Department of Computer Science & Engineering
National Institute of Technology
(Formerly Regional Engineering College, Tiruchirappalli)
Tiruchirappalli – 620015
Ph: +91 (431) 2503200

B. Tech. (CSE) – Curriculum

Semester-wise Curriculum (ADMITTED IN 2011,2012)

THIRD SEMESTER

CODE	COURSE TITLE	L	T	P	C
CS201	Discrete Mathematics	3	0	0	3
CS203	Principles of Programming Languages	3	0	0	3
CS205	Numerical Computing	3	0	0	3
CS207	Data Structures	3	0	0	3
CS209	Digital Computer Fundamentals	3	0	0	3
CS211	Computer Organization and Architecture	3	0	0	3
CS213	Programming Languages Laboratory	0	0	3	2
CS215	Data Structures Laboratory	0	0	3	2
TOTAL CREDITS					**22**

FOURTH SEMESTER

CODE	COURSE TITLE	L	T	P	C
CS202	Automata and Formal Languages	3	0	0	3
CS204	Digital System Design	3	0	0	3
CS206	Logical Foundations of Computer Science	3	0	0	3
CS208	Introduction to Algorithms	3	0	0	3
EC214	Basics of Communication Engineering	3	0	0	3
MA204	Introduction to Probability Theory	3	0	0	3
CS214	Digital System Design Laboratory	0	0	3	2
CS216	Algorithms Laboratory	0	0	3	2
TOTAL CREDITS					**22**

FIFTH SEMESTER

CODE	COURSE TITLE	L	T	P	C
CS301	Systems Programming	3	0	0	3
CS303	Computer Networks	3	0	0	3
CS305	Microprocessor Systems	3	0	0	3
CS307	Software Engineering	3	0	0	3
CS309	Combinatorics and Graph Theory	3	0	0	3
MA304	Principles of Operational Research	3	0	0	3
CS313	Microprocessor Systems Laboratory	0	0	3	2
CS315	Systems Programming Laboratory	0	0	3	2
TOTAL CREDITS					**22**

SIXTH SEMESTER

CODE	COURSE TITLE	L	T	P	C
CS302	Information security	3	0	0	3
CS304	Operating Systems	3	0	0	3
CS306	Database Management Systems	3	0	0	3
HM302	Corporate Communication	3	0	0	3
CS308	Artificial Intelligence and Expert Systems	3	0	0	3
	Elective - I	3	0	0	3
CS314	Operating Systems Laboratory	0	0	3	2
CS316	Database Laboratory	0	0	3	2
TOTAL CREDITS					**22**

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SEVENTH SEMESTER

CODE	COURSE TITLE	L	T	P	C
CS401	Distributed Computing	3	0	0	3
CS403	Web Technology	3	0	0	3
CS405	Principles of Compiler Design	3	0	0	3
CS407	Advanced Computer Architecture	3	0	0	3
	Elective - II	3	0	0	3
	Elective - III	3	0	0	3
CS413	Compiler Design Laboratory	0	0	3	2
CS415	Web Technology Laboratory	0	0	3	2
CS449	Comprehensive Viva-Voce				3
TOTAL CREDITS					**25**

EIGTH SEMESTER

CODE	COURSE TITLE	L	T	P	C
CS402	Advanced Database Management Systems	3	0	0	3
HM402	Industrial Economics	3	0	0	3
	Elective - IV	3	0	0	3
	Elective - V	3	0	0	3
CS498	Project Work				6
TOTAL CREDITS					**18**

Total Credits in the B. Tech. Course = 22 + 22 + 22 + 22 + 25 + 18 = 131
Total Minimum Credits required = 176 (131 + 45)

List of Electives for Sixth Semester: (One)

1. CS352 Design and Analysis of Parallel Algorithms
2. CS354 Advanced Microprocessor Systems

List of Electives for Seventh Semester: (Two)

1. CS451 Principles of Cryptography
2. CS453 Network Principles & Protocols
3. CS455 Mobile Computing
4. CS457 Computer Graphics and Image Processing
5. EC453 ARM System Architecture
6. EE453 Fuzzy Systems
7. Any Elective from Other Department

List of Electives for Eighth Semester: (Two)

1. CS452 Real Time Systems
2. CS454 Data Warehousing And Data Mining
3. CS456 Advanced Topics in Algorithms
4. CS458 CAD for VLSI
   (NPTEL URI: http://nptel/web/coursecontents_comp.php?sem=Semester%206)
5. EC464 Display Systems
6. EE456 Artificial Neural Networks
7. Any Elective from Other Department

Reserved List of Electives

(To be exchanged with offered list of electives based on requirements in future)

1. CS355 Fault Tolerant Computing Systems
2. CS357 Networked Multimedia Systems
3. CS359 High Speed Networks
4. CS363 Object Oriented System Design
5. CS358 Distributed Data Base Systems
6. CS360 Software Design & Practices

THIRD SEMESTER

CS201: Discrete Mathematics

Credit: 3

Objectives

To get familiar and understand the fundamental notions in discrete mathematics

To understand and demonstrate the basic concept of an algorithm and its application in combinatorial mathematics

To identify the basic properties of graphs and trees and model simple applications

Unit – I

Set Theory - Set operations, properties - power set - methods of proof - relations, graph and matrix of a relation - partial and total orders, well ordering - equivalence relations, classes and properties - functions, 1-1, onto and bijective

Unit – II

Induction and Combinatorics - Peano's axioms - Mathematical induction (simple and strong) - pigeon-hole principle - principle of inclusion and exclusion

Unit – III

Algebraic Structures - Semi-groups, monoids, groups, subgroups and their properties - cyclic groups - cosets - permutation groups - Lagrange's theorem - Cayley's theorem - normal subgroups - homomorphism of groups - quotient groups - rings and fields

Unit – IV

Recurrence Relations and Generating Functions - Homogeneous and inhomogeneous recurrences- solving recurrences - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.

Unit – V

Graph Theory - - Representation of a graph - Trees - Cycles - Paths and connectedness - Graph Isomorphism - Operations on graphs - Vertex and edge cuts

Outcomes

Ability to distinguish between the notion of discrete and continuous mathematical structures

Ability to construct and interpret finite state diagrams and DFSA Application of induction and other proof techniques towards problem solving

Text Book

K. D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd.

Reference Books

1. Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall
2. R. Balakrishnan and K.Ranganathan, "A Text Book of Graph Theory", Springer
3. D. S. Chandrasekharaih, “Discrete Mathematical Structures”, Prism Books, 2005

CS203: Principles of Programming Languages

Credit: 3

Objectives

To provide an introduction to formalisms for specifying syntax and semantics of programming languages

To provide an exposure to core concepts and principles in contemporary programming languages

To analyze and optimize the complexity of the programming languages.
To explore the concept of concurrent and parallel programming

Unit – I

Introduction to Language Paradigms - Criteria for good language design - Data types - Abstraction - Imperative languages - Pascal, C - design issues.

Unit – II

Object-Oriented Programming - Data encapsulation - Classes in C++ - Over loading - Derived classes - Information hiding - Inheritance and polymorphism - Generic functions.

Unit – III

Functional Programming - Introduction to LISP - Lists - Storage allocation for lists - Some useful functions - Error handling.

Unit – IV

Logic Programming - Computing with relations - Introduction to Prolog - Data structures in Prolog - Programming techniques - Control in Prolog - Cuts.

Unit – V

Parallel Programming - Synchronizations - Concurrency - Deadlocks - Mutual exclusion - Concurrent programming - Communicating sequential processes: input-output commands.

Outcomes

Ability to program in different language paradigms and evaluate their relative benefits

Knowledge of, and ability to use, language features used in current programming languages
Develop algorithms for problem solving

Text Book

R. SETHI, "Programming Languages: Concepts and Constructs", II Ed., Pearson Education, 1996

Reference Book

Robert W. Sebesta, "Concepts of Programming languages", IV Ed., Pearson Education 1999

CS205: Numerical Computing

Credit: 3

Objectives

To learn about existence and uniqueness criteria for numerical methods
To solve systems of linear equations by direct methods
To use iterative methods to solve systems of non-linear equations

Unit – I

Non-Linear Systems - Various types of errors - Bisection method - Regula falsi method - Newton-Raphson method - Graffe's method - Bairstow's method - Newton's method for solving $f(x,y) = 0$ and $g(x,y) = 0$.

Unit – II

Linear Systems - Gaussian elimination - Iterative methods - Sufficient conditions for convergence - LU decomposition method - Power method to find the dominant Eigen value and Eigen vector.

Unit – III

Interpolation and Curve Fitting - Newton's forward and backward interpolation - Method of least squares to fit equations of the form $y = ab^2$ and $y = ax^2 + bx + c$.

Unit – IV

Numerical Differentiation and Integration - Simpson's one-third rule - Simpson's three-eighth rule - Double integration using trapezoidal and Simpson's one-third rule.

Unit – V

Numerical Solution of Differential Equations - Euler's method - Taylor's method - Runge-Kutta method of fourth order - Numerical solution of Laplace equation - One-dimensional heat flow equation and wave equation by finite difference methods.

Outcomes

- Ability to understand numerical algorithms
- Skill set in implementing algorithms to solve mathematical problems

Text Book

P. Kandasamy and K. Thilagavathy, “Numerical Methods”, S. Chand Publication, 2007.

Reference Books

C. F. Gerald and P. O. Wheatley, "Applied Numerical Analysis", McGraw Hill, 1981

Cheneg and Kincaid, "Introduction To Numerical Computing", Tata McGraw-Hill, 1998

CS207: Data Structures

Credit: 3

Objectives

To understand the various techniques of sorting and searching
To design and implement arrays, stacks, queues, and linked lists
To understand the complex data structures such as trees and graphs

Unit – I

Development of Algorithms - Notations and analysis - Storage structures for arrays - Sparse matrices - Stacks and Queues: Representations and applications.

Unit – II

Linked Lists - Linked stacks and queues - Operations on polynomials - Doubly linked lists - Circularly linked lists - Dynamic storage management - Garbage collection and compaction.

Unit – III

Binary Trees - Binary search trees - Tree traversal - Expression manipulation - Symbol table construction - Height balanced trees - Red-black trees.

Unit – IV

Graphs - Representation of graphs - BFS, DFS - Topological sort - Shortest path problems. String representation and manipulations - Pattern matching.

Unit – V

Sorting Techniques - Selection, Bubble, Insertion, Merge, Heap, Quick, and Radix sort - Address calculation - Linear search - Binary search - Hash table methods.

Outcomes

- Ability to write programs to implement stacks, queues, linked lists
- Application of trees and graphs in real world scenarios
- Technical knowhow on the implementation of sorting searching algorithms

Text Books

1. J. P. Tremblay and P. G. Sorenson, "An Introduction to Data Structures with applications", Second Edition, Tata McGraw Hill, 1981
2. M. Tenenbaum and Augestien, “Data Structures using C”, Third Edition, Pearson Education 2007.

Reference Book

1. Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, Universities Press (I) Pvt. Ltd.

CS209: Digital Computer Fundamentals

Credit: 3

Objectives

To impart the essential knowledge on the fundamentals and applications of digital circuits and digital computing principles

To provide an overview on the design principles of digital computing systems

To provide technical knowledge about various digital hardware components

Unit – I

Binary codes - Weighted and non-weighted - Binary arithmetic conversion algorithms - Error detecting and error correcting codes - Canonical and standard boolean expressions - Truth tables.

Unit – II

K-map reduction - Don't care conditions - Adders / Subtractors - Carry look-ahead adder - Code conversion algorithms - Design of code converters - Equivalence functions.

Unit – III

Binary/Decimal Parallel Adder/Subtractor for signed numbers - Magnitude comparator - Decoders / Encoders - Multiplexers / Demultiplexers - Boolean function implementation using multiplexers.

Unit – IV

Sequential logic - Basic latch - Flip-flops (SR, D, JK, T and Master-Slave) - Triggering of flip-flops - Counters - Design procedure - Ripple counters - BCD and Binary - Synchronous counters.

Unit – V

Registers - Shift registers - Registers with parallel load - Memory unit - Examples of RAM, ROM, PROM, EPROM - Reduction of state and flow tables - Race-free state assignment - Hazards.

Outcomes

Gain knowledge on the basic logics and techniques related with digital computers

Expertise to design and implement various complicated digital systems

Text Book

Morris Mano, "Digital Design", Prentice Hall of India, 2001

Reference Book

W. H. Gothmann, "Digital Electronics - An Introduction to Theory and Practice", Prentice Hall of India, 2000

CS211: Computer Organization and Architecture

Credit: 3

Objectives

To understand how computers are constructed out of a set of functional units and how the functional units operate, interact, and communicate

To understand the factors and trade-offs that affect computer performance

To understand the concrete representation of data at the machine level and how computations are performed at the machine level

Unit – I

Basic structure of computers - Operational concepts - Bus structures - Arithmetic operations - Memory operations - Addressing modes - Basic I/O operations - Performance.

Unit – II

Arithmetic - Addition & subtraction of signed numbers - Multiplication - Integer division - Floating point operations.

Unit – III

Processing unit - Control unit - Pipelining - Multiple bus organization - Hardwired control - Micro programmed control - Hazards - Data path - Embedded systems.

Unit – IV

Memory system - Basic concepts - Semiconductor RAM memory - Cache memory - Performance considerations - Virtual memory - Secondary storage.

Unit – V

I/O Organization - Accessing I/O devices - Interrupts - DMA - Buses - Interface circuits - Serial communication links.

Outcomes

Ability to understand the merits and pitfalls in computer performance measurements

Ablity to understand memory hierarchy and its impact on computer cost/ performance

Technical knowhow of the advantage of instruction level parallelism and pipelining for high performance processor design

Text Book

C. Hamacher, Z. Vranesic, and S. Zaky, "Computer Organization", McGraw Hill, Fifth Edition, 2002

Reference Book

W. Stallings, "Computer Organization and Architecture", Pearson education, First Edition, 2002

CS213: Programming Languages Laboratory

Credit: 2

Objectives

To know and understand the principal programming abstractions

To be able to express computational solutions in the main programming idioms

To be able to program in imperative, concurrent, functional and object-oriented programming languages.

Experiments

1. UNIX shell programming
2. Programming tools and windows
3. Network File Systems
4. Network Information Systems
5. Message Passing Interface
6. Functional programming techniques through LISP
7. Object-oriented programming techniques through C++/Java
8. Logic programming through techniques PROLOG

Outcomes

Ability to write program in specific language (C, C++/Java, Scheme, and PROLOG)

Ability to test and debug the programs for critical errors
Ability to analyze and optimize program

CS215: Data Structures Laboratory

Credit: 2

Objectives

To analyze the time and space complexities and efficiency of various algorithms.

To understand the practical application of linear and nonlinear data structures. To introduce and practice advanced algorithms, programming techniques necessary for developing sophisticated computer application programs.

Experiments

Problems in C/C++/ Java using data structures involving arrays, stacks, queues, strings, linked lists, trees, graphs.
Operations on stacks, queues and linked lists

Conversion of infix expressions to postfix and evaluation of postfix expressions
Implementation of priority queue

Implementation of Binary Tree and Binary Search
Tree Implementation of Sorting Techniques

Outcomes

Ability to apply and implement the learned algorithm for problem solving
Ability to identify the data structure to develop program for real time applications

FOURTH SEMESTER

CS202: Automata and Formal Languages

Credit: 2

Objectives

To provide a challenging introduction to some of the central ideas of theoretical computer science

To provide a set of mathematical tools for understanding complex systems such as universes and minds

Unit – I

Finite Automata - Deterministic, non-deterministic and equivalence - Equivalence of regular expressions and FA - Moore and Mealy machines.

Unit – II

Regular Languages - Pumping lemma of regular sets - Myhill Nerode theorem - Minimization of finite automata - Chomsky hierarchy of languages.

Unit – III

Text-Free Language - Context-free grammar - Derivation trees - Ambiguity simplification - Normal forms - UVWXY theorem - Applications.

Unit – IV

Pushdown Automata - Definitions - Context free languages - Construction of PDA for simple CFLs - Linear bounded automata.

Unit – V

Turing Machines - Universal Turing Machines - Types of Turing Machines - Techniques - Halting problem - Stack automata - Definitions.

Outcomes

Proficiency with mathematical tools and formal method

Technical knowhow on applying the techniques to computing

Text Book

J. E. Hopcroft and J. D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 2001

Reference Book

Peter Linz, "An Introduction to Formal Language and Automata", Narosa Pub. House, Reprint 2000

CS204: Digital System Design

Credit: 3

Objectives

To understand the architecture of basic building blocks, logic gates, adders, multipliers, shifters and other digital devices

- To understand the logic of minimization techniques including Karnaugh
- Maps To understand the structure of field programmable logic circuits FPGAs
- To analyze design of combinational logic, sequential circuits, PLA, PAL

Unit – I

Introduction to VLSI design - Basic gate design - Digital VLSI design - Design of general boolean circuits using CMOS gates.

Unit – II

Verilog Concepts – Basic concepts – Modules & ports & Functions – useful modeling techniques – Timing and delays – user defined primitives.

Unit – III

Modeling Techniques – Gate level modeling – Dataflow modeling – Physical modeling – Structural / Data flow modeling – Switch level modeling.

Unit – IV

Advanced Verilog Concepts – Synthesis concepts – Inferring latches and flip-flops – Modeling techniques for efficient circuit design.

Unit – V

Design of high-speed arithmetic circuits - Parallelism - Pipelined Wallace tree tipliers - Systolic algorithms - Systolic matrix multiplication.

Outcomes

Ability to design basic digital circuits and systems.

Ablilty to understand and use high-level hardware description languages such as VHDL or Verilog to design combinational or sequential circuits

Text Book

Samir Palnitkar, "Verilog HDL Synthesis", BS Publications, First Edition, 2001

Reference Book

Bhaskar, "Verilog HDL Synthesis", BS Publications, First Edition, 2001

CS206: Logical Foundations of Computer Science

Credit: 3

Objectives

To study about the notions, mechanisms, and properties of weakest preconditions

To learn how to create a strong guarded commands and its related theorems To learn the basics of propositional logic and its conversions

To analyze the principles and proofs of predicate calculus.

Unit – I

Review of Prepositional Calculus - Validity - Satisfiability related concepts - CNF and DNF forms - Conversion of arbitrary prepositional formula to CNF or DNF.

Unit – II

Compactness idea - Resolution principle and proof of the theorem - Review of predicate calculus - Interpretation of formulae in predicate calculus.

Unit – III

Prenex normal form and examples - Application of logic in programming - Proof rules for structured statements (assignment, while, repeat-until, for statements).

Unit – IV

Pre-conditions / Post-conditions - Weakest precondition - Notion of machine - Mechanism and Wp as a predicate transformer - Properties of Wp.

Unit – V

Guarded Commands - General form of if command - Wp of if - Related theorem - General form of do command - Wp of do - Need for strong guards.

Outcomes

Ability to define and convert the prepositional formula.

Knowledge of predicate calculus and its application in programming. Ability to identify the related theorems and proofs of predicate calculus.

Text Books

D. Gries, "The Science of Programming", Narosa, 1981

S. Alagic, M. A. Arbib, "The Design of Well-Structured and Correct Programs", SpringerVerlagn, 1978

Reference Book

E. W. Djikstra, "A Discipline of Programming", Prentice Hall, Englewood Cliffs, 1976

CS208: Introduction to Algorithms

Credit: 3

Objectives

To understand the importance of algorithm and its complexity

To analyze the complexity of an algorithm in terms of time and space complexities

To design and implement various programming paradigms and its complexity

Unit – I

Algorithms - Examples - Tournament method - Evaluating polynomial functions - pre-processing of coefficients - solving recurrence equations.

Unit – II

Divide and Conquer method - Strassen's matrix multiplication - Greedy method - Knapsack problem - Job sequencing with deadlines - Minimum spanning trees.

Unit – III

Dynamic Programming - Multistage graphs - All pair's shortest paths - Optimal binary search trees - Travelling salesman problem - Fast Fourier transform.

Unit – IV

Randomized Algorithms and Amortized Analysis - Las Vegas and Monte Carlo types - Randomized quick sort and its analysis - Min-Cut algorithm.

Unit – V

NP-Hard and NP-complete problems - Basic concepts - Reducibility - Cook's theorem (without proof) - Turing machines - NP-Hard graph problems.

Outcomes

- Ability to analyze the time and space complexity, given an algorithm
- Apply the techniques of algorithm in solving real world problems
- Systematic development of an algorithm for solving a problem

Text Book

T. H. Cormen, C. E. Leiserson, R. L. Rivest, "Introduction to Algorithms", The MIT press, Cambridge, Massachusetts and McGraw Hill, 1990

Reference Book:

A. V. Aho, J. E. Hopcroft and J. D. Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley, 1974

EC214: Basics of Communication Engineering

Credit: 3

Objectives

To have a detailed study of various analog and digital modulation and demodulation techniques

To have a thorough knowledge of various multiplexing schemes and Data communication protocols

To know about the standards and mechanisms of television systems

Unit – I

Principles of Amplitude Modulation, single and double side band - suppressed carrier system and frequency modulation - varactor diode and reactance modulator - AM detectors - FM discriminators - AM and FM transmitters and receivers.

Unit – II

Sampling theorem - pulse modulation techniques - PAM, PWM and PPM concepts - PCM encoder and decoder - multliplexing - time division multiplexing and frequency division multiplexing.

Unit – III

Data transmission using analog carriers - MODEMS employing FSK, QPSK, QAM and MSK - asynchronous and synchronous transmission - error control techniques - data communication protocols - link oriented protocols - asynchronous protocols.

Unit – IV

Microwave links, Optical communication principles - Satellite communication systems - Pagers - Cellular phones - EPABX.

Unit – V

Requirements and standards - need for scanning - interlaced scanning - VSB modulation - types of camera tubes and picture tubes - B/W and color systems - PAL - CCTV -Cable TV - Microwave relay systems.

Outcomes

Gain a thorough knowledge of communication systems

Able to build a miniature communication system

Text Book

1. Simon Haykin - Communication systems.
2. R. R. Gulathi - Modern Television Engineering & Practice.
3. John G. Proakis and M. Salehi - Communication Systems Engineering.

Reference Books

1. Kennedy - Electronic Communication systems.
2. Taub and Schilling – Principles of Communication Systems, Tata McGraw Hill, 2nd Edition.
3. William Stallings – Data & Computer Communications, PHI, 7th Edition.
4. Wayne Tomasi – Electronic Communications Systems (Fundamentals through advanced), Pearson Education, 5th Edition.

MA204: Introduction to Probability Theory

Credit: 3

Objectives

To introduce the fundamental concepts and theorems of probability theory
To apply elements of stochastic processes for problems in real life

To understand elementary queuing concepts and apply elsewhere in computer science.

Unit – I

Axioms of probability theory - Probability spaces - Joint and conditional probabilities- Bayes' Theorem- Independent events.

Unit – II

Random Variable and random vectors - Distributions and densities. Independent random variables – Functions of one and two random variables.

Unit – III

Moments and characteristic functions - Inequalities of Chebyshev and Schwartz. Convergence concepts.

Unit – IV

Random processes - Stationarity and ergodicity - Strict sense and wide sense stationary processes - Covariance functions and their properties - Spectral representation - Wiener-Khinchine theorem.

Unit – V

Gaussian processes - Processes with independent increments - Poisson processes - Lowpass and Bandpass noise representations.

Outcomes

- Understand the necessity of randomness concept in practical situation
- Approximate the real problems using stochastic process and deduce
- results Deduce useful results and interpret them based on the analysis of queuing theory

Text Books

Davenport, Probability and Random Processes for Scientist and Engineers, McGraw-Hill

Papoulis, A., Probability, Random variables and Stochastic Processes, McGraw Hill.

CS214: Digital System Design Laboratory

Credit: 2

Objectives

To develop programs in Hardware Description Language

To design and implement synchronous sequential, asynchronous sequential circuits

To be familiar with basic combinational and sequential components used in the typical data path designs

Experiments

Design of a 32-bit carry look-ahead adder with logarithmic depth using Verilog

Design of a Wallace tree multiplier using Verilog

- Design of a 4-bit DSP processor using Verilog
- Burning the 4-bit DSP processor on a FPGA

Outcomes

Ability to design synchronous sequential circuits using basic flip-flops, counters, PLA, PAL

Familiarize with the necessary software skills to design basic digital systems
Technical expertise in debugging the digital circuits

CS216: Algorithms Laboratory

Credit: 2

Objectives

To learn how to analyze the complexity of algorithms

To compare and evaluate algorithms in terms of time and space complexity

To program brute force, divide and conquer, decrease and conquer, transform and conquer, greedy, and dynamic techniques

Experiments

- Estimating worst-case/average-case complexity of algorithms via programs
- Determining machine constants
- Programs involving some advanced data
- structures Implementing example problems
- Illustrating the different paradigms of algorithm design
- Solving miscellaneous problems e.g. problems in string manipulation, graph theory, optimization

Outcomes

Ability to solve and analyze general algorithms based on space and time complexity

Ability to implement and empirically compare fundamental algorithms and data structures to real-world problems

Knowledge about different algorithmic paradigms and optimization

FIFTH SEMESTER

CS301: Systems Programming

Credit: 3

Objectives

To introduce the major programming paradigms, data structures and principles involved in systems programming

To acquire comprehensive knowledge about various system components and its functionalities as well as the interactions with hardware resources

To provide basic insight about writing system programs for each system components

To gain knowledge about developing interfaces for various system components and its issues

Unit – I

Fundamentals of language processors - Language specification - Data structure for language processing - Scanning - Parsing.

Unit – II

Assemblers - Elements of assembly language programming - Single pass and two pass assembler - Assembler for IBM PC.

Unit – III

Macro Processors - Macro definition and call - Macro expansion - Conditional and nested macro calls - Design of a macro processor.

Unit – IV

Loaders - Relocation and linking concepts - Relocating programs - Design of a linker - Linking for overlays - A linker for MSDOS.

Unit – V

Linkers - Software tools - Text editor - Debug monitors - Interpreters - Program generators - User interfaces - Recent trends and developments.

Outcomes

Obtain deep knowledge about basic systems programming paradigms
Knowhow on the importance and design principles of various system component

Text Book

D. M. Dhamdhere, "System Programming and Operating Systems", Tata McGraw Hill, 3rd Edition, 2002

Reference Books

J. J. Donovan, "Systems Programming", McGraw Hill, 1984

Leland L. Beck, "An Introduction to Systems Programming", Addison-Wesley, 4th Edition, 2001

CS303: Computer Networks

Credit: 3

Objectives

To provide insight about networks, topologies, and the key concepts

To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities

To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP

To know the basic concepts of network security and its various security issues related with each layer

Unit – I

Introductory Concepts - Network hardware - Network software - Physical layer - Guided transmission media - Cable television.

Unit – II

Data Link Layer - Design issues - Channel allocation problem - Multiple access protocols - Ethernet - Wireless LAN - 802.11 architecture.

Unit – III

Network Layer - Design issues - Routing algorithms - Congestion control algorithms - Quality of Service - Internetworking.

Unit – IV

Transport Layer - Transport service - Elements of transport protocols - User Datagram Protocol - Transmission Control Protocol.

Unit – V

Application Layer - DNS - Electronic mail - World Wide Web - Multimedia - Network security.

Outcomes

Obtain insight about basic network theory and layered communication architectures

Provide solutions to various problems in network theory

Text Books

1. A. S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition, 2003
2. W. Stallings, "Data and Computer Communication", Pearson Education, Fifth Edition, 2001

Reference Book:

Behrouz A. Foruzan, “Data Communication and Networking”, Tata McGraw Hill, 2004

CS305: Microprocessor Systems

Credit: 3

Objectives

To acquire knowledge about the hardware architectures and the functional blocks of each microprocessors (8085, 8086, and 8088)

To know the functionality of common peripheral controllers and its interfaces with various peripheral devices

To gain the practical development of applications using microprocessors (8085 and 8086)

Unit – I

8085 Microprocessor - Architecture - Bus organization - Registers - ALU - Instruction set of 8085 - Instruction format - Addressing modes - Timing diagrams.

Unit – II

Serial I/O - Interrupts - Data transfer techniques - Parallel data transfer using 8155 - DMA transfer using 8257 DMA controller.

Unit – III

Microprocessor System Design - System design using interrupt controller - Floppy Disk Controller - CRT controller.

Unit – IV

Microprocessor Interfacing Techniques - Interfacing memory and I/O devices - Interfacing A/D converters and D/A converters - Recent trends and developments.

Unit – V

8086/8088 - Internal architecture - Instruction set - Segmented memory concepts - Memory interfacing [ROM/DRAM] - Bus concepts.

Outcomes

- Technical knowhow in identifying the basic components of microprocessors
- Ability to build a microprocessor/microcontroller based system for practical applications

Text Book

R. S. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085/8080A", Wiley Eastern Ltd, Second Edition, 1986

Reference Book

D. V. Hall, "Microprocessors and Digital Systems", McGraw Hill International students, Second Edition, 1986

CS307: Software Engineering

Credit: 3

Objectives

To understand the importance of software engineering lifecycle models in the development of software

- To understand the various design principles in modelling a software
- To develop a software which adheres to the standard benchmarks To
- undergo the technical know in the process of software testing

Unit – I

Software Process – Introduction – S/W Engineering Paradigm – life cycle models (waterfall, incremental, spiral, WINWIN spiral, evolutionary, prototyping) – system engineering – computer based system – life cycle process – development process

Unit – II

Software Requirements – Functional & non-functional – user-system requirement engineering process – feasibility studies – elicitation – validation & management – software prototyping – S/W documentation – Analysis and modelling

Unit – III

Design Concepts and Principles – modular design – design heuristic – S/W architecture – data design – architectural design – transform & transaction mapping – Introduction to SCM process – Software Configuration Items.

Unit – IV

Software Testing – Taxonomy of S/W testing – levels - black box testing – testing boundary conditions – structural testing — regression testing– S/W testing strategies – unit testing – integration testing – validation testing – system testing and debugging.

Unit – V

Software Project Management - S/W cost estimation – Function point models – COCOMO model – Delphi method – S/W challenges – S/W maintenance.

Outcomes

- Enhance the Software Project Management skills
- Develop a functioning software which benchmarks to the international standards

Text Book

R. S. Pressman, "Software Engineering - A practitioners approach", III Edition, McGraw Hill International editions, 1992.

Reference Books

IAN Sommerville, “Software Engineering”, Pearson Education Asia, VI Edition, 2000.

Pankaj Jalote, “An Integrated Approach to software Engineering”, Springer Verlag, 1997.

James F. Peters and Witold Pedryez, “Software Engineering – An Engineering Approach”, John Wiley and Sons, New Delhi.

CS309: Combinatorics and Graph Theory

Credit: 3

Objectives

To obtain basic knowledge about graphs, their properties and applications as models of networks

To formulate problems in terms of graphs, solve problems, and apply algorithms

To be familiar with a wide variety of graph theoretic ideas, notation, algorithms, and useful proof techniques

Unit – I

Permutations and Combinations - Distribution of distinct / non-distinct objects - Generating functions for combinations - Portion of integers - Ferrers graph.

Unit – II

Recurrence Relations - Linear recurrence relations with constant coefficients - Solution by the technique of generating functions - Permutations with restrictions on relative positions.

Unit – III

Basic Definitions - Trees and fundamental circuits - Cut-sets and Cut-vertices - Connectivity and Separability - Network flows - 1 and 2 isomorphism.

Unit – IV

Planar and Dual Graphs - Kuratowski's graphs - Representations of a planar graph - Vector space associated with a graph - Subspaces - Orthogonal vectors and spaces.

Unit – V

Matrix Representation of Graphs - Circuit matrix - Cutset matrix - Path matrix - Adjacency matrix - Coloring problems - Algorithms for fundamental circuits, cut-vertices and separability.

Outcomes

- Develop problem solving skills in the field of graph
- Application of pigeonhole principle and rules for counting, permutations, and combinations problems.

Text Books

E. S. Page and L. B. Wilson, "An introduction to computational combinatorics", Cambridge University Press, 1979

D. E. Knuth, O. Patashuk, and R. L. Graham, "Concrete Mathematics", 1994.

Reference Book

Douglas. B. West, "Introduction to Graph Theory", Second edition. Prentice Hall,2001

MA304: Principles of Operational Research

Credit: 3

Objectives

To classify and formulate real-life problem for modelling, solving and applying for decision making.

To study the formulation and various methods of solutions for linear programming, transportation, assignment , CPM and PERT problems

To solve problems using dynamic programming method

Unit - I

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method-Primal Dual problems.

Unit – II

Dual theory and Sensitivity analysis-Transportation and assignment problems-Applications(Emphasis should be more on problems than theory)

Unit – III

CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations-example-Sequencing problems.

Unit – IV

Replacement problems-Capital equipment-Discounting costs-Group replacement. Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models-Single period inventory models with shortage cost.

Unit – V

Dynamic programming-Formulation-Invest problem-General allocation problem-Stage coach problem-Production Scheduling.

Outcomes

Analyse problems in engineering, management, or business environment, focusing on important details

Formulate of real problems in terms of input-output-parameters relationships and identify the solution procedure

Text Books

H. A. Taha, operational research-An introduction, Macmillan, 1976

F. S. Hiller and G. J. Liebermann, Introduction to operational research (7^{th} edition)

B. E. Gillet, Introduction to operational research-A computer oriented algorithmic approach, McGraw Hill, 1989

H. M. Wagner, Principles of operational research with applications to managerial decisions, PH, Inc, 1975

CS313: Microprocessor Systems Laboratory

Credit: 2

Objectives

To understand and learn the assembly language programming of various microprocessor architectures

To obtain the practical training of interfacing the peripheral devices with the processor.

To control the components of a microprocessor based system through the use of interrupts.

To have a practical knowledge on assembling PC hardware, installation and troubleshooting the Microprocessor and Microcontrollers.

Experiments

- Solving problems using 8085
- Interfacing various devices with the microprocessor: A/D converter, D/A converter, seven segment display, stepper motor, external keyboard, interrupt controller and 8251 for serial data transfer

  Interfacing using microcontroller trainer kits
- PC hardware assembly
- Installation and trouble shooting

Outcomes

Obtain knowledge to doe programs in assembly language programming using the trainer kits

Utilize development kits effectively for the real time applications of various peripheral devices with the processor

Hands on experience in interfacing devices such as A/D converter, D/A converter, seven segment display, stepper motor with the microprocessor

CS315: Systems Programming Laboratory

Credit: 2

Objectives

To develop system software for a broad range of engineering and scientific applications.

To provide a deep understanding of the basic issues of interacting programs directly with the operating systems

To design and implement software tools like text editor, interpreter, program generator, etc.

Experiments

Symbol table (Tree-storage) construction

Implementation of single pass and two-pass assembler, macro pre-processor, module binder (with limited instruction set)

Implementation of software tools like text editor, interpreter, program generator, etc.

Outcomes

Clarity about the concrete view on the theoretical and practical aspects of system programming

Acquire skills with the basic tools used to develop software in C on Unix platform

Technical knowhow of the working principle of single pass and two-pass assembler, etc.

SIXTH SEMESTER

CS302: Information Security

Credit: 3

Objectives

To understand the threat models and the basic types of authentication mechanisms

To analyze cryptographic techniques, protocols, formats, and standards

To analyze different log files and understand Cyber laws to recover and secure the data

Unit – I

Introduction to security and services, vulnerabilities and countermeasures, malicious code, goals of security- prevention, detection, and recovery.

Unit – II

Cryptography-Types of encryption, confidentiality using symmetric encryption, PKI, RSA, Key management, Diffie- Hellman, ECC, CA, etc., authentication protocols.

Unit – III

Securing the systems-Network security protocols: SSL, IPSEC, Kerberoes, X.509 Authentication service, Electronic mail security S/MME, Application security- SSL, PGP, SET.

Unit – IV

Network perimeter security-Secured router configuration, firewall, design principles, trusted systems, VPN, IDS, IPS penetration testing, NAT.

Unit – V

Computer forensics and Cyber laws- data recovery, security policies and procedures, security lifestyle management, security audit, managed security services

Outcomes

- Apply cryptographic algorithms to avoid data accessing by unauthorized
- users Implement security algorithms as per the need of organization

Technical knowhow to extract required information from a huge log files

Text Books

1. Rick Lehtinen, G. T. Gangemi, SR.,Computer Security Basics, Second Edition, O'Reilly Pubs, June 2006.
2. Bruce Schneier, Applied Cryptography, Second Edition, John Wiley & Sons, 1996
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: Private Communication in a Public World, 2nd Edition, Prentice Hall, 2002.
4. William Stallings, Cryptography and Network Security, Fourth Edition, Prentice Hall, 2005
5. Stephen Northcutt, Karen Kent, and Lenny Zeltser, Inside Network Perimeter Security, Sams Publications, 200
6. Marije, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, 2004.

CS304: Operating Systems

Credit: 3

Objectives

To know the basics such as process and CPU scheduling algorithms
To understand the critical regions and dead lock problem

To understand virtual memory concept, thrashing problem and page replacement algorithms
To understand the file tables, access algorithms, and spoofing

Unit – I

Basic OS Concepts - User's view of the OS - Architectural support - Thread and process scheduling - Pre-emptive and non-preemptive - FCFS, SJF, Round Robin, Multilevel Queue.

Unit – II

Synchronization - Peterson's solution - Bakery algorithm - Hardware-based solutions - Semaphores - Critical regions - Problems of synchronization - Deadlock prevention and recovery - Banker's algorithms.

Unit – III

Memory Management - Segmentation, Paging and Virtual memory - Case study of x86 32-bit memory management unit - FCFS, FRU - Belady's anomaly - Stack-based algorithms - Thrashing - Working set.

Unit – IV

Design of the Unix File System - Buffer caches - File system organization - Inodes - Super blocks - File access algorithms - File tables - Inode tables - Network file systems.

Unit – V

I/O Organization - Block and character device drivers - Unix system file protection mechanism - Access and capability lists - Authentication - Spoofing - Case study of a virus on UNIX.

Outcomes

Implement CPU scheduling algorithms and resolve problems related to critical regions

- Implement page replacement algorithms like FCFS, LRU, etc. Technical
- knowhow to change UNIX access controls to protect the files

Text Book

A. Silberchatz and P. B. Galvin, "Operating System Concepts", Addison Wesley, VI Edition, 2005.

Reference Book

W. Stallings, "Operating Systems", Prentice Hall, V Edition, 2005.

CS306: Database Management Systems

Credit: 3

Objectives

To understand the different database models and language queries to access databases

To understand the normalization forms in building an effective database tables To protect the data and the database from unauthorized access and manipulation

Unit – I

Databases - Need - Concepts - Architecture - Data independence - Data modeling: Entity-relationship model - Weak entity sets - Mapping ER model to Relational model.

Unit – II

Concepts - Integrity constraints - Relational algebra - Relational calculus - Tuple relational calculus - Domain relational calculus - Overview of QBE.

Unit – III

SQL Queries - Nested queries - Aggregate operators - Null values - Embedded SQL - Database security - Views - Queries on views.

Unit – IV

Schema Refinement - Functional dependencies - Normalization - Decomposition - Armstrong's axioms - 3NF, BCNF, 4NF - Multi-valued dependencies.

Unit – V

Object-oriented data model - Object identity and pointers - Object definition and manipulation language - Object-oriented databases - Object relational databases - Recent trends.

Outcomes

- Install, configure, and interact with a relational database management system
- Master the basics of SQL and construct queries using SQL

Build a database management system that satisfies relational theory and provides access to users

Text Book

A. Silberchatz, F. Korth, and S. Sudarshan, "Database System Concepts", Fourth Edition, McGraw Hill, 2002.

Reference Book

R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Third Edition, Pearson Education, 2000

HM302: Corporate Communication

Credit: 3

Objectives

To introduce the students to the corporate world and its culture

To prepare for participation in seminars, group discussions, and interviews
To prepare students to present the ideas effectively

To enable the students write research papers and technical proposals

Outcomes

Gain confidence in dealing with different culture of people from across the globe

Systematically put forward the ideas in an effective manner to the global world

CS308: Artificial Intelligence and Expert Systems

Credit: 3

Objectives

To know about basic concepts of NLP and Machine Learning

To obtain a thorough knowledge of various knowledge representation schemes To have an overview of various AI applications

To study about various heuristic and game search algorithms
To know about various Expert System tools and applications

Unit – I

Search Strategies - Hill climbing - Backtracking - Graph search - Properties of A* algorithm - Monotone restriction - Specialized production systems - AO* algorithm.

Unit – II

Searching game trees - Minimax procedure - Alpha-beta pruning - Introduction to predicate calculus.

Unit – III

Knowledge Representation - Reasoning - STRIPS - Structured representation of knowledge - Dealing with uncertainty.

Unit – IV

Introduction to Expert Systems - Inference - Forward chaining - Backward chaining - Languages and tools - Explanation facilities - Knowledge acquisition.

Unit – V

Natural Language Processing - Introduction - Understanding - Perception - Machine learning.

Outcomes

Students gain thorough knowledge of AI applications, heuristics, Expert Systems, NLP, and Machine Learning techniques

Acquaintance with programming languages such as LISP and PROLOG.

Text Book

G. Luger, W. A. Stubblefield, "Artificial Intelligence", Third Edition, Addison-Wesley Longman, 1998.

Reference Book

N. J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 1980

CS314: Operating Systems Laboratory

Credit: 2

Objectives

To understand and write program in Unix environment
To design and implement the scheduling algorithms
To design and implement advanced file system operations

Experiments

Designing a command shell in Java
Synchronization of processes
Study of scheduling algorithms
Implementation of a file system
Advanced file system implementation

Outcomes

- Familiarize with the shell commands in Unix environment
- Ability to write system level programs

CS316: Database Laboratory

Credit: 2

Objectives

To understand basic concepts and terminology related to DB and storage management

To program simple database applications in Oracle/VB/DB2
To write application software with host language interface

Experiments

Exercises to be based on Sybase / Oracle / Postgres / VB / Power Builder / DB2 / MS-Access.

Applications involving vendor development systems, stores management system, finance management etc.
Creation and querying of database tables

Design of tables by normalization and dependency analysis
Writing application software with host language interface

Outcomes

- Ability to write queries on database tables in Oracle/VB/DB2
- Ability to apply normalization procedures in the database tables
- Design and develop applications using database technology

SEVENTH SEMESTER

CS401: Distributed Computing

Credit: 3

Objectives

To critically appraise advanced technologies for developing distributed systems

To practically examine the development of Microkernel, Distributed algorithms, Time stamping in distributed systems

To critically investigate the problems and pitfalls of distributed systems

To understand the assumptions and limitations of the underlying distributed systems

Unit – I

Distributed Systems - Goal - Advantages over centralized systems - Organization of multiprocessor systems - Hardware/software concepts - Review of layered protocols.

Unit – II

Client/Server Model - Microkernel - RMI - Distributed algorithms - Time stamping - Circulating tokens - Diffusing computations.

Unit – III

Mutual Exclusion Algorithm - Election algorithm - Detecting loss of tokens and regeneration - Distributed deadlock detection algorithms - Distributed termination algorithms.

Unit – IV

File Replication - Semantics of file sharing - Remote access methods - Fault tolerant issues - Introduction to distributed operating systems.

Unit – V

Introduction to Distributed Operating Systems - Motivations - Management systems - Levels of distribution transparency - Architecture - Introduction to concurrency control.

Outcomes

Ability to analyze, design, build, and deploy distributed computer systems using a variety of current application technologies and architecture

Promote the utilisation of industry standard distributed computing technologies such as J2EE and .NET

Text Books

1. George Coulouris and Jean Dollimore, and Tim Kindberg, "Distributed System Concepts and Design", 4th Edition, Addison Wesley, 2005
2. A. S. Tanenbaum, "Distributed Operating Systems", Prentice Hall, 1995.

Reference Book

S. Ceri and G.Pelagatti, "Distributed Databases - Principles and Systems", McGraw Hill, 1985

CS403: Web Technology

Credit: 3

Objectives

To have an overview of Internet Protocols and Client/Server models.

To understand the basics of Web Designing using HTML, DHTML, and CSS. To study about Socket Communication and RMI.

To learn the basics about Client side scripts and Server side scripts

Unit – I

Internet Principles – basic web concepts – Client/ server model – Retrieving data from Internet –Internet Protocols and applications

Unit – II

HTML forms – HTML tags emulation – Links and addressing- HTML and Images

Unit – III

Streaming – Networking Principles – Sockets for Clients – Sockets for Servers – Protocol Handlers – Content Handlers – Multicast sockets – Remote method Invocation.

Unit – IV

Scripts - Java Script, VB Script, DHTML, XML, CGI, Servlets.

Unit – V

Server Scripts - Java Sever Pages (JSP), Active Server pages (ASP), Simple applications – On-line databases – Monitoring user events – Plug-ins – Database connectivity.

Outcomes

Students gain a thorough knowledge of Internet principles, Web Designing tools

Able to build real world applications using Socket Communication, Client side, and Server side Scripting languages

Text Books:

1. Eillotte Rusty Harold, "Java Network Programming", O'Reilly Publications, 1997.
2. Harvey M. Deitel and Paul J. Deitel, "Internet & World Wide Web How to Program", 4th edition, 2008.
3. N. P. Gopalan and J. Akilandeswari, "Web Technology – A Developer's Perspective", PHIO Pvt Ltd., New Delhi-, 2007.

Reference Books:

1. Jason Hunter and William Crawford, "Java Servlets Programming", O'Reilly Publications, 1998.
2. Jeff Frantzen and Sobotka, "Java Script" Tata McGraw Hill, 1999.
3. Eric Ladd and Jim O'donnell, "Using HTML 4, XML and Java", Prentice Hall of India – QUE, 1999.

CS405: Principles of Compiler Design

Credit: 3

Objectives

To understand the various stages involved in the design of a compiler

To have a grasp on the syntactic and semantic structure in the compiler design

Unit – I

Introduction - Structure of a compiler - Different phases of a compiler - Finite automata and lexical analysis.

Unit – II

Syntactic specification - Context-free grammars - Derivation and parse trees - Basic parsing techniques.

Unit – III

LR Parsers - SLR, Canonical LR and LALR - Syntax-directed translation schemes - Various forms of intermediate code.

Unit – IV

Translation of array references: procedure calls, declarations and case statements - Symbol tables - Run-time storage administration - Error detection and recovery.

Unit – V

Code Optimization - Loop optimization - DAG representation of basic blocks - Code generation from DAG's - Compiler compilers: YACC - Attributed parser generators.

Outcomes

Technical expertises to design, develop, and implement a compiler for any language.

Text Book

A. V. Aho, R. Sethi, and J. D. Ullman, "Compilers, Principles, Techniques and Tools", Pearson Education, 13th Indian Reprint, 2003

Reference Book

J. P. Tremblay and P. G. Sorrenson, "The Theory and Practice of Compiler Writing", McGraw Hill, 1985

CS407: Advanced Computer Architecture

Credit: 3

Objectives

To understand the fundamental knowledge in architecture design, pipelined processor design, and their impacts on performance

To understand the fundamental knowledge in memory hierarchy

To assess the communication and the computing possibilities of parallel system architecture

Unit – I

Parallel computer models - Flynn's classification - Parallel and vector computers - System, implicit and explicit parallelism - Multi-vector and SIMD computers - PRAM and VLSI models.

Unit – II

Program and network properties - Data and control dependence - Hardware and software parallelism - Partitioning and scheduling - Interconnection architectures.

Unit – III

Performance laws - Metrics and measures - Amdahl's law for fixed workload - Bounded speed-up model - Scalability analysis and approaches.

Unit – IV

Symbolic Processors - CISC and RISC architectures - Super scalar processors and their features - Memory hierarchy.

Unit – V

Linear Pipeline Processors - Basic considerations - Basics of non-linear pipeline processors - Design of pipelined architecture - Recent trends and developments.

Outcomes

Ability to understand parallelism both in terms of a single processor and multiple processors

Technical understanding of parallel hardware constructs

Text Book

K. Hwang, "Advanced Computer Architecture, Parallelism, Scalability, Programmability", McGraw Hill, New York, 1993

Reference Book

D. A. Patterson and J. L. Hennessy, "Computer Architecture: A Quantitative Approach", Harcourt Asia, Morgan Kaufmann, 1999

CS413: Compiler Design Laboratory

Credit: 2

Objectives

To provide a deep insight into the various programmatic stages in building a compiler

Experiments

Design of lexical analyzers and parsers like recursive-descent parser for a block structured language with typical constructs

Exercises using LEX and YACC

Quadruples/Triples generation using LEX and YACC for a subset of a block structured language, e.g. PASCAL

Outcome

Complete understanding of the working principles of a compiler

Technical expertise to design, develop, and implement a compiler for any language

CS415: Web Technology Laboratory

Credit: 2

Objectives

- To develop skills in Web Designing using HTML, DHTML, and CSS.
- To implement application protocols such as HTTP request, FTP, SMTP, POP3 in Java Socket Programming

To develop programming skills in using client side and server side scripting languages

Experiments

Designing a static web page using HTML.

Designing a dynamic web page using DHTML using different style sheets

Working with AWT and different Layouts in Java

Programs using Java Applets

Programs for creating simple chat application using Datagram sockets and Datagram packets

Java Socket programming to implement HTTP request, FTP, SMTP, POP3

Programs using Java servlets to create three-tier applications

Outcomes

Programming skillset in developing internet applications

Know how on developing sophisticated web sites and web applications

EIGHTH SEMESTER

CS402: Advanced Database Management Systems

Credit: 2

Objectives

To understand the basic concepts and terminology related to DBMS and Relational Database Design

To the design and implement Distributed Databases.

To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports

Unit – I

Concepts - EER-to-Relational mapping - Integrity constraints in data modeling - Review of normalization theory - Review of file structures and access methods.

Unit – II

Basic Algorithms - Use of heuristics - Optimization algorithm - Heuristic optimization of query graphs - Using cost estimations in query optimization.

Unit – III

More Concepts - Concurrent execution - Implementation of atomicity, durability - Isolation - Recoverability - Serializability of schedules - Testing for conflict - Serializability - View serializability.

Unit – IV

Lock-based protocols - Timestamp-based protocols - Validation-based protocols - Multiversion schemes - Deadlock handling.

Unit – V

Log-based recovery - Buffer management - Recovery with concurrent transactions - Recovery techniques - Shadow paging. Database System Architectures - Parallel databases - Advanced transaction processing - Emerging database applications - Recent trends and developments.

Outcomes

Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries.

Knowhow of the file organization, Query Optimization, Transaction management, and database administration techniques

Text Book

A. Silberschatz, H. F. Korth, and S. Sudarshan, "Database System Concepts", Fourth Edition, McGraw Hill, 2000

Reference Book

R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Third Edition, Pearson Education, 2000

HM402: Industrial Economics

Credit: 3

Objectives

To provide the analytical skills required for understanding problems in industrial economics, including applications of game theory

To analyze various aspects of strategic interaction between firms and the determinants of industrial structure

To apply economic models of firm behaviour to analyse questions in business strategy, competition policy, and regulation

Unit – I

Industrial Economics - Elasticity of demand and supply - Consumption laws - Types of competitions - Keynesian employment theory - Production, planning and control.

Unit – II

Money Banking & Financial Management - Functions of commercial and central banking - The problem of foreign exchange - Sources of industrial finance - Management accounting.

Unit – III

General Management - Principles of management - Scientific management - Advanced techniques in management: MBE, MBO, MBC, MBP, MIS - Quantitative techniques in management.

Unit – IV

Marketing Management - Definition of marketing - Market research - Need for marketing - Sales forecasting - Product life cycle - Market segmentation.

Unit – V

Personnel Management & Industrial Psychology - Selection and recruitment - Training and development - Job evaluation and merit rating - Worker participation - Quality - Work life.

Outcomes

Ability to understand the determinants of the size and structure of firms and the implications of the separation of ownership and control

Ability to recognize and explain the basic determinants of market structure and the key issues in competition policy and regulation

Text Books

Gupta, G. S., "Managerial Economics", Tata McGraw Hill, 1993 Edition.
Rasad, L. N., "Principles of Management Theory and Practice", Sultan & Chand, 1992 Edition.

Reference Books

Davar, S. R., "Personal Management & Industrial Relations", Vikas Publishing (P) Ltd., 1993 Edition.

List of Electives

CS352: Design and Analysis of Parallel Algorithms

Credit: 3

Objectives

To learn about parallel computing models, design and analyze parallel algorithms for PRAM machines and Interconnection networks.

Unit – I

Introduction to Parallel Computers - SIMD - EREW, CREW - SM-SIMD algorithms - Shared memory SIMD - Tree and mesh interconnection computers.

Unit – II

Sorting - Sorting on a linear array - Sorting on a mesh - Sorting on EREW SIMD computer - MIMD enumeration sort - MIMD quick sort - Sorting on other networks.

Unit – III

Matrix operations - Mesh transpose - Shuffle transpose - EREW transpose - Mesh multiplication - Cube multiplication - Matrix by vector multiplication - Tree multiplication.

Unit – IV

Numerical problems - Linear equations - SIMD algorithm - Roots of nonlinear equations - MIMD algorithm - Partial differential equations - Computing Eigen values.

Unit – V

Graph problems - Computing the connectivity matrix - Finding connected components - Traversal - Minimal alpha-beta tree - Storage requirements.

Outcomes

To enable the student to design and analyze parallel algorithms

Text Book

S. G. Akl, "The Design and Analysis of Parallel Algorithms", Prentice Hall of India, 1989.

Reference Book

S. Lakshmivarahan and S. K. Dhall, "Analysis and Design of Parallel Algorithms - Arithmetic and Matrix Problems", McGraw Hill, 1990

CS354: Advanced Microprocessor Systems

Credit: 3

Objectives

To describe the function of the microprocessor and detail its basic operation
To understand the concepts of advanced architecture in the microprocessors
To describe the function and purpose of each program-visible registers in microprocessor
To describe the memory access in real mode and protected mode

Unit – I

80286 Architecture - Instruction set - Addressing modes - Real mode - Protected mode - 80386 Architecture - Address segmentation - Paging - Segment registers.

Unit – II

Basic 486 Architecture - 486 memory system and memory management - Features of Pentium memory and I/O systems - Pentium memory management - Introduction to Pentium Pro features.

Unit – II

Introduction to PCs - Study of PC system layout - SCSI, CD-ROM & multimedia - Development of PC - PC components - Features and system design - Motherboards - Buses - BIOS.

Unit – IV

IDE Interface - Magnetic storage principles - Hard disk storage - Floppy disk storage - Optical Storage - Physical drive installation and configuration - Video hardware - Audio hardware.

Unit – V

Input devices - Power supply chassis - Building/upgrading systems - PC diagnostics - Testing and maintenance.

Outcomes

Technical understanding of the functionality of 80286 architecture to design advanced microprocessors systems

Ability to design and use new interface techniques principle to access the peripherals.

Familiarize with the internal structure of motherboard and its components Technical knowhow in designing a new chip

Text Book

D. V. Hall, "Microprocessor and Interfacing Programming and Hardware", McGraw Hill, II Edition, 1999.

Reference Book

B. B. Brey, "The Intel Microprocessors 8086/8088, 80186/ 80188, 80286, 80386, 80486 and Pentium and Pentium Pro Processor", Prentice Hall of India, V Edition, 2006.

CS451: Principles of Cryptography

Credit: 3

Objectives

To gain knowledge about the mathematics of the cryptographic algorithms.

To get an insight into the working of different existing cryptographic algorithms. To learn how to use cryptographic algorithms in security.

Unit – I

Origins of Cryptography - Issues - Codes and ciphers - Preliminary ideas of factoring and testing - gcd and its complexity.

Unit – II

Symmetric Key Cryptosystems - Block ciphers - Substitution ciphers - DES and Feistel ciphers and the problem of breaking them - The field Z/pZ - Euler's φ function.

Unit – III

Stream Ciphers - Linear feedback shift registers and associated results - Geffe generator - Diffe-Hellman key exchange - Bit commitment using symmetric key.

Unit – IV

Public-key Cryptosystems - Discrete logarithm - RSA and Miller-Rabin - Authentication - Digital signatures - Merkle-Hellman Knapsack public key cipher.

Unit – V

Factoring and other topics - Pollard ρ-heuristic - Pollard p-1 algorithm - Quadratic sieve algorithm - Zero-knowledge proof idea - Recent developments.

Outcomes

- Design and implement a new unbreakable cryptosystem
- Blend the existing cryptographic algorithms with the existing communication protocols

  Analyze and application of cryptography for secure eCommerce and other secret transactions

Text Book

A. J. Menezes, P. Van Oorschot , and S. Vanstone, "Handbook of Applied Cryptography", CRC Press

Reference Book

William Stallings, "Cryptography and Network Security", Pearson Education, 3rd Edition, Reprint 2003

CS453: Network Principles and Protocols

Credit: 3

Objectives

Understand the architecture of the Internet protocols as a layered model

To understand the fundamentals of data transmission, encoding and multiplexing

To understand how the various components of wide area networks and local area networks work together

Unit – I

Introduction to Networks - Applications of networks - Architecture - Topology - Switching - SLIP - PPP - ALOHA protocols - CSMA/CD - IEEE 802.3, 802.4, 802.5.

Unit – II

Network Layer Issues - Routing - Congestion control - Internetworking - Issues - Address learning bridges - Spanning tree - Source routing - Bridges - Routers - Gateways.

Unit – III

Network Protocols - IP datagram - hop by hop routing - ARP/RARP - Subnet addressing - Address masking - ICMP - RIP/RIPV2 - OSPF - DNS - LAN and WAN multicast.

Unit – IV

Transport Layer - Design issues - Connection management - Transmission Control Protocol (TCP) - User Datagram Protocol (UDP).

Unit – V

Application Layer - Telnet - TFTP - FTP - SMTP - Ping - Finger - Bootstrap - Network Time Protocol - SNMP.

Outcomes

Familiarization of the different layers of TCP/IP protocol stack

Understanding of the working principle of different protocols at different layers

Text Book

A. S. Tanenbaum, "Computer Networks", Third Edition, Prentice Hall India, 1997

Reference Book

W. Richard Stevens, "TCP/IP Illustrated - Volume I, The protocols", Addition-Wesley Professional Computing Series, 1994

CS455: Mobile Computing

Credit: 3

Objectives

To understand the fundamentals of Mobile communication systems.

To understand the different multiplexing scheme.

To understand the significance of different layers in mobile system

Unit – I

Introduction to Wireless Networks – Applications – History – Simplified Reference Model – Wireless transmission – Frequencies – Signals – Antennas – Signal propagation – Multiplexing – Modulation – Spread spectrum – Cellular Systems.

Unit – II

MAC – Motivation – SDMA, FDMA, TDMA, CDMA –Telecommunication Systems – GSM – DECT – TETRA – UMTS – IMT-2000.

Unit – III

Wireless LAN – Infrared Vs Radio transmission – Infrastructure – Adhoc Network – 802.11 – HIPERLAN – Bluetooth – Mobile Network Layer – Mobile IP – Dynamic Host Configuration Protocol.

Unit – IV

Adhoc Networks – Mobile Transport Layer – Traditional TCP – Indirect TCP – Snooping TCP – Mobile TCP – Fast retransmit / Fast recovery – Transmission / Time-out freezing – Selective retransmission – Transaction Oriented TCP.

Unit – V

Support for Mobility – File Systems – WWW – Wireless Application Protocol.

Outcomes

Understand the concepts of mobile and wireless communications.

Apply the knowledge gained in exploring, application and protocol development.

Text Book

Jochen Schiller, "Mobile Communications", Pearson Education, Asia Publications, 2000.

Reference Book

William Stallings, "Wireless Communication and Networks".

CS457: Computer Graphics and Image Processing

Credit: 3

Objectives

To understand basic algorithms for computer graphics and image processing.

To understand various filters, Point processing, and Arithmetic operations in image processing.

To understand different applications of graphics and image processing.

Unit – I

Graphics Systems and Graphical User Interface - Pixel, Resolution – Graphical devices: input and output devices – Hard copy devices – Direct screen interaction – Color models.

Unit – II

Geometric display primitives - Points, Lines and Polygons. Point display method, 2D Transformations and Viewing : Transformations – Types. Homogeneous coordinates – Window to view port transformations. Clipping: Point, Lines, Polygons.

Unit – III

Image Formation and types – Image operations – Arithmetic, Geometric and Morphological Operations - Basic geometric transformations - Sampling and Quantization.

Unit – IV

Image segmentation and Feature extraction - Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection –Thresholding – Region Based Segmentation – Morphology - WaterSheds – Motion Segmentation, Feature Analysis and Extraction.

Unit – V

Image Classification – Image Recognition – Image Understanding – Video Motion Analysis – Image Fusion – Steganography – Mosaics – Color Image Processing.

Outcomes

Creation of software tools such as Games, Animation, and Recognition system

Text Books

Donald Hearn & M. Pauline Baker, and warren R. Carithers, “Computer Graphics”, Prentice-Hall of India, Fourth edition 2011.

Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, Third edition, 2011.

Reference Books

Newmann, W. M. and Sproull, R. F., "Principles of Interactive Computer Graphics", Tata McGraw-Hill, Second edition, 2008.

Foley, J. D., Van Dam, A., Fiener, S. K., and Hughes J. F., “Computer Graphics", Second edition, Pearson education, 2008.

Anil Jain, K., “Fundamentals of Digital Image Processing”, Prentice-Hall of India, 2001.

EC453: ARM System Architecture

Credit: 3

Objectives

To understand the importance of ARM architecture in the context of shift in computing device

To gain knowledge of ARM constructs in the field of System Architecture To understand the ARM architecture in detail in comparison with other contemporary architectures

Unit – I

RISC Machine - ARM programmer's model - Development tools - ARM assembly language programming.

Unit – II

ARM Organization - ARM instruction execution - ARM implementation - ARM Coprocessor interface - ARM instruction set.

Unit – III

Floating Point Architecture – Expressions - Conditional statement loops - Functions and procedures - Use of memory - Run-time environment.

Unit – IV

Thumb Instruction Set - Thumb programmer's model - Thumb branch instruction - Thumb data processing instructions - Data transfer instructions - Implementation.

Unit – V

Memory Hierarchy - Architectural support for operating systems - Memory size and speed - Cache memory management - Operating systems - ARM processor chips.

Outcomes

Gain technical knowhow in the area of ARM architecture

Develop ARM architecture based projects

Reference Book

S. Furber, "ARM System Architecture", Addison-Wesley, 1996.

EE453: Fuzzy Systems

Credit: 3

Objectives

- To understand the importance of fuzziness in real world scenarios
- To expose students to fuzzy methods of analysing problems that involves incomplete or vague criteria

  To understand the standards and techniques deployed in the development os a fuzzy system

Unit – I

Different faces of imprecision – inexactness – Ambiguity – Undecidability - Fuzziness and certainty - Fuzzy sets and crisp sets.

Unit – II

Intersection of Fuzzy sets - Union of Fuzzy sets - the complement of Fuzzy sets - Fuzzy reasoning.

Unit – III

Linguistic variables - Fuzzy propositions - Fuzzy compositional rules of inference- Methods of decompositions and defuzzification.

Unit – IV

Methodology of Fuzzy Design - Direct & Indirect methods with single and multiple experts

Unit – V

Applications - Fuzzy controllers - DC motor speed control - Neuro Fuzzy systems, Fuzzy Genetic Algorithms.

Outcomes

Gain technical knowhow in dealing with fuzzy data

Imply the fuzzy rules and techniques in modelling a better prototype
Application of fuzzy systems in solving engineering problems

Reference Books

Zimmermann, H. J., “Fuzzy set theory and its applications”, Allied publishers limited, Madras, 1966.

Klir, G. J., and Folger, T., “Fuzzy sets, uncertainty and information”, PHI, New Delhi, 1991.

Earlcox, “The Fuzzy Systems Handbook”, AP Professional Cambridge, MA02139, 1994.

CS452: Real Time Systems

Credit: 3

Objectives

To study issues related to the design and analysis of systems with real-time constraints.

To learn the features of Real time OS.

To study the various Uniprocessor and Multiprocessor scheduling mechanisms.

To learn about various real time communication protocols.

To study the difference between traditional and real time databases

Unit – I

Introduction to real-time computing - Structure of a real-time system - Characterization of real-time systems and tasks - Performance measures.

Unit – II

Task Assignment and Scheduling - Uniprocessor scheduling algorithms - Task assignment - Mode changes - Fault tolerant scheduling.

Unit – III

Real-time Communication - Network topologies and architecture issues - Protocols - Contention-based, token-based, polled bus - Fault tolerant routing.

Unit – IV

Real-time Databases - Transaction priorities and aborts - Concurrency control issues - Scheduling algorithms - Two-phase approach to improve predictability.

Unit – V

Programming Languages and Tools - Hierarchical decomposition - Run-time error handling - Overloading - Timing specification - Recent trends and developments.

Outcomes

Knowledge about Schedulability analysis.

Ability to learn Real-time programming environments.

- Knowledge about real time communication and databases.
- Ability to develop real time systems.

Text Book

C. M. Krishna and Kang G. Shin, "Real-Time Systems", International Edition, McGraw Hill Companies, Inc., New York, 1997

CS454: Data Warehousing and Data Mining

Credit: 3

Objectives

To understand the principles of Data warehousing and Data Mining.

To be familiar with the Data warehouse architecture and its Implementation.
To know the Architecture of a Data Mining system.

To understand the various Data preprocessing Methods.
To perform classification and prediction of data.

Unit – I

Introduction - Relation To Statistics, Databases- Data Mining Functionalities-Steps In Data Mining Process-Architecture Of A Typical Data Mining Systems

Unit – II

Data Preprocessing and Association Rules-Data Cleaning, Integration, Transformation, Reduction, Discretization Concept Hierarchies-Data Generalization And Summarization

Unit – III

Predictive Modeling - Classification And Prediction-Classification By Decision Tree Induction-Bayesian Classification-Prediction-Clusters Analysis: Categorization Of Major Clustering Methods: Partitioning Methods - Hierarchical Methods

Unit – IV

Data Warehousing Components -Multi Dimensional Data Model- Data Warehouse Architecture-Data Warehouse Implementation-Mapping The Data Warehouse To Multiprocessor Architecture- OLAP.

Unit – V

Applications of Data Mining-Social Impacts Of Data Mining-Tools-WWW-Mining Text Database-Mining Spatial Databases.

Outcomes

Technical knowhow of the Data Mining principles and techniques for real time applications.

Text Books

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2002.
2. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining, & OLAP”, Tata McGraw- Hill, 2004.

Reference Books

1. Usama M. Fayyad, Gregory Piatetsky - Shapiro, Padhrai Smyth, and Ramasamy Uthurusamy, "Advances In Knowledge Discovery And Data Mining", The M.I.T Press, 1996.
2. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley & Sons Inc., 1998.
3. Sean Kelly, "Data Warehousing In Action", John Wiley & Sons Inc., 1997.

CS456: Advanced Topics in Algorithms

Credit: 3

Objectives

To introduce fundamentals of contemporary topics in algorithms
To provide an exposure to graduate level topics in algorithms

Unit – I

Review of first level portions – different paradigms – different problems from various domains.

Unit – II

Randomized Algorithms – Los vegas and Moute Carlo-Chernoff Bound – Probabilistic Amplification – Typical randomised algorithms e.g. Min cut, Randomised Quick Sort, Randomised Selection, Primdity testing.

Unit – III

Graph algorithms – Review – BFS, DFS, Topological Sort, Shortest paths – B-Trees, AVL Trees.

Unit – IV

Graph Algorithms – MIS, Coloring problems, vertex cover, introduction to perfect graphs.

Unit – V

Approximation algorithms – Ratio bound vertex cover, Set covering, Travelling Salesman problem, Subset sum.

Outcomes

Ability to pursue an advanced course in algorithms offering in-depth study of one topic
Ability to pursue research in advanced topics in algorithms

Text Books

1. T. H. Cormen, C. E. Leiserson, and R. L. Rivest, "Introduction to Algorithms", The MIT press, Cambridge, Massachusetts and McGraw Hill, 1990.
2. H. S. Wilf, Algorithms and complexity, Prentice hall.

CS360: Software Design and Practices

Credit: 3

Objectives

To explain the role and importance of modelling in software requirements, architecture and design activities

- To demonstrate the practical application of several modelling languages
- To derive complete detailed design from requirements specification
- To design a creative process to manage the complexity of software system

Unit – I

Software Engineering - Paradigms - Planning - Cost estimation - Software project scheduling - Risk analysis and management - Requirements and specifications - Stakeholders needs and analysis.

Unit – II

Structured Design - Design principles - Problem partitioning and hierarchy - Modularity - Top-down and bottom-up strategies - Transformation of a DFD to a structure chart - Coupling and cohesion.

Unit – III

Object-oriented analysis - UML - Use case - Conceptual model - Class analysis patterns - Overview - Diagrams - Aggregation - Collaboration - Sequence - Class - Managing analysis and design.

Unit – IV

Architecture Concepts - Design methods - Design patterns - Design processes and strategies - Design by template incremental design.

Unit – V

Structured systems analysis and structured design - JSP - JSD.

Outcomes

- Ability to translate a specification into a design
- Familiarize with standard UML notations and understand how to model requirements with Use Cases

Text Books

1. David Budgen, "Software Design", Second Edition, Pearson Education, 2004.
2. R. S. Pressman, "Software Engineering", Fifth Edition, McGraw Hill Inc., 2001.

Reference Book

E. D. Downs, Peter Clare, and Jan Coe, "Structured System Analysis and Design Methods - Application & Context", Prentice Hall, 1998

CS458: CAD for NPTEL

Please refer to the link:
http://nptel/web/coursecontents_comp.php?sem=Semester%206

EC464: Display Systems

Credit: 3

Objectives

To gain exposure in the basics of the display systems

To illustrate the current design practices of the display systems

Unit – I

Introduction to displays. Requirements of displays. Display technologies, CRT, Flat panel and advanced display technologies. Technical issues in displays

Unit – II

Head mounted displays. Displays less than and greater than 0.5 m diagonal. Low power and light emitting displays

Unit – III

Operation of TFTs and MIMS - LCDs, Brightness. Types of LCD displays

Unit – IV

Emissive displays, ACTFEL, Plasma display and Field emission displays, operating principle and performance

Unit – V

CRT as the display of the future. Projection systems with light valve and CRT technologies.

Outcomes

Application of the acquired knowledge in practical design of a display system

Text Books

L. W. Mackonald and A. C. Lowe, "Display Systems, Design and Applications", Wiley, 1997

EE456: Artificial Neural Networks

Credit: 3

Objectives

To gain exposure in the field of neural networks and relate the human neural system into the digital world

To provide knowledge of computation and dynamical systems using neural networks

Unit – I

Perceptron Architecture- Single-Neuron Perceptron- Multi-Neuron Perceptron-

Unit – II

Perceptron Learning Rule- Constructing Learning Rules- Training Multiple-Neuron Perceptrons.

Unit – III

Simple Associative Networks- Unsupervised Hebb Rule- Hebb Rule with Decay- Instar Rule-Outstar Rule- Kohonen Rule.

Unit – IV

Adaline Network- Madaline Network -Mean Square Error- LMS Algorithm- Back Propagationa Neural networks – Hopfield Networks

Unit – V

Adaptive Filtering- Adaptive Noise Cancellation- Forecasting – Neural control applications – Character recognition.

Text Books

Hagan Demuth Beale, 'Neural network design', PWS publishing company, 1995

Freeman, J.A and Skapura, D.M., 'Neural networks-Algorithms, applications and programming techniques' Addison Wesley, 1991

Satish Kumar, Neural Networks – A classroom approach', Tata McGraw-Hill Publishing Company Limited, 2004

Outcomes

Acquire skill set to innovate and build a smart and intelligent engineering application using ANN

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