B.Tech (CSE) Syllabus
Batch Starting 2008-2009

NATIONAL INSTITUTE OF TECHNOLOGY,TIRUCHIRAPALLI-15
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
CURRICULAM PLAN FOR THE SEMESTER SYSTEM

The Total Minimum credits required to complete B.Tech Computer Science and Engineering is 176(131+45)

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**

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 -131

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 CRYPTOGRAHY
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 EIGTH 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

CS201 DISCRETE MATHEMATICS

1. **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 - composition of relations and functions - inverse functions.

2. **Induction and Combinatorics** - Peano's axioms - Mathematical induction (simple and strong) - pigeon-hole principle - principle of inclusion and exclusion - review of permutations and combinations - distribution problems - derangements - bijection principle.

3. **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.

4. **Recurrence Relations and Generating Functions** - Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.

5. **Graph Theory** - Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Sub graphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity.

TEXT BOOK:

- *K.D.JOSHI, "Discrete Mathematics", Wiley Eastern Ltd.*

REFERENCE BOOKS:

- *ARTHUR GILL, "Applied Algebra for Computer Science", Prentice Hall*
- *R.BALAKRISHNAN, K.RANGANATHAN, "A Text Book of Graph Theory", Springer*
- *D.S.CHANDRASEKHARAIH, "Discrete Mathematical Structures",Prism Books,2005*

CS203 PRINCIPLES OF PROGRAMMING LANGUAGES

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

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

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

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

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

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

1. **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 $g(x,y) = 0$.

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

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

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

5. **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.

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", Mc Graw-Hill, 1981*
- *CHENEG and KINCAID, "Introduction to Numerical Computing", Tata McGraw-Hill, 1998*

CS207 DATA STRUCTURES

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

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

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

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

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

TEXT BOOKS:

- J.P.TREMBLAY and P.G.SORENSON, "An Introduction to Data Structures with applications", Second Edition, Tata McGraw Hill, 1981
- M.TENENBAUM AND AUGESTIEN , “Data Structures using C”, Third Edition, Pearson Education 2007.

REFERENCE BOOK:

- *SARTAJ SAHNI, “Data Structures, Algorithms and Applications in C++”, Universities press(I) Pvt Ltd.*

CS209 DIGITAL COMPUTER FUNDAMENTALS

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

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

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

4. **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.

5. **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.

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

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

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

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

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

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

TEXT BOOK:

- C.HAMACHER, Z.VRANESIC, S.ZAKY, "Computer Organization", V Edition, McGraw Hill, 2002

REFERENCE BOOK:

- W.STALLINGS, "Computer Organization and Architecture", I Edition, Pearson education, 2002

CS213 PROGRAMMING LANGUAGES LABORATORY

- UNIX shell programming
- Programming tools and windows
- Network File Systems
- Network Information Systems
- Message Passing Interface
- Functional programming techniques through LISP
- Object-oriented programming techniques through C++/Java
- Logic programming through techniques PROLOG

CS215 DATA STRUCTURES LABORATORY

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

CS202 AUTOMATA AND FORMAL LANGUAGES

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

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

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

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

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

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

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

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

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

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

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

TEXT BOOK:

- SAMIR PALNITKAR, "Verilog HDL Synthesis",I Edition,BS Publications,2001

REFERENCE BOOK:

- BHASKAR, "Verilog HDL Synthesis",I Edition,BS Publications,2001

CS206 LOGICAL FOUNDATIONS OF COMPUTER SCIENCE

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

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

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

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

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

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

PREREQ CS207

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

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

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

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

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

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

1. AM AND FM SYSTEMS

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.

2. PULSE AND DIGITAL COMMUNICATION

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

3. DATA COMMUNICATION TECHNIQUES

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.

4. MODERN COMMUNICATION SYSTEMS

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

5. TELEVISION SYSTEM

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.

TEXT BOOKS:

- SIMON HAYKIN - Communication systems.
- RR GULATHI - Modern Television Engineering & Practice.
- JOHN G PROAKIS & M SALEHI - Communication Systems Engineering.

REFERENCE BOOKS:

- KENNEDY - Electronic Communication systems.
- TAUB & SCHILLING – Principles of Communication Systems, Tata McGraw Hill, 2nd Edition.
- WILLIAM STALLINGS – Data & Computer Communications, PHI, 7th Edition.
- WAYNE TOMASI – Electronic Communications Systems (Fundamentals through advanced), Pearson Education, 5th Edition.

MA204 INTRODUCTION TO PROBABILITY THEORY

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

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

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

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

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

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

- 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

CS216 ALGORITHMS LABORATORY

- 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

CS301 SYSTEMS PROGRAMMING

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

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

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

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

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

TEXT BOOK:

- D.M.DHAMDHERE, "System Programming and Operating Systems", III Edition, Tata McGraw Hill, 2002

REFERENCE BOOKS:

- J.J.DONOVAN, "Systems Programming", McGraw Hill, 1984
- LELAND L.BECK, "An Introduction to Systems Programming", 4th Edition, Addison-Wesley, 2001

CS303 COMPUTER NETWORKS

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

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

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

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

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

TEXT BOOKS:

- A.S.TANENBAUM, "Computer Networks", Pearson Education, IV Edition, 2003
- W.STALLINGS, "Data and Computer Communication", Pearson Education, V Edition, 2001

REFERENCE BOOK:

- BEHROUZ A. FORUZAN, “Data Communication and Networking”, Tata McGraw Hill, 2004

CS305 MICROPROCESSOR SYSTEMS

PREREQ CS204, CS207

1. **8085 Microprocessor** - Architecture - Bus organization - Registers - ALU - Instruction set of 8085 - Instruction format - Addressing modes - Timing diagrams.

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

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

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

5. **8086/8088** - Internal architecture - Instruction set - Segmented memory concepts - Memory interfacing [ROM/DRAM] - Bus concepts.

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

1. **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 – system engineering hierarchy.

2. **Software Requirements –** Functional & non-functional – user-system requirement engineering process – feasibility studies – requirements – elicitation – validation & management – software prototyping – prototyping in the software process – S/W document – Analysis and modelling – data, functional and behavioural models – structured analysis and data dictionary.

3. **Design Concepts and Principles** – Design Process & Concepts – modular design – design heuristic – design model & document – S/W architecture – data design – architectural design – transform & transaction mapping – SCM – Need for SCM – Version Control – Introduction to SCM process – Software Configuration Items.

4. **Software Testing** – Taxonomy of S/W testing – levels – test activities – types of S/W test – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing – testing in the large – S/W testing strategies – strategic approach & issues – unit testing – integration testing – validation testing – system testing and debugging.

5. **Software Project Management –** Measures & Measurements – S/W complexity & science measure – size measure – data & logic structure measure – information flow measure – S/W cost estimation – Function point models – COCOMO model – Delphi method – Defining a task network – Scheduling – Earned Value Analysis – S/W challenges – S/W maintenance.

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

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

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

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

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

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

TEXT BOOKS:

- E.S.PAGE and L.B.WILSON, "An introduction to computational combinatorics", Cambridge University Press, 1979
- D.E.KNUTH, O.PATASHUK, 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

1. **Introduction to operational research**-Linear programming problems (LPP)-Formulation of a LPP-Graphical method-Simplex method-Big M Method-Two phase method-Dual simplex method-Primal Dual problems.
2. **Dual theory and Sensitivity analysis**-Transportation and assignment problems-Applications(Emphasis should be more on problems than theory)
3. **CPM and PERT** –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations-example-Sequencing problems-2 machines and n jobs, n machines and 2 jobs, m machines n jobs problem.
4. **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.
5. **Dynamic programming**-Formulation-Invest problem-General allocation problem-Stage coach problem-Production Scheduling.

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

- 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

CS315 SYSTEMS PROGRAMMING LABORATORY

- 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.

CS302 INFORMATION SECURITY

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

2. Cryptography-Types of encryption, classical encryption techniques, IDEA, block ciphers and data encryption standard, advanced encryption standard, confidentiality using symmetric encryption, PKI, RSA, Key management, Diffie- Hellman, Elliptic curve cryptography, certificate authority, etc., identification and authentication protocols.

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

4. Network perimeter security-Understanding Network Security Perimeter, Secured router configuration, firewall, design principles, trusted systems, virtual private network, intrusion detection system, vulnerability assessment, penetration testing, intrusion prevention system, network address translation.

5. Computer forensics and Cyber laws-Computer forensics, data recovery, security policies and procedures, security lifestyle management, security awareness, enforcement, information classification, documentation, security audit, managed security services, cyber laws, legal issues- the law affecting information.

TEXT & REFERENCE BOOKS:

- RICK LEHTINEN, G.T. GANGEMI, SR.,Computer Security Basics, Second Edition, O'Reilly Pubs, June 2006.
- BRUCE SCHNEIER, Applied Cryptography, Second Edition, John Wiley & Sons, 1996
- CHARLIE KAUFMAN, RADIA PERLMAN, MIKE SPECINER, Network Security: Private Communication in a Public World, 2nd Edition, Prentice Hall, 2002.
- STEPHEN NORTHCUTT, KAREN KENT, LENNY ZELTSER, Inside Network Perimeter Security, *Sams Publications, 2005.*

- MARJIE T BRITZ, Computer Forensics and Cyber Crime: An Introduction (Paperback), Prentice Hall, 2004.
- SAM C. MCQUADE , Understanding and Managing Cybercrime (Paperback), Prentice Hall, 2003
- WILLIAM STALLINGS, Cryptography and Network Security, Fourth Edition, Prentice Hall, 2005.

CS304 OPERATING SYSTEMS

1. **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.

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

3. **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.

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

5. **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.

TEXT BOOK:

- A.SILBERCHATZ, 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

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

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

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

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

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

TEXT BOOK:

- A.SILBERCHATZ, F.KORTH, S.SUDARSHAN, "Database System Concepts", IV Edition, McGraw Hill, 2002.

REFERENCE BOOK:

- R.ELMASRI, S.B.NAVATHE, "Fundamentals of Database Systems", III Edition, Pearson Education, 2000

CS308 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

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

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

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

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

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

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

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

CS316 DATABASE LABORATORY

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

CS401 DISTRIBUTED COMPUTING

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

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

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

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

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

TEXT BOOKS:

- GEORGE COULOURIS, JEAN DOLLIMORE, TIM KINDBERG, "Distributed System Concepts and Design", 4th Edition, Addison Wesley, 2005
- A. S. TANENBAUM, "Distributed Operating Systems", Prentice Hall, 1995.

REFERENCE BOOK:

- S. CERI, G.PELAGATTI, "Distributed Databases - Principles and Systems", McGraw Hill, 1985

CS403 WEB TECHNOLOGY

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

2. **HTML forms** – HTML tags emulation – Links and addressing- HTML and Images

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

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

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

TEXT BOOKS:

- EILLOTTE RUSTY HAROLD, "Java Network Programming", O'Reilly Publications, 1997.
- HARVEY M. DEITEL AND PAUL J. DEITEL, "Internet & World Wide Web How to Program", 4th edition, 2008.
- N.P.GOPALAN, J.AKILANDESWARI, "Web Technology – A Developer's Perspective", PHIO Pvt Ltd., New Delhi-, 2007.

REFERENCE BOOKS:

- JASON HUNTER, WILLIAM CRAWFORD, "Java Servlets Programming", O'Reilly Publications, 1998.
- JEFF FRANTZEN AND SOBOTKA, "Java Script" Tata McGraw Hill, 1999.
- ERIC LADD, JIM O'DONNELL, "Using HTML 4, XML and Java", Prentice Hall of India – QUE, 1999.

CS405 PRINCIPLES OF COMPILER DESIGN

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

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

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

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

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

TEXT BOOK:

- A.V.AHO, R.SETHI, J.D.ULLMAN, "Compilers, Principles, Techniques and Tools", Pearson Education, 13th Indian Reprint, 2003

REFERENCE BOOK:

- J.P. TREMBLAY, P.G. SORRENSON, "The Theory and Practice of Compiler Writing", McGraw Hill, 1985

CS407 ADVANCED COMPUTER ARCHITECTURE

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

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

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

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

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

TEXT BOOK:

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

REFERENCE BOOK:

- D.A.PATTERSON, J.L.HENNESSY, "Computer Architecture: A Quantitative Approach", Harcourt Asia, Morgan Kaufmann, 1999

CS413 COMPILER DESIGN LABORATORY

- 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

CS415 WEB TECHNOLOGY LABORATORY

- 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

CS402 ADVANCED DATABASE MANAGEMENT SYSTEMS

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

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

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

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

5. **Log-based recovery** - Buffer management - Recovery with concurrent transactions - Recovery techniques - Shadow paging.

6. **Database System Architectures** - Parallel databases - Advanced transaction processing - Emerging database applications - Recent trends and developments.

TEXT BOOK:

- A.SILBERSCHATZ, H.F.KORTH, S.SUDARSHAN, "Database System Concepts", IV Ed, McGraw Hill, 2000

REFERENCE BOOK:

- R.ELMASRI, S.B.NAVATHE, "Fundamentals of Database Systems", III Ed., Pearson Education, 2000

HM402 INDUSTRIAL ECONOMICS

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

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

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

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

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

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 BOOK:

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

LIST OF ELECTIVES

CS352 DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS

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

2. **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.

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

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

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

TEXT BOOK:

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

REFERENCE BOOK:

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

CS354 ADVANCED MICROPROCESSOR SYSTEMS

1. **80286 Architecture** - Instruction set - Addressing modes - Real mode - Protected mode - 80386 Architecture - Address segmentation - Paging - Segment registers.

2. **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.

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

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

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

TEXT BOOK:

- D.V.HALL, "Microprocessor and Interfacing Programming and Hardware", Mc Graw 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

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

2. **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.

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

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

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

TEXT BOOK:

- A.J. MENEZES, P. VAN OORSCHOT, 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

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

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

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

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

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

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

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

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

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

4. 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.

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

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

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

2. 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.

3. Introduction to Digital Image Processing - Image Formation and types – Image operations – Arithmetic, Geometric and Morphological Operations - Basic geometric transformations - Sampling and Quantization.

4. 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.

5. Applications of Image Processing - Image Classification – Image Recognition – Image Understanding – Video Motion Analysis – Image Fusion – Steganography – Mosaics – Color Image Processing.

TEXT BOOKS:

- Donald Hearn & M. Pauline Baker , and warren R. Carithers, "Computer Graphics", Prentice-Hall of India, Fourth edition 2011.
- Rafael C. Gonzalez, 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

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

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

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

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

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

REFERENCE BOOK:

- S. FURBER, ARM System Architecture, Addison-Wesley, 1996.

EE453 FUZZY SYSTEMS

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

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

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

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

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

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

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

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

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

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

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

TEXT BOOK:

- C.M. KRISHNA, KANG G. SHIN, "Real-Time Systems", International Edition, McGraw Hill Companies, Inc., New York, 1997

CS454 DATA WAREHOUSING AND DATA MINING

1. Introduction - Relation To Statistics, Databases- Data Mining Functionalities-Steps In Data Mining Process-Architecture Of A Typical Data Mining Systems-Classification Of Data Mining Systems - Overview Of Data Mining Techniques.

2. Data Preprocessing and Association Rules - Data Preprocessing-Data Cleaning, Integration, Transformation, Reduction, Discretization Concept Hierarchies-Concept Description: Data Generalization And Summarization Based Characterization-Mining Association Rules In Large Databases.

3. Predictive Modeling - Classification And Prediction: Issues Regarding Classification And Prediction-Classification By Decision Tree Induction-Bayesian Classification-Other Classification Methods-Prediction-Clusters Analysis: Types Of Data In Cluster Analysis- Categorization Of Major Clustering Methods: Partitioning Methods − Hierarchical Methods

4. Data Warehousing - Data Warehousing Components -Multi Dimensional Data Model- Data Warehouse Architecture-Data Warehouse Implementation- -Mapping The Data Warehouse To Multiprocessor Architecture- OLAP - Need- Categorization Of OLAP Tools.

5. Applications - Applications of Data Mining-Social Impacts Of Data Mining-Tools-An Introduction To DB Miner-Case Studies-Mining WWW-Mining Text Database-Mining Spatial Databases.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CS456 ADVANCED TOPICS IN ALGORITHMS

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

2. **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.

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

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

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

TEXT BOOKS:

- T.H.CORMEN, C.E. LEISERSON, R.L. RIVEST, "Introduction to Algorithms", The MIT press, Cambridge, Massachusetts and McGraw Hill, 1990.
- H. S. Wilf, Algorithms and complexity, Prentice hall.

CS360 SOFTWARE DESIGN AND PRACTICES

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

2. **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.

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

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

5. **Structured systems analysis and structured design** - JSP - JSD.

TEXT BOOKS:

- DAVID BUDGEN, "Software Design", Second Edition, Pearson Education, 2004.
- R.S.PRESSMAN, "Software Engineering", Fifth Edition, McGraw Hill Inc., 2001.

REFERENCE BOOK:

- ED DOWNS, PETER CLARE, 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

Please refer to the website of ECE department of NITT.

EE 456 ARTIFICIAL NEURAL NETWORKS

Please refer to the website of EEE department of NITT.