B.Tech. Information Technology
List of Electives

Elective-I

S.No.	Paper Code	Paper Name
1.	TIT 011	Digital Image Processing
2.	TCS 033	Bioinformatics
3.	TIT 012	Multimedia Systems

Elective-II

1.	TCS 031	Data Mining & Data Warehousing
2.	TIT 021	IT for Forensic Science
3.	TCS 034	Data Compression

Elective-III

1.	TCS 041	Real Time Systems
2.	TIT 031	Advance Computer Architecture
3.	TCS 044	Embedded Systems
4.	TIT 032	Storage & Information Management

Elective-IV

1.	TCS 054	Mobile Computing
2.	TIT 041	Soft Computing
3.	TIT 042	Software Quality Engineering

(TIT 701) CRYPTOGRAPHY AND NETWORK SECURITY

Unit-I

Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers.

Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

Unit-II

Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms.

Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.

Unit-III

Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA).

Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

Unit-IV

Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.

Unit-V

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management.

Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET).

System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

Books:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersy.
2. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
3. Bruce Schiener, "Applied Cryptography".

(TIT 702) ARTIFICIAL INTELLIGENCE

Unit-I: Introduction

Introduction to Artificial Intelligence, Simulation of sophisticated & Intelligent Behavior in different area, problem solving in games, natural language, automated reasoning visual perception, heuristic algorithm versus solution guaranteed algorithms.

Unit-II: Understanding Natural Languages

Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammars, Shanks Conceptual Dependency, grammar free analyzers, sentence generation, and translation.

Unit-III: Knowledge Representation

First order predicate calculus, Horn Clauses, Introduction to PROLOG, Semantic Nets Partitioned Nets, Minskey frames, Case Grammar Theory, Production Rules Knowledge Base, The Inference System, Forward & Backward Deduction.

Unit-IV: Expert System

Existing Systems (DENDRAL, MYCIN), domain exploration, Meta Knowledge, Expertise Transfer, Self Explaining System.

Unit-V: Pattern Recognition
Introduction to pattern Recognition, Structured Description, Symbolic Description, Machine perception, Line Finding, Interception, Semantic, & Model, Object Identification, Speech Recognition.
Programming Language: Introduction to programming Language, LISP, PROLOG

Books:
1. Charnick "Introduction to Artificial Intelligence." Addision Wesley
2. Rich & Knight, "Artificial Intelligence"
3. Winston, "LISP", Addison Wesley
4. Marcellous, "Expert Systems Programming", PHI
5. Elamie." Artificial Intelligence, "Academic Press
6. Lioyed, Foundation of Logic Programming,"Springer Verlag

(TIT 011) DIGITAL IMAGE PROCESSING

UNIT-I
Introduction and Fundamentals
Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.
Image Enhancement in Spatial Domain
Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

UNIT-II
Image Enhancement in Frequency Domain
Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.
Image Restoration
A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

UNIT-III
Color Image Processing
Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation.
Morphological Image Processing
Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

UNIT-IV
Registration
Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth
Segmentation
Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

UNIT-V
Feature Extraction
Representation, Topological Attributes, Geometric Attributes
Description
Boundary-based Description, Region-based Description, Relationship.
Object Recognition
Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching

Books:
1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.

(TCS 033) BIOINFORMATICS

Unit I: **Introduction**
Bioinformatics objectives and overviews, Interdisciplinary nature of Bioinformatics, Data integration, Data analysis, Major Bioinformatics databases and tools. Metadata: Summary & reference systems, finding new type of data online.

Molecular Biology and Bioinformatics: Systems approach in biology,Central dogma of molecular biology, problems in molecular approach and the bioinformatics approach, Overview of the bioinformatics applications.

Unit II: **The Information Molecules and Information Flow**
Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, -Translation, Genes- the functional elements in DNA, Analyzing DNA,DNA sequencing. Proteins: Amino acids, Protein structure, Secondary, Tertiary and Quaternary structure, Protein folding and function, Nucleic acid-Protein interaction.

Unit III: Perl
Perl Basics, Perl applications for bioinformatics- Bioperl, Linux Operating System, Understanding and Using Biological Databases, Java clients, CORBA, Introduction to biostatics.

Unit IV: Nucleotide sequence data
Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses.

Unit V: **Biological data types and their special requirements**: sequences, macromolecular structures, chemical compounds, generic variability and its connection to clinical data. Representation of patterns and relationships: alignments, regular expressions, hierarchies and graphical models.

Books:

1. O'Reilly, " Developing Bio informatics computer skills", Indian Edition's publication
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics concepts, skills & Applications", CBS Publishers
3. Rashidi, Hooman and Lukas K. Buehler, "Bioinformatics Basic Applications" CRC Press.
4. "Bioinformatics" , Addison Wesley
5. Stephen Misner & Stephen Krawetz, " Bioinformatics- Methods & Protocols"

(TIT 012) MULTIMEDIA SYSTEMS

Unit-I: Introduction
Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment

products
Stages of Multimedia Projects
Multimedia hardware, Memory & storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Unit-II: Multimedia Building Blocks
Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

Unit-III: Data Compression
Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modelling. Finite Context Modelling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.

Unit-IV: Speech Compression & Synthesis
Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.

Unit-V: Images
Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file formatic animations Images standards, JPEG Compression, Zig Zag Coding, Multimedia Database.Content based retrieval for text and images,**Video:**Video representation, Colors, Video Compression, MPEG standards, MHEG Standard Video Streaming on net, Video Conferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database, recent development in Multimedia.

Books:

1. Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill.
2. Buford "Multimedia Systems" Addison Wesley.
3. Agrawal & Tiwari "Multimedia Systems" Excel.
4. Mark Nelson "Data Compression Book" BPB.
5. David Hillman "Multimedia technology and Applications" Galgotia Publications.
6. Rosch "Multimedia Bible" Sams Publishing.
7. Sleinreitz "Multimedia System" Addison Wesley.
8. James E Skuman "Multimedia in Action" Vikas.

(TCS 031) DATA MINING AND WAREHOUSING

Unit-I
Overview, Motivation(for Data Mining),Data Mining-Definition & Functionalities, Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy

Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation. **Data Reduction**:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

Unit-II
Concept Description:- Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisions, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, Association rule mining, mining Single-Dimensional Boolean Association rules from Transactional Databases– Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases

Unit-III
Classification and Predictions:
What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbor classifiers, Genetic Algorithm.

Cluster Analysis:
Data types in cluster analysis, Categories of clustering methods, Partitioning methods.
Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

Unit-IV
Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.

Unit-V
Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

Books:
1. M.H.Dunham,"Data Mining:Introductory and Advanced Topics" Pearson Education
2. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier
3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World : A Practical Guide for Building Decision Support Systems, 1/e " Pearson Education
4. Mallach,"Data Warehousing System",McGraw –Hill

(TIT 021) IT FOR FORENSIC SCIENCE

UNIT I
Overview of Biometrics, Biometric Identification, Biometric Verification, Biometric Enrollment, Biometric, System Security.
Authentication and Biometrics: Secure Authentication Protocols, Access Control Security Services, Authentication Methods, Authentication Protocols, Matching Biometric Samples, Verification by humans.
Common biometrics: Finger Print Recognition, Face Recognition, Speaker Recognition, Iris Recognition, Hand Geometry, Signature Verification, Positive and Negative of Biometrics.
Matching: Two kinds of errors, Score distribution, Estimating Errors from Data, Error Rate of Match Engines, Definition of FAR and FRR.
UNIT II
Introduction to Information Hiding: Technical Steganography, Linguistic Steganography, Copy Right Enforcement, Wisdom from Cryptography
Principles of Steganography: Framework for Secret Communication, Security of Steganography System, Information Hiding in Noisy Data , Adaptive versus non-Adaptive Algorithms, Active and Malicious Attackers, Information hiding in Written Text.
UNIT II I
A Survey of Steganographic Techniques: Substitution systems and Bit Plane Tools, Transform Domain Techniques: - Spread Spectrum and Information hiding, Statistical Steganography, Distortion Techniques, Cover Generation Techniques.
Steganalysis: Looking for Signatures: - Extracting hidden Information, Disabling Hidden Information.
UNIT IV
Watermarking and Copyright Protection: Basic Watermarking, Watermarking Applications, Requirements and Algorithmic Design Issues, Evaluation and Benchmarking of Watermarking system.
UNIT V
Transform Methods: Fourier Transformation, Fast Fourier Transformation, Discrete Cosine Transformation, Mellin-Fourier Transformation, Wavelets, Split Images in Perceptual Bands. Applications of Transformation in Steganography.

References:
1. Katzendbisser, Petitcolas, " Information Hiding Techniques for Steganography and Digital Watermarking", Artech House.
2. Peter Wayner, "Disappearing Cryptography: Information Hiding, Steganography and Watermarking 2/e", Elsevier
3. Bolle, Connell et. al., "Guide to Biometrics", Sp ringer

(TCS 034) DATA COMPRESSION

Unit - I: Introduction

Compression Techniques: Loss less compression, Lossy Compression, Measures of prefonnance, Modeling and coding, Mathematical *Preliminaries* for Lossless compression: A brief introduction to information theory, Models: Physical models,

Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.

Unit – II: Huffman coding

The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.

Unit-III: Arithmetic Coding

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Move-to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression.

Unit – IV: Mathematical Preliminaries for Lossy Coding

Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.

Unit-V: Vector Quantization

Advantages of Vector Quantization *over* Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured *Vector* Quantizers.

Books:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers

(TCS 801) DISTRIBUTED SYSTEMS

Unit–I
Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges.
System Models: Architectural models, Fundamental Models

Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection.

Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms.

Unit–II

Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.

Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system.

Unit–III

Distributed Objects and Remote Invocation: Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI case study.

Security: Overview of security techniques, Cryptographic algorithms, Digital signatures Cryptography pragmatics, Case studies: Needham Schroeder, Kerberos, SSL & Millicent.

Distributed File Systems: File service architecture, Sun Network File System, The Andrew File System, Recent advances.

Unit–IV

Transactions and Concurrency Control: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

Unit –V

Distributed Algorithms: Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching, Introduction to Wave & traversal algorithms, Election algorithm.**CORBA Case Study**: CORBA RMI, CORBA services.

Books:
1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Ed.
3. Gerald Tel, "Distributed Algorithms", Cambridge University Press

(TIT 802) IT INFRASTRUCTURE MANAGEMENT

UNIT I
- **Infrastructure Management Overview**

  Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business.

UNIT II
- **Preparing for Infrastructure Management**

  Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).

UNIT III
- **Service Delivery Processes**

  Service-level management, financial management and costing, IT services continuity management, Capacity management, Availability management.

UNIT IV
- **Service Support Processes**

  Configuration Management, Service desk. Incident management. Problem management, Change management, Release management.

UNIT V
- **Storage and Security Management**

  Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management

  Introduction to Storage, Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, Disaster Recovery, Hierarchical space management, Database & Application protection, Bare machine recovery, Data retention

Reference Books:
- Foundations of IT Service Management: based on ITIL, by Jan Van Bon, Van Haren Publishing, 2nd edition 2005
- High Availability: Design, Techniques, and Processe, by Floyd Piedad, Michael Hawkins, Prentice Hall, 2000
- IT Organization: Building a Worldclass Infrastructure, by Harris Kem, Stuart Gaiup, Guy Nemiro, Publisher: Prentice Hall, 2000
- IT Systems Management: Designing, Implementing, and Managing World-Class Infrastructures Rich Schiesser, Prentice Hall PTR; 2001

(TCS 041) REAL TIME SYSTEMS

UNIT-I: Introduction

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT-II: Real Time Scheduling

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT-III: Resources Access Control

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

UNIT-IV: Multiprocessor System Environment

Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.

UNIT-V: Real Time Communication

Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.

Books:
1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Real-Time Systems: Scheduling, Analysis, and Verification by Prof. Albert M. K. Cheng, John Wiley and Sons Publications.

(TIT 031) ADVANCE COMPUTER ARCHITECTURE

Unit-I: Introduction

Introduction to parallel computing, need for parallel computing, parallel architectural classification schemes, Flynn's , Fengs classification, performance of parallel processors,

distributed processing, processor and memory hierarchy, bus, cache & shared memory, introduction to super scalar architectures, quantitative evaluation of performance gain using memory, cache miss/hits.

Unit-II: Multi-core Architectures
Introduction to multi-core architectures, issues involved into writing code for multi-core architectures, development of programs for these architectures, program optimizations techniques, building of some of these techniques in compilers, OpenMP and other message passing libraries, threads, mutex etc.

Unit-III: Multi-threaded Architectures
Parallel computers, Instruction level parallelism (ILP) vs. thread level parallelism (TLP), Performance issues: Brief introduction to cache hierarchy and communication latency, Shared memory multiprocessors, General architectures and the problem of cache coherence, Synchronization primitives: Atomic primitives; locks: TTS, ticket, array; barriers: central and tree; performance implications in shared memory programs; Chip multiprocessors: Why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; Snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI; performance trade-offs; pipelined snoopy bus design; Memory consistency models: SC, PC, TSO, PSO, WO/WC, RC; Chip multiprocessor case studies: Intel Montecito and dual-core, Pentium4, IBM Power4, Sun Niagara

Unit-IV: Compiler Optimization Issues
Introduction to optimization, overview of parallelization; Shared memory programming, introduction to OpenMP; Dataflow analysis, pointer analysis, alias analysis; Data dependence analysis, solving data dependence equations (integer linear programming problem); Loop optimizations; Memory hierarchy issues in code optimization.

Unit-V: Operating System Issues and Applications
Operating System issues for multiprocessing Need for pre-emptive OS; Scheduling Techniques, Usual OS scheduling techniques, Threads, Distributed scheduler, Multiprocessor scheduling, Gang scheduling; Communication between processes, Message boxes, Shared memory; Sharing issues and Synchronization, Sharing memory and other structures, Sharing I/O devices, Distributed Semaphores, monitors, spin-locks, Implementation techniques on multi-cores; OpenMP, MPI and case studies Case studies from Applications: Digital Signal Processing, Image processing, Speech processing.

Books:
1. Hwang, " Advanced Computer Architecture", New Age International
2. Quin, "Parallel Computing, Theory & Practices", McGraw Hill

(TCS 044) EMBEDDED SYSTEMS

Unit-I

Introduction to embedded systems: Classification, Characteristics and requirements

Unit-II

Timing and clocks in Embedded systems, Task Modeling and management, Real time operating system issues.

Unit-III

Signals, frequency spectrum and sampling, digitization (ADC, DAC), Signal Conditioning and Processing.
Modeling and Characterization of Embedded Computation System.

Unit-IV

Embedded Control and Control Hierarchy,
Communication strategies for embedded systems: Encoding and Flow control.

Unit-V

Fault-Tolerance
Formal Verification.

Books:
1. H.Kopetz, "Real-Time Systems", Kluwer, 1997.
2. R.Gupta, "Co-synthesis of Hardware and Software for Embedded Systems", Kluwer 1995.

(TIT 032) STORAGE & INFORMATION MANAGEMENT

Unit-I: Introduction to Storage Technology
Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

Unit-II: Storage Systems Architecture
Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.

Unit-III: Introduction to Networked Storage
JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (SCSI, FCIP, FCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview including technologies like virtualization & appliances.

Unit-IV: Introduction to Information Availability
Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques.

Unit-V: Managing & Monitoring
Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and pro-active management best practices, Provisioning & configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview.

(TCS 054) MOBILE COMPUTING

Unit – I
Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit - II

Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit – III

Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Unit - IV

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Unit – V

Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

Books:
1. J. Schiller, Mobile Communications, Addison Wesley.
2. A. Mehrotra , GSM System Engineering.
3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.
4. Charles Perkins, Mobile IP, Addison Wesley.
5. Charles Perkins, Ad hoc Networks, Addison Wesley**.**

(TIT 041) SOFT COMPUTING

Unit-I: ARTIFICIAL NEURAL NETWORKS

Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohnen's self organizing networks - Hopfield network.

Unit-II: FUZZY SYSTEMS

Fuzzy sets and Fuzzy reasoning - Fuzzy matrices - Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.

Unit-III: NEURO - FUZZY MODELING

Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation.

Unit-IV: GENETIC ALGORITHMS

Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method.

Unit-V: SOFTCOMPUTING AND CONVENTIONAL AI

AI search algorithm - Predicate calculus - Rules of interference – Semantic networks - Frames - Objects - Hybrid models - Applications.

Books:
1. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall 1998.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 1997.
3. Laurene Fausett, "Fundamentals of Neural Networks", Prentice Hall, 1994.
4. George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA 1995.
5. N. J. Nelsson, "Artificial Intelligence - A New Synthesis", Harcourt Asia Ltd., 1998.
6. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y, 1989.

(TIT 042) SOFTWARE QUALITY ENGINEERING

UNIT-I: Introduction
    Defining Software Quality, Software Quality Attributes and Specification, Cost of Quality, Defects, Faults, Failures, Defect Rate and Reliability, Defect Prevention, Reduction, and Containment, Overview of Different Types of Software Review, Introduction to Measurement and Inspection Process, Documents and Metrics.

UNIT-II: Software Quality Metrics
    Product Quality Metrics: Defect Density, Customer Problems Metric, Customer Satisfaction Metrics, Function Points, In-Process Quality Metrics: Defect Arrival Pattern, Phase-Based Defect Removal Pattern, Defect Removal Effectiveness, Metrics for Software Maintenance: Backlog Management Index, Fix Response Time, Fix Quality, Software Quality Indicators.

UNIT-III: Software Quality Management and Models

Modeling Process, Software Reliability Models: The Rayleigh Model, Exponential Distribution and Software Reliability Growth Models, Software Reliability Allocation Models, Criteria for Model Evaluation, Software Quality Assessment Models: Hierarchical Model of Software Quality Assessment.

UNIT-IV: Software Quality Assurance

Quality Planning and Control, Quality Improvement Process, Evolution of Software Quality Assurance (SQA), Major SQA Activities, Major SQA Issues, Zero Defect Software, SQA Techniques, Statistical Quality Assurance, Total Quality Management, Quality Standards and Processes.

UNIT-V: Software Verification, Validation & Testing:

Verification and Validation, Evolutionary Nature of Verification and Validation, Impracticality of Testing all Data and Paths, Proof of Correctness, Software Testing, Functional, Structural and Error-Oriented Analysis & Testing, Static and Dynamic Testing Tools, Characteristics of Modern Testing Tools.

Books:
1. Jeff Tian, Software Quality Engineering (SQE), Wiley-Interscience, 2005; ISBN 0-471-71345-7.
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, Addison-Wesley (2002), ISBN: 0201729156

(TIT-751) CRYPTOGRAPHY AND NETWORK SECURITY LAB

The following programs should be implemented preferably on 'UNIX' platform using 'C' language (for 1-5) and other standard utilities available with 'UNIX' systems (for 6-8) :-

1. Implement the encryption and decryption of 8-bit data using 'Simplified DES Algorithm' (created by Prof. Edward Schaefer) in 'C'.

2. Implement 'Linear Congruential Algorithm' to generate 5 pseudo-random numbers in 'C'.

3. Implement Rabin-Miller Primality Testing Algorithm in 'C'.

4. Implement the Euclid Algorithm to generate the GCD of an array of 10 integers in 'C'.

5. Implement RSA algorithm for encryption and decryption in 'C'.

6. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the configured parameters.

7. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.

8. Configure a firewall to block the following for 5 minutes and verify the correctness of

this system using the configured parameters:

(a)   Two neighborhood IP addresses on your LAN
(b)   All ICMP requests
(c)   All TCP SYN Packets

(TIT-752) ARTIFICIAL INTELLIGENCE LAB

The following programs should be implemented preferably on '**UNIX**' platform:

1.   Write a LISP program to solve water-jug problem using heuristic function.

2.   Create a compound object using Prolog.

3.   Write a Prolog program to show the advantage and disadvantage of green and red cuts.

4.   Write a Prolog program to use the BEST FIRST SEARCH applied to the 8-puzzle problem.

5.   Implement (a) Forward Chaining (b) Backward Chaining (c) Problem Reduction

6.   Implement STEEPEST ASCENT HILL CLIMBING using LISP

7.   Implement COUNT PROPAGATION NETWORK using Prolog

(TIT-851) IT INFRASTRUCTURE MANAGEMENT LAB

The following exercises should be done preferably on '**UNIX**' platform using the IT Infrastructure Management tools available with all the standard distributions. These tools expose the basic functionalities required by an integrated IT Infrastructure Management System.

1.   (a) Configure the IP addressing and subnetting on a LAN using **'ifconfig'**.
       (b) Check the basic IP connectivity using **'ping'** command**.**
       (c) Inspect the Routing table and **ARP** cache of a LAN server.
       (d) Use **'traceroute'** to watch the route your IP packet takes for reaching destination.
       (e) Use **'tcpdump'** to monitor **'ping'** and **'traceroute'** from your machine.

2.   (a) Create a user group and permit it to access **'Telnet'** service over a LAN.
       (b) Restrict the **'Telnet'** service to maximum five users at a time.
       (c) Configure the **'Cron'** daemon to stop **'Telnet'** service and reboot the system after five minutes of usage by at least three users.

3.   (a) Create a text file containing records of employees in text form line wise.
       (b) Save this file and edit its copy for some changes and save it.
       (c) Use **'diff '**command to generate a patch for the original file.
       (d) Use the **'patch'** command to patch the original file to make it similar to the edited copy.
4.   (a) Create a text file containing records of employees in text form line wise.
       (b) Save this file and edit its two copies independent of each other.

(c) Save both new versions as two new files.

(d) Now use **'diff3'** command to compare and create a third file containing merged output.

(e) Again create the merged file using **'–m'** option of the **'diff3'** command.

5.   (a) Create a text file containing records of employees in text form line wise and save it.

    (b) Establish the '**CVS'** repository over a network and store the original file in it.

    (c) Now edit the file and save its edited version in the repository.

    (d) Store at least five continuously edited versions of the file in the **'CVS'** repository.

    (e) Now retrieve version 1.0 and 3.0 from the repository.

6.   (a) Use **'tar'** to create multi-file non-zipped and zipped archives (using **gzip** and **bzip2**).

    (b) Update the non-zipped tarball by adding three new files to it and list its final contents.

    (c) Now extract the contents of both the tarballs to two different directories.

    (d) Inspect the retention of user permissions on the files before the archiving & after the extraction.

7.   (a) Use **LDAP** to access **'Telnet'** service on a LAN server.

    (b) Use **/etc/hosts.allow** and **/etc/hosts.deny** to allow & deny access to web service to two hosts on the LAN.

    (c) Use **'iptables'** or similar utility to block TCP SYN segments from a particular IP address for port 25 using firewall rules.

    (d) Use an **IDS tool** (e.g. tripwire, snort) to track changes in /var/log/messages after every 5 minutes and to monitor the ICMP requests coming to the host.

(TCS-852) DISTRIBUTED SYSTEMS LAB

The following programs should be developed preferably on '**UNIX**' platform:-

1.   Simulate the functioning of Lamport's Logical Clock in 'C'.

2.   Simulate the Distributed Mutual Exclusion in 'C'.

3.   Implement a Distributed Chat Server using TCP Sockets in 'C'.

4.   Implement RPC mechanism for a file transfer across a network in 'C'

5.   Implement 'Java RMI' mechanism for accessing methods of remote systems.

6.   Simulate Balanced Sliding Window Protocol in 'C'.

7.   Implement CORBA mechanism by using 'C++' program at one end and 'Java' program on the other.

U.P. TECHNICAL UNIVERSITY

LUCKNOW

Syllabus

of

4th Year (Sem. VII & Sem. VIII)

B. TECH. INFORMATION TECHNOLOGY