COMPUTER SCIENCE & ENGINEERING

5th Semester				6th Semester			
Subject Code	***Theory***	***Contact Hrs L-T-P***	***Credits***	***Subject Code***	***Theory***	***Contact Hrs L-T-P***	***Credits***
MA-301 CY-301	Optimization in Engg. OR Bio-Environmental Engg	3-0-0	3	CY-301 MA-301	Bio-Environmental Engg. OR Optimization in Engg	3-0-0	3
EC-321	Digital Signal Processing	3-0-0	3	CS-300	Data Communication & Computer Networks	3-0-0	3
IC-313 EC-333	Control System Engg. OR Microprocessors & Microcontrollers	3-0-0	3	EC-333 IC-313	Microprocessors & Microcontrollers OR Control System Engineering	3-0-0	3
CS-301	Operating Systems	3-0-0	3	CS-302	Computer Architecture	3-0-0	3
CS-303	Computer Organization	3-0-0	3	CS-304	Design &Analysis of Algorithms	3-0-0	3
MA-303	Discrete Mathematical Structure	3-0-0	3		Elective – I	3-0-0	3
		18	**18**			**18**	**18**
Subject Code	***Practicals / Sessional***	***Contact Hrs L-T-P***	***Credits***	***Subject Code***	***Practicals / Sessional***	***Contact Hrs L-T-P***	***Credits***
EC-371 EC-373	Digital Signal Processing Lab OR Microprocessors& Microcontrollers Lab	0-0-3	2	EC-373 EC-371	Microprocessors & Microcontrollers Lab OR Digital Signal Processing Lab	0-0-3	2
CS-371	Computer Organization Lab	0-0-3	2	CS-380	Computer Network Lab	0-0-3	2
CS-373	Unix & Shell Programming Lab	0-0-3	2	CS-382	Algorithm Analysis & Design Lab	0-0-3	2
	Total	**9**	**6**		**Total**	**9**	**6**
	Grand Total	**27**	**24**		**Grand Total**	**27**	**24**

MA-301 OPTIMIZATION IN ENGINEERING (3-0-0)

MODULE-I (15 Hours)
Two variable LP model, Graphical sensitivity analysis, The Simplex method, Computational details, Simplex algorithm, Artificial Starting solution, Degeneracy, Alternative optima , unbounded solution. Duality and Sensitivity analysis, primal Dual relation, Transportation Model, Non-traditional transportation model, Assignment model, Humgarian method, Networks, Shortest route problem, Maximal flow method.

MODULE-II (13 Hours)
Integer linear programming, Illustration Branch & Bound Algorithm, Cutting-plane algorithm, Dynamics programming, Knapsack model, Decision analysis & Game Theory, Simulation modelling, Monte-Carlo simulation for discrete events.

MODULE-III (12 Hours)
Nonlinear programming, Unconstrained optimizations, unimodal function, Necessary & sufficient conditions, Newton Raphson method, constrained algorithm, Direct search method, gradient method.

TEXT BOOKS
1. H. A Taha, Operations Research: An Introduction, Pearson Education, (7^{th} Edition); Ch-2[2.1,2.2 (2.2.1, 2.2.2), 2.3], Ch-3[3.1, 3.3, (3.3.1, 3.3.2) 3.4, 3.5], Ch-4[4.1, 4.2, 4.4 (4.4.1), 4.5 (4.5.1, 4.5.2)], Ch-5[5.1, 5.3(5.3.1, 5.3.2), 5.4(5.4.1)], Ch-6[6.1, 6.3 (6.3.1, 6.3.2), 6.4 (6.4.1, 6.4.2)], Ch-9 [9.1, 9.2(9.2.1, 9.2.3)], Ch-10 [10.3.1 Ch-14 **:**14.3, 14.4], Ch-18 [18.1**,** 18.4], Ch-20[20.1(20.1.1), 20.2 (20.2.1, 20.2.2)], Ch-21[21.1]

REFERENCE BOOKS
1. F.S Hiller, G. J. Libermen, An Introduction to Operations Research: Concepts & Cases, 8^{th} Edition, TMH Publication.
2. Kalyanmayee Dev, Optimization for Engineering Design, PHI Publication

CY-301 BIO-ENVIRONMENTAL ENGINEERING (3-0-0)

MODULE –I (22 hours)
Fundamentals of Ecology: Components and structures of Eco-system. Levels of organization in the biotic components of the Eco-system. Eco-system processes- Energy flow-primary and secondary production, tropic level, food chain & food web and Bio-magnification. Decomposition and Nutrient Cycling- Biogeochemical cycles of nature- Carbon cycle, Nitrogen cycle and Hydrological cycle.

Fundamentals of Chemistry and Microbiology
Water chemistry : Concentration expressions, mole concept and Stoichiometry. Physical & chemical properties of water. Organic chemical properties and their measurement, parameters like BOD, COD, and TOC & TOD Inorganic properties like pH, Alkalinity, Hardness, conductivity and Solubility.
Atmospheric chemistry – structure of atmosphere, chemistry of primary and secondary air pollutants.
Chemical Reaction- Chemical & Bio-chemical Reactions fundamentals of reaction kinetics, Reactor configurations and material balances.
Microbiology – Important microbes in Environmental Engineering, Microbial growth and decay rates, Aerobic & Anaerobic group of bacteria.

ENVIRONMENTAL POLLUTION
Water Pollution:- Water quality standard and parameter (Indian Standard Drinking Water Specifications, IS 10500, 1991), Physical, Chemical and Biological methods of assessment of water quality, Aquatic Pollution, Fresh Water Pollution:- Organic Pollution, Oxygen Sag Curve, Eutrophication and Acidification, Estuarine water quality, Marine Pollution and Ground water

pollution. Parameters of organic content of water quality, DO and BOD in streams, Deaeration and Reaeration kinetics in streams (Streeter – Phelps oxygen sag formula)
Air Pollution:- Primary and Secondary pollutants, units of concentration, Global air pollution-Acid rain , Global warming and ozone layer depletion. Air pollution meteorology – Ambient and Adiabatic lapse rate, Atmospheric stability Lapse rates and Dispersion, Atmospheric Dispersion.
Noise Pollution: Sources of noise, Physical properties of sound, resultant and equivalent sound levels, Noise control measures and impact of noise on human health.

MODULE-II (14 Hours)

ENVIRONMENTAL POLLUTION CONTROL

Water Treatment:- Conventional water treatment comprising of Pre-treatment – Screenings, Aeration and Equalisation Primary Treatment – Sedimentation, Coagulation, Filtration Disinferction – Chlorination, Breakpoint chlorination Advanced water treatment – Fluoridation, Deflouridation, Ion-Exchange and Reverse Osmosis.
Wastewater Treatment (Domestic waste water) : Wastewater flow and characteristics Pretreatment-Screenings, Grit chamber, Equalisation and storage. Primary treatment – Sedimentation and coagulation Biological treatment (Aerobic) Activated Sludge Process (ASP) with complete mix reactor and design parameters. Biological treatment (Anaerobic)
Municipal Solid Waste (MSW) : Physical, Chemical and Energy properties of MSW, MSW Management – Composting, MSW Management – Landfill Operations
Hazardous Waste Management: Characterization, Hazardous Waste Treatment – Incineration
Industrial Air Emission Control : Gaseous Emission Control – Absorption, Adsorption and Condensation, Particulate Emission Control – Gravity Settling Chamber, Cyclone Separator, Bag Filter and Electrostatic Precipitator, Flue gas desulpherisation, NO_x Emission Control and Fugitive Emission

MODULE-III (6 Hours)

ENVIRONMENTAL MANAGEMENT

Evolution of environmental legislation in India, Environment, Development and Sustainable Development, ISO 14,000- Environmental Management Systems – Life Cycle Assessment
Elements of waste minimization- strategy-Reduction at source, Recycling/Reuse/ Recovery, Waste treatment and Disposal, Waste minimization program, Cost benefit analysis and advantage of clean technology
Environmental Impact Assessment
Stages of EIA procedure – Screening, Scoping, Environmental Impact Statement (EIS), Public Participation and Review, Generic Structure of EIA report:- Project Profile, Baseline Data Collection, Impact Prediction and Assessment, Environmental Management Plan (EMP) and Post EMP Monitoring.

TEXT BOOKS

1. Gerard Kiely, Environmental Engineering, Tata McGraw Hill Publishing Company Limited
2. Peavy, Rowe and Tchobanoglous, Environmental Engineering, Tata McGraw Hill Company Ltd.1981,(International Edition).
3. C.S.Rao, Environmental Pollution Control Engg., Wiely Eastern Ltd, New Delhi,1999.

EC - 321 DIGITAL SIGNAL PROCESSING (3-0-0)

MODULE-I (12 Hours)

Introduction to Discrete Time Signals & Systems: Discrete time signals, Elementary examples , Classification, Discrete Time Systems, Block diagram representation , Classification, **Analysis of discrete time LTI System:** Response of LTI systems to arbitrary inputs (convolution sum), properties of convolution and the interconnection of LTI systems, causal LTI systems, stability of LTI systems, systems with finite- duration and infinite-duration Impulse response, Recursive and non-recursive

discrete time systems, LTI systems characterized by constant coefficient Difference Equations, Solution of linear constant coefficient Difference equations, **Implementation of Discrete time systems:** Structures for the realization of LTI systems (Form I, Form II, Cascade, Parallel, Lattice), Recursive and Non-recursive realizations for FIR systems. **Correlation of Discrete time signals:** Cross correlation and auto correlation sequence, Properties of the autocorrelation and cross correlation sequence. **Z transform:** The Z-transform and one sided Z-transform properties of Z transform, Inversion of the Z-transform, solution of difference equations, causality and stability of LTI systems in the Z-domain.

MODULE-II (12 Hours)

Frequency analysis of Discrete time Signals: Energy density spectrum of aperiodic signals, Relationship of the Fourier Transform to the Z-transform, The spectrum, Fourier Transform of Signals with poles on the unit circle.

LTI Systems as Frequency-selective filters:- Lowpass, highpass, bandpass filters, Digital resonators, Notch filters, Comb filters, Allpass filters

Inverse systems and Deconvolution: Minimum phase, maximum phase and mixed phase systems, system identification and deconvolution, Homomorphic deconvolution.

The Discrete Fourier Transform: DFT and IDFT, DFT as a linear transformation, relationship of DFT with Z-transform, properties of the DFT, Circular convolution, circular correlation, filtering of long data sequences: overlap-add and overlap-save method.

MODULE-III (12 Hours)

Fast Fourier Transform: Direct computation of DFT, Radix-2 FFT algorithm, DIT and DIF FFT, Applications of FFT: efficient computation of DFT of two real sequences, efficient computation of DFT of a 2 N point real sequence.

Power Spectrum Estimation: computation of the Energy Density Spectrum, the Periodogram, DFT in power spectrum estimation, Bartlett method, Welch Method, Blackmann & Tookey method

Digital Filter: Causality and its implications, characteristics of practical frequency selective filter, FIR filter design using different windows (Rectangular, Hann, Hamming, Bartlet, Kaiser), FIR filter design using frequency sampling method, Design of IIR filters: Impulse invariant method, Bilinear transformation method.

TEXT BOOKS

1. J.G. Proakis & D.G. Manolakis, Digital Signal Processing- Principles, Algorithms and Applications, Pearson Education.
2. Schilling & Harris, Fundamentals of Digital Signal Processing, Thomson Learning.

REFERENCE BOOKS

1. J.R. Johnson, Introduction to Digital Signal Processing, PHI
2. Sanjit K. Mitra, Digital Signal Processing : A Computer Based Approach, Tata McGraw Hill

IC-313 CONTROL SYSTEM ENGINEERING (3-0-0)

MODULE-I (10 Hours)

Introduction : Basic concepts of control systems, open loop and closed loop systems, difference between open loop and closed loop systems, classifications.

Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Masoin's gain formula, application of SFG to control systems.

Feedback theory : Types of feedbacks, effect of degenerative feedback on control systems, regenerative feedback. Components : A.C. Servo Motor, DC servo motor, synchros,

MODULE-II (10 Hours)

Time domain analysis : Standard test signals : Step, ramp, parabolic and impulse signals. Time response of 1st order systems to unit step and unit ramp inputs. Time response of 2^{nd} order to unit

step input. Time response specifications. Steady state errors and error constants of different types of control systems Generalized error series method

Concepts of stability : Necessary conditions of stability, Hurwitz stability criterion, routh stability criterion, application of routh stability criterion to linear feedback systems, relative stability.

MODULE-III (15 Hours)

Root locus techniques : Root locus concepts, rules for construction of root loci, determination of root locus, root contours. Frequency domain analysis: Introduction, bode plots, determination of stability from Bode plots, polar plots Nyquist stability criterion, Applications of nyquist to the liner feedback system. Closed loop frequency response: Constant M circles, constant N circles, use of Nicolas chart Controllers:Introduction propostional, derivative and integral control actions, P, PI and PID controllers.

TEXT BOOKS

1. D.Roy Choudhury, Modern Control Engineering, PHI
2. K. Ogata, Modem Control Engineering, PHI
3. L.J. Nagrath, M. Gopal, Control Systems Engineering, Third Edition, New Age International Publishers.

REFERENCE BOOKS

1. Samarjit Ghosh, Control System, Theory & Applications, Pearson Education
2. Eroni Umez Erani. System Dynamic and Control, PWS Publishing, International Thompson Publishing Company

EC- 333 MICROPROCESSORS & MICROCONTROLLERS (3-0-0)

MODULE-I (12 Hours)

Microprocessor Architecture:- Introduction to Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control MODULE, 8085 Instruction Timing & Execution. Instruction Set and Assembly Language Programming of 8085:- Instruction set of 8085, Memory & I/O Addressing, Assembly language programming using 8085 Instruction Set, use of Stack & Subroutines. Memory Interfacing:- Interfacing EPROM & RAM Memories Interrupts:-8085 Interrupts

MODULE-II (12 Hours)

Microprocessor Based System Development Aids:- Programmable Peripheral Interface: 8255, Programmable DMA Controller: 8257, Programmable Interrupt Controller: 8259, Microcontroller (Architecture and Programming):- Introduction to 8051 Microcontrollers (Architecture, Pin description), 8051 Assembly Language Programming (JUMP, LOOP, CALL Instructions), I/O Port Programming, 8051 Addressing Modes, Arithmetic & Logic Instructions, Microcontroller Interrupts and Interfacing to 8255:- 8051 Interrupts, Interfacing to 8255

MODULE-III (12 Hours)

Intel 8086 (16 bit processors):-8086 Architecture, Addressing Modes, Instruction Format, Pins & Signals, 8086 Basic System Concept, Interfacing with Memories, 8086 Interrupts.

Intel 80386 :- Introduction to 80386 Microprocessor, Architecture, Pins & Signals, Memory System, Registers, 80386 Memory Management, Paging Technique, Protected Mode Operation, brief introduction to 80387 Math Coprocessor. Pentium Processors (Only features):- Introduction to Pentium Processors, Memory System, Input/Output System, Branch Prediction Logic, Floating Point MODULE, Cache Structure, Superscalar Architecture. (only the features of Pentium Processor mentioned above are to be discussed)

TEXT BOOKS

1. Ghosh & Sridhar, 0000 to 8085 -Introduction to Microprocessor for Scientists & Engineers, PHI publication
2. A.K. Roy & K.M. Bhurchandi, Advanced Microprocessor and Peripherals (Architecture, Programming & Interfacing), TMH Publication
3. Mazidi & Mazidi, The 8051 Microcontroller & Embedded Systems, Pearson / PHI publications

CS-301 OPERATING SYSTEMS (3-0-0)

MODULE-I (15 Hours)

Introduction: What is an Operating System, Evolution of operating system, Simple Batch Systems, Multiprogramming and Time Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems. **Operating system structures**: O.S. Services, system calls, operating system structure. **Process Management:** Process concept, Process Scheduling, Operation on Processes, Cooperating Processes. Inter-process communication. Threads: User and Kernel level threads. **CPU Scheduling:** Basic concepts, scheduling criteria, scheduling algorithms. **Process synchronization:** Background , Critical section problem, Hardware Primitives Semaphore, Overview of classical synchronization problems, Monitors

MODULE-II (15 Hours)

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, Recovery from Deadlock. **Memory management:** Background, address Binding, Logical versus Physical Address space, Overlays, contiguous Allocation. Paging, Segmentation. Segmentation with paging. **Virtual Memory:** Background, Demand paging, performance of Demand paging, Page Replacement Algorithms. Allocation of frames, Thrashing,

MODULE – III (10 Hours)

File-system: File concept, Access Methods, Directory structure & implementation, Allocation Method, Free space management. **I/O systems:** Overview, I/O Hardware, Application of I/O interface, Kernel I/O - subsystem Transforming I/O requests to Hardware Operations. Secondary storage Structure: Disk Structure, Disk Scheduling, Disk Management, Swap space Management, Disk Reliability. UNIX Operating System calls and interprocess communication, Case study.

TEXT BOOK

1. Abraham Silberschatz and Peter Bear Galvin, Operating System Concepts, Addison Wesley.

REFERENCE BOOKS

2. H.M Deitel, Operating System, Addison Wesley
3. Milenkovic, M , Operating Systems – concepts and Design, McGraw Hill International.
4. Andrew, S Tannenbaum, Operating System, PHI

CS-303 COMPUTER ORGANIZATION (3-0-0)

MODULE-I (14 Hours)

Basic structure of computers: Functional units, operational concepts, bus structure, software, performance, multiprocessor and multicomputer , machine instruction and programs, memory location and addresses, memory operations, instruction and instruction sequencing, Execution cycle, instruction format, addressing modes, assembly languages, basic I/O operations, subroutine,

additional instructions, RISC , CISC.

MODULE-II (13 Hours)

Arithmetic: Addition and subtraction of signed number, design of fast adders, multiplication of positive numbers, signed operand multiplication, fast multiplication, integer division, floating point numbers (IEEE) and operations.

MODULE-III (13 Hours)

Basic processing units: Fundamental concepts, execution of complete instructions, Multibus organization, hardwired control, **Micro programmed control Memory system**: Basic concepts, Virtual memory, memory management requirements, secondary storage cache memory and performance consideration.

TEXT BOOKS

1. V.Carl Hamacher, Zvonko G. Vranesic, Sajwat G. Zaky, Computer Organization and Architecture & Computer Organization , McGraw Hill .
2. David A. Patterson, John L. Hennessy, Computer Organization and Design, Elsevier.

REFERENCE BOOK

1. Morris Mano , Computer System Architecture, 3rd Edition, PHI .

MA–303 DISCRETE MATHEMATICAL STRUCTURE (3-0-0)

MODULE – I (12 Hours)

Logic , Propositional Equivaleries , Predicates & Quantifiers, Nested Quantifiers, Methods of proof, Induction, Recursion, Counting, Permutation & Combination, Pigeonhole, Principle , Advanced counting techniques, Principles of inclusion-Exclusion, Recurrence relation, Generating function. Relation, Equivalence Relation, Partial order relation.

MODULE – II (12 Hours)

Graphs, kind of Graph, Adjacency matrix, Isomorphism, Euler & Hamiltonians path, Planar graph, Graph Coloring, Trees, Spanning, trees, minimum spanning trees. Boolean Algebra, Two element Boolen algebra, Disjunctive & conjunctive normal forms, Minimal sum product, Kannaugh Maps.

MODULE -III (16 Hours)

Algebraic structure, Monoid , Semi group, properties , Isomorphism , Cyclic group, Coding theory , Rings, Fields, Integrals Domain, Finite fields, Polynomial rings.

TEXT BOOKS

1. K. H. Rosen , Discrete Mathematics & its Application 5th Edition, TMH Publishers
2. Thomas Koshy , Discrete Mathematics with Applications, Academic press an inprint of Elsevier,2004
3. C. . Liu ,Elements of Discrete Mathematics 2nd Edition McGraw Hill publications
4. R. P. Grimaldi , B. V. Ramana , Discrete & combinatorial Mathematics 5th Edn Pearson
5. D. S. Malik & M. K. Sen , Discrete Mathematical Structures Theory & Application Thomson

CS-300 DATACOMMUNICATION & COMPUTER NETWORKS (3-0-0)

MODULE – I (12 Hours)

Overview of Data Communications and Networking, Physical Layer: Analog and digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairments, Digital Transmissions: Line Coding Block coding, sampling, Transmission Mode. Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing: FDM,

WDM, TDM. Transmission Media: Guided Media, Unguided Media (Wireless) Circuit Switching and Telephone Network: Circuit Switching, Telephone Network.

MODULE – II (12 Hours)

Data Link Layer: Error Detection and Correction: Type of Errors, Detection, Error Correction. Data Link Control and Protocols: Flow and error Controls, stop-and-wait ARQ. Go-Back. N ARQ, selective Repeat ARQ, HDLC. Point-to-point Access: PPP, Point-to-point Protocol, PPP Stack, Multiple Access: Random Access, controlled Access, Channelizsation. Local Area Network: Ethernet, Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LANs: IEEE 802.11,Bluetooth virtual circuit : Frame Relay and ATM

MODULE – III (16 Hours)

Network Layer: Host to Host Delivery: Internetworking, addressing and routing Network Layer Protocols: ARP, RARP,ICMP,IPV6 and ICMPR6, Transport Layer: Process to process Delivery: UDP:TCP congestion control and quality of service. Application Layer :Client Server Model, Socket Interface Domain Name System(DNS): Electronic Mail(SMTP) and file transfer(FTP)HTTP and WWW.

TEXT BOOK

1. Behrouz A Forouzan , Data Communication and Networking , Third Edition, Tata McGraw - Hill Publishing Company Limited

REFERENCE BOOKS

1. Larry L. Peterson and Bruce S. Davie , Computer Networks: Third Edition, A system Approach, Elsevier
2. A.S. Tannenbaum, Computers Networks, PHI
3. William Stallings, Data and Computer Communication, PHI.
4. Peterson & Davice, Computer Networks, Elsevier

CS-302 COMPUTER ARCHITECTURE (3-0-0)

MODULE-I (08 Hours)

Input output organization: Accessing I/O devices programmed I/O, interrupt driven I/O, DMA, buses, Interface circuits, standard I/O interfaces (PCI, SCSI, and USB).

MODULE-II (17 Hours)

Architectural classification of parallel processing(Flynn's), **Pipelining:** Basic concepts, instruction and arithmetic pipelining, data hazards, instruction hazard ,influence on instruction sets, data path and control consideration, superscalar operation, performance consideration, pipeline reservation table, pipeline memory organization, job sequencing and collision prevention, pipeline scheduling.

MODULE-III (15 Hours)

Array processor: SIMD array processor, SIMD interconnection network, **SIMD computers and performance enhancement:** the space of SIMD computers, the ILIAC-IV and BSP systems, the massively parallel processor, performance enhancement methods. **Multiprocessor:** functional structure, interconnection networks, parallel memory organizations, **some example of multiprocessor**: C.MMP, CRAY X-MP.

TEXT BOOKS

1. Kai Hwang, Faye A. Briggs, Computer Architecture and Parallel Processing. McGraw-Hill .
2. V.Carl Hamacher, Zvonko G. Vranesic, Sajwat G. Zaky, Computer Organization and Architecture & Computer Organisation, Mc. Graw Hill Publication.

REFERENCE BOOK

1. David A. Patterson, John L. Hennessy, Computer Organization and Design, Elsevier.

CS-304 DESIGN & ANALYSIS OF ALGORITHMS (3-0-0)

MODULE-I (14 Hours)

Introduction to design and analysis of algorithms: Introduction to Complexity, Growth of functions, asymptotic notations, Different algorithm design techniques, **Recurrences:** Solutions of Recurrences by Substitution, Recursion Tree method and Master methods. **Design and Analysis of Divide and Conquer Algorithms** (Binary Search, Merge sort and Quick sort), **Heap sort**: Heaps, Building Heaps, Heap sort Algorithm and Priority Queue.

MODULE-II (16 Hours)

Dynamic Programming Algorithms: Matrix Chain Multiplication, Elements of Dynamic Programming vs Greedy Programming, Longest Common Subsequence. **Greedy Algorithms:** Activity Selection Problems, Elements of Greedy Strategy, Fractional Knapsack Problem, Huffman Codes. **Graph Algorithms:** Representation of Graphs, Breadth-first Search, Depth-first Search, Minimum Spanning Trees, Prim's algorithm and Kruskal's Algorithm, Single –Source Shortest Paths (Bellman-Ford and Dijkstra's Algorithms).All-Pairs Shortest Paths (Floyd-Warshall Algorithm).

MODULE-III (10 Hours)

String Matching: Robin-Karp, String Matching algorithm, NP-Completeness: Polynomial time, Polynomial-time verification, NP-Completeness and Reducibility, NP-Complete Problems (without proof).**Approximation Algorithm** (Traveling Sales man problem).

TEXT BOOK

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms. 2nd edition, McGraw-Hill, PHI(2nd Edition)

REFERENCE BOOKS

1. Horowitz E. & Sahni S,Fundamentals of Computer Algorithms, Galgotia A. V. Aho, J. E. Hopcroft, and J. D. Ullman, The Design and Analysis of. Computer Algorithms, Addison Wesley.
2. Michael T. Goodrich, Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, John Wiley & Sons, Inc
3. S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani : Algorithms, McGraw-Hill 2006

ELECTIVE-I

IT-417	**MANAGEMENT INFORMATION SYSTEM**
CS-308	**SYSTEM PROGRAMMING**
MA-401	**SIMULATION MODELLING**
EC-452	**SOFT COMPUTING**
CS-312	**E-COMMERCE**
CS-314	**COMPUTER GRAPHICS AND MULTIMEDIA**

IT-417 MANAGEMENT INFORMATION SYSTEM (3-0-0)

MODULE-I (12 Hours)
Fundamentals of Information Systems, Systems approach to problem solving, Developing information system solutions. Information system components, Information quality, Data resource management, Database, Data models, Information Systems in marketing, manufacturing, HRM, Accounting and Finance.

MODULE-II (12 Hours)
Information analysis and design tools : Decision tools, Decision Table, Structured Analysis, Dataflow Analysis, Tools for dataflow strategy, Developing dataflow diagrams, Leveling, Data dictionary, Structured flow chart, HIPO, Warnier/ORR diagram.

MODULE-III (12 Hours)
Planning & implementation of Information Systems, Transaction Processing Systems, Executive information Systems, Decision Support Systems, Expert Systems, Knowledge Management. Computer crime, Security (Goals, risks, controls, security & recovery measures of IS, economics of information security) & ethical challenges.

TEXT BOOKS

1. James A. O'Brien, George M. Marakas, Management Information Systems, Eighth Edition, 2008, McGraw-Hill Education
2. Kenneth C. Laudon, Jane P. Laudon, Management Information Systems, Tenth Edition, Pearson Education

REFERENCE BOOKS

1. Kenneth E. Kendall, Julie E. Kendall , System Analysis and design, PHI Learning Pvt. Ltd
2. James A. Senn ,Analysis & Design of Information Systems, McGraw-Hill Education
3. Effy Oz, Management Information Systems, Sixth Edition, 2009, CENGAGE Learning India Pvt. Ltd., New Delhi.
4. Robert G. Murdick, Joel E. Ross, James R. Claggett, Information Systems for Modern Management, Third Edition, PHI Learning Pvt. Ltd., New Delhi.
5. Stephen Haag, Maeve Cummings, Amy Philips, Management Information Systems, Sixth Edition, 2007, McGraw-Hill Education (India), New Delhi.
6. Gordon B. Davis, Margarethe H. Olson, Management Information Systems, Second Edition, 1985, McGraw-Hill Education (India), New Delhi.
7. Mahadeo Jaiswal, Monika Mital, Management Information Systems, First Edition, 2004, Oxford University Press, New Delhi.

CS-308 SYSTEM PROGRAMMING (3-0-0)

MODULE- I (10 Hours)
Introduction: System Software, Application Software, Machine Structure, Evolution of components of a programming system (Assembler, Loader, Macros, Compiler, Formal Systems), Evolution of Operating Systems, Functions of Operating System. Machine Structure: General Machine Structure, Approach to a new machine, Memory Registers, Data, Instructions, special features. Machine Language: Long Way, No looping, Address Modification, Looping, Introduction to Assembly Language Program

MODULE- II (10 Hours)
Assemblers: Design Procedure, Design of Assembler, Table Processing. Macros Language and Macro Processor: Macro Instructions, Features of a Macro Facility, Implementation. Loaders: Loader Schemes, Design of an Absolute Loader, Direct Linking loader, Bootstrap Loader.

MODULE- III (12 Hours)
Programming Languages: Importance of High Level Languages, Features, Data Types and Data Structures, Storage Allocation and Scope Name, Accessing Flexibility, Functional Modularity, Asynchronous Operations, Extensibility and Compile time Macros. Formal Systems: Uses of Formal Systems, Formal Specification, Formal Grammars, Backus-Naur Form, Canonic Systems, Canonic Systems vs Formal Systems Compilers: Introduction to Compilers, Phases of a compiler(Lexical Phase, Syntax Phase, Interpretation Phase, Optimization, Code Generation, Assembly, passes of a compiler), Intermediate Form, Storage Allocation, Code Generation, Data Structure

TEXT BOOK

1. John J Donovan, Systems Programming , McGraw-Hill Education.

REFERENCE BOOKS

2. Leland Beck, System Software: An Introduction to systems programming, Pearson
3. Nityashri, System Software , McGraw-Hill Education.
4. Dhamdhere , Operating System and System Programming, McGraw-Hill Education
5. Hoover, System Programming with C and Unix, Pearson Education

MA-401 SIMULATION MODELLING (3-0-0)

MODULE-I (14 Hours)
Introduction to Systems, Models and simulations, Discrete-event simulation, simulation of a single server queuing system, Steps in a sound simulation study, Continuous, Discrete-continuous and Monte Carlo Simulation, Advantages, Disadvantages and pitfall of simulation. List processing in simulation, Single-Server queuing simulation with Simlib. Simulation Software (classification and desirable features)

MODULE-II (14 Hours)
Review of Statistics, Random variables, Simulation output data and stochastic processes, Estimation of means, variances and correlations, Confidence intervals and Hypothesis testing, strong law of large numbers, Building valid, credible and appropriately detailed simulation model , Instruction, level of model detail, verification of simulation computer programs Techniques for increasing model validity and credibility. Selection of input probability distributions, Hypothesizing, families of distributions, estimation of parameters, Determining how representative the fitted distributions are.

MODULE-III (14 Hours)
Random-number generators (Linear congruential generators, composite generators, Testing random-number generators) Generating random variates (Inverse transform, composition, convolution, acceptance-rejection of methods), Output data analysis for a single system (Transient and steady) State behavior of stochastic process, Types of simulations with regard to output analysis, statistical analysis for terminating simulations.

TEXT BOOKS

1. A.M. Law, Simulation Modeling and Analysis, 4th Edition, TMH , 2008.
2. N.Deo- Simulation and Modeling (PE)
3. Banks, Earson, Nelson & Nicol : Discrete Event system simulation

EC- 452 SOFT COMPUTING (3-0-0)

MODULE-I

Neural networks, Introduction, Neuron Models, Supervised and Unsupervised Learning Methods, Single Neuron/ Perceptron Networks, Training Methods, Applications to Linearly separable problems, Multi layered perceptrons, Back-propagation algorithm, Introduction to Fuzzy systems, Membership function, Fuzzy relational operation, fuzzy IF THEN rules, Defuzzyffication – Sugeno and Mamdani type systems, Adaptive Neuro-Fuzzy Sytems, Training Methods.

MODULE-II

Genetic Algorithm: Basic Concepts, Search Space, Working Principle. Encoding: Binary, Octal, Hexadecimal, Permutation, Value and Tree. Decoding, Fitness Function, Selection: Roulette-wheel, Tournament, Rank and Steady-state. Elitism, Crossover: Single-Point, Two-Point, Multi-Point, Uniform, Matrix And Cross Over Rate, Mutation: Mutation, Mutation Rate.

Ant Colony Optimization: Ant Foraging Behavior, Combinatorial Optimization, Routing In Communication Network,

MODULE-III

Application: Control; Communication Engineering; System Identification And Pattern Classification, Function Optimization, Adaptive System Identification, Channel Equalization.

TEXT BOOKS

1. S. Haykin, Neural Networks, A Comprehensive Foundation, Pearson Education, India
2. Martin T. Hagan, Howard B. Demuth, Mark H. Beale; Neural Network Design; (ISBN: 0-9717321-0-8); Thomson 2002
3. Jang, Sun and Mizutani; Neuro-Fuzzy and Soft-Computing – A computational approach to learning and machine intelligence, Prentice Hall of India David E. Goldberg, Genetic Algorithms in search, Optimization and machine learning, 1989.

REFERENCE BOOKS

1. Satish Kumar, A Classroom approach, Neural Networks: Tata McGraw Hill, 2004, ISBN: 9780070482920

CS-312 E-COMMERCE (3-0-0)

MODULE-I (15 Hours)

Electronic Commerce: Overview, Definitions, Advantages & Disadvantages of E-Commerce, Threats of E-Commerce, Managerial Prospective, Rules & Regulations for Controlling E-Commerce, Cyber Laws. **Technologies :** Relationship Between E-Commerce & Networking, Different Types of Networking for E-Commerce, internet, Intranet, **EDI Systems Wireless Application Protocol** : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement for E-Commerce. **Business Models of E-commerce**; Model Based on Transaction Type, Model Based on Transaction Party - B2B, B2C, C2B, C2C, E-Governance.

MODULE-II (15 Hours)

E-strategy: Overview, Strategic Methods for developing E-Commerce. Four C's (Convergence, Collaborative Computing, Content Management & Call Centre). **Convergence:** Technological Advances in Convergence - Types, Convergence and its implications, Convergence & Electronic Commerce. **Collaborative Computing**: Collaborative product development, Simultaneous

Collaboration. **Content Management:** Definition of content, Web **Traffic& Traffic management:** Content Marketing. Call Centre : Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Centre, Customer Premises Equipment (CPE). [6L] Supply Chain Management : E-logistics, Supply Chain Portal, Supply Chain planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power, CRM, Issues in CRM.

MODULE-III (10 Hours)

E-Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats & Protections. **E-Marketing** : Home - shopping, E-Marketing, Tele-marketing Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, protocols (UN EDI FACT / GTDI, ANSIX - 12, Data Encryption (DES / RSA), **Risk of E-Commerce** : Overview, Security for E-Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital Certificates, Digital Signatures. ERP: Business function, Processes and data requirement, SAP, BANN, JD Edwards, Business re-engineering.

TEXT BOOKS

1. Bhaskar Bharat , Electronic Commerce - Technologies & Applications. TMH.
2. E-commerce , Strategy Technologies & Applications, Tata McGraw Hill.

REFERENCE BOOKS

1. MM Oka , E-commerce, EPH
2. Kalakotia, Whinston , Frontiers of Electronic Commerce, Pearson Education.
3. Loshin pete, Murphy P.A. ,Electronic Commerce, Jaico Publishing Housing
4. Murthy : E-Commerce, Himalaya publishing.
5. J. Christopher & T.H.K. Clerk , Global E-Commerce, University Press
6. Reynolds, Beginning E-Commerce, SPD
7. Krishnamurthy, E-Commerce Mgmt, Vikas.

CS-314 COMPUTER GRAPHICS & MULTIMEDIA (3-1-0)

MODULE –I (12 Hours)

A survey of Computer Graphics: Overview of graphics System: Video Display Devices, Raster-Scan and Random scan systems, Input Devices, Hard Copy Devices.

Graphical User Interface and Interactive Input methods: The User Dialogue, Input of Graphical data, Input Function, Initial Values for input Device parameters, Interactive Picture construction.

Output primitives: points and lines, Bresenham's Line Algorithm, Mid-Point Circle Drawing Algorithm, Filled Area Primitives.

Two Dimensional Geometric Transformation: Basic transformation (Translation, rotation, Scaling) Matrix Representation and Homogeneous coordination, Composite Transformations, Reflection, shears, Transformation between coordinate system.

MODULE –II (16 Hours)

Two Dimensional viewing: the viewing Pipeline, Viewing coordinate reference frame, window-to-view port coordinate Transformation.

Line Clipping (Cohen-Sutherland Algorithm) and polygon clipping (Sutherland-Hodgeman Algorithm)

Three Dimensional Object Representations: Polygon Surface, quadratic surface, spline representative, Bezier Curves and surfaces. B-spline Curve

Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite, Transformation, Modelling and Coordinate Transformation.

Three Dimensional viewing: Viewing Pipeline, Viewing Coordinates, Projections (Parallel and Prospective)

Visible surface detection method: Back Face detection, depth buffer, scan line, depth sorting, Area subdivision.

Illumination Models: Basic Models, Displaying Light Intensities, Halftone Pattern and dithering Techniques.

Surface Rending Methods: Polygon Rendering Methods, Gouraud and Phong shading.

MODULE – III (12 Hours)

Multimedia system : Organization & Architecture, QoS Architecture, Digital Representation of sound, Elements of Audio system, synthesizer, MIDI. Transmission of video signals, television broadcasting standards.

Data Compression: Introduction, types of compression, JPEG Image compression techniques, MPEG standards overview, MPEG compression techniques, DVI technology.

Animation: *Introduction, uses of Animation, Keyframes and tweening, types of animation, principle of animation.*

Multimedia Information System: Operating system support, User interfaces, Multimedia. Database system, Application of Multimedia system.

TEXT BOOKS

1. D.Hearn & M. Baker, Computer Graphics, Pearson Education.
2. P. K. Bufford, Multimedia System, AWL

REFERENCE BOOKS

1. Z.Xiang and R.Plastock, Computer Graphics, MGH
2. M.Hanmandlu, Computer Graphics, BPB Publication.
3. R. Parekh, Principle of Multimedia, TMH

5^{th} & 6^{th} Sessional

EC -371 DIGITAL SIGNAL PROCESSING LAB (0-0-3)

(Any 8 experiments should be completed)

1. Different types of Signal generation using MATLAB. (both continuous and discrete.)
2. Linear Convolution of sequences. (Without using the inbuilt function conv() available in MATLAB.)
3. Circular Convolution of two Sequences
   i) Computation of circular convolution
   ii) Computation of linear convolution using circular convolution & comparison of result with the result obtained from linear convolution.
4. Correlation between sequences
   i) Finding auto correlation of a sequence
   ii) Finding cross correlation of 2 sequences.
   iii) Finding power spectral density of a sequence.
   iv) Finding correlation using convolution
   v) Finding circular correlation between sequences

5. Finding the convolution (linear and circular) and correlation (linear & circular) of periodic sequences using DFT and IDFT.
6. Implementation of DFT (Fast Fourier Transform) and IFFT algorithms using
   i) Decimation in Time (DIT)
   ii) Decimation in Frequency (DIF)
7. Design of FIR filters (lowpass, highpass, bandpass) Using windowing technique (hamming window, hanning, window rectangular window, Kaiser window) and comparison of their frequency responses.
8. Design of IIR filter.
   i. Design of Butterworth Filter
   ii. Design of Chebyshev filter
9. Convolution of long duration sequences using overlap add & overlap save methods using DFT and IDFT
10. Working with a DSP processor. (fixed point -TMS320C-5X / Floating point) series.
    i) Implement convolution (Linear & circular convolution)
    ii) FIR & IIR filtering implementation .

EC- 373 MICROPROCESSOR & MICROCONTROLLER LAB (0-0-3)

NOTE: Total 10 (Ten) Experiments Have To Be Completed.
(2 from Gr – A , 4 from Gr – B , 2 from Gr – C, 2 from Gr – D)

A) 8085

1. Addition, Subtraction, Multiplication, Division of two 8 bit numbers resulting 8/16 bit numbers.
2. Smallest /Largest number among n numbers in a given data array
3. Binary to Gray Code / Hexadecimal to decimal conversion.

B) 8051MICROCONTROLLER(Compulsory)

4. Initialize data to registers and memory using immediate, register , direct and indirect addressing mode

OPTIONAL *(any one)*

5. Addition, subtraction of 16 bit numbers.
6. Multiplication, Division of 16 bit numbers
7. Transfer a block of data to another memory location using indexing.

C) INTERFACING (Compulsory)

8. Operation of 8255 using 8085 & 8051 microcontroller
9. Generate square waves on all lines of 8255 with different frequencies (concept of delay program)

OPTIONAL *(Any Two)*

10. Study of stepper Motor and its operations (Clockwise, anticlockwise, angular movement, rotate in various speeds)
11. Study of Elevator Simulator
12. Generation of Square, triangular and saw tooth wave using Digital to Analog Converter
13. Study of 8253 and its operation (Mode 0, Mode 2, Mode 3)
14. Study of Mode 0, Mode 1, BSR Mode operation of 8255.
15. Study of 8279 (keyboard & Display interface)
16. Study of 8259 Programmable Interrupt controller.
17. Study of Traffic Light controller

D) 8086(Compulsory)

18. Addition, subtraction, Multiplication , Division of 16 bit nos + 2's complement of a 16 bit no.

Optional (any one)

19. Marking of specific bit of a number using look-up table.
20. Largest /Smallest number of a given data array.
21. To separate the Odd and Even numbers from a given data array.
22. Sorting an array of numbers in ascending/descending order
23. Finding a particular data element in a given data array.

CS-371 COMPUTER ORGANIZATION LAB (0-0-3)

1. Simulation of fast multiplication and division algorithm using MATLAB or C program.
2. Using floppy drive trainer kit show the read and write process by the movement of R/W head.
3. Show the above experiment using CD drive trainer kit.
4. Using dot matrix printer trainer kit show the printing of character by giving the ASCII code and strobe pulse.
5. Study of different parts of computer like mother board, SMPS, CD drive, Floppy drive etc.
6. Assembly of different components of a computer along with study of connectors, ports, chipsets etc.
7. Show the working of a CPU using CPU trainer kit.
8. A study project on some hardware technologies memory, serial bus, parallel bus, USB standard etc.

CS-373 UNIX & SHELL PROGRAMMING LAB (0-0-3)

Experiment-1

Unix Command

Experiment-2

vi Editor Command

Experiment-3

Find multiplication table of a given number.

Write a script language to view no. of arguments given with command and print the arguments.

Experiment-4

Write a script language find greatest of three numbers using if then else stmt.

Write a script language to generate 1 to n using do while statement.

Experiment-5

Write script language to calculate given salary of person given basic salary, DA 40%, HRA is 40% of basic pay as input.

Write script language to find sum of digits of a input number.

Experiment-6

Write script language to find out max min element in an array.

Write script language to merge the content of two array.

Experiment-7

Write script language to combine contents of one file to another.

Experiment-8

Implement FCFS scheduling algorithm using shell script.

Implement SJF scheduling algorithm using shell script.

CS-380 COMPUTER NETWORK LAB (0-0-3)

1. Acquaintance of Comp. Network, Network Specification and study of different Network components such as NIC, HUB, SWITCH etc.
2. Adapter Configuration, Services, Clients and Protocols.
3. IP classification and Configuration, Sub netting and Subnet Masking.
4. Peer- to Peer Configuration – I
5. Peer- to Peer Configuration, sharing of resources, user creation and sharing protections.
6. Client-Server Networking with 2000/2003
7. Server Installation
8. User & Group Management
9. Active directory Services
10. DHCP Services
11. Print services
12. IIS configuration, Telnet Services, Remote Access Services etc.
13. Socket Programming in Java
14. WAP in java creating client and server sockets and implement day time server. Server time should be calculated in client side ?
15. WAP in java for the above client server program to implement in echo server so that paragraph may be sent back?
16. WAP to implement a simple calculator may be implemented in server mode?
17. WAP to implement a chart server. Also include swing to make the program user friendly?
18. General Troubleshooting.
19. Introduction to NOVEL Server.
20. Introduction to NOVEL Client.

CS-382 ALGORITHM ANALYSIS & DESIGN LAB (0-0-3)

(All the problems have to be implemented using C / C++ programs)

Elementary Problem (5 is compulsory and any four among the rest)

1. Using a stack of characters, convert an infix string to a postfix string.
2. Implement polynomial addition using a single linked list.
3. Implement insertion routine in an AVL tree using rotation.
4. Implement binary search and linear search in a program
5. Implement heap sort using a max heap.
6. Implement DFS/ BFS routine in a connected graph
7. Implement Dijkstra's shortest path algorithm using BFS

Greedy Algorithm (Any Two)

1. Given a set of weights, form a Huffman tree from the weight and also find out the code corresponding to each weight.
2. Take a weighted graph as an input, find out one MST using Kruskal / Prim's algorithm
3. Given a set of weight and an upper bound M – Find out a solution to the Knapsack problem.

Divide and Conquer Algorithm (Any One)

1. Write a quick sort routine, run it for a different input sizes and calculate the time of running. Plot in graph paper input size verses time.
2. Implement two way merge sort and calculate the time of sorting

Dynamic Programming (Any one)

1. Given two sequences of character, find out their longest common subsequence using dynamic programming.
2. Matrix Chain Multiplication.

NP Complete and NP Hard problems

1. Find out a solution to Traveling Sales Man problem of an input graph.

COMPUTER SCIENCE & ENGINEERING

7th Semester				8th Semester			
Subject Code	***Theory***	***Contact Hrs L-T-P***	***Credits C***	***Subject Code***	***Theory***	***Contact Hrs L-T-P***	***Credits C***
HS-401	Principles of Management	3-0-0	3	CS-400	Software Engineering	3-0-0	3
CS-401	Relational Database Management System	3-0-0	3	CS-402	Compiler Construction	3-0-0	3
CS-403	Theory of Computation	3-0-0	3		Elective – IV	3-0-0	3
	Elective – II	3-0-0	3		Elective – V	3-0-0	3
	Elective – III	3-0-0	3				
		15	**15**			**12**	**12**
Subject Code	***Practicals / Sessional***	***Contact Hrs L-T-P***	***Credits***	***Subject Code***	***Practicals / Sessional***	***Contact Hrs L-T-P***	***Credits***
CS-471	RDBMS Lab	0-0-3	2	CS-480	Seminar	0-0-3	1
CS-473	Seminar	0-0-3	1	CS-482	Major Project	0-0-10	7
CS-475	Minor Project	0-0-6	3	CS-484	Comprehensive Viva – Voce		2
CS-477	Summer Training	0-0-3	2				
	Total	**12**	**8**		**Total**	**15**	**10**
	Grand Total	**27**	**23**		**Grand Total**	**27**	**22**

HS – 401 PRINCIPLES OF MANAGEMENT (3-0-0)

MODULE-I (12 hours)

Introduction to Management: Science, Theory and Practice; Importance and Scope of Management; Evolution of Management Thought; Management and Environment- Environmental Impact on the Management Process; Globalisation and Business Environment; Social Responsibilities and Obligations of Business Management.

Importance of Management in Engineering and Technology - Critical Factors in Managing Technology, Management of Technology and Global Competitiveness, Formulation of a Technology Strategy; Creating the Product-Technology-Business Connection, Technology Planning, Technology as an Instrument of Competition.

MODULE-II (12 hours)

The Process of Management; Planning – Essentials of Planning and Managing by Objectives, Strategies, Policies, Planning Perishes, and Decision Making; Organising – Principles of Organization, Organization Structure, Effective Organizing and Organization Culture; Directing – Crisis Management and Corporate Governance; Staffing – Selection, Training, Development, Appraisal, Knowledge Management; Controlling – The System and Process of Controlling, Control Techniques and Information Technology.

MODULE-III (12 hours)

Functions of Management – Marketing Function of Management, Morden Concept of Marketing, Functional Classification of Marketing, Marketing Mix, Fundamental Needs of Customers, Role of Distribution Channels and Advertising; Financial Functions of Management – Concept of Financial Management, Project Appraisal, Tools of Financial Decision Making, Introduction to Short-Term and Long-Term Sources of Financing.

TEXT BOOKS

1. Harold Koontz and Heinz Weihrich, Essentials of Management, Tata McGraw Hill, 8th Edition, 2010.
2. C. R. Basu, Business Organisation and Managemnt, Tata McGraw Hill, 3rd Reprint, 2008.
3. Management of Technology, Tarek Khalil, Tata McGraw-Hill Edition, 2009.

REFERENCE BOOKS

1. C. B. Gupta, Management – Theory and Practice, 14th Edition, S. Chand & Sons, 2009.
2. I. M. Pandey, Financial Management, Vikas Publications, 9th Edition, 2009.

CS- 401 RELATIONAL DATABASE MANAGEMENT SYSTEMS (3-0-0)

MODULE-I (15 Hours)

Introduction to Database: Characteristics of the Database approach, Advantages & Disadvantages of using DBMS approach. Database System Architecture: Data abstraction, Schema, Instances, Three Schema Architecture and data Independece, Types of Database users, DBA. Data base languages, Data Models: DML, DDL, DCL, Entity Relationship(ER), Relational mapping ER model to Relational Model, Object oriented data model , Object relational data model. Relational Query Language: Relational algebra, Tuple and Domain relational Calculus and SQL.

MODULE-II (15 Hours)

Relational Database Design: Informal Design Guidelines for Relational schema. Relational database design: 1NF, concept of functional dependency, Relation keys, canonical cover, Decomposition of

relational schemas, 2NF, 3NF, BCNF, Multivalued dependency, 4NF. Query Processing and Optimization: Evaluation of Relational Algebra Expression, Query Equivalence, Join strategy, Query optimization algorithms.

MODULE-III (10 Hours)

Introduction to Transaction Processing: Transaction, Properties of Transaction, Serializability, Recoverability. Concurrency Control Techniques: Locking, Timestamp ordering, Multi version scheme , Storage Strategies: Indices, B-Trees, Hashing, Database Recovery: Failure classification, Recovery and Atomicity, Log-based recovery and Check pointing, Introduction to advanced querying: Data mining and Data warehousing.

TEXT BOOKS

1. Ramez Elmasri and Shamkant Navathe, Fundamental of Database Systems. 4th Edition, Pearson Education.
2. Seilberschatz, H. Korth, S Sudharsan, Database System Concepts, McGraw-Hill.

REFERENCE BOOKS

1. C.J. Date, An Introduction to Database Systems, Pearson Education.
2. Bipin C. Desai, An Introduction to Database System, Galgotia.

CS-403 THEORY OF COMPUTATION (3-0-0)

MODULE-I (16 Hours)

Introduction to Automata Theory, Finite Automata (DFA & NFA),Finite Automata with Epsilon-Transitions, Conversion of NFA to DFA, Regular Expressions and Languages, Finite Automata & Regular Expression, Properties of Regular Languages.

MODULE-II (12 Hours)

Grammar, Chomsky's hierarchy of grammars, Context-Free Grammars (CFG) and Languages: Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages. Pushdown Automata, Languages of PDA, Equivalence of PDA's and CFG's, Properties of Context-Free Languages

MODULE-III (12 Hours)

Introduction to Turing Machine: Definition, Extension of Turing machine, Non-deterministic TM, Equivalence of various TM formalisms. **Undecidability:** Church Turing Thesis, Universal Turing Machine, Halting Problem, Other unsolvable problems. **Computational Complexity & NP-Completeness:** Class P, Class NP, Reductions, Class NP-Completeness, Dealing with NP-Completeness.

TEXT BOOK

1. J. E. Hopcroft, R. Motwani & J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Education Asia-2002.

REFERENCE BOOKS

2. Peter Linz, Introduction to Formal Language and Automata, Narosa Publishing House (Third Edition)-2004.
3. Michael Sipser, Introduction to the theory of Computation, Thomson Books
4. John. C Martin, Introduction to Languages and the Theory of Computation. The McGraw-Hill Companies.
5. Eitan Gurari , An Introduction to the Theory of Computation, Computer Science Press.

ELECTIVE – II

CS-405	**AD-HOC NETWORK**
CS-407	**WEB TECHNOLOGY**
EI-425	**EMBEDDED SYSTEM DISIGN**
CS-411	**CRYPTOGRAPHY AND SECURITY**
CS-413	**COMPUTATIONAL INTELLIGENCE**
CS-415	**FINANCIAL ENGINEERING**

CS-405 AD-HOC NETWORKS (3-0-0)

MODULE-III (12 Hours)
Wireless LANS and PANS, Wireless Wans And Mans, Wireless Internet, Ad- Hoc Wireless Networks.
MODULE-III (12 Hours)
Mac Protocols for Ad-hHoc Wireless Networks, Routing Protocols For Ad Hoc Wireless Networks, Multicast Routing In Ad -hoc Wireless Networks.
MODULE-III (12 Hours)
Transport Layer And Security Protocols For Ad Hoc Wireless Networks, Quality of Service In Ad Hoc Wireless Networks, Energy Management In Ad Hoc Wireless Networks, Recent Advances in Wireless Networks
TEXT BOOKS

1. C. Siva Ram Murty and B.S. Manoj, Ad Hoc Wireless Networks, Architectures and Protocols, Pearson Education, 2nd Edition (2.1 , 2.3 , 2.5, 3.1 TO 3.10, 4.1 TO 4.6, 5.1 TO 5.3, 6.1 TO 6.7, 7.1 – 7.9, 8.1-8.11, 9.1-9.12, 10.1- 10.6, 11.1 – 11.6, 14.1 – 14.6)

REFERENCE BOOK

1. William Stallings, High-Speed Networks and Internets Performance and Quality of Service, Pearson Education 2nd Edition.

CS-407 WEB TECHNOLOGY (3-0-0)

MODULE-I (15 Hours)
Internet Basics: Basic Concepts, Communication on the Internet, Internet Domains, TCP/IP and Internet, Application Protocols, Idea of Web Server, Web Browser. Web Design: HTML Tags, Color and Background, text formatting tags, creating hyperlinks and anchors, Image, Image map, table, frame, Designing Forms and controls, Multimedia in Web DHTML, Style sheet. Client Side Scripting: Introduction to Client side Scripting, Programming Fundamentals, Java Script Document Object Model, built in object, form object and element, working with data, flow control structures, operator, custom function and object, data entry and validation using tables and forms using JavaScript. Server Side Scripting: Introduction to Server side Scripting, ASP Objects and Components, Working of .asp files, CGI Basics, Why CGI is used? How it Works? Get and Post methods.
MODULE-II (15 Hours)
Introduction to Java Enterprise Edition 5: Programming for the Enterprise, Enterprise Architecture (Single tier, two tier, three tier, N tier, Enterprise) and Technologies, Introduction to Web Application. Java Servlets: Introduction to Web Containers, Servlet Programming, Servlet vs. Applet, Servlet API, GenericServlet Class, HttpServlet Class, Servlet Architecture, Servlet life Cycle, Working with Servlet, Working with Databases, Servlet Sessions, Cookies, Context and Collaboration. Java Server Pages: Basics and Architecture, Life Cycle of JSP Page, JSP Directives, Scripting Elements, Standard Action Elements of JSP, Implicit Objects and scope, Writing JSP application with standard Tag Libraries, Connecting to Databases. XML: Introduction, XML Document Syntax, Document Type Definition, Parsing valid XML, SAX, DOM.
MODULE-III (8 Hours)
Distributed Computing Using RMI: Basics, RMI Architecture, Locating Remote Objects, RMI Exceptions, and Developing Applications with RMI, Understanding Directory Services and JNDI. Enterprise Java Beans: Introduction, EJB vs. Java Beans, EJB Architecture, Features/ Benefits of EJB, Types of EJB, Working with Session Beans, Entity Beans.

TEXT BOOKS

1. Ivan Bayross, Web Technologies, Vol-I and Vol-II , BPB Publication.
2. Subrajmanyam Allamaraju and others, Professional Java Server Programming J2EE 1.3, SPD.

REFERENCE BOOKS

1. Ivan Bayross and Others, Java Server Programming for Professional covers JAVA EE 5, SPD.
2. Danny Ayers and others, Professional Java Server Programming, Wrox Press ltd, SPD.
3. Dream Tech Press , Java Server Programming (J2EE 1.4) Black Book,
4. Bruce W. Perry, Java Servlet & JSP, Cookbook SPD-O'Reilly
5. SL-134 Web Component with Servlets & JSP Technologies, Sun Solaris.
6. FJ-310-EE5 Developing Applications for the Java EE Platform, Sun Solaris.
7. SL-285-SE6 Developing Applications with the Java SE Platform, Sun Solaris.

EI-425 EMBEDDED SYSTEM DESIGN (3-0-0)

MODULE-I (14 Hours)

Introduction: An Embedded System, Processor in the System, Other hardware units, Software embedded into a system, Exemplary Embedded System-on-Chip (SOC) and VLSI circuit.

Devices and Device Drivers: I/O Devices, Timer and counting Devices, Serial communication using IC, CAN and advanced I/O buses between the networked multiple devices, Host system or computer parallel communication between networked I/O multiple devices using ISA,PCI, PCI-X and advanced buses, Device Drivers, Parallel Port Device Drivers in a System. Serial Port Device in a system, Interrupt servicing (Handling) mechanism.

MODULE-II (14 hours)

Software and Programming Concepts: Processor selection for an embedded system, memory selection for an embedded system, Embedded programming in C++, Embedded Programming in JAVA, Unified modeling language (UML), Multiple Processes and Application, Problem of sharing data by multiple tasks and routines, Inter Process Communication.

Real Time Operating System:

Operating system services, I/O subsystem, Network Operating System, Real time and Embedded System, Need of well tested and debugged Real time Operating System (RTOS), Introduction to C/OS-II.

MODULE-III (12 hours)

Case Studies of Programming with RTOS: Automatic vending machine, Adaptive Cruise Control System for a Car, Smart Card.

Hardware and Software Co-design: Embedded system project management, embedded system design and co-design issues in system development process, Design cycle in development phase for an embedded system, Use of software tools for development of an embedded system, Issues in embedded system design.

TEXT BOOKS

1. Raj Kamal, Embedded systems-Architecture, Programming and Design. Tata McGraw Hill,
2. Stephen A. Edwards, Kluwer Languages for Digital Embedded Systems, 2000, ISBN:

REFERENCE BOOKS:

1. Stuart R. Ball, Embedded Microprocessor Systems: Real World Design, Butterworth-Heinemann Publishers, 3rd edition, 2002,
2. Jack G. Ganssle, The Art of Programming Embedded systems, academic Press,1992,

CS-411 CRYPTOGRAPHY AND SECURITY (3-0-0)

MODULE-I (14 Hours)
Introduction: Service, Mechanisms and attacks, Symmetric key encipherment, Mathematics of Cryptography, Traditional Symmetric key ciphers, Modern Symmetric key ciphers.
MODULE-II (14 Hours)
DES, AES, Encipherment using Modern Symmetric key ciphers, asymmetric key Encipherment , Primes, Primality Testing, Factorization, Quadratic Congruence, RSA Cryptosystem.
MODULE-III (12 Hours)
Message Integrity and Message Authentication, Digital Signature, Key Management, Security at the Application layer.

TEXT BOOK
1. Behrouz A. Forouzan, Cryptography And Network Security, The McGraw-Hill Companies, Special Indian Edition.

REFERENCE BOOKS
1. William Stallings, Cryptography and Network Security – Principles and Practices, Prentice Hall of India, Third Edition, 2003.
2. D. Stinson, Cryptography, Theory and Practice 2nd Edition, 2004 published by Chapman & Hall/CRC.
3. Atul Kahate, Cryptography and Network Security, Tata McGraw-Hill, 2003.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, Security in Computing, Third Edition, Pearson, 2003.

CS-413 COMPUTATIONAL INTELLIGENCE (3-0-0)

MODULE-I (12 Hours)
Introduction to Soft Computing: Soft computing constituents and conventional Artificial Intelligence, Neuro-Fuzzy and Soft Computing characteristics. Fuzzy Sets, Fuzzy Rules and Fuzzy Reasoning: Introduction, Basic definitions and terminology, Set-theoretic operations, MF Formulation and parameterization, More on fuzzy union, intersection, and complement, Extension principle and fuzzy relations, Fuzzy If-Then rules, Fuzzy reasoning. Fuzzy Inference System: Mamdani fuzzy models, Sugeno Fuzzy Models, Tsukamoto fuzzy models, other considerations. Least Square Method for system Identification: System Identification , Basic of matrix manipulations and calculus, Least-square estimator, Geometric interpretation of LSE, Recursive least-square estimator, Recursive LSE for time varying systems, Statistical Properties and maximum likelihood estimator, LSE for nonlinear models.
MODULE-II (15 Hours)
Derivative-based optimization: Descent methods, the method of steepest descent, Newton's methods, Step size determination, conjugate gradient methods, Analysis of quadratic case, nonlinear least-squares problems, Incorporation of stochastic mechanism. Derivative-free optimization: Genetic algorithm simulated annealing, random search, Downhill simplex search, Swarm Intelligence, genetic programming. Adaptive Networks: Architecture, Back propagation for feed forward networks, Extended back propagation for recurrent networks, Hybrid learning rule: combing steepest descent and LSE. Supervised learning neural networks: Perceptions, Adaline, Back propagation multi layer perceptions, Radial Basic Function networks.
MODULE-III (13 Hours)
Learning from reinforcement: Failure is the surest path to success, temporal difference learning, the art of dynamic programming, Adaptive heuristic critic, Q-learning, A cost path problem, World

modeling, other network configurations, Reinforcement learning by evolutionary computations. Unsupervised learning and other neural networks: Competitive learning networks, Kohonen self-organizing networks, learning vector quantization, Hebbian learning, principal component networks, and the Hopfield network. Adaptive Neuro-fuzzy inference systems: ANFIS architecture, Hybrid learning algorithms, Learning methods that cross-fertilize ANFIS and RBNF, ANFIS as universal approximator, Simulation examples, Extensions and advance topics. Coactive Neuro-fuzzy modeling: towards generalized ANFIS: Framework, Neuro functions for adaptive networks, Neuro-Fuzzy spectrum, Analysis of adaptive learning capability.

TEXT BOOKS

1. J.S.R. Jng, C.T. Sun and E. Mizutani, Neuro-fuzzy and Soft Computing, PHI.
2. S. Rajasekaran, G.A. Vijaylakshmi Pai,:Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI.

CS-415 FINANCIAL ENGINEERING (3-0-0)

MODULE-I (14 Hours)

Basic financial mathematics (Time value of money, annuities, Amortization, Yields, Bonds), Term structure of interest rates (Spot rates, static spread, spot rate curve and yield curve), Option basics (exchange traded options, Basic option strategies), Arbitrage in Option pricing (Arbitrage argument, relative Option prices, Put-call parity, American options), Forward contracts and futures contracts.

MODULE-II (13 Hours)

Option Pricing Models (Binomial Model, Black-scholes formula, American puts on non-divided paying stock, options or stocks that pay dividend), sensitivity analysis of options (sensitivity measures – Greeks, Numerical techniques), Extensions of option Theory (corporate securities, Stock index options, foreign exchange options) Futures options and forward options, swaps.

MODULE-III (13 Hours)

Continuous time Derivative Pricing – Black – Scholes differential equation and applications, Hedging with options and futures, Finite – Difference and Monte – Carlo Methods for pricing options. Modern portfolio theory (Mean – variances analysis of risk and return, The capital asset pricing model, factor models, value at risk).

TEXT BOOK

1. Yuh – Danh Lyuu, Financial Engineering and computation, Cambridge University press, 2002
2. Elsavier, Financial Engineering, New Edition, 2009-10

REFERENCE BOOKS

1. J.C. Hull, Options, Futures and other Derivatives, PHI, 7th Edition, 2009
2. S.N. Deftici, Principles of financial Engineering, Academic Press – 2008.

ELECTIVE – III

CS-417 ADVANCED OPERATING SYSTEM

CS-419 DATA MINING

CS-421 REAL TIME SYSTEM

CS-423 DISTRIBUTED DATABASE SYSTEM

CS-425 ARTIFICIAL INTELLIGENCE

CS-427 UNIX PROGRAMMING & APPLICATIONS

CS-417 ADVANCED OPERATING SYSTEM (3-0-0)

MODULE-I (15 Hours)

Process Synchronization: Introduction to advanced OS, It's evolution , Categorization, **Distributed operating system:** Architectures, issues in Distributed operating systems, Limitation of Distributed Systems, Lamports logical clock, Global states Chandy Lampert's global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport Algorithm, Ricart-Agrawala Algorithm. Suzuki-Kasami Broadcart Algorithm.

MODULE-II (10 Hours)

Distributed File System : Basic concepts of Distributed deadlock detection, Distributed File System Architecture, Design issues, Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing, Process Migration, **Distributed CS Implementation:** Models, Naming, Process migration, Remote Procedure Calls. Fault Tolerance and Recovery: Backward and Forward recovery, Checkpoints, Synchronous Check pointing and recovery , Commit protocol, Voting protocol.

MODULE-III (15 Hours)

Multiprocessor System: Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements. Design & implementation Issue. Introduction to parallel programming. Multiprocessor Synchronization. Performance, Coprocessors, RISC & data flow: Introduction, Necessity, Measures, Techniques, Bottlenecks & saturation, Feedback loops, Coprocessors, RISC. **Security and Production:** Security-threats & goal penetration attempts, Security Policies & mechanisms, Authentication, Protections & acess control Formal models of protection Cryptography worms & viruse.

TEXT BOOK

1. Mukesh Singnal and Niranjan G. Shivaratri , Advanced Concepts in operating System, TMH.

REFERENCE BOOKS

2. Milan Milenkovic, System Concepts & Design, TMH
3. H.M. Beitel, Operating System, Pearson.

CS-419 DATA MINING (3-0-0)

MODULE-I (15 Hours)

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Major issues in Data Mining, OLAP Technology for Data Mining, Multidimensional Data Model. **Data Preprocessing:** Needs Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

MODULE-II (10 Hours)

Mining Association Rules in Large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

MODULE-III (15 Hours)

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy. **Cluster Analysis Introduction:** Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods.

TEXT BOOK

1. Jiawei Han & Micheline Kamber Harcourt India., Data Mining – Concepts and Techniques.

REFERENCE BOOK

2. Arun K. Pujari, Data Mining Techniques, University Press
3. David J. Hand, Heikki Mannila and Padhraic Smyth, Principles of Data Mining, MIT Press, Fall 2000.
4. Mehmed Kantardzic, Wiley, Data Mining: Concepts, Models, Methods, and Algorithm, IEEE Press, 2002.
5. Daniel T. Larose, John Wiley, Discovering Knowledge in Data : An Introduction to Data Mining, John Wiley & Sons, Hoboken, New Jersey, 2004.

CS-421 REAL TIME SYSTEM (3-0-0)

MODULE-I (12 Hours)

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modeling timing constraints , Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations. Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks.

MODULE-II (15 Hours)

Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization, Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system,POSIX, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

MODULE-III (13 Hours)

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Examples of applications requiring real-time communication, Basic concepts, Real-time communication in a LAN. Soft Real-time communication in a LAN. Hard real-time communication in a LAN. Bounded access protocols for LANs. Performance comparison, Real-time communication over packet switched networks. Qos framework, Routing, Resource reservation, Rate control, Qos models.

TEXT BOOK

1. Rajib Mall, Real-time Systems Theory and Practice, Pearson Education

CS-423 DISTRIBUTED DATABASE SYSTEM (3-0-0)

MODULE-I (14 Hours)
Introduction to Distributed Data Processing and Distributed Database system, Relational DBMS Concept-Normalization, Integrity Rules, Relational Data Languages, Functional Layers of Relational DBMS, Data Communication Concepts-Types of Computer Networks, Protocol Standards, Broadband Networks, Wireless Networks, Internet, DBMS Standardization, Distributed DBMS Architecture and Models.

MODULE-II (14 Hours)
Distributed Database Design Strategies and Issues, Fragmentation, Allocation, Semantic Data Control, View Management, Data Security, Complexity of Relational Algebra Operations, Objectives and Characterization Query Processing, Layers of Query Processing, Query Decomposition and Data Localization, Distributed Query Optimization Introduction to Transaction Management: Properties of Transaction, Types of Transaction, Distributed Concurrency Control, Serialization, Concurrency Control Mechanisms, Concurrency Control Algorithms, Deadlock Management, Relaxed Concurrency Control.

MODULE-III (12 Hours)
Reliability concepts and Measures: Failures and Fault Tolerance in Distributed Systems, Failures in Distributed DBMS, Local and Distributed Reliability Protocols, Network Partitioning, Fundamental Object Concepts and Models, Object Distribution Design, Client/Server Architecture, Object Management and Storage, Object Query Processing.

TEXT BOOKS

2. OZSU & Valduriez, Principles of Distributed Database System, Pearson Education.
3. C. J. Date, An Introduction to Database Systems, Pearson Education.

CS-425 ARTIFICIAL INTELLIGENCE (3-0-0)

MODULE-I (15 Hours)
Introduction to AI, The foundation of AI, The History of AI, The state of Art, Intelligent Agent, How agent should act, Structure of Intelligent Agent, Environments, Solving Problem by Searching, Formulating Problems, Searching for solutions, Search Strategies, Avoiding repeated search, Constraint Satisfaction Problem. Informed Search Methods: Best-First Search, Heuristic Functions, Memory Bounded Search, Iterative Improvement Algorithms, Knowledge & Reasoning : A Knowledge based Agent, The Wumpus world Environment, Representation Logic and Reasoning.

MODULE-II (15 Hours)
Propositional Logic, An Agent for the Wumpus world, First Order Logic: Syntax and Semantics, Extensions and Notational variations, Using first order logic, Logical Agent for Wumpus world. Inference in First-Order Logic, Inference Rules involving Quantifiers, Generalized Modus Ponens, Forward and Backwards Chaining, Clausal form, Semantic nets, Planning, A simple planning agent, From problem solving to planning, Planning in situation calculus, Basic representation for planning. Uncertainty: Acting under Uncertainty, Basic Probabilistic Notation, Axioms of Probability, Bayes' Rules and its use.

MODULE-III (10 Hours)
Learning in Neural and Belief Networks, How the brain works, Neural Network, Perceptrons, Multilayer Feed Forward Networks, Application of Neural Networks, Bayesian Methods for Learning Belief Networks. Practical Natural language Processing, Practical Application, Efficient Parsing, Scaling up Lexicon, scaling up the grammar, Ambiguity, Discourse Understanding. Derivative free optimization techniques: Genetic Algorithm, Simulated Annealing.

TEXT BOOK

1. S. Russell & P. Norvig, Artificial Intelligence A Modern Approach , Pearson Education

REFERENCE BOOKS

2. E. Rich and K. Knight, Artificial Intelligence ,Tata Mc Graw-Hill Edition.
3. Nils J. Nilsson Morgan, Artificial Intelligence : A New Synthesis, Kaufman Publishers
4. Daniel G. Bobrow, Artificial Intelligence in Perspective , MIT Press

CS-427 UNIX PROGRAMMING & APPLICATIONS (3-0-0)

Module-I (14 Hours)

Introduction to UNIX, UNIX system organization, Files and directories, Library Functions and system calls, Editors. Linux, Linux Architecture, Linux file system, Kernel, Process Management in Linux, System call for Files, Processes and Signals. Types of shells, Shell variables, Shell scripts, Shell commands, the environment, Integer arithmetic and string manipulation, Special command line characters, Decision making and loop control, controlling terminal input, arrays.

Module-II (14 Hours)

I/O Redirection and Piping, , Shell control statements, Shell Meta- characters, Shell Scripts, Shell keywords, Shell Procedures and Reporting, Handling documents, scheduling of processes at command. Command line argument, Background processes, process synchronization, sharing of data, user-id, group-id, pipes, message queues, semaphores, shared variables, prototyping, Coding, Compiling,TestingandDebugging.

Module-III (14 Hours)

System administration Common administrative tasks, identifying administrative files – configuration and log files , Role of system administrator , Managing user accounts-adding & deleting users , changing permissions and ownerships , Creating and managing groups , modifying group attributes , Temporary disable user's accounts, creating and mounting file system , checking and monitoring system performance file security & permissions. Getting system information with name , host name , disk partitions & sizes, users, kernel . Backup and restore files, installing and removing packages in Linux. Configure X-windows starting & using X desktop.

TEXT BOOKS

1. Mark. G. Sobell, A Practical Guide to Linux Commands, Editors and Shell Programming , Pearson Education
2. Sumitabha Das, UNIX Concepts and Applications, Tata McGraw-Hill.

CS-400 SOFTWARE ENGINEERING (3-0-0)

MODULE-I (15 Hours)

Introduction to Information System Development: Overview of System Analysis and Design, Categories of Information Systems, System development Strategies, Implementation and Evaluation, Tools for System development, **Introduction to software Engineering:** Basic concepts about software and program and Evolution of Software Engineering, Basic concepts on process and life cycle models. **Models:** Waterfall, Prototype, Evolutionary, Incremental, spiral, V, RADM etc. Requirement Analysis: Introduction to software specification, its needs and importance, formal specification methods. SRS: Attributes of good SRS and organization of SRS document.

MODULE-II (15 Hours)

Software design: Methods and strategies, desirable design attributes, Concept of good design, Cohesion and coupling. Function-Oriented Software Design: structured system analysis and structured design, formal approach design, data flow oriented design. Software coding and testing: coding standard and guidelines, code review, software inspection, **Testing:** Unit, Integration, System testing, black box and white box testing Incremental testing, formal proof of correctness, software matrix. Introduction to software verifications.

MODULE-III (10 Hours)

Software Reliability and Quality Management: S/W and H/W reliability, Reliability Matrices, S/W quality, ISO 9000 , Software engineering management: introduction to capability maturity model, quality assurance and software cost estimation (Delphi, COCOMO). Introduction to Computer-aided Software Engineering, Software reuse and maintenance.

TEXT BOOKS

1. Rajib Mall, Fundamentals of Software Engineering, PHI.
2. R.S. Pressman, Software Engineering, A practitioner's approach, McGraw Hill.

REFERENCE BOOKS

1. P. Jalote, An integrated approach to software engineering. Narosa
2. G. Booch, Object-Oriented analysis and design, Benjamin / Cumming Publishing Co. New York.
3. James A. Senn, Analysis and Design of Information Systems, McGraw Hill
4. Hong Zhu, Software Design Methodology, Elsevier

CS-402 COMPILER CONSTRUCTION (3-0-0)

MODULE-I (13 Hours)

Introduction to Compiling: Analysis of the source program, the phases of a compiler, The grouping of phases, Compiler-construction tools. A Simple One-pass compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines, Lexical Analysis: The Role of lexical analyser, Input buffering, Specification of tokens, Recognition of tokens, A language specifying lexical analyzers, Finite automata(DFA & NFA), Design of a lexical analyzer generator.

MODULE-II (12 Hours)

Syntax Analysis: The role of parse, Context-free grammars, Top-down parsing, Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Syntax- Directed Translation: Syntax directed definitions, Construction of Syntax tree, Bottom-up evaluation, L-attributed definitions, Top-down definition, Bottom-up evaluation, Recursive evaluators, Space for attribute values at compile time.

MODULE-III (15 Hours)

Type Checking: Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Overloading of functions and operators, Polymorphic functions, Run-Time Environments: Source language issues, Storage organisation, Storage allocation strategies, Intermediate code generation: Intermediate languages, Declaration, Assignment statements, Boolean expressions, Case statements, Back patching, Procedure calls. Code Generation: Issues in the design of a code generator, Target machine, Run-Time storage management, basic blocks and flow graphs, Next-use information, A simple code generator, Register allocation and assignment, The dag representation of basic blocks, Generating code from dags. Code Optimization: The principal sources of optimisation, Optimization of basic blocks, Loops in flow graphs, Introduction to global data-flow

analysis, Iterative solution of data-flow equation, Code-improving transformations, Data-flow analysis of structured flow graphs, Efficient data-flow algorithms.

TEXT BOOK

1. A.V. Aho, R. Sethi & J.D. Ullman, Compilers Principles, Techniques, and Tools, Pearson Education

REFERENCE BOOKS

2. Torben Ægidius Mogensen, Basics of Compiler Design, DIKU, University of Copenhagen.
3. Niklaus Wirth: Compiler Construction, Computer Science-Department, ETH Zurich Addison-Wesley Publication
4. Pat Terry, Compilers and Compiler Generators: an introduction with C++ International, Thomson Computer Press.
5. Engineering a Compiler, Keith D Cooper, Linda Torczon – 2004, Elsevier

ELECTIVE – IV

CS-404	**PARALLEL AND DISTRIBUTED SYSTEM**
CS-406	**MOBILE COMPUTING**
EI-423	**VLSI DESIGN**
EC-421	**DIGITAL IMAGE PROCESSING**
CS-408	**WIRELESS SENSOR NETWORK**
CS-410	**PATTERN RECOGNITION**

CS-404 PARALLEL AND DISTRIBUTED SYSTEM (3-0-0)

MODULE-I (12 Hours)

Introduction to parallel computing: Motivation and Scope. **Parallel Programming Platforms**: Trends in microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of parallel Computing platforms, physical Organization of parallel platforms, communication costs in parallel Machines, Routing Mechanisms for interconnection Network, Impact of Process Processors mapping and mapping Techniques.

MODULE-II (18 Hours)

Principles of parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Balancing, Methods for containing. Interactions overheads, Parallel Algorithm Models. Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and reduction All-Reduce and Prefix sum operations, scatter and Gather, All-to-All personalized communication, circular shift, improving the speed of some communication operation. Analytical Modeling of Parallel Programs: Performance Metrics for Parallel Systems, Effect of Granularity of Performance, scalability of parallel system, Minimum Execution Time and Minimum Cost-optimal execution Time, Asymptotic Analysis of parallel Programs, Other scalability Metrics. Programming using the message passing paradigm.

MODULE-III (10 Hours)

Dense Matrix Algorithm: Matrix-vector Multiplication, Matrix-Matrix algorithm, Solving a System of linear equations. Sorting: Bubble Sort and its variants, Quick Sort.Graph Algorithms: Minimum spanning Tree (Prim's Algorithm) shortest path (Dijkstra's Algorithm)

TEXT BOOK

1. Ananth Gram, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Second Edition, Person Education.

REFERENCE BOOKS

2. M. J. Quinn: Parallel Computing, Theory & Practise, McGraw-Hill.
3. Zomaya, editor: Parallel & Distributed Computing Hand Book, McGraw Hill
4. Joseph J'a J'a, An Introduction to Parallel Algorithms , Addison- Wesley
5. Kai Hwang and Zhi Wei Xu, Scalable Parallel Computing, TMH, New Delhi, 2003
6. David E, Culler & Jaswander Pal Singh , Parallel Computing Architecture , Morgan Kaufman , 1999.

CS-406 MOBILE COMPUTING (3-0-0)

MODULE-I (10 Hours)

Introduction to Personal Communications Services (PCS): PCS Architecture, mobility management, Networks signaling, Global System for Mobile Communication (GSM) System overview : GSM Architecture, Mobility management, Network signaling**. General Packet Radio Services (GPRS)**: GPRS Architecture, GPRS Network Nodes, Mobile Data Communication ; WLANs (Wireless LANs) IEEE 802.II standard, Mobile IP.

MODULE-II (15 Hours)

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML), **Wireless Local Loop (WLL):** Introduction to WLL Architecture, wireless Local Loop Technologies. Third Generation (3G) **Mobile Services**: Introduction to International Mobile Telecommunications 2000 (IMT 2000) Vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

MODULE-III (15 Hours)

Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. **Wireless Enterprise Networks**: Introduction to Virtual Networks, Blue tooth technology, Blue tooth

Protocols. Server-side programming in Java, Pervasive web application architecture, Device independent example application.

TEXT BOOKS

1. Burkhardt, Pervasive Computing, Pearson
2. J. Schiller, Mobile CommunicationPearson
3. Sandeep Singhal, The Wireless Application Protocol, Pearson
4. Raj Pandya, Mobile and Personal Communication Systems and Services, Prentice Hall of India, 2001.

REFERENCE BOOKS

1. Mark Ciampa, Thomson learning, Guide to Designing and Implementing Wireless LANs, Vikas, 2001.
2. Ray Rischpater, Wireless Web Development, Springer.
3. Sandeep Singhal, The Wireless Application Protocol, Pearson.
4. P. Stavronlakis, Third Generation Mobile Telecommunication Systems, Springer.

EI-423 VLSI DESIGN (3-0-0)

MODULE – I (10 hours)

Introduction: Historical evolution of VLSI, Moore's Law, VLSI Design Methodologies, Front end design and Back end design

VLSI Fabrication: Fabrication processes, NMOS Fabrication, CMOS Fabrication, CMOS N-well process, Layout Design Rules, Stick Diagrams, Mask Layout Design

MOS Transistor: Review of structure and operation of MOSFET, NMOS, CMOS, MOSFET V-I characteristics, MOSFET capacitances, Short channel effects, MOSFET scaling, Modeling of MOSFET Transistors – Basic concept of SPICE level-1, level-2 and level-3 model equations.

MODULE – II (12 hours)

MOS Inverters: Basic MOS inverters and their characteristics, inverters with resistive load and with n-type MOSFET load, CMOS inverter Switching characteristics and interconnect effects, Delay time definition and calculations, inverter design with delay constraints, estimation of parasitics, switching power dissipation of CMOS inverters

Combinational MOS Logic Circuits: CMOS logic, complex logic circuits, pass transistor and transmission gate logic, sequential logic circuit: SR latch, clocked & flip-flop circuits, CMOS D latch and edge triggered flip-flop.

MODULE – III (12 hours)

Dynamic Logic Circuits: Dynamic logic, basic principles, high performance dynamic logic circuits, Memories: ROM, Dynamic RAM, SRAM, flash memory

VHDL: Introduction, Behavioral Modeling, Sequential processing, Data Types, Sub program & Packages, Attributes, Configurations, VHDL design of adders, Multiplexer, Decoder, Latch, S-R flip flop, D flip flop, Memory circuits, Front end e-CAD tools

VLSI eCAD: VLSI Design methodology, Full custom, Semi-custom and Programmable designs, VLSI Design Flow, FPGA based designs, standard cell based designs, floor planning and place and route, Back end e-CAD tools

Design Verification and Testing: simulation at various levels including timing verification, fault models, Design strategies for testing chip level and system level test techniques.

TEXT BOOKS

1. Kang and Yussuf Leblebici, CMOS Digital Integrated Circuits – Analysis & Design Sung Mo, Tata McGraw Hill.
2. D.L.Perry, VHDL Programming by examples, Tata McGraw Hill

REFERENCE BOOKS

1. J.M.Rabey, Anantha Chandrakasan and Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective , Pearson Education.
2. Geiger et al., VLSI Design Techniques for Analog and Digital Circuits, McGraw Hill

EC – 421 DIGITAL IMAGE PROCESSING (3-0-0)

INTRODUCTION: Fundamental steps in Digital Image Processing, Components of an image processing system, DIGITAL IMAGE FUNDAMENTALS: Image sampling and quantization, Some basic relationships between pixels, Linear and nonlinear operations, IMAGE ENHANCEMENT IN SPATIAL DOMAIN: Some basic gray level transformations, Histogram processing, Smoothing and Sharpening spatial filters, IMAGE ENHANCEMENT IN FREQUENCY DOMAIN: Smoothing and Sharpening frequency domain filters, Homomorphic filtering, IMAGE RESTORATION: Noise models, Restoration in the presence of noise only-spatial filtering, Estimating the degradation functions, Inverse filtering, COLOR IMAGE PROCESSING: Color models, Pseudo-color processing, IMAGE COMPRESSION: Image compression models, Loss-less and Lossy compression, MORPHOLOGICAL IMAGE PROCESSING: Dilation and erosion, Opening and closing, Some basic morphological algorithms, IMAGE SEGMENTATION: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation, RECENT DEVELOPMENTS.

TEXT BOOKS

1. R. C. Gonzalez and R.E. Woods, Digital Image Processing, Pearson Education, 2006
2. R. C. Gonzalez , R.E. Woods and Eddins, Digital Image Processing using MATLAB, Pearson Education

REFERENCE BOOKS

1. A.K. Jain, Fundamentals of Digital Image Processing, Pearson Education, 2007
2. B.Chanda & D. Dutta Majumdar , Digital Image Processing and Analysis, PHI, 2001.
3. Alasdair McAndrew , Introduction to Digital Image Processing with MATLAB, Cengage Learning, 2004

CS-408 WIRELESS SENSOR NETWORK (3-0-0)

MODULE-I (12 Hours)

Introduction: Networked wireless sensor devices, Applications, design challenges. Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, and Mobile deployment. Localization: issues & approaches, Network-wide localization, Theoretical analysis of localization techniques. Synchronization: Issues & Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

MODULE-II (15 Hours)

Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference. Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols. Sleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage, Set K-cover algorithms.

MODULE-III (13 Hours)
Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks. Data-centric networking: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, the database perspective on sensor networks. Reliability and congestion control: Basic mechanisms and tunable parameters, Reliability guarantees, Congestion Control, Real-time scheduling.

TEXT BOOKS

1. Kazem Sohraby, Daniel Minoli, Taieb Znati , Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley Inter Science.
2. Edgar H. Callaway, Wireless Sensor Networks: Architectures and Protocols, Jr. Auerbach Publications, CRC Press.

REFERENCE BOOKS

1. C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati , Wireless Sensor Networks: Edited Springer.
2. Bhaskar Krismachari, Networking Wireless Sensors, Cambridge University Press

CS-410 PATTERN RECOGNITION (3-0-0)

MODULE-I (10 Hours)
Basics of pattern recognition, Bayesian decision theory, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, Discrete features, Parameter estimation methods, Maximum- Likelihood estimation, Gaussian mixture models, Expectation - maximization method, Bayesian estimation

MODULE-II (15 Hours)
Hidden Markov models for sequential pattern classification, Discrete hidden Markov models, Continuous density hidden Markov models, Dimension reduction methods , Fisher discriminant analysis, Principal component analysis, Non-parametric techniques for density estimation, Parzen - window method , K-Nearest Neighbors method.

MODULE-III (10 Hours)
Linear discriminant function based classifiers , Perceptron, Support vector machines, Non-metric methods for pattern classification , Non-numeric data or nominal data , Decision trees, Unsupervised learning and clustering, Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation

TEXT BOOKS

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009

ELECTIVE – V
(Open Elective)

CS-412	**ADVANCED JAVA**
IT-410	**OBJECT ORIENTED ANALYSIS AND DESIGN WITH UML**
CS-416	**BIOINFORMATICS**
CS-418	**ADVANCED COMPUTER NETWORK**
CS-420	**HUMAN COMPUTER INTERFACE**
CS-422	**CLUSTER AND GRID COMPUTING**

CS-412 ADVANCED JAVA (3-0-0)

MODULE – I (10 Hours)

Introduction to Java graphics programming with awt and swing package. Classes and methods of swing package. Icons and Labels, Text Fields, Buttons, Jbutton Class, Check Box, Radio Buttons, The Container, Panel, Windows, and Frame Classes, Combo Box, Tabbed Panes, Scroll Panes. Java IO Package. File Handling through IO Package.

MODULE – II (12 Hours)

Networking through Java net package. Sockets, Remote Method Invocation.

JDBC Fundamentals. Establishing Connectivity and working with connection interface working with statements Creating and Executing SQL statements working with Result Set Object & Result Set Meta Data. Bean concepts, Events in bean box, Bean customization, Persistence, Application, deployment using swing, advanced swing techniques, JAR file handling.

MODULE – III (14 Hours)

XML: Introduction, XML Document Syntax, Document Type Definition, Parsing valid XML, SAX, DOM.Servlets : Introduction to Servlets (Life cycle of servlets, Java Servlets Development Kit, creating, compiling and running servlet). The servlet API : javax.servlet package. Reading the servlet Parameters, Reading Initialization parameter. The javax.servlet.http.Package. Handling HTTP Request and Response (GET / POST Request) Using Cookies, Session Tracking.

JSP

Advantages of JSP technology (Comparision with ASP/Servlet). JSP Architecture, JSP Access Model. JSP Syntax Basic(Directions, Declarations, Expressions, Scriptlets, Comments). JSP Implicit Objects, Object Scope. Syncronization Issue. Exception Handling, Session Management.

TEXT BOOK

1. Herbert Schildt , Java2, The Complete Reference, 5th Edition, TMH.
2. Kathy Sierra and Bert Bates, Head First Java, O'Reilly.

REFERENCE BOOKS

1. Khalid A. Mughal , Rolf W. Rasmussen , Programmer's Guide to Java A Comprehensive Primer, Second Edition
2. Java Black Book By Steve Holzner, O'Reilly.

IT-410 OBJECT ORIENTED ANALYSIS AND DESIGN WITH UML (3-0-0)

MODULE –I (8 Hours)

Overview of Object Oriented Concepts: Basic mechanisms, Key concepts, related technical terms, Advantages of OOD. **Object-Oriented S/W design:** Object oriented vs. function-oriented design, The Importance of Modeling, Principles of Modeling, Object oriented modeling. **Introduction to UML**: Overview, conceptual model Architecture, software development life cycle, Rational Unified Process.

MODULE –II (15 Hours)

Basic structural Modeling: Classes, Relationships, Common mechanisms, Diagrams, class diagrams. **Advanced structural Modeling:** Advance classes and relationship, Interfaces, types and Roles Object diagrams, packages.

MODULE –III (17 Hours)

Basic behavioral Modeling: Use cases, use case diagrams, Interaction diagram, Activity diagrams, state chart diagrams, component diagrams, deployment diagrams, patterns and frame works.

A CASE STUDY:

(Ex: - ATM, Trading System, Banking System, Library Information System, Student Information System etc.)

TEXT BOOKS

1. Peerson Grady Booch, Rambaugh, Ivar Jacohson: Unified Modeling language, User Guide, Pearson Education
2. Rajib Mall Introduction to Software Engineering by, PHI.

REFERENCE BOOKS

1. Pankaj Jalote , An Integrated approach to SW Engineering .
2. H. Srimathi, H. Sriram, A. Krishnamurthy, Object Oriented Analysis & Design Using UML, Scitech
3. Craig Larman : Applying UML and Patterns.

CS-416 BIOINFORMATICS (3-0-0)

MODULE-I (12 Hours)

Basic Concepts of Molecular Biology: Cellular Architecture, Nucleic Acids (RNA & DNA) Transcription and Translations, Open reading frame, Genetic code, Protein structure and function, Molecular biology tools. Suffix Trees: Definition and examples Ukkonen's linear-time suffix tree algorithm, Applications longest common sub strings of two strings, Recognizing DNA contamination. Pair wise Sequence Alignment (Edit distance, Dynamic Programming Calculation of edit distance, string similarity, gaps).

MODULE-III (14 Hours)

Pair wise sequence alignment local, Multiple String Alignment, Need of MSA, Family & Super Family representation, multiple sequence comparison for structural inferences, Multiple alignments with sum-of- pairs, consensus objective functions. Database searching for similar sequence (FASTA, BLAST), PAM, BLOSOM SUBSTITUTION MATRICES.

MODULE-III (14 Hours)

Sequencing (DNA sequencing, shortest superstring problem, DNA Arrays, sequencing by Hybridization)

Phylogenetic analysis (Evolutionary Trees, Distance and character based true reconstruction, Reconstructing trees from additive matrices, Evlutionary trees and hierarchical clustering –VPGMA Neighbors Joining,) small and large parsivrony problem.

TEXT BOOKS

1. Dan Gusfield, Algorithm on strings, Trees and Sequences: Computer Science & Computational Biology, Cambridge University Press, 1997 (Chapters: 5, 6, 7, 10, 11, 14 & 15 relevant portions)
2. N. C. Jones and P. A PEVZNER- An Introduction to Bioinformatics Algorithms- MIT press, 2009 (chapters 3, 8 7 10 – relevant portions)
3. D. E. Krane & M. L. Raymer- Fundamental concepts of Bioinformatics – Pearson Education, 2003 (Chapter-1)

REFERENCE BOOK

1. D. Baxevanis, B. F. Francis one llitte Bioinformatics, Wiley- Interscience

CS-418 ADVANCED COMPUTER NETWORK (3-0-0)

MODULE–I (10 Hours)
Introduction, TCP/IP Protocol suite, High speed networks; Frame Relay, ATM, High speed LANs
MODULE-II (15 Hours)
Performance Modeling and Estimation: overview of probability and stochastic process, Queuing Analysis, Self-similar traffic. Congestion and traffic management: Congestion control in Data networks & Internets, link level flow and error control, TCP traffic control,
MODULE–III (15 Hours)
Internet Routing: Overview of Graph theory and least-cost paths, Interior routing protocols, Exterior routing protocols .Quality of service in IP Networks: Integrated and differentiated services, protocol of QOS support, Compression: Overview of Information Theory, Lossless compression, Lossy compression

TEXT BOOK
1. William Stalling : High-speed Networks and Internets , Pearson Education.

REFERENCE BOOKS
1. B. A. Forouzan, Data Communications and Networking, McGraw Hill,
2. D. Comer, Internetworking with TCP/IP, Volume 1, Third edition. Prentice-Hall,

CS-420 HUMAN COMPUTER INTERFACE (3-0-0)

MODULE-I (13 Hours)
Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design . The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface. Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.
MODULE-II (14 Hours)
Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design. Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls.
MODULE-III (13 Hours)
Components – text and messages, Icons and increases – Multimedia , colors , uses problems , choosing colors. Software tools – Specification methods, interface – Building Tools . Interaction Devices, Keyboard and function keys – pointing devices – speech recognition digitization and generation –image and video displays.

TEXT BOOKS
1. Wilbert O Galitz, The essential guide to user interface design, Wiley Dreama Tech.
2. Ben Shneidermann, Designing the user interface. 3rd Edition Pearson Education Asia.

REFERENCES BOOKS
1. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Human, Computer Interaction., Pearson.
2. Prece, Rogers, Sharps, Interaction Design, Wiley Dreamtech,
3. Soren Lauesen , User Interface Design, Pearson Education.

CS-422 CLUSTER AND GRID COMPUTING (3-0-0)

MODULE-I (13 Hours)
Introduction : High Performance Computing (HPC), Grand Challenge Problems-Computational and communication intensive, Parallel Architectures-Classifications-SMP, MPP, NUMA, Clusters and Components of a Parallel Machine, Conventional Supercomputers and it's limitations, Multi-processor and Multi-Computer based Distributed Systems.

MODULE-I (13 Hours)
Cluster and Grids: Cluster Components-Processor/machine, High Speed Interconnections-goals, topology, latency, bandwidth, Example Interconnect: Myrinet, Inifiniband , QsNet, Fast Ethernet, Gigabit Ethernet, Light weight Messaging system/Light weight communication Protocols, Cluster Middleware-Job/Resource Management System, Load balancing, Scheduling of parallel processes, Enforcing policies, GUI, Introduction to programming tools such as PVM, MPI,

MODULE-I (13 Hours)
Cluster Operating Systems Examples: Linux, MOSIX, CONDOR, Characteristics of Grid, Computational services, Computational Grids, Data grids/Storage grids, management and applications, Different components of Grid-Grid fabric, Grid middleware, Grid applications and portal, Globus toolkit Ver.2.4, web services, MDS,GRAM, Grid Security –Cryptography, Authentication, Integrity, Digital Signature, Digital Certificates, Certificate Authority, MD-5, RSA, GSI,GSSAPI, Directory Service, LDAP,GRID FTP,GASS Fault Tolerance: Fault detection and diagnosis of Clusters and Grids.

TEXT BOOKS

1. D. Janakiram, Grid Computing, Tata McGraw Hill, 2005
2. R. K. Buyya, High Performance Cluster Computing: Programming and Applications, Vol 2, Prentice Hall, NJ, USA, 1999.
3. Pankaj Jalote, Fault Tolerance in Distributed Systems, Prentice Hall, 1994.
4. J. J. Jos & R. K. Buyya, High Performance Cluster Computing: Architectures and Systems, Vol I, Prentice Hall, NJ, USA, 1999.
5. R. K. Buyya & K. Bubendorfer, Market Oriented Grid and Utility Computing, Wiley, 2008.
6. J. Jaseph & C. Fellenstein, Grid Computing, Pearson, 1st Ed, 2004.

7th SESSIONAL

CS-471 RDBMS LAB (0-0-3)

1. Use of SQL syntax: insertion, deletion, updating using SQL.
2. Program segments in embedded SQL using C as host language to find average grade point of a student, etc.
3. SQL querying using Oracle functions
4. Table creation using constraints and referential integrity.
5. Sub queries and Join
6. Exploring Oracle objects like view, index sequence etc.
7. Introduction to PL SQL.
8. Introduction to Procedure and Function and Programming procedure and functions.
9. Use of Cursor for the programming approach.
10. Introduction to Trigger and Packages for programming approaches.
11. Use of package (ORACLE) for programming approaches.
12. Use of package (DB2) for programming approaches.
13. Programs on JDBC/ODBC to print employ's / student's/ information of a particular department.