I & II SEMESTER SYLLABUS

CS 115 COMPUTER PROGRAMMING

Concepts, definitions, taxonomy and history of computer programming, operating systems and program execution, Introduction to Unix, Input/output devices, Storage devices, Flow chart and algorithm development, Computer program. C programming: Data TypesOperators, Conditional statements, Loops, Arrays, Strings, Functions, Structures.

Textbook:

1. C programming By Ritchie & Kernighan
2. UNIX programming By Kernighan & Pike
3. C Programming ByBalaguruswamy

References:

1. Programming with C ByGottfried

Course Outcomes:

- Learn fundamental knowledge of computer hardware and number systems
- Learn basic terminology used in computer programming
- Develop ability to write, compile and debug programs in C language
- Design programs involving decision structures, loops and functions
- Understand the dynamics of memory by the use of pointers

III SEMESTER SYLLABUS

CSE 211 DISCRETE STRUCTURES

Mathematical induction, Propositional and first order logic, Set theory, Relations, Equivalence relation, Partial orders relation, Total order relation, Lattices, Boolean algebra, Functions, Groups theory, Graphs theory, Discrete numeric functions, Generating functions, Recurrence relation, Finite state machine. Mealy Machine and Moore Machine.

Textbook:

1. Element of Discrete Mathematics By C. L. Liu

References:

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen

Course Outcomes:

- Be familiar with fundamental mathematical concepts such as sets, relations and functions.
- Understand the notion of mathematical thinking, mathematical proofs and logics such as predicate logic, propositional logic and inference rules.
- Be familiar with group theory such as semigroup, monoid, groups.
- Be familiar with recurrence relations, graphs and trees.
- Be familiar with formal language, grammars and finite state machine.

CSE 212 DATA STRUCTURES

Introduction to Data Structures, Algorithm Evaluation, Arrays, Multi-dimensional Arrays, Sparse Matrices, Structure, Pointers, Stacks: representation of stacks and basic operations, applications of Stacks, Prefix, Postfix and Infix notations and conversion, Recursion, Towers of Hanoi. Queues: Types of Queue and its application. Linked lists: Types of Linked list, implementation of Stack and Queue using Linked list, Polynomial representation and Arithmetic. Trees: binary tree, n-ary Tree, Tree Traversal, AVL Trees, Binary Search trees, Graphs: Representation, Traversing. Searching: Sequential Search, Binary Search, and Hashing. Sorting: External and Internal Sort, Selection Sort, Bubble Sort, Insertion Sort, Radix Sort, and Bucket Sort.

Textbook:

1. Fundamentals of Data Structures Horowitz and Sahni
2. Data Structure Using C Tanenbaum

References:

1. Classic Data Structures Samantha
2. Data Structures, Schaum's Series

Course Outcomes:

- Concept and importance of data structures
- Learn to implement various types of data structure.
- Learn how to determine algorithm correctness and its efficiency

CSE 213 DIGITAL ELECTRONICS

Number system, radix conversion, Binary codes, Boolean algebra, Logic gates, simplification of Boolean expressions. Combinational circuit: Full and half adder, Full and half subtracter, Parallel adder and subtracter, BCD adder, Excess 3 adder, Magnitude comparator, Look-ahead carry generator, Multiplexer and De-multiplexer, Encoder and Decoder. Sequential circuits: Flip-Flop, Designing of sequential circuit, Minimization of sequential circuit, Synchronous and Asynchronous system, Synchronous Counter Designing, Asynchronous counter, Registers, Shift registers, Serial and parallel registers, Johnson and rings counter.

Textbook:

1. Digital Electronics by Morris Mano

References:

1. Digital Circuits & Design by Arivazhagan S Salivahanan

Course Outcomes:

- Learn about number system used to represent numbers in computer.
- Study of digital logic gates and their implementation.
- Learn the implementation of various combinational circuit e.g. multiplexer, decoder, parallel adder and subtracter.
- Study and implementation of sequential circuit.

CSE 214 DIGITAL COMMUNICATION

Characterization of communication signals: Bit rate Baud rate, Sampling, Nyquist bit rate, Shannon Theorem, Bandwidth, Throughput. PCM, Delta Modulation, Serial & parallel transmission, Amplitude modulation, frequency modulation and phase modulation, ASK, BPSK, QPSK, FSK, QAM, Modems. Multiplexing, Spread spectrum modulation: Pseudo noise sequences, DS & FH spread spectrum. Synchronous and asynchronous transmission, Line coding scheme, Error detection and correction.

Textbook:

1. Data Communication and Networking B AForouzan

References:

1. Digital Communications Simon Haykin,
2. Principles of Communication Systems Herbert Taub& D L Schilling
3. Data & Computer Communication William Stallings

Course Outcomes:

- Learn about the basic concepts of how digital data is transferred across various types of data communication links.

CSE 215 PRINCIPLES OF PROGRAMMING LANGUAGES

Preliminary concepts of programming language, Issues in Language Translation: Syntax, Semantics, Stages, analysis and synthesis, Data types, Expressions and Statements, Subprograms and Blocks, Abstract Data types, Exception handling, Parameter Passing, Scoping Rules, Runtime Environment, Logic Programming Language, Functional Programming Languages, Object-oriented programming. Semantic gap, Language evaluation criteria, Introduction to 4G Languages, Implementations of modern programming languages-Java, C#. Concurrency: Subprogram level concurrency, semaphores, monitors, message passing.

Textbook:

1. Concepts of Programming Language Robert .W. Sebesta

References:

1. Programming Languages Louden
2. Programming languages Ghezzi
3. Programming Languages Design and Implementation Pratt and Zelkowitz

Course outcome

- To improve ability to develop effective algorithms,
- Improve use of existing programming languages, increase vocabulary of useful programming constructs
- To make easier to design a new programming language.

CSE 216 LINEAR ALGEBRA & NUMERICAL METHODS

Numerical solutions of non-linear algebraic equations by Bisection, Regula-falsi, Secant, Newton-Raphson Methods and Newton-Raphson Method with Multiple Roots.

Numerical solutions of systems of simultaneous linear algebraic equations by Gauss elimination method, Gauss Jorden method, Crout's triangularization method, Jacobi's iterative method and Gauss Seidel iterative method.

Finite difference and interpolation, Numerical differentiation, Numerical integration: trapezoidal rule, Simpson's rules 1/3 & 3/8 and Weddle's rule.

Numerical solution of differential equation: Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge's Method and Runge-Kutta's Method.

Matrix: Algebra of matrices, Elementary Row and Column operations, determinants, Rank and nullity, systems (Homogeneous and Non-homogeneous) of linear equations, Eigen values and Eigen vectors, Cayley-Hamilton theorem.

Vector Space: Vector spaces, Subspaces, Linear combinations and subspaces spanned by a set of vectors, Linear dependence and Linear independence.

Textbook:

1. Higher Engineering Mathematics by Dr. B. S. Grewal.

Course Outcomes:

- Understanding the theoretical and practical aspects of the use of numerical methods
- Implementing numerical methods for a variety of multidisciplinary applications

IV SEMESTER SYLLABUS

CSE 221 PROBABILITY & QUEUEING THEORY

Permutations, combinations, counting, summation, generating function, recurrence relations, asymptotic. Sample space and events- Probability- The axioms of probability- Some Elementary theorems- Conditional probability- Baye's theorem- Random variable- Discrete and continuous- Distribution- Distribution function, Distribution, Binomial and poison distribution Normal distribution- related properties.

Queuing theory- Classification, stationary process, markov process, Binomial process, Poisson process, Birth and death process, Markov chain.

Textbook:

1.Probability and Statistics with reliability, Queuing and Computer Science Trivedi K.S.

References:

1. Reliability Engineering Balagurusamy .E
2. Fundamental of Queuing Theory Gross D,and Harris C.M.
3. Probability Statistics and Queuing Theory Allen, A.O.

Course Outcomes:

- Acquainted with basic concepts of probability theory, permutations, combinations, Sample space, axioms of probability.
- Introduced to the techniques of developing discrete & continuous probability distributions and its applications.
- Able to describe a random process in terms of its mean and correlation functions.
- Aware with the special processes like Poisson, Renewal processes, birth & death process and derive the backwards & forwards equation.
- Able to specify a given discrete and Markov chain in terms of a transition diagram.
- To understand basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

CSE 222 COMPUTER ARCHITECTURE

Central processor organizations: basic building blocks, bus organized computer memory, address structure, register transfer languages, instruction formats, expanding op-codes and addressing modes. Control unit organization: hardwired control & micro-programmed control organization, control memory, address sequencing micro-instruction formats, micro-program sequencer, micro-programming. Arithmetic processor design: addition and subtraction algorithm, multiplication algorithm, division algorithm, processor configuration, and floating point arithmetic. Input-Output organization: Asynchronous Data Transfer, Asynchronous Communication Interface, Modes of Transfer: Interrupt-Initiated, Direct Memory Access (DMA). Memory Organization: Main Memory, Auxiliary Memory, Associative Memory: Hardware Organization, Cache Memory: Mapping Schemes, Virtual Memory: Address Space and Memory Space, Address Mapping. Structure of multiprocessors, Introduction to parallel processing, Flynn's classification, pipeline processing, pipeline hazards.

Textbook:

1. Computer Architecture Morris Mano,

References:

1. Computer Organization and architecture William Stallings
2. Computer Organization& Architecture T.K. Ghosh,

Course Outcomes:

- Learn about functioning of computer.
- Learn about structure of computer.
- Learn about various components used in computers like CPU, Memory and I/O.
- Learn about computer design (ALU and CU design).

CSE 223 THEORY OF COMPUTATION

Finite State Systems, Regular Expressions, Output machines, Regular sets, Context Free Grammar (CFG), simplification of CFG, normalization of CFG, Push Down Automata, CFL, CSL and LBA, Turing Machine, Recursive and RE sets, undecidability, Chomsky Hierarchy.

Text Book:

1. Introduction to automata theory, language & computations Hopcroaft& O.D. Ullman, R Mothwani,

Reference Books:

1. Theory of Computer Sc. (Automata, Languages and computation): K.L.P. Mishra & N. Chandrasekaran,
2. Introduction to formal Languages & Automata Peter Linz,
3. Fundamentals of the Theory of Computation- Principles and Practice Ramond Greenlaw and H. James Hoover
4. Introduction to the Theory of Computation Michael Sipser

Course Outcomes:

- Able to construct deterministic and nondeterministic finite state automata (DFA and NFA) for solving simple decision problems.
- Able to evaluate the computational complexity of algorithms involved in the decision problems of finite state automata, and using pumping lemma to demonstrate the non-regularity of languages.
- Able to compute the minimal state machine corresponding to a DFA.
- Understand and construct context-free grammars (CFG) for formal definitions involving recursion such as regular expressions; and also understand the fundamental role played by CFG in designing formal computer languages with simple examples.
- Understand basic properties of Turing machines and computing with Turing machines.
- Able to evaluate the computational complexity of algorithms involved in the decision problems of context free grammars and push down automaton, classify and simplify grammars into their useful canonical forms.

CSE 224 DATABASEMANAGEMENT SYSTEM

Fundamentals of DBMS, different data models. Relational database systems. ER modelling, Enhanced ER Model, ER to Relational Mapping. Relational Database Design, integrity constraints, functional dependency constraints, assertions, triggers, Normalization in relational approach. Relational algebra and calculus. SQL, overview of query processing and

cost estimation, Query Optimization, Transaction processing and concurrency control. Data storage and indexing, B-Trees and B+ Trees, Overview of advanced databases.

Textbook:

1. Fundamentals of Database Systems Elmasri&Navathe

References:

1. Database System Concepts Silberschatz, Korth&Sudershan .
2. An Introduction to Database Systems C. J. Date

Course Outcomes:

- Learn about the concept of data, databases and database management systems.
- Learn about how to handle databases.

CSE 225 ANALYSIS & DESIGN OF ALGORITHMS

Fundamentals of algorithm, asymptotic complexity, recursive algorithms, recurrence relation, heap, priority queue and heap sort. Algorithm Design Techniques their control abstractions and related problems: Divide and conquer, Greedy strategy, Dynamic programming, Backtracking, Branch and bound, least cost search. Introduction to lower-bound theory, Search Trees: BST, AVL, B and B+ trees. Introduction to NP-Complete and NP Hard problems.

Textbook:

1. Computer Algorithms Horowitz and Sahani.

References:

1. An Introduction to Algorithms Thomas H Cormen,Ronald L. Rivest

Course Outcomes:

- Learn different algorithm design techniques and study related problems.
- Learn to determine algorithm correctness and its efficiency.
- Learn various searching, sorting and graph traversal algorithms.
- How search trees help in searching effectively.
- Learn to use various techniques for efficient algorithm design like divide and conquer, greedy and dynamic algorithms.
- Understand NP completeness and identify different NP complete problems.

CSE 226 SOFTWARE ENGINEERING

Introduction to software engineering, software process & process models, Software metrics and measurements, software project management, software project planning, scheduling and tracking, cost estimation methods. Requirements analysis: Principles, complexity, methods, structured analysis, SRS Documentation. Design principles: abstraction, refinement, modularity, control hierarchy, structured partitioning, design types and methods. Software coding: coding style, coding efficiency, capability maturity model (CMM), Software quality assurance, Software testing: Software testing techniques, choice and classification of test data, verification & validation methods. Software maintenance, configuration management, system documentation, software reusability.

Textbook:

1. An Integrated Approach to Software Engineering Pankaj Jalote,
2. Software Engineering: A Practitioner's Approach R S. Pressman.

References:

1. Pearson Edu, "Software Engineering by Ian sommerville", 9th edition, 2010

Course Outcomes: -

- The main purpose of this course is to impart knowledge on the basic principles of software development life cycle.
- Understand the software life cycle models.
- Understand the importance of the software development process.
- Understand the importance of modeling and modeling languages.
- Design and develop correct and robust software products.

CSE 311 COMPILER DESIGN

Compilers and translators, structure of compiler its different phases, Compiler construction tools. Lexical analyzer, Specification and recognition of tokens, input buffering.Syntax analyzer, top down and bottom up parsing. Syntax directed definition, syntax directed translation scheme, intermediate codes: syntax tree, post fixed expressions,three address code, quadruples and triples. Code optimization, DAG, Code generation,Symbol table implementation, Error handling

Textbook:

1. Compilers Principle, Techniques and Tools, Alfread V.AHO, Ravi Sethi and J.D. Ullman

References:

1. Theory and practice of compiler writing Tremblay & Sorenson

Course Outcomes:

- Understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc
- Understand the basic techniques used in compiler construction such as lexical analysis, top-down, bottom-up parsing, context-sensitive analysis, and intermediate code generation.
- Understand the basic data structures used in compiler construction such as abstract syntax trees, symbol tables and three-address code.
- To learn the new code optimization techniques to improve the performance of a program in terms of speed & space

CSE 312 OPERATING SYSTEM

Operating system functions and characteristics, design issues, Process abstraction, process management, system calls, threads, process hierarchy, CPU scheduling, comparative study of scheduling algorithms Process synchronization and inter-process communication, message passing mechanisms, Process synchronization constructs Deadlock Characterization, prevention and avoidance, deadlock detection and recovery. Memory management techniques, overlays, dynamic linking, virtual memory concept. Disk structure, Disk scheduling, File System, file access and allocation methods, directory system, file protection mechanisms, implementation issues, Device Management: Hardware organization, device scheduling policies, device drivers. Case Studies: Windows, UNIX, Linux.

Textbook:

1. Operating system Silberschatz and Galvin

References:

1. Operating system Deital
2. Operating system Andrew S. Tanenbaum
3. Operating Systems Gary Nutt &NabenduChaki

4. Operating system a concept based Approach By D.MDhamdhere

CSE 313 MICROPROCESSOR

Introduction of Microprocessor, Evolution of Microprocessor, Types of Microprocessor, History of Computers, Memory, Memory organization.8085: Pin Diagram of Microprocessor 8085, Architecture of 8085 and Operations of its Component.8086: Pin Diagram of Microprocessor 8086-88, Architecture of 8086, Difference between 8085 and 8086, Programming Model, Real mode memory addressing, Introduction to protected mode memory addressing memory paging, Interrupts: hardware and software interrupts.Addressing modes: Data, program, Stack, memory-addressing modes Assembly language programming: Instruction set of 8086, Memory Segmentation, Stack and sub routine.Interfacing: 8251(Universal Synchronous/Asynchronous Receiver/Transmitter), 8253 & 8254 (Programmable Interval Timer), 8255 (Programmable Peripheral Interface), 8259(Programmable Interrupt Controller), 8257(Direct Memory Access), 8279 (keyboard & display, controller).8051(Micro-controller): Pin Diagram, Architecture, Memory Organization, Counters and Timers, SFRs (Special Function Registers), Microcontroller Interrupts and Power Consumption Control

Textbook:

1. Advanced Microprocessors and Peripherals by Ray and Bhurchandi

Course Outcomes:

- Learn about structure and types of microprocessors.
- Study of Assembly level and hardware level programming language.
- Learn about the various types of interfacing with microprocessor.
- Study of microcontroller.

VI SEMESTER SYLLABUS

CSE 321 COMPUTER NETWORKS

Introduction to TCP/IP and OSI reference model, polling techniques, multiplexing, and concentration, transmission media used in physical layer. MAC protocols ALOHA, CSMA/CA, CSMA/CD Ethernet, token bus, token ring, (IEEE 802.3, IEEE 802.4, IEEE 802.5) DLL protocols, error correction and detection codes, flow control protocols performance evaluation with error or without error, protocol specification and verification, framing, HDLC. Switching techniques, Routing and congestion in network layer, routing and congestion control algorithms. Connection management in transport layer, protocols of transport layer, TCP , UDP etc., world wide web (www), electronic mail(E-mail), Study of high speed fibre optic networks, FDDI.

Textbook:

1. Computer Network Tannenbaum.

References:

1. Computer Network W. Stalling.
2. Data network Dimitris and Galliger.
3. Computer Networking: A Top down Approach James F. Kurose, Keith W. Ross

Course Outcomes:

- Understand computer network basics, network architecture, TCP/IP and OSI reference models.
- Identify and understand various techniques and modes of transmission.
- To study data link protocols, multi-channel access protocols and IEEE 802 standards for LAN.
- To study routing and congestion in network layer with routing algorithms and classify IPV4 addressing scheme.
- To study the elements and protocols of transport layer
- Understand network security and study various protocols such as FTP, HTTP, Telnet, DNS.

CSE 322 DATA WAREHOUSING & MINING

Introduction to data mining - kinds of data, relational databases, traditional databases, advanced database systems. Data Mining functionalities and patterns generated.

Data Preprocessing: - Data Cleaning, Data Integration and Transformation, Data Reduction Data Discretization. Concept Hierarchy Generation Data Warehouse and OLAP Technology- A Multidimensional Data Model Stars, Snow flake and Fact Constellations Schemas for Multidimensional Databases, OLAP operations, Data Warehouse Architecture

Associations and Correlations- the Apriori Algorithm, Finding Frequent Item sets Using Candidate Generation Mining, Frequent Item sets without Candidate Generation Mining, and Frequent Item sets Using Vertical Data Format.

Classification- Classification by Decision Tree Induction, Bayesian Classification Rule-Based Classification, Associative Classification

Prediction- Linear Regression and Non linear Regression

Clustering- Similarity and distance measures, Outliers, Partitioning and hierarchical Methods, Mining Social Network, spatial databases, multidimensional databases, text databases and World Wide Web.

Textbook:

1. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei,

References:

1. Data Mining Introduction and Advance Topic Margaret H. Dunham and S. Sridhar
2. Data Warehousing in the real World, Sam Anahory and Dennis Murray

CSE 323 ARTIFICIAL INTELLIGENCE

Meaning and definition of artificial intelligence, Production systems: types, characteristics, study and comparison search techniques: BSF, DSF, hill climbing, best first search, A* algorithm, AO* algorithm etc, types of control strategies. Knowledge representation: Problems faced, propositional and predicate logic, resolution and refutation, deduction, theorem proving. Reasoning: introduction, reasoning methods, Baye‘s theorem, Bayesian network, fuzzy logic. Slot and filler structures: semantic networks, frames, conceptual dependency, scripts etc. Game playing and its techniques, planning techniques, study of blocks world problem in robotics, understanding, natural language processing and common sense. Learning and its techniques, neural networks and its applications, expert systems.

Textbook:

1. Artificial Intelligence Elaine Rich and Kevin Knight .

References:

1. Introduction to Artificial Intelligence Eugene Charniak and Drew McDermott
2. Neural Networks, Fuzzy Logic & Genetic Algorithms: Synthesis & Applications S. Rajasekaran, G.A. VijyalakshmiPai
3. Artificial Intelligence: A New Synthesis Nils J. Nilsson

Course Outcome

- Learn to apply human intelligence on computer.
- Learn to represent knowledge.
- Design of experts system.

DEPARTMENTAL ELECTIVES FOR V AND VI SEMESTER

CSE 331 ADVANCED COMPUTER ARCHITECTURE

Pipeline processor principles and design, Instruction set architecture; Memory addressing; Instruction composition; Instruction-level parallelism; Hazards: dynamic scheduling, branch prediction; Memory hierarchy; Processor case studies; Multiprocessor introduction: Shared-memory architectures, their synchronization and consistency issues, advanced multi-core topics; Transactional Memory; Interconnection networks.

Textbook:

1. Computer Architecture: A Quantitative Approach, J. L. Hennessy and D. A. Patterson

References:

1. Computer Architecture and parallel processing Kai Hwang, Briggs
2. Advanced Computer Architecture: Parallelism, Scalability, Programmability Kai Hwang,
3. Parallel Computer Architecture: A Hardware/Software Approach David Culler, J.P. Singh and Anoop Gupta
4. Computer Architecture & Organization John P. Hayes

Course outcome

- How high processing and multi core machine works.
- Designing of multi core processing unit.

CSE 332 SOFTWARE REUSABILITY

Software Engineering Process, Software Reuse Factors, Reuse driven Software Engineering Business, Overview of software reuse metrics. Architectural Style: Object oriented software engineering Application and component systems, Use Case Components, Object components, Layered architecture. Approaches for software reuse - Patterns, Frameworks and Components. Pattern and Framework Approaches: Design patterns, Analysis patterns, Organizational patterns, Anti-patterns. Creational Patterns, Structural Patterns, Behavioral Patterns, Architectural Patterns. Component System Engineering & Application System Engineering: Requirement analysis, Robustness analysis, Designing, Implementing, Testing and Packaging of the Component system. Case Studies.

Textbook:

1. Reuse-Based Software Engineering: Techniques, Organizations, and Controls Hafedh Mili and Sherif M. Yacoub.
2. Software Reusability Wilhelm Schafer, Diaz Prieto and Wilhelm Shafer .

References:

1. Reusability and Software Construction: C Jerry and D. Smith.
2. Design Patterns: Elements of Reusable Object-Oriented SoftwareRichard Helm, Erich Gamma, John Vlissides and Ralph Johnson.

Course outcome

- Learn the methods of Design and implementation of software components so that they can be reused.

CSE 333 CAD OF DIGITAL SYSTEMS

Digital Systems And VLSI, Basic Electrical Properties Of CMOS, Data Structure in VLSI design, Fabrication And Devices, Logic Gates, Combinational Logic Networks, Sequential Machines, Subsystem/ Peripheral Design, Validation And Testability, Floor planning and Architecture Design

Textbook:

1. Modern VLSI Design: IP-Based Design Wayne Wolf

References:

1. Basics VLSI Design Pucknell and Eshraghian

Course outcome

- Learn about how to design very large scale processing unit.
- Hardware programming.

CSE 334 PARALLEL & DISTRIBUTED ALGORITHMS

Introduction to parallel algorithm, data parallel and control parallel approach, models of parallel computation, dense matrix algorithm , sorting searching, selection and graph algorithms. Introduction to distributed algorithms, synchronous algorithms network model, leader election algorithm, minimum spanning tree, shortest path, distributed consensus k agreement problem, two phase commit, three phase commit, mutual exclusion algorithms, and applications of distributed algorithm.

Textbook:

1. Parallel algorithms Michael. J. Quinn

References:

1. Distributed algorithm Nancy Lynch
2. Implicit Parallel Programming in Ph, Rishiyur S. Nikhil, 1947- Arvind

Course outcome:

- How to design parallel algorithm from serial.
- How to process parallel algorithm of distributed environment.

CSE 335 DISTRIBUTED DATABASES

Introduction to Distributed Database Systems, Distributed DBMS Architecture, Distributed Database Design, Semantic Data Control, Overview of Query Processing, Introduction to Transaction Management, Distributed Concurrency Control, Parallel Database Systems, Distributed Object Database Management systems, Database Interoperability

Textbook:

1. Distributed Databases Principles and Systems, Stefano Ceri and Guiseppe Pelagatti.

References:

1. Principles of Distributed Database Systems, M. Tamer Ozsu Patrick Valduriez

Course outcome

- Students will learn the techniques used for data fragmentation, replication and allocation during the distributed database design process.

- By evaluating simple strategies for executing a distributed query to select the strategy that minimizes the amount of data transfer.
- Will learn how the two phase commit protocol is dealt with committing a transaction that accesses databases stored at multiple nodes.
- Will learn how the distributed concurrency control based on the distinguished copy techniques and the voting methods.

CSE 336 EMBEDDED SYSTEM

Introduction, Hardware & electronics fundamentals, Peripherals Program Design and Analysis, Processes and Operating system, Real time Operating system. Memory, Interfacing Examples of Embedded systems: Digital Camera Examples, Smart card application, embedded database applications, etc. State Machine and Concurrent Process Models, Control Systems Verilog programming, Programming of mobile and Hand-held devices IC Technology Full-Custom (VLSI) IC Technology, Semi-Custom (ASIC) IC Technology, Programmable Logic Device (PLD) IC Technology, FPGA Hardware Software Partitioning, Hardware/Software Co-Simulation, Intellectual Property Cores, Low Power design

Textbook:

1. Embedded system Design, Frank Vahid, Tony Givargis

References:

1. Computer as Components, Wayne Wolf
2. 8051 Microcontroller & Embedded Systems, Rajiv Kapadia
3. The 8051 Microcontroller & Embedded Systems, Mazidi&Mazida

Course Outcome

- Ability to create hardware for any software for real time processing.

CSE 337 CRYPTOGRAPHY

Introduction to cryptography, Security Attacks, Mechanism and Services, Cryptosystems, Conventional encryption model and techniques, classical encryption techniques – substitution ciphers and transposition ciphers – Hill Cipher, Vigenere, Playfair, Caesar, Multiplicative, Enigma machine, cryptanalysis, stream and block ciphers. Block ciphers principals, feistel and non-feistel structure, DES, 3DES, AES, IDEA encryption and decryption, key distribution. Finite field: Introduction to graph, ring, and field, modular arithmetic, Fermat's

and Euler's theorem, Euclid's algorithm, Chinese remainder theorem, Comparison of symmetric and public-key cryptographic systems, Modern Trend in asymmetric-key cryptography – Elliptic curve based cryptography, Principals of public-key cryptosystems, RSA algorithm, Diffie-Hellman key exchange algorithm, Message Authentication and Hash Function: security of hash functions and MACS, message digest, MD5, SHA, RIPEMD, HMAC

Textbook:

1.Cryptography and Network Security: Principles and Practice, William Stallings

References:

1. Cryptography Theory and Practice, Douglas R. Stinson
2. Applied Cryptography: Protocols, Algorithms, Bruce Schneier

Course Outcomes:

- Compare and contrast a range of different cryptosystems from an applied viewpoint
- List and elaborate the differences between secret key and public key cryptosystems
- Identify the different approaches to quantifying secrecy
- Explain the role of hash functions in Information Security

CSE 338 HETERGENEOUS COMPUTING

Basic computer architecture, Multi core architecture, Multi core programming, Introduction of Heterogeneous computing, Types of Heterogeneous computing.CPU-GPU based Heterogeneous computing with CUDA: From Graphics Processing to General-Purpose Parallel Computing, CUDA: General-Purpose Parallel Computing Architecture, CUDA Programming Model, CUDA Programming Interface, Hardware Implementation, CUDA Performance Guidelines, CUDA Built-in functions.FGPA based Heterogeneous computing : FPGA, FPGA Applications; introduction to Xilinx (ise 9.2), cell architecture of an FPGA, rent's rule, slice, Introduction to VHDL, entity, architecture, component, port map, VHDL module, VHDL test bench, synchronous and asynchronous circuits, Bernstein's conditions, control flow and data flow language.

Textbook:

1. CUDA : Programming Massively Parallel Processor: A hands-on Approach. Authors: David Kirk, Wen-meihwu ELSEVIER Inc.

2. The VHDL Handbook by David R. Coelho.

References:

1. CUDA by Example: An Introduction to General Purpose GPU Programming by Jason Sanders and Edward Kandrot .
2. 100 Power Tips For FPGA Designers by Evgeni Stavinov.

Course Outcomes:

- Learn about how to process any code on different types of processing units present on single machine.
- Learn about GPU based Heterogeneous computing
- Learn about FGPA based Heterogeneous computing

CSE 339 DIGITAL IMAGE PROCESSING

Introduction to Image Processing Systems, Digital Image Fundamentals:- Image model, Relationship between Pixels, Imaging geometry, Camera model, Image Sensing and Acquisition, Sampling and quantization, Image Enhancement and in spatial Domain: Point processing, Neighbourhood Processing, High pass filtering, High boost filtering, zooming. Image Enhancement based on Histogram modelling, Image Enhancement in frequency domain: 1D& 2D Fourier transform, Low pass frequency domain filter, High pass frequency domain filters, Homomorphics filtering, Image Segmentation, Detection of discontinuation by point detection, line detection, edge detection, Edge linking and boundary detection Local analysis, global by graph, theoretic techniques, Thresh-holding, Morphology, Representation and description, Discrete image transform, Image Compression, Wavelet transformation, Image geometry, Image restoration.

Textbook:

1. Digital Image Processing Gonzalez & Wood

References:

1. Digital Image Processing A.K. Jain .Image Processing Dhananjay K.

Course outcome

- How to handle and process different types of images in computers.

CSE341 E-COMMERCE & E-GOVERNANCE

Introduction: Electronic Commerce, Technology and Prospects, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, E-Commerce Strategy, E-Commerce emerging Issues and implementation issues, E- Commerce Law, Govt. policies and Agenda. Electronic Payment Systems: Credit cards, debit cards, smart cards, e-credit accounts, e-money, Marketing on the web, marketing strategies, advertising on the web, customer service and support, introduction to m-commerce. E-payment security. E-Government, theoretical background of e-governance, issues in e-governance applications, evolution of e-governance, its scope and content, benefits and reasons for the introduction of e- governance, e-governance models- broadcasting, critical flow, comparative analysis, mobilization and lobbying ,interactive services/G2C2G. E-readiness, e-government readiness, E- Framework, step & issues, application of data warehousing and data mining in e-government, Case studies: NICNET-role of nationwide networking in e-governance, e-seva. E-Government systems security: Challenges and approach to e-government security, security concern in e-commerce, security for server computers, communication channel security, security for client computers.

Textbook:

1. Electronic Commerce: A Managerial Perspective Efraim Turban, Jae Lee

Course outcome

- Learn about various electronic -commerce methods and their security issues.
- Learn about various e-governance policies.

CSE 342 ADVANCED DATA STRUCTURES

Amortized complexity, Double-ended priority queues, Leftist trees, Binomial heaps, Fibonacci heaps, Dictionaries, Optimal Binary Search Trees, Red-black trees, Splay Trees, Binary Tries, Compressed Binary Tries, Suffix Trees, Bloom Filters, Interval Trees, Priority Search Trees, Skip lists, Treaps, Selection trees & k-way merging, String matching algorithms, disjoint set ADT, Network flow algorithms. Augmenting data structures.

Textbook:

1. Data Structures, Algorithms and Applications in C++ by Sartaj Sahani Second Edition, Universities Press, 2007

References:

1. Fundamentals of data structures in C++, by E. Horowitz, S. Sahni, and D. Mehta, Second Edition, Silicon Press, 2007

Course Outcomes:

- To understand some of the application specific advanced data structures and analyze their amortized complexity.
- To successfully decide how the use of a particular data structure can successfully reduce running time of different applications.

CSE 343 COMPUTER GRAPHICS

Introduction to raster & random graphics fundamentals, Display devices & comparison Point plotting, line drawing & circle drawing & their algorithm like DDA &Bressenhams, Video Basics- Graphics input/ output devices techniques, Mouse, tablets, stylus, light pen, valuators, digitizers, and plotter Devices independent graphics systems, positioning constraints, rubber band technique, dragging, inking& Painting, Data Structure of Computer Graphics, 2-D Transformation, Clipping, Windowing, View port, 3-D transformation, clipping, viewing transformations, projection, curve generation methods. Graphics packages, segmented files,

Geometric models, Picture Structure. Raster graphics, Character Displaying, Natural images Solid Area. Scan Conversion, Raster display hardware, Filling areas, aliasing & anti-aliasing Hidden surface elimination, Shading, Application to Simple Engineering Problem.

Textbook:

1. Computer Graphics D. Hern and M.P. Baker.

References:

1. Principles of Interactive Computer Graphics William M. Newman
2. Computer Graphics Multimedia and Animation Malay k Pakhira. PHI

Course Outcomes:

- Learn about the development of computer graphics technologies
- Learn about the various operations which can be applied on computer graphics.

OPEN ELECTIVES FOR V AND VI SEMESTER

CSE 351 MULTIMEDIA

Introduction to multimedia, Multimedia system design, Data and file format standards, Data compression and decompression techniques, Lossy and lossless compression, Multimedia input and output technologies, Storage and retrieval technologies, Multimedia Communications, Multimedia communication protocols (UDP, RTP, RTCP, XTP, TELNET, IP Multicast etc), Network performance parameters, Streaming. Multimedia Applications and Design issues, Hypermedia message, Integrated multimedia message standards. Multimedia authoring system and tools user interface design.

Textbook:

1. Multimedia system Design Prabhat K Andleigh and KiranThakrar

References:

1. Multimedia Communications Fred Halsall

Course Outcomes:

- Learn about various types of multimedia formats and their processing.

CSE 352 OBJECT ORIENTED DESIGN& MODELING

Object oriented programming concepts, Object Orientation, OMT Methodology, Object and Class, Link and Association, Generalization, Aggregation, Multiple Inheritance, Packages. Object Meta modeling, Functional Modeling. Analysis: Object Model, Data Dictionary, Dynamic Model, Functional Model, Interaction Modeling-Use case model, Sequence model, and Activity models, State Charts, System Design, Object Design, Implementation-Implementation using programming language and Database, UML Modeling.

Textbook:

1. Object-Oriented Modeling and Design Michael Blaha / William Premerlani

References:

1. Object Oriented Software Engineering Using UML Patterns and Java by Bruegge and Dutoit Pearson Publications

Course Outcomes:

- Analyzing and Designing Problems Using Object-Oriented Analysis and Design Techniques
- To teach the students a solid foundation on object-oriented principles

- To teach the student the essential and fundamental aspects of object oriented analysis and design, in terms of "how to use" it for the purpose of specifying and developing software.
- Understanding the fundamental principles through advanced concepts of analysis and design using UML

CSE 353 SIMULATION& MODELING

Systems, modelling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation. Pseudo random numbers, methods of generating random variables, discrete and continuous distributions, testing of random numbers, concepts of Queuing theory. Design of simulation experiments: Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation. Simulation languages: Comparison and selection of simulation languages, study of these simulation language. Case studies: Development of simulation models using simulation language studied for systems like queuing systems, Production systems, Inventory systems, maintenance and replacement systems and Investment analysis.

Textbook:

1. System Simulation Geoffrey Gordon

References:

1. System Simulation with Digital Computer Narsingh Deo

Course Outcomes:

- Learn to apply human intelligence on computer.
- Learn to represent knowledge.
- Design of experts system.
- Study to design a model and simulate it for any real life complex problem.
- Mathematical representation of any real life problem.
- Study of queuing model theory that is used to model and simulate real life problem.

CSE 354 UNIX INTERNALS & SHELL PROGRAMMING

Evolution of Unix OS, Architecture of the UNIX OS, Heavy kernel and micro kernel architecture, the buffer cache, internal representation of files (inode, accessing blocks,

releasing blocks, structure of regular files, conversion of a path name to an inode, inode assignment to a new file, allocation of disk block) Comparisons of UNIX file system with other file systems. System calls for the file systems, OPEN, READ, WRITE, and CLOSE, PIPES, the pipe system call , opening a named pipes, reading and writing pipes, closing pipes, DUP, mounting and amounting file system, LINK ,UNLINK, SYSTEM call for TIME and CLOCK. The structure of processes, process states and transitions, layout of system memory, the context of a process, saving the context of the process, manipulation of the process address space.Light weight process (Threads) kernel level thread, user level thread Process control, process creation, signals, process termination, awaiting process termination, the user id of a process, changing the size of the process, the system BOOT and INIT process. Shell programming, study of different type of shell like C shell, Bourne shell etc. shell script, shell command, looping and making choices, for Loop, while and until, passing arguments to scripts, programming in different shells. Inter process communication, process tracing, network communication, sockets multiprocessor system, problem of multiprocessor systems, solution with master a slave processor, solution with semaphores, study of distributed UNIX system.

Textbook:

1. The Design of UNIX Operating System Maurice J Bach.

Course Outcomes:

- Learn about internal architecture of UNIX operating system.
- How to design shell scripts.
- Learn how to modify kernel code.

CSE 355 INFORMATION THEORY & CODING

Information and entropy information measures, Joint Entropy, Conditional Entropy, Mutual Information, Relationship between Different Entropies Shannon's concept of Channel Capacity and Channel Redundancy Types of Channels: Symmetric channel, Binary Symmetric Channel, Cascaded Channels, Binary Erasure Channel, Continuous Channel. Theorem for discrete memory less channel. Information capacity theorem.

Source coding, Coding Efficiency, Shannon Fano Coding. Error detecting and error correcting codes, Types of codes: block codes, hamming and Lee metrics, linear block codes, parity check codes, cyclic code. Convolutional codes. Compression : loss less and lossy

compression, Huffman Coding, LZW algorithm, Binary image compression schemes, Video image compression techniques.

Textbook:

1. Communication Systems: Analog and Digital by Singh and Sapre TMH Publications
2. Multimedia Communications by Fred Halsall (Pearson Publications).

References:

1. Information Theory, Coding and Crptography, by R Bose, TMH 2007
2. Multimedia system Design by Prabhat K Andleigh and Kiran Thakrar (PHI Publications).

Course Outcomes:

- Learn the basic principles and applications of information theory.
- Develop an understanding of how information is measured in terms of probability and entropy, and the relationships among different entropies.
- Generalize the concept of discrete channels and measures of information to their continuous forms.
- Understand the concept of source coding and their different types.
- Understand different text, video and image compression techniques.

CSE 356 STATISTICAL METHODS

Introduction to Statistics, Meaning of Statistics as a Science, Importance of Statistics. Scope of Statistics, Introduction to Data Analysis, Population and Sample, Types of characteristics , Types of data, Notion of a statistical population, Methods of sampling, Presentation of Data, Data Visualization, Measures of Central Tendency, Measures of Dispersion, Moments, Skewness and Kurtosis, Theory testing ,Optimization, Hypothesis Testing, Bayesian Statistics,7 Subjective Probabilities, Heuristic analysis, Histograms:, Regression, Correlation, Error, Relational Databases, Cleaning Data:

Textbook:

1. Dawn Griffiths: Modern Head First Statistics, O Reilly Publication
2. Snedecor and Cochran: Statistical Methods, Oxford and IBH Publishers

References:

1. Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World Press Pvt. Ltd., Kolkata.

2. Mukhopadhyay, P.: Mathematical Statistics (1996), New Central Book Agency, Calcutta, Introduction to Mathematical Statistics, Ed. 4 (1989), MacMillan Publishing Co. New York.

Course Outcomes:

- Have good working knowledge of the most commonly used statistical methods, including
- Statistical modelling and the omnipresent role of variability
- Efficient design of studies and construction of effective sampling plans
- Exploratory data analysis
- Formal inference process
- Have background in probability, statistical theory, and mathematics, including especially calculus, linear algebra and symbolic and abstract thinking
- Have good mastery of several standard statistical software packages and facility with data management strategies

VII SEMESTER SYLLABUS

CS411TCP/IP & WEB TECHNOLOGY

Introduction to TCP/IP network model, IP: Internet Protocol- IP header, IP Routing Principal, IP Fragmentation, Checksum, IP options. Subnetting, Subnet masks, Supernetting, CIDR Directly/indirectly connected machines, IP addresses. Ethernet, framing, ARP, ARP Cache, ARP Packet Format, RARP, Serial Links, Bridges, Spanning Tree algorithm, ICMP- ICMP message type, ICMP address mask request and reply, ICMP Query and Error message, determining the path MTU.RARP and ARP. Transport layer protocols: TCP and UDP: TCP and UDP header, Connection Establishment and Termination, TCP State Transition diagram, Segmentation, Maximum Segment Size. ISN and sequence numbers. TCP data transfer -- sliding windows, slow start, congestion avoidance, fast retransmit, fast recovery. TCP – Timeout and Retransmission. Sockets. Web Technology: DNS, IGMP, FTP, POP, SMTP, HTTP, HTML, XML Basic concept of client/server computing.

Textbook:

1. W Richard Stevens, TCP/IP Illustrated Vol. I: The Protocols, Pearson Education Asia, 2000.

References:

1. W Richard Stevens, TCP/IP Illustrated Vol. III: TCP for Transaction, HTTP, NNTP, and the UNIX Domain Protocols, Pearson Education Asia, 2000.

CSE 416 NETWORK SECURITY

Introduction to Network Security: Network security needs. Threats to network security, kind of computer security, security policies, security mechanisms, attacks, security tools and basic cryptography, transposition/substitution, block cipher principles, Introduction to Symmetric crypto primitives, Asymmetric crypto primitives, Data Encryption Standard (DES), Message Digests, Message Authentication and Hash Functions, Hash and Mac Algorithms, Principles of Public key cryptosystems, RSA, Selection of public and private keys. Key distribution centers and certificate authorities, digital signature standard (DSS), kerberos, Real-time communication security, IPsec, Electronic mail security, Firewalls and web security, Intruders and viruses, trusted system, password management, zero knowledge protocols, malware – privacy, honey pot, defense programming, web application vulnerability, DHS, attack, semantic attack, DoS, DDoS, wireless attack, Intrusion detection system.

Textbook:

1. Cryptography and Network Security, William Stallings

References:

1. Introduction to Network Security, Krawetz, Cengage

Course Outcomes:

- How to secure information on Internet.
- How to authenticate users on Internet.
- To master information security governance.
- Understanding external and internal threats to an organization.
- Familiarity with information security awareness and a clear understanding of its importance

DEPARTMENTAL ELECTIVES FOR VII AND VIII SEMESTER

CSE 431 SOFTWARE TESTING

Software Testing Principles, Quality, Testing flow process. Defect Classification: Origin of Defects, Classes, Repository and Design, Developer/Tester Support for Developing a Defect Repository. Test Case Design Strategies: Black Box Approach , Random Testing, Equivalence Class Partitioning, Boundary Value Analysis, COTS, White Box approach, Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic, Additional White Box Test Design Approaches, Evaluating Test Adequacy Criteria. Unit testing, Integration tests, System testing, Regression testing and Acceptance testing, Test Plan Writing. Testing Tools. Criteria for Test Completion. Types of system testing - Acceptance testing: performance testing, Regression Testing internationalization testing, ad-hoc testing, Alpha – Beta Tests, testing OO systems, usability and accessibility testing. Testing services: Test Planning, Test Plan Components, Test Plan Attachments, Locating Test Items ,test management , test process ,Reporting Test Results. Software test automation: Skills needed for automation, scope of automation, design and architecture for automation, requirements for a test tool, challenges in automation, Test metrics and measurements –project, progress and productivity metrics.

Textbook:

1. Software Testing – Principles and Practices, Pearson education, 2006, Srinivasan Desikan and Gopalaswamy Ramesh.
2. Foundations of Software Testing, Pearson Education, 2008, Aditya P.Mathur.

References:

1. Software Testing in the Real World – Improving the Process Edward Kit
2. Effective Software Testing Elfriede Dustin
3. The Art of Software Testing Glenford J. Mayers
4. Foundations of Software Testing Aditya P. Mathur

Course Outcomes:-

- Various test processes and continuous quality improvement.
- Types of errors and fault models.
- Methods of test generation from requirements.
- Test adequacy assessment using: control flow, data flow, and program mutations.
- The use of various test tools.
- Application of software testing techniques in commercial environments.

CSE 432 CLOUD COMPUTING

Cloud Computing: Introduction, Working of cloud computing, benefits; Understanding Cloud Computing: Developing cloud computing services, Discovering cloud services; Cloud Computing for Everyone: Centralizing email communications, Cloud computing for community; Cloud Computing for the Corporation: Managing Schedules, Managing Projects; Using Cloud Services: Collaborating on Calendars, Schedules, and Task Management, Collaborating on Project Management Outside the Cloud: Other Ways to Collaborate Online: Collaborating via Web-Based Communication Tools, Collaborating via Social Networks and Groupware. Case Study: Different cloud models- Private cloud , Public cloud. Creation of private/public cloud using different hypervisors

Textbook:

1. Cloud Computing Michael Miller,

References:

1. Implementing and Developing Cloud Computing Applications David E.,Y. Sarna,

Course Outcomes:

- Learn how to reduce spending on technology infrastructure

- How to get more work done in less time with less people (Streamline processes).

CSE 433 DISTRIBUTED COMPUTING

Distributed Computing: Introduction, Types, and Various system models. Communication and Processes: RPC, RMI and others, Client and Server threads. Clock Synchronization: Types of clock and their synchronization, Introduction to distributed mutual exclusion, Election of a process, Consensus and related problems; Consistency: Various types of consistency, Consistency protocols, Fault tolerance: Introduction to fault tolerance, Process resilience; Protection and security in distributed systems: Various types of security techniques, Cryptography; Examples of distributed systems: Distributed file systems, Distributed shared memory and others.

Textbook:

1. Distributed Systems Principles and paradigms Andrew S. Tanenbaum and Maarten
2. Distributed systems, concepts and design, George Colouris, Jean Dollimore and Tim Kindberg.

Course Outcomes:-

- Students will attain knowledge of various architectures used to design distributed systems, such as client-server and peer-to-peer.
- Students will be able to build distributed systems using various interprocess communication techniques, such as remote method invocation, remote events, distributed mutual exclusion, distributed monitors and tuple spaces.
- Students will attain the knowledge of different distributed algorithms, such as logical clocks and leader election and also students can analyze and explain current distributed systems research.

CSE 434 PATTERN RECOGNITION

Introduction to Pattern Recognition, Regular Pattern, Irregular Pattern, Approaches to Pattern Recognition, Parametric, Non-Parametric Approaches. Parzen window method for density estimation, Feature selection, Search methods, Pattern Recognition Applications., Discriminant functions, Decision surfaces, Classification algorithms: Naive Bayes, Random Tree, Random Forest, Multiple Polynomial Regression, Classification using SVM. Classifier

Ensembles, , Linear Regression, Introduction to hidden Markov models (HMMs), Discrete HMMs and Evaluation problem, Forward method for evaluation problem, Backward method for evaluation problem, Parameter estimation for HMMs, Continuous density HMMs (CDHMMs),Types of Clustering, K-Mean Clustering, Iso-data Clustering, Clustering Metrics, Clustering applications, Fuzzy K-Mean, Clustering tendency, Semi Supervised learning. Fuzzy variants of classification and clustering algorithms, Neural networks fundamentals, Genetic Algorithms, Neural and Genetic based approaches for Pattern recognition, Self organizing maps, Advantages/Disadvantages of Neural based approaches for Pattern Recognition.

Textbook:

1. Pattern recognition and image processing Earl Gose

References:

1. Pattern classification Duda, Hart, stork.

Course Outcomes:

- To teach the students the fundamentals of Pattern Recognition
- To perform case study of various pattern recognition applications
- To perform case study of various tools available for pattern recognition.

CSE 435 COMPUTER VISION

Introduction to computer vision, computer imaging system, Image formation and sensing CVIP tools, Image representation. Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization. Image Enhancement in the Spatial Domain, Image Enhancement in the Frequency Domain, Homomorphic Filtering. Image Restoration, Colour Image Processing, Segmentation, Thresholding, The Use of Motion in Segmentation, Image Compression, Error-Free Compression, Lossy Compression, Image Compression,Standards, Wavelets and Multiresolution Processing, Multiresolution Expansions, Wavelet Transforms. Chain code, Tracking and Motion model, Reflectance map, Photometric stereo.

Textbook:

1. Computer vision Dana H. Ballard

References:

1. Computer Vision Young, Tzay Y.

Course Outcomes:

- Learn about how to make computer to understand its environment by getting human like vision capabilities.

CSE 436 RANDOMIZED ALGORITHMS

Introduction to randomized algorithms. Game Theoretic Techniques. Probabilistic Method, Markov Chains and Random Walks. Randomized Data Structures: Treaps, skip lists, Hash tables. Geometric algorithms and linear programming, Graph algorithms, Approximate Counting, Online Algorithms.

Textbook:

1. Randomized Algorithm Motwani and Raghavan

Course Outcomes:

- Learn how to employ a degree of randomness as part of its logic.
- Learn How to distinguish between algorithms that use the random input to reduce the expected running time or memory usage.

CSE 437 NATURAL LANGUAGE PROCESSING

Regular Expressions and Automata, N-grams, Part-of-Speech Tagging, Hidden Markov and Maximum Entropy Models, Formal Grammars of English, Syntactic Parsing, Statistical Parsing, Features and Unification, Language and Complexity, The Representation of Meaning, Computational Semantics, Computational Lexical Semantics, Information Extraction, Question Answering and Summarization, Machine Translation

Textbook:

1.Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", C. D. Jurafsky and J. Martin.

References

1.Foundations of Statistical Natural Language Processing, Manning and H. Schutze.

2. Computational Approaches to Morphology and Syntax (Oxford Surveys in Syntax & Morphology), 1st Edition, Roark &Sproat,.

Course Outcomes

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems.
- Be able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Be able to design, implement, and analyze NLP algorithms.

CSE 438 MOBILE COMPUTING

Introduction to Mobile Communications and Computing, novel applications, GSM: Mobile services, System architecture, and new data services. (Wireless) Medium Access Control :Motivation for a specialized MAC, DMA, FDMA, TDMA, CDMA. Mobile Network Layer: Mobile IP, IP packet delivery, Dynamic Host Configuration Protocol (DHCP). Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP. Database Issues: client server computing with adaptation, transactional models, and quality of service issues. Mobile Ad hoc Networks (MANETs): Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs. Protocols and Tools: Wireless Application Protocol-WAP. Bluetooth and J2ME.

Textbook:

1. Mobile Communications Jochen Schiller

References:

1. Handbook of Wireless Networks and Mobile Computing Stojmenovic and Cacute
2. Fundamentals of Mobile and Pervasive Computing Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren

Course Outcomes:

- Learn about different types of mobile communication

CSE 439 QUANTUM COMPUTING

Quantum Computing: Overview of traditional computing and Quantum computing, Church-Turing thesis, Circuit model of computation, Quantum physics and Computation, Dual

vectors, Operators; Qubits and Quantum modle of computation: State of a quantum system, Time evolution of a closed system, Composite systems, States and general quantum operations, Quantum gates, Universal sets of quantum gates; Quantum Algorithms: Superdense coding, quantum teleportation, probabilistic versus quantum algorithms, phase kick-bac, the Deutsch algorithm, Quantum phase estimation and Quantum Fourier Transform , Shor's algorithm for order finding ,Quantum search algorithm; Quantum computational complexity and error: Computational complexity, Black-box model, Lower bounds for searching, General black-box lower bounds, Classical error correction , Fault tolerance, Quantum error correction.

Textbook:

1. Quantum Computing V. Sahni,

References:

1. An introduction to Quantum Computing P. Kaye, R. Laflamme, and M. Mosca,

Course Outcomes:

- Learn How a quantum computer will be able to perform any task that a classical computer can.

CSE 441 SENSOR NETWORKS

Introduction of ad-hoc/sensor networks: key definitions, advantages, unique constraints and challenges, applications, and wireless communications/radio characteristics. Media Access Control and routing protocols for Ad-Hoc wireless networks: issues, classification and protocols. Networking Sensors: features, deployment of sensor networks, sensor tasking and control. Sensor Network platforms and tools: Berkley Motes ,Sensor network programming challenges ,Embedded Operating System. Transport layer, QoS issues and security protocols for ad hoc and sensor networks. Simulators for wireless ad hoc and sensor networks. Applications of Ad-Hoc/Sensor Network and Future Directions.

References:

1. Ad hoc Wireless Networks C. Siva Ram Murthy & B. S. Manoj
2. Wireless Sensor Networks: Information Processing Approach Feng Zhao and Leonidas J. Guibas.

Course Outcomes:

- Learn about different types of network which can be handled by sensors.

- Learn about processing of various protocol and their implementation in Sensor networks.

CSE 442 WEB SEARCH & MINING

Boolean Retrieval, Evaluation, Term vocabulary and posting list, Dictionaries and Tolerant Retrieval, index compression, Scoring, term weighting and the Vector Space Model, Computing Score, Evaluation in information retrieval, Classification: Naïve Bayes, SVM, Link Analysis.

Textbook:

1. C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available at http://nlp.stanford.edu/IR-book).

References

1. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, Addison-Wesley, 2009 (available at http://ciir.cs.umass.edu/irbook/).
2. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 (2nd Edition).

Course Outcomes

- Introduce students to the concepts and techniques of Information Retrieval, Web Search, Data Mining, and Machine Learning for extracting knowledge from the web.
- Develop skills of using recent data mining software for solving practical problems of Web Mining.
- Gain experience of doing independent study and research.

CSE 443 BIG DATA ANALYTICS

Overview of Big Data: Introduction, history, elements, related knowledge, big Data in Businesses, and types of big data analytics. Technologies for Handling Big Data: Understanding Hadoop Ecosystem: HDFS, Map Reduce YARN, HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie etc. Understanding of Apache Spark: Programming in Scala, Spark Core, Interactive Data Analysis with Spark Shell, Writing a Spark Application, Spark Streaming, Spark SQL, Machine Learning with Spark Graph Processing with Spark.

Understanding of Apache storm : Introduction to Apache Storm ,Use Cases of Apache Storm, Key features and Architecture of a Storm cluster, Storm Programming. Big Data Privacy and Ethics: Big data privacy, Risk in big data, Big data ethics, Transparency and Identity.

Textbook:

1. Hadoop: The Defiantive Guide, By Tom White O'Rielly Publications 4th edition 2015.
2. High Performance Spark, By Holden Karau, Rachel Warren O'Rielly Publications 2014.
3. Getting Started with Storm, By Jonathan Leibiusky, Gabriel Eisbruch, Dario SimonassiO'Rielly Publications 2014.

References:

1. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and GraphBy David Loshin
2. Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data: Analytics for Enterprise Class Hadoop and Streaming Data By Paul Zikopoulos, Chris Eaton.
3. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, By Michael Minelli, Michele Chambers, AmbigaDhira.

Course Outcomes

- This Course provides an insight to big data processing requirement and processing mechanism.
- It provides a scalable and speedy solution to handle huge data processing.
- It helps to analyze new business opportunities and next generation computations.
- It helps to give the knowledge about big data batch processing using apache Hadoop tool.
- It helps to give the knowledge about real time, interactive and iterative big data processing using apache spark tool.
- It helps to give knowledge about streaming data processing using apache storm.

- This course note that the gains in performance of NoSQL versus RDBMS's due to differences in how the data is persisted and managed in memory and on disk.

CSE 444 SOFT COMPUTING

Introduction to neural networks, Working of an artificial neuron, Perceptron, Back propagation algorithm, Adalines and Madalines. Supervised and unsupervised learning, Counter-propagation networks, Adaptive Resonance Theory, Kohonen's Self Organizing Maps, Neocognitron, Associative memory, Bidirectional Associative Memory.

Introduction to fuzzy logic and fuzzy sets, fuzzy relations, fuzzy graphs, fuzzy arithmetic and fuzzy if-then rules, Process control using fuzzy logic, Decision-making fuzzy systems, Applications of fuzzy logic, Hybrid systems like neuro-fuzzy systems.

Evolutionary Computation: Population-based Search: genetic algorithms and evolutionary computation, Swarm optimization, Ant colony optimization. Search techniques like Simulated Annealing, Tabu search etc.

Textbooks:

1. Soft Computing and Intelligent Systems Design by F.O.Karray and C.De Silva,Pearson Publication
2. Neural Networks, Fuzzy Logic and Genetic Algorithms by Rajsekaran and Pai, PHI Publication.

Course Outcomes:

- To introduce the ideas of neural networks, fuzzy logic, genetic algorithms.
- To enable problem solving using soft computing techniques.

OPEN ELECTIVES FOR VII AND VIII SEMESTER

CSE 451 GRAPH THEORY

Definition of a graph and directed graph, simple graph. Degree of a vertex, regular graph, bipartite graphs, sub graphs, complete graph, complement of a graph, operations of graphs, isomorphism and homomorphism between two graphs, directed graphs and relations. Walks, paths and circuits, connectedness of a graph, Disconnected graphs and their components, Konigsberg 7-bridge problem, around the world problem, Euler graphs, Hamiltonian paths and circuits, Existence theorem for Eulerian and Hamiltonian graphs. Trees and their properties, distance and centre in a tree and in a graph, rooted and binary trees, spanning trees and forest, fundamental circuits, cut sets, connectivity and separability,1- isomorphism, 2-isomorphism, breadth first and depth first search. Incidence matrix and its sub matrices, Reduced incidence matrix, circuit matrix, fundamental circuit matrix, cut set matrix, fundamental cut set matrix, path matrix, adjacency matrix of a graph and of digraph. Planar graphs, Euler‘s formula, Kuratowski‘s graphs, detections of planarity, geometric dual, combinatorial dual. Chromatic number, independent set of vertices, maximal independent set, chromatic partitioning, dominating set, minimal dominating set, chromatic polynomial, colouring and four colour problem, coverings, matching in a graph. Network flows, Ford-Fulkerson algorithm for maximum flow, Dijkstra algorithm for shortest path between two vertices, Kruskal and Prim‘s algorithms for minimum spanning tree.

Textbook:

1. Graph Theory with Applications to engineering and computer science Deo Narsingh.

References:

1. A first Look at Graph Theory Clark John and Holton D.A.,
2. Graphs and Applications:
3. An Introductory Approach Aldous and Wilson,
4. Graph Theory Reinhard Diestel,

Course Outcomes:

- Learn about different types of algorithm which can be applied on graph.
- Learn about different types of application of graph theory in computer science.

CSE 452 OPTIMIZATION TECHNIQUES

Engineering application of Optimization, Formulation of design problems as mathematical programming problems, General Structure of Optimization Algorithms ,Constraints, The Feasible Region, Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming, Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc. Real life Problems and their mathematical formulation as standard programming problems.

Textbook:

1. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou

References:

1. An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak
2. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
3. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
4. John K. Karlof (2006). Integer programming: theory and practice. CRC Press. ISBN 978-0-8493-1914-3.
5. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.
6. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the-Art. Springer. ISBN 978-3-540-68274-5.
7. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

Course Outcomes

- To enable students to do the mathematical formulation of real life problems.
- To teach students various optimization techniques to tune parameters.

- To perform case study of various tools available for standard mathematical programming problems

CSE 453 CYBER CRIME & INFORMATION WARFARE

Introduction of cyber crime, challenges of cyber crime, categorizing cyber crime, cyber terrorism, virtual crimes, perception of cyber criminals: hackers, insurgents and extremist group, interception of data, surveillance and protection, criminal copy right infringement, cyber stalking, hiding crimes in cyber space and methods of concealment. Anonymity and markets, privacy and security at risk in the global information society, privacy in cyber space, war fare concept, information as an intelligence weapon, attack and retaliation attack and defense. An I-WAR risk analysis model, implication of I –WAR for information managers, perceptual intelligence and I-WAR, handling cyber terrorism and information warfare, Jurisdiction.

Textbook:

1. Principle of cyber-crime Jonathan Clough

References:

1. Information warfare: Corporate attack and defence in digital world William Hutchinson, Mathew Warren

Course Outcomes:

- Learn about different types of cyber-attacks.
- Learn how to secure the computer/networks from these cyber-attacks.

CSE 454 WIRELESS NETWORKS

Introduction to wireless communication, and future trends, Wireless Generations and Standards, Wireless Physical Layer Concepts, fundamentals of antennas, Cellular Concept and Cellular System Fundamentals. Spread Spectrum Modulation Techniques, Coding and Error Control, Multiple Access Technique for Wireless Communications, OFDM. Wireless LAN Technologies, Wireless IEEE Standards, Mobile Network Layer (Mobile IP). Mobile Transport Layer (Mobile TCP), Mobile Data network (GPRS), WAP Model and architecture, Introduction to Ad hoc networks, Sensor networks, Bluetooth networks and Wireless Mesh networks.

Textbook:

1. Mobile Communications Schiller

2. Principles of Wireless Networks: A Unified Approach Pahalvan, K. and Krishnamurthy,

References:

1. Wireless communication Principles and Practice, T. S. Rappaport
2. Wireless Communications and Networking William Stallings

Course Outcomes:

- Learn about different types of wireless networking models.
- Learn about processing of various protocol and their implementation in wireless network.

CSE 455 NEURAL NETWORKS

Introduction to neural networks, working of a biological and an artificial neuron, neural network architectures, single and multi-layer neural networks, perceptron, linear seperability, perceptron training algorithm, backpropagation algorithm. Adalines, Madalines, adaptive multi-layer networks, prediction networks, radial basis functions. Difference between supervised and unsupervised learning, winner takes all networks, Counter-propagation networks, Adaptive resonance theory, Neocognitron. Associative Memory, Hopfield networks, Bi-directional associative memory, Bolzmann's training. Various types of optimization methods like gradient descent, simulated annealing etc. Introduction to fuzzy logic, neuro-fuzzy systems, Applications of neural networks.

Textbook:

1. Elements of artificial neural networks by Kishan Mehrotra, Chilukuri K. Mohan and Sanjay Ranka.

References:

1. Neural networks and fuzzy systems by Bart Kosko, Prentice Hall of India.
2. Fundamentals of artificial neural networks by Mohammad H. Hassoun, Prentice Hall of India.

Course outcomes:

- Learn basic concepts of neural networks and some commonly used neural network architecture and learning algorithms.
- Learn how to apply neural networks to problems in the field of pattern recognition, image processing, forecasting and optimization.

CSE 456 EHTICAL HACKING

Ethical hacking Overview, TCP/IP Concepts Review, network and computer Attacks, Network enumeration and Foot printing- DNS query, Whois query, OS finger printing, Banner grabbing Programming for security professionals- Web application vulnerabilities, Buffer overflow attack, Session hijacking, Code injection attacks- Cross Site Scripting attack, SQL injection attack. Password hacking, windows hacking, network hacking, anonymity and email hacking. Web servers hacking, session hijacking, Surveillance, desktop and server OS Vulnerabilities, Database attacks, hacking wireless networks, cryptography, network protection systems, Trojan and backdoor applications, legal resources, virtualization and Ethical Hacking.

Textbook:

1. Ethical Hacking and Network Defense. Michael T. Simpson, Kent Backman, James Corley

References:

1. Hacking Exposed—Network Security Secrets & Solutions, Stuart McClure Joel Scambray, George Kurtz

Course Outcomes:

- Learn about various flaws of what is being hacked.
- Learn about how to reveal and fixed these flaws.

CSE 457 BIOMETRICS

Introduction and definitions of biometric. Traditional authenticated methods and technologies. Biometric technologies: Fingerprint, Face, Iris, Hand Geometry, Gait Recognition, Ear, Voice, Palmprint, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA. The Law and the use of Multibiometrics systems. Statistical measurement of biometric. Biometrics in Government Sector and Commercial Sector. Case Studies of biometric system., Biometric Transaction. Biometric System Vulnerabilities.

Textbook:

1. Biometrics for network security, Paul Reid, hand book of Pearson

Reference:

1. Handbook of Fingerprint Recognition, D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, Springer Verlag.

2. BIOMETRICS: Personal Identification in Networked,A. K. Jain, R. Bolle, S. Pankanti (Eds.), Society, Kluwer Academic Publishers, 1999.
3. Biometric Systems: Technology, Design and Performance Evaluation, J. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Springer.

CSE 458 MACHINE LEARNING

Supervised Learning-Feature Selection, Cross Validation, Bootstrapping, Normalization Classification: Naïve Bayes, Bayesian Network, C4.5, ID3, Support Vector Machine, Extreme Learning Machine, Neural Network, VC Dimension, Regularization, Regression: Linear, Polynomial, Multiple Linear Regression, Support Vector Regression. Committee Machines/ Ensemble Learning: Bagging, Boosting. Unsupervised Learning- Clustering: K-Nearest Neighbour, K-Means, Fuzzy K-Means, Hierarchical Clustering, Single Linkage, Complete Linkage, Average Linkage, Non Spherical Clustering Algorithms. Statistical Testing Methods, Probabilistic Inference, Neural Network, Deep Learning Neural Network, Evolutionary Algorithms. Machine Learning Applications: Text Classification, Disease Diagnosis, Biometric Systems, Real Valued Classification.

Textbook:

1. Pattern Recognition and Machine Learning, Bishop, C. M. (2006),Springer, ISBN 0-387-31073-8

References:

1. (2012) Foundations of Machine Learning, MehryarMohri, Afshin Rostamizadeh, Ameet Talwalkar ,MIT Press ISBN 978-0-262-01825-8.
2. Machine Learning, Mitchell, T. (1997). McGraw Hill. ISBN 0-07-042807-7,

Course outcomes:

- To teach students what is Machine Learning?
- To make students learn about the Theoretical/ Practical understanding techniques of machine learning algorithms.
- To perform case study of various Machine Learning tools.
- To perform case study of state of art problem and their possible solution using machine learning

CSE 459 INTEGER PROGRAMMING

Introduction; Model Building and Enhancements; Relaxation and Bounds, Introduction to Computational Complexity, Branch-and-Bound Frameworks, Branch and cut, and Dantzig-Wolfe decomposition. Strong Valid Inequalities; Lifting Procedures, Decomposition/Partitioning; Column Generation; Lagrangian Relaxation, 9 Implicit Enumeration , Advanced modeling; Reformulation-Linearization Technique. Fundamentals of integer Programming , complexity, computation, and polyhedral theory

Textbook:

1. Integer and Combinatorial Optimization John Wiley & Sons, Nemhauser, G.L. and Wolsey, L.A., 1999.

References:

1. Integer Programming, M. Conforti, G. Corneujols, and G. Zambelli, Springer (2015).

Course outcomes:

The goals of this course are for students to:

- Understand how integer variables are used for formulating complex mathematical models.
- Be able to assess the difficulty of integer programming problems using the tools of complexity theory.
- Understand and be able to use common methodology for the solution of integer programs.
- Understand the basic concepts of polyhedral theory and how they apply to integer programming.
- Understand the theory of valid inequalities and how it applies to the solution of integer programs.

CSE 460 SUPPORT VECTOR MACHINES

Fundamentals of classification and Regression, Hard-margin and soft-margin SVMs, concepts of kernels and feature spaces, basics of optimization and quadratic programming,elements of statistical learning theory and generalization theory, implementation issues, SMO algorithm, selected advanced topics (multi-classification, support vector regression), Application of SVM to real life classification and regression problems.

Textbook:

1. Support Vector Machines by K.P. Soman and kemel

References:

1. Learning with Kernels, B. Schölkopf, A. J. Smola (2002)
2. Support Vector Machines for Pattern Classification, S. Abe (2005)

Course outcomes:

- The focus of this course is on obtaining practical experience with using SVMs and on understanding the core concepts the theory is built on.
- There are many free SVM libraries available, as well as commercial packages. After this course, students will be able to pick any of these tools, and use them correctly (and optimally) in their research fields.
- Not as a black-box, but with understanding of the inner-workings, being aware of potential issues that may occur.