers.)

Display Description: Screen co-ordinates, user co-ordinates; Graphical data structures (compressed incremental list, vector list, use of homogeneous co-ordinates); Display code generation; Graphical functions; The view algorithms, two-dimensional transformation.


Graphic Languages: Primitives (constants, actions, operators, variables), plotting and geometric transformations, display subroutines.

3-D Graphics: Wire-frame perspective display, Perspective depth, Projective transformations, Hidden line and surface elimination, Transparent solids, Shading.

GKS is to be used as the standard teaching tool.

Books/References:


CS 523 Enterprise Resource Planning 3-0-0 3

UNIT I


UNIT II


UNIT III


UNIT IV

UNIT V

Books/References:


CS 524 | Theory of Computation | 3-0-0 | 3
Turning Machine(TM) - Model, Computable Languages and Functions, TM construction technique, Modification of TM, Church’s Hypothesis; Undecidability – The Problem, Properties of Recursive & Recursively Enumerable Languages, Universal TM, Rice’s Theorem, Post’s Correspondence Problem; Intractable Problems, Polynomial Time and Space, The class P and the other problems, Boolean Satisfiability. The class NP, Polynomial-time Reduction, Introduction to Cook’s Theorem, Some NP-Complete problems.

Books/References:

1. Lewis & Papadimitriou, Elements of The Theory of Computation, Pearson Education.
2. John C. Martin, Introduction to Languages and the Theory of Computation, TMH.

CS 502 | System Software | 2-0-2 | 3
Overview: Definition and classification of system software.
**Assemblers**: Assembly language, Assembly process, Assembler data structures, Assembler macros and macroprocessors.

**Linkers and loaders**: Basic concepts, Static and Dynamic linking, shared libraries, loaders, overlays. Case study of UNIX linking system, Windows DLL, OLE, ActiveX.

**Debugger**: Types, features, case study: gdb/dbx.

**Editors**: Types, Structure, case study of vi, sed and wordstar.

**Unix Utilities**: Make, RCS, sed, grep, awk, etc.

**Compiler Principles**.

**Books/References**:

1. Dhandhere, System programming and operating systems, Tata McGraw Hill.
2. Sumitabha Das, Unix System V.4 Concepts and Applications, TMH.
3. Linux Manuals.

<table>
<thead>
<tr>
<th>CS 507</th>
<th>Computer Networks</th>
<th>3-0-1</th>
<th>4</th>
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</table>


Data Transport: Connection management, Quality of Service, TCP/IP Protocol, ATM.

Session Management: Session establishment and maintenance, Dialogue management, Recovery.

End-to-end Data: Presentation formatting issues and methods: XDR, ASN.1, NDR; Data Compression, Lossless Compression Algorithms- Run length encoding, DPCM, Dictionary-based methods, Image compression- JPEG, Video compression- MPEG; Security and authentication techniques, Encryption algorithms.

Applications: E-mail, Remote login, File transfer, Network file system, Network management.

UNIX network programming with TCP/IP; Network File System, Novell Netware, and Windows NT installation, configuration and use.

**Books/References**:

1. Tanenbaum A.S., Computer Network, 3e, PHI (EEE).
2. Stalling W, Data and Computer Communication, 5e, PHI (EEE).

<table>
<thead>
<tr>
<th>CS 508</th>
<th>Database Management Systems</th>
<th>2-1-2</th>
<th>5</th>
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</table>

**Overview**: Concept of database, data independence, redundancy Control; Database architecture - ANSI model.

**Modeling of real world situation**: Entity-relationship model; Data models: Network, Hierarchical, Ralational.

**Relational data model**: DDL, DML: relational algebra and calculus; functional dependencies, normal forms, decomposition, integrity rules; Query languages for relational systems: SQL, QBE, query optimization, embedded SQL.

Database transactions, concurrency control, recovery and security issues in databases.
Brief treatment of: Client-server models, distributed databases, object-oriented databases, deductive databases, multimedia databases, active databases.

Books/References:

1. Silberschatz and Korth, Database system concepts, McGraw Hill.
2. Elmasri and Navathe, Fundamentals of database systems; Narosa Publishing Co.

<table>
<thead>
<tr>
<th>IT 503</th>
<th>Multimedia Systems</th>
<th>3-0-2</th>
<th>4</th>
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</thead>
</table>
| Concept of Multimedia Data; Various File Formats; Multimedia data Model e.g. RMDM Compression & Decompression: 

Books/References:

1. Andleigh and Thakrar, Multimedia Systems Design, Prentice Hall PTR

<table>
<thead>
<tr>
<th>IT 504</th>
<th>E-Commerce</th>
<th>3-0-0</th>
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<tbody>
<tr>
<td>Introduction to E-Commerce; Networking; Web Tools, recommender System, Web Auctions, Information Retrieval, Agents for E-Commerce; Electronic Payment System: iKP Protocols and other related protocols, security analysis;</td>
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Books/References:


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<tr>
<th>IT 506</th>
<th>Logic Programming</th>
<th>3-0-0</th>
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<tbody>
<tr>
<td>Logic as a Language for Problem Solving, Sentence structure, Implication and Interface, General Structure and Computational Behaviour of Logic Programs, Procedural interpretation of Logic, Algorithmic view of logic program execution; Pragmatic and Stylistic considerations for structuring of program and data; Specification, Verification and synthesis of logic programs; Elementary features of typical logic implementations, Contribution of Logic Programming to Theory, practice and technology of computing.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Books/References:

3. Lloyd, J W., Foundations of Logic Programming, Springer Verlag

<table>
<thead>
<tr>
<th>IT 510</th>
<th>Advanced Operating Systems</th>
<th>3-0-1</th>
<th>4</th>
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</table>

Multithreaded systems: Threads-usage, design issues and Implementation, synchronization primitives. Processor Management & Scheduling, Memory management.
Real-time operation System: Design issues and Implementation
Advance Programming Laboratory in UNIX: Drivers, scheduler, threads, IPC, file system.

Books/References:

1. Tanenbaum, Modern Operating Systems, PHI (EEE)

<table>
<thead>
<tr>
<th>CS 532</th>
<th>Compiler Design</th>
<th>3-0-1</th>
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Overview of phases of a compiler, Languages and grammar.
Lexical analysis: Finite automata, Lexical analyzer, Lexical analyzer generator.
Parsing: Top-down and Bottom-up parsers, shift-reduce parser, recursive descent (operator precedence) parser, LL(1); LR(0), SLR, LALR parsers, Syntax-directed translation, Parser generator.
Semantic Analysis: Declaration processing, Type checking, Symbol tables.
Error handling and recovery.
Code optimization: An introduction to the techniques.

Books/References:

2. Dhandhere, System programming and operating systems, Tata McGraw Hill.

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<tr>
<th>CS 602</th>
<th>Image Processing</th>
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Introduction: Digital Image representation; Fundamental steps in Image processing, Elements of digital Image processing systems.
Image Transforms: Fourier, Walsh, Hademord, discrete cosine and Hotelling transforms and their properties.

Image Enhancement: Enhancement by point processing, spatial filtering, Frequency domain enhancement, Color image processing.


Image Compression: Image Compression models, Error-free compression, Lossy compression, Image compression standards.

Image Segmentation: Detection of discontinuities, edge linking, Thresholding.

Representations and Descriptions: Chain codes, shape numbers, moments and Fourier and other descriptors.

Books/References:


| CS 607 | Optimization Technique | 3-0-0 | 3 |


Integer programming : Introduction, Branch and bound techniques, Binary linear programming, Travelling salesman problems.

Dynamic programming: Deterministic and probabilistic dynamic programming.

Game Theory

Books/References:

2. G. Hadley : Linear Programming, Narosa Publications
4. K. V. Mital, Optimisation Methods, Wiley Eastern