IIT-JU

Course Curriculum of Doctor of Philosophy (Ph.D) in Information Technology

Institute of Information Technology
Jahangirnagar University
Savar, Dhaka-1342
Web:www.juniv.edu/iit
Email: iit@juniv.edu
Phone: 88-02-7791045-51 (PABX 1239)
Fax: 88-02-7791052

PhD Program

The Degree of Doctor of Philosophy (hereinafter called the Ph.D. degree) in Information Technology shall be awarded by the University in recognition of the successful completion by a candidate of a program of advanced study and research and acceptance by the Academic Council of the thesis submitted by the candidate after a period of at least two years of registration at the University for the Ph.D. degree.

COURSE CURRICULUM FOR
PH.D IN INFORMATION TECHNOLOGY

IT 7001 Advanced Database Systems

IT 7002 Advanced Artificial Intelligence

IT 7003 Code Optimization

IT 70004 Data Mining & Knowledge Discovery

IT 70005 Digital Image Processing

IT 70006 Distributed Computing

IT 70007 Distributed Databases

IT 7008 Distributed Operating System

IT 7009 Advanced Neuroinformatics

IT 7010 Human Computer Interaction

IT 7011 Information Retrieval

IT 7012 Multi-Media Application Development

IT 7013 Network Security

IT 7014 Object Oriented Software Engineering

IT 7015 Soft Computing

IT 7016 Advanced Computer Architecture

IT 7017 Advanced Data Structures and Algorithms

IT 7018 Advanced Unix Programming

IT 7019 Advances in Computing

IT 7020 Bio-Informatics

IT 7021 Computational Geometry

IT 7022 Computer Communication

IT 7023 Fault Tolerant Systems

IT 7024 Advanced Machine Learning

IT 7025 Advanced Mobile Computing

IT 7026 Parallel Computing and Algorithms

IT 7027 Pattern Recognition

IT 7028 Scalable Parallel Computing Architectures

IT 7029 Secured Data Base Application Development

IT 7030 Wireless Networks and Mobile Computing

IT 7031 Biophysics

IT 7032 Biomechanics

IT 7033 Biomedical Instrumentation

IT 7034 Biomedical Signal Processing

IT 7035 Advances in Neural Engineering

IT 7036 Multimedia Communication Systems

IT 7037 Satellite Communication

IT 7038 Cellular Network Planning

IT 7039 Fiber – Optic Communication

IT 7040 Switching Systems

IT 7041 Wireless Networks

IT 7042 Advanced Digital Communication

IT 7043 Modeling of Data Networks

IT 7044 Telecommunication Network Management

IT 7045 Advanced Digital Signal Processing

IT 7046 Error control Coding Techniques in Communications

IT 7047 Stochastic Signals and Systems

IT 7048 Signal Processing for Wireless Systems

IT 7049 Advanced Mathematical Modeling for Biological Systems

IT 7050 Mathematical Modeling for Finance

DETAIL SYLLABUS

IT 7001 ADVANCED DATABASE SYSTEMS

Introduction: Distributed Data Processing, Distributed Databases System, promises of DDBS, Problem areas. Overview of Relational DBMS: Relational Databases Concepts, Normalization, Integrity rules, Relational data languages.

Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture.

Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.

Query Processing and Decomposition: Query processing Objectives, Characterization of query processors, layers of query of query processing, query decomposition, Localization of distributed data.

Distributed query Optimization: Query optimization, centralized query optimization, Distributed query optimization algorithms.

Transaction Management: Definition, properties of transaction, types of transactions. Distributed concurrency control. Serialization, concurrency control Mechanism & Algorithms. Time stamped and Optimistic concurrency control Algorithms, Dead lock Management.

Distributed DBMS Reliability: Reliability concepts and Measures, fault-tolerance in Distributed systems, failures in Distributed DBMS, local & Distributed Reliability Protocols, site failures and Network partitioning. Parallel Database Systems: Database Series, Parallel Architecture, Parallel DBMS Techniques, Parallel exception problems, Parallel Execution for Hierarchical architecture.

Distributed object Database Management Systems: Fundamental object concepts and Models, Object Distributed Design, Architectural Issues, Object Management, Distributed Object storage, Object query Processing.

Object Oriented Data Model: Inheritance, object identity, persistent programming languages, persistence of objects, comparing ODDBMS and ORDBMS.

TEXT & REFERENCE BOOKS:

1. Principles of Distributed Database Systems, 2/e, OZSU, Valduriez, Sridhar, Pearson.
2. Distributed Databases, Stefan Seri, Pelagatti Willipse, TMH
3. Database System Concepts, 5/e, Korth, Silberschatz, Sudershan, TMH
4. Database Management Systems, 3/e, Raghuramakrishnan, Johhanes Gehrke, TMH
5. Data Base Principles, Programming, and Performance, 2/e, P O' Neil, E O'Neil, Elsevier.

IT 7002 ADVANCED ARTIFICIAL INTELLIGENCE

Introduction: AI problems, AI technique, Problem as state space search, problem characteristics, production systems, types of production systems, Design of Search programs Heuristic search techniques: Generate and test, Hill climbing, Best first search, Problem reduction, Constraint satisfaction, Means-Ends Analysis.

Game Playing: Minimax search procedure, adding alpha-beta cutoffs, additional refinements, Iterative deepening, Statistical Reasoning: Probability and Bayes theorem, Certainty factors and Rules based systems, Bayesian Networks, Dempster Shafer theorem UNIT III :Knowledge Representation: Theorem proving using Predicate logic, Resolution, Natural Deduction, Knowledge representation using Rules, Forward versus Backward Reasoning, Matching, Control Artificial Knowledge Structures: Semantic Networks, Frames, Conceptual Dependency diagrams, Scripts

Planning: Components of planning system, goal stack planning, nonlinear planning using constraint posting, Hierarchical planning, Reactive systems Natural Language Processing: Steps in NLP, Syntactic processing, Semantic analysis, Discourse and Pragmatic processing, Statistical NLP, Spell checking.

Learning: Rote learning, learning by taking advice, learning in problem solving, Learning from examples, Explanation based learning, Discovery, Analogy, Formal learning theory, NN learning and Genetic learning. Genetic Algorithms: survival of the fittest principle in Biology, Genetic Algorithms, Significance of Genetic operators, termination parameters, Evolving Neural nets, Ant Algorithms

Fuzzy Set Theory: Classical & Fuzzy set theory, Interval Arithmetics, Operations on Fuzzy sets Fuzzy Logic Theory: Classical logic theory, Boolean Logic, Multivalued Logics

Applications of Fuzzy Logic: PQE – Decision Making Investment – Examples Fuzzy Rule base and Fuzzy Modeling: If-Then Rules, Fuzzy Modeling: System modeling, Static fuzzy systems, Parameter Identification

Fuzzy Control Systems: PLC, closed loop, fuzzy controllers, examples, Fuzzy PID controllers – type1 and type 2

TEXT & REFERENCE BOOKS:

1. Intelligence, 3/e, E.Rich, K.Knight, TMH.
2. Introduction to Fuzzy Systems, G Chen, Trung Tat Pham, Chapman & Hall/CRC, 2009.
3. Artificial Intelligence, A Modern Approach, 2/e, Stuart Russel, Peter Norvig, PHI/PEA.
4. Artificial Intelligence and Expert Systems, Patterson, PHI.
5. Artificial Intelligence, A Systems Approach, Tim Jones, Infinity Science Press.

IT 7003 ADVANCED CODE OPTIMIZATION

Introduction: Review of Compiler Structure, Advanced Issues in Elementary Topics, The Importance of Code Optimization, Structure of Optimizing Compilers, Placement of Optimizations in Aggressive Optimizing Compilers.

Compiler Internal Representations and Run time support: Intermediate Representations: Issues in Designing an Intermediate Language, High-Level Intermediate Languages, Medium-Level Intermediate Languages, Low-Level Intermediate Languages, Multi-Level Intermediate Languages, Our Intermediate Languages: MIR, HIR, and LIR, Representing MIR, HIR, and LIR in ICAN, ICAN Naming of Data Structures and Routines that Manipulate Intermediate Code, Other Intermediate-Language Forms Run-Time Support: Data Representations and Instructions, Register Usage, The Local Stack Frame, The Run-Time Stack, Parameter-Passing Disciplines, Procedure Prologues, Epilogues, Calls, and Returns, Code Sharing and Position-Independent Code, Symbolic and Polymorphic Language Support.

Control Flow Analysis: Approaches to Control-Flow Analysis, Depth-First Search, Preorder Traversal, Postorder Traversal, and Breadth-First Search, Dominators, Loops and Strongly Connected Components, Reducibility, Interval Analysis and Control Trees, Structural Analysis.

Data-Flow Analysis: Reaching Definitions, Basic Concepts: Lattices, Flow Functions, and Fixed Points, Taxonomy of Data-Flow Problems and Solution Methods, Iterative Data-Flow Analysis, Lattices of Flow Functions, Control-Tree-Based Data-Flow Analysis, Structural Analysis, Interval Analysis, Other Approaches, Du-Chains, Ud-Chains, and Webs, Static Single-Assignment (SSA) Form, Dealing with Arrays, Structures, and Pointers, Automating Construction of Data-Flow Analyzers.

Dependence Analysis and Optimization: Dependence Analysis and Dependence Graph: Dependence Relations, Basic-Block Dependence DAGs, Dependences in Loops, Dependence Testing, Program-Dependence Graphs Introduction to Optimization: Flow Sensitivity and May vs. Must Information, Importance of Individual Optimizations, Order and Repetition of Optimizations.

Early Optimizations: Constant-Expression Evaluation, Scalar Replacement of Aggregates, Algebraic Simplifications and Reassociation, Value Numbering, Copy Propagation, Sparse Conditional Constant Propagation.

Register Allocation: Register Allocation and Assignment, Local Methods, Graph Coloring, Priority-Based Graph Coloring, Other Approaches to Register Allocation.

Control-Flow and Low-Level Optimizations: Unreachable-Code Elimination, Straightening, If Simplifications, Loop Simplifications, Loop Inversion, Unswitching, Branch Optimizations, Dead-Code Elimination, Branch Prediction.

Procedural/Inter-procedural Analysis and Optimizations Tail-Call Optimization and Tail-Recursion Elimination, Procedure Integration, In-Line Expansion, Leaf-Routine Optimization and Shrink Wrapping Interprocedural Control-Flow Analysis: The Call Graph, Interprocedural Data-Flow Analysis, Interprocedural Constant Propagation, Interprocedural Alias Analysis, Interprocedural Optimizations, Interprocedural Register Allocation.

TEXT & REFERENCE BOOKS:

1. Advanced Compiler Design and Implementation, Muchnick, Elsevier, 2008.
2. Engineering a Compiler, Keith D Cooper, Linda Torczon, Elsevier.
3. Compiler Design in C, Allen Holub, PHI, 1990.

4. Compilers Principles, Techniques and Tools, Aho, Sethi, Ullman, PEA, 2006.
5. Crafting a compiler with C, Charles N. Fischer, Richard J. Leblanc, Benjamin Cummings, Wesley.

IT 7004 DATA MINING AND KNOWLEDGE DISCOVERY

Introduction to Data Mining: Types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, OLAP and multi-dimensional data Analysis.

Classification: Basic Concepts, Decision Trees, and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: Due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier.

Classification-Alternative techniques: Nearest Neighborhood classifier, Bayesian Classifier, Support Vector Machines: Linear SVM, Separable and Non Separable case.

Association Analysis: Problem Definition, Frequent Item-set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithms.

Handling categorical, continuous attributes, concept hierarchy, sequential, sub-graph patterns

Clustering: Overview, K-means, Agglomerative Hierarchical clustering, DBSCAN.

Cluster Evaluation: Overview, Unsupervised Cluster evaluation using cohesion and separation, using the proximity matrix, Scalable clustering algorithms.

Web Data mining: Introduction, Web terminology and characteristics, web content mining, web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of web pages, Enterprise search.

TEXT & REFERENCE BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, PEA.
2. Introduction to Data Mining with Case Studies, GK Gupta , Prentice Hall.
3. Data Mining: Introductory and Advanced Topics, Margaret H Dunham, PEA, 2008.
4. Fundamentals of data warehouses, 2/e, Jarke, Lenzerini, Vassiliou, Vassiliadis, Springer.
5. Data Mining Theory and Practice, Soman, Diwakar, Ajay, PHI, 2006.
6. Data Mining, Concepts and Techniques, 2/e, Jiawei Han , Micheline Kamber , Elsevier, 2006.

IT 7005 DIGITAL IMAGE PROCESSING

Digital Image fundaments: Introduction, An image model, sampling & quantization, basic relationships between Pixels, imaging geometry.

Image Transforms: Properties of 2 – D Fourier transform, FFT algorithm and other separable image transforms. Walsh transforms. Hadamard, Cosine, Haar, Slant transforms, KL transforms and their properties.

Image Enhancement: Background, enhancement by point processing, histogram processing, spatial filtering and enhancement in frequency domain, color image processing.

Image filtering and restoration: Degradation model, diagnolisation of circulant and block circulate matrices, Algebraic approach to restoration, inverse filtering, least mean squares and interactive restoration, geometric transformations.

Image compression: Fundamentals, image compression modes, error free compression, lossy compression, image compression standards.

Image segmentation: Detection of discontinuities, edge linking and boundary detection thresholding, region – oriented segmentation, use of motion in segmentation.

Representation and description: Various schemes for representation, boundary descriptors, and regional descriptors.

Image Reconstruction: Image reconstruction from Projections, Radon Transforms; Convolution/Filter back – Project Algorithms.

TEXT & REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing, A.K.JAIN, PHI
2. Fundamentals of Digital Image Processing, Anna durai, shanmuga lakshmi, Pearson

3. Introduction to Digital Image Processing, Alasdair, McAndrew, Cengage
4. Digital Image Processing, 3/e, GONZALEX, WOODS, Addison Wesley
5. Digital Image Processing, Castleman, Pearson
6. Digital Image Processing, S Jayaraman, SEsakkirajan, T Veerakumar,TMH

IT 7006 DISTRIBUTED COMPUTING

Introduction to distributed programming: Anatomy of a Distributed Application, Requirements for Developing Distributed Applications, What Does Java Provide? Introduction to sockets programming: Sockets and Streams, URLs, URL Connections, and Content Handlers, The Class Loader.

Distributing Objects: Why Distribute Objects?, What's So Tough About Distributing Objects?, Features of Distributed Object Systems, Distributed Object Schemes for Java, CORBA, Java RMI, RMI vs. CORBA Threads: Thread and Runnable, Making a Thread, Managing Threads at Runtime, Networked Threads.

Security: Security Issues and Concerns, The java.security Package, Identities and Access Control, Keys: Public, Private, and Secret, Digital Signatures, Data Encryption, Choosing a Cryptographic Algorithm.

Message-Passing Systems: Messages Defined, Why Do We Need Messages?, Message Processing, Fixed Protocols, Adaptable Protocols, Message Passing with Java Events, Using Remote Objects Databases: An Overview of JDBC, Remote Database Applications, Multi-Database Applications.

RMI: The Basic Structure of RMI, The Architecture Diagram Revisited, Implementing the Basic Objects, The Rest of the Server, The Client Application The RMI Registry: Why Use a Naming Service? The RMI Registry, The RMI Registry Is an RMI Server, Examining the Registry, Limitations of the RMI Registry, Security Issues.

Naming Services: Basic Design, Terminology, and Requirements, Requirements for Our Naming Service, Federation and Threading, The Context Interface, The Value Objects, ContextImpl, Switching Between Naming Services, The Java Naming and Directory Interface (JNDI) The RMI Runtime: Reviewing the Mechanics of a Remote Method Call, Distributed Garbage Collection, RMI's Logging Facilities, Other JVM Parameters.

Service Oriented Architecture: Introduction, Defining a Service, Defining SOA, Identifying Service Candidates, Identifying Different Kinds of Services, Modeling Services, Making a Service Composable, Supporting Your SOA Efforts, Selecting a Pilot Project, Establishing Governance.

Introduction to Web Services: Introduction, Using Publicly Available Web Services to Test Against, Installing Metro, Installing Oracle WebLogic, Creating and Deploying the Simplest Web Service, Creating and Deploying a Service to WebLogic, Setting Up a Maven 2 Service and Client Project, Understanding WSDL, Using References in NetBeans to Generate Web Service Clients, Monitoring SOAP Traffic with Metro, Monitoring SOAP Traffic with TCPMon.

TEXT & REFERENCE BOOKS:

1. Java Distributed Computing, Jim Farley, O'Reilly.
2. Java RMI Designing and Building,The Basics of RMI Applications, William Grosso, O'Reilly.
3. Java SOA Cookbook SOA Implementation Recipes, Tips, Techniques, Eben Hewitt, O'Reilly, 2009.
4. Service Oriented Architecture With Java, Malhar Barai, Vincenzo Caselli, Binildas A. Christudas, Packt Publishing, 2008.
5. Distributed Programming with Java, Qusay H. Mahmoud, Manning Publisher 2000.
6. Java in Distributed Systems, Concurrency, Distribution and Persistence, Marko Boger, 2001.
7. Developing Distributed and E-commerce Applications, Darrel Ince, 2/e, Wesly, 2004.
8. Java Message Service (O'Reilly Java Series), Richard Monson-Haefel, David Chappell.
9. Sun SL 301 Distributed Programming with Java.
10. Java Tutorial, http://java.sun.com/docs/books/tutorial/index.html.

IT 7007 DISTRIBUTED DATABASES

Introduction: Features of distributed databases, features of Centralized databases, level of distributed transparency Reference Architecture, types of Data Fragmentation, distribution Transparency, Access primitives, and Integrity constraints.

Distributed Database Design: A frame work, the design of database fragmentation, the allocation of fragments.

Query Processing: Translation of global queries into fragment queries, query optimization.

Distributed Transaction Management: A framework, transaction atomicity, 2-phase commit.

Concurrency control: Foundations, distributed deadlocks, timestamps.

Reliability: Basic concepts, commit protocols, consistent view of Network, Detection and Resolution of Inconsistencies, check points and cold restart.

Commercial Systems: Tranclem's ENCOMPASS Distributed database systems, IBM's Inter system communication, feature of distributed ingress and Oracle.

Heterogeneous databases: General problems – brief study of multi base.

TEXT & REFERENCE BOOKS:

1. Distributed Database systems Principles and Systems, Ceri S. Pelagatti. G, MGH.
2. Principles of Distributed Database Systems, 2/e, M. Tamer Ozsu, Sridhar, PEA.
3. Database system Concepts, 5/e,Silberschatz, F.Korth, Sundrashan,MGH,2006.
4. 4. Modern database Management, 7/e, Hoffer, Prescott, McFadden, PEA, 2007.

IT 7008 DISTRIBUTED OPERATING SYSTEMS

Processes Threads: Introduction to Threads, Threads in Distributed Systems.

Clients: User Interfaces, Client-Side Software for Distribution Transparency.

Servers: General Design Issues, Object Servers.

Code Migration: Approaches to Code Migration, Migration and Local Resources, Migration in Heterogeneous Systems, Example: D'Agents.

Software Agents: Software Agents in Distributed Systems, Agent Technology.

Naming Entities: Names, Identifiers, and Addresses, Name Resolution, The Implementation of a Name Space, Example: DNS, X.500.

Locating Mobile Entities: Naming versus Locating Entities, Simple Solutions, Home-Based Approaches, Hierarchical Approaches.

Removing Unreferenced Entities: The Problem of Unreferenced Objects, Reference Counting, Reference Listing, Identifying Unreachable Entities.

Synchronization: Clock synchronization, logical clocks, global state, election algorithms, mutual exclusion, distributed transactions.

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Distribution Protocols, Consistency Protocols, Examples: Orca and Causally-Consistent Lazy Replication.

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery.

Distributed Object-Based Systems: CORBA, Distributed Com, Globe and Comparison of CORBA, DCOM, and Globe.

Distributed File Systems: Sun Network File System, Coda File System, Plan~9, XFS and SFS, Scalable Security, Comparison of Distributed File Systems.

Distributed Document-Based Systems and Coordination-Based Systems: Distributed Document-Based Systems: The World Wide Web, Lotus Notes, Comparison of WWW and Lotus Notes. Distributed Coordination-Based Systems: Introduction to Coordination Models, TIB/Rendezvous, JINI, Comparison of TIB/Rendezvous and JINI.

TEXT & REFERENCE BOOKS:

1. Distributed Systems, Principles and Paradigms, 2/e, Tanenbaum, M Van Steen, PHI.
2. Advanced concepts in Operating Systems, Mukesh Singhal, Niranjan G. Shivaratri, TMH, 2005.
3. Distributed Operating Systems and Algorithm Analysis, Chow, Johnson, PEA.

4. Distributed Systems Concepts and Design, 4/e, George Coulouris, Dollimore, Kindberg, PEA.
5. Distributed Operating Systems, Pradeep K. Sinha, PHI, 2009.
6. Operating Systems, Internals & Design Principles, 6/e, William Stallings, PEA.
7. Distributed Systems Computing over Networks, Joel M.Crichlow, PHI.

IT 7009 ADVANCED NEUROINFORMATICS

Cell and Molecular Biology of the Neuron, Issues of Neuroinformatics, Modeling and Simulation, Neuronal Encoding and Decoding, Neuroelectronics, Single Neuron Modeling, Conductance Based Neuronal Modeling, Modeling Neuronal Network, Neuronal Plasticity and Learning, Processing and Analysis of Neuronal Time Series, Visualization of Atlas Based Time Series. Data Management and Summary Databases, The Neuroinformatics Workbench.

TEXT & REFERENCE BOOKS:

1. Eric R. Kandel, James H. Schwartz, and Thomas M. Jessel, Principles of Neural Science, 4th Ed., New York: McGraw-Hill, 2000.
2. Michael A. Arbib, and Jeffrey S. Grethe, Computing the Brain: A Guide to Neuroinformatics, San Diego: Academic Press, 2001.
3. Peter Dayan, and L F Abbott, Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, Cambridge: MIT Press, 2001.
4. Eugene M. Izhikevich, Dynamical systems in Neuroscience: The Geometry of Excitability and Bursting, Cambridge: MIT Press, 2007.
5. Chris Eliasmith, and Charles H. Anderson, Neural Engineering: Computation, Representation, and Dynamics in Neurobiological Systems, Cambridge: MIT Press, 2003.
6. Bertil Hille, Ionic Channels of Excitable Membranes, 2nd Ed., Sunderland: Sinauer Associates Inc., 1992.
7. Stephen H. Koslow, Michael F. Huerta, Neuroinformatics: An Overview of the Human Brain Project, New Jersey: Lawrence Erlbaum Associates Inc., 1997.

IT 7010 HUMAN COMPUTER INTERACTION

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.

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: Windows new and Navigation schemes selection of window, selection of devices based and screen based controls.

Components: 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, drivers.

TEXT & REFERENCE BOOKS:

1. The Essential guide to user interface design, Wilbert O Galitz, Wiley DreamaTech.
2. Designing the user interface. 3/e, Ben Shneidermann , PEA.
3. Human Computer Interaction. Dix, Fincay, Gre Goryd, Abowd, Russell Bealg, PEA.
4. Interaction Design PRECE, ROGERS, SHARPS, Wiley Dreamtech.

5. User Interface Design, Soren Lauesen, PEA.

IT 7011 INFORMATION RETRIEVAL

Introduction to Information storage and retrieval systems: Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation Introduction to Data structures and algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

Inverted Files: Introduction, Structures used in Inverted Files, Building an Inverted file using a sorted array, Modifications to the Basic Techniques.

Signature Files: Introduction, Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays.

Lexical Analysis and Stoplists: Introduction, Lexical Analysis, Stoplists.

Stemming Algorithms: Introduction, Types of Stemming algorithms, Experimental Evaluations of Stemming, Stemming to Compress Inverted Files.

Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.

String Searching Algorithms: Introduction, Preliminaries, The Naive Algorithm, The Knutt – Morris - Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm.

TEXT & REFERENCE BOOKS:

1. Modern Information Retrieval,Ricardo Baeza-Yates, Neto, PEA,2007.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.
3. Information Retrieval: Algorithms and Heuristics, Grossman, Ophir Frieder, 2/e, Springer, 2004.
4. Information Retrieval Data Structures and Algorithms, Frakes, Ricardo Baeza-Yates, PEA.
5. Information Storage and Retieval, Robert Korfhage, John Wiley & Sons.
6. Introduction to Information Retrieval, Manning, Raghavan, Cambridge University Press.

IT 7012 MULTIMEDIA AND APPLICATION DEVELOPMENT

Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

Fundamental Concepts in Cideo and Digital Audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

Action Script I: ActionScript Features, Object-Oriented ActionScript, Datatypes and Type Checking, Classes, Authoring an ActionScript Class.

Action Script II: Inheritance, Authoring an ActionScript 2.0 Subclass, Interfaces, Packages, Exceptions.

Application Development: An OOP Application Frame work, Using Components with ActionScript MovieClip Subclasses.

Multimedia Data Compression: Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression, Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.

Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD).

TEXT & REFERENCE BOOKS:

1. Fundamentals of Multimedia , Ze-Nian Li , Mark S. Drew, PHI/PEA.
2. Essentials ActionScript 2.0, Colin Moock, SPD O,REILLY.
3. Digital Multimedia, Nigel chapman & jenny chapman, Wiley-Dreamtech.
4. Macromedia Flash MX Professional 2004 Unleashed, PEA.
5. Multimedia & Communications Technology, Steve Heath, Elsevier (Focal Press).
6. Multimedia Applications, Steinmetz, Nahrstedt, Springer.
7. Multimedia Basics, Weixel Thomson.
8. Multimedia Technology & Applications, David Hilman , Galgotia.
9. Multimedia Technologies, Banerji, Mohan Ghosh, MGH.

IT 7013 NETWORK SECURITY

Introduction to Network Security: Attacks, services, Security. A model of Inter network Security, Steganography, One time PADS.

Basic and ESOTERIC Cryptographic Protocols: Key Exchange, Authentication, Formal Analysis of Authentication and key Exchange Protocols, Multiple & Public Key Cryptography, Secret Splitting & Sharing Secure elections, Secure multiparty, Communication, Digital Cash.

Crypto Graphic Algorithms (Block Cipher): RC2, GOST, CAST, BLOW FISH, SAFEER, RC5, NEWDES, CRAB, Theory of Block Cipher design.

Key Management: Key lengths, Generating Keys, Transferring, Verification, Updating, Storing, Backup, Compromised, Lifetime of, Destroying Keys, Public key Management.

Digital Signature Algorithms: Digital Signature, DSA, DSA variants, Gost, Discrete Lagorithm, One – Schnorr – Shamir digital Signatures, Esign, Cellular Automata.

Mails: Electronic Mail & IO Security good Privacy, SIMIME, IP Security Architecture, Authentication Header, Encapsulating Security, Pay load Key Management Issues.

Security: Web Security Web Security requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

Viruses and Threats: Intruders, Viruses, Worms and Firewalls Intruders, Viruses and Related Threats, Firewall Design Principles, Trusted Systems.

TEXT & REFERENCE BOOKS:

1. Applied Cryptography, 7/e, Bruce SCHNEIER John Wiley & Sons Inc.
2. Cryptography and Network Security, William Stallings, PHI.
3. Introduction to cryptography with coding Theory, 7/e, Wade Trappe, C. Washington, PEA.
4. Cryptography and Information Security, V.K. Pachghare, PHI.
5. Cryptography and Network Security, Forouzan, TMH, 2007.
6. Cryptography and Network Security, 2/e, Kahate , TMH.
7. Modern Cryptography, Wenbo Mao, PEA

IT 7014 OBJECT ORIENTED SOFTWARE ENGINEERING

Introduction to Classical Software Engineering: Historical, Economic and Maintenance aspects. Introduction to OO Paradigm. Different phases in structured paradigm and OO Paradigm. Software Process and different life cycle models and corresponding strengths and weaknesses.

Planning and Estimation: Estimation of Duration and Cost – COCOMO components of software. Project Management plan – one case Study.

Tools for Step-wised Refinement: Cost -Benefit analysis, Introduction to software metrics and CASE tools. Taxonomy and scope of CASE

tools. Introduction to testing, with focus on Utility, Reliability, Robustness, Performance, Correctness.

Modules to Objects: Cohesion and Coupling, Data Encapsulation and Information hiding aspects of Objects. Inheritance, polymorphism and Dynamic Binding aspects. Cohesion and coupling of objects. Reusability, Portability and Interoperability aspects.

Requirement Phase: Rapid Prototyping method, Specification phase -Specification Document-Formal methods of developing specification document-Examples of other semi -formal methods of using Finite-State-Machines, Petri nets and E-Language.

Analysis phase: Use case Modeling -Class Modeling -Dynamic Modeling, Testing during OO Analysis.

Design phase: Data oriented design – Object Oriented design – Formal techniques for detailed design. One case study. Challenges in design phase.

IIM Phases: Implementation , Integration and maintenance phases-OOSE aspects in these phases.

TEXT & REFERENCE BOOKS:

1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH
2. Object oriented and classical software Engineering, Timothy Lethbridge, Robert Laganiere, TMH

IT 7015 SOFT COMPUTING

Introduction: Uncertainty and Evidence, Shafer Dumpster belief and possibility Theory, Random sets and mass assignments, Dumpsters Rule, Fuzzy Measures and aggregation operators, Bayesian Networks. Graphical methods.

Automated Learning-1: Supervise vs unsupervised learning, Decision Tree induction, rule induction algorithms.

Automated Learning-2: Bayesian network learning algorithms, Evolutionary algorithms.

Fuzzy Methods: Fuzzy set theory, fuzzy control (including model based control), Fuzzy Decision trees.

Neural Networks: Adaptive Networks, Supervised Learning NN, Reinforcement Learning, Unsupervised Learning.

Hybrid systems: Neuro Fuzzy Systems, Backpropagation Network supported by Fuzzy, GA based weight determination applications.

Genetic Algorithms: Encoding, Fitness functions, reproduction,Fuzzy Genetic Algorithms.

Applications: Practical Examples from areas such as Medical, Management, and control, GA in fuzzy logic controller design.

TEXT & REFERENCE BOOKS:

1. Neuro Fuzzy and Soft Computing, A Computational approach to learning and Machine, Jyh-Shing Roger Jang, Cuen Tsai Sun, Eiji Mizurani, PEA.
2. Machine Learning, Tom Mitchell, MGH, 1997.
3. Soft Computing Techniques and Applications, Robert John, R. Birkenhead, Ralph Birkenhead.
4. Neural Networks, Fuzzy logic and genetic algorithms, S Rakasekharan, GA Vijayalakshmi, PHI.
5. Principles of Soft Computing, Sivanandam, Deepa, Wiley India, 2008.
6. Soft Computing and Intelligent Systems Design, Karry, De Silva, PEA, 2004.

IT 7016 ADVANCED COMPUTER ARCHITECTURE

Parallel Computer Models, Program and Network Properties: Parallel Computer Models: Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks Program and Network Properties: Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

Processors and Memory Hierarchy: Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Backplane Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models.

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic

Pipeline Design, Superscalar and Super pipeline Design.

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers, Message-Passing Mechanisms.

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, SIMD Computer Organizations: BSP and CM2 Architectures, The Connection Machine CM-5: CM5 Architecture and Inter process communication.

Parallel Models, Languages, and Compilers: Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays, Code Optimization and Scheduling, Loop Parallelization and Pipelining.

TEXT & REFERENCE BOOKS:

1. Kai Hwang, Advanced computer Architecture: Parallelism, Scalability, Programmability, TMH, 2000.
2. Computer Architecture – A quantitative approach, 4/e, John L. Hennessey, David A. Patterson, Morgan Kaufmann / Elsevier, 2007.
3. Parallel Computing Architecture: A hardware/ software approach, David E. Culler, Jaswinder Pal Singh, Morgan Kaufmann / Elsevier, 1997.
4. Computer Organization and Architecture – Designing for Performance, 7/e, William Stallings, PEa, 2006.
5. Computer Organization and Design, 4/e, Patterson, Elsevier, 2008.
6. Computer Architecture & Parallel Processing, Kai Hwang, Faye A. Briggs, TMH

IT 7017 ADVANCED DATA STRUCTURES AND ALGORITHMS

Lists, Stacks, Queues and Trees: Lists, Stacks and Queues: Abstract Data Types (ADTs), The List ADT, vector and list in the STL, Implementation of vector, Implementation of list, The Stack ADT, The Queue ADT. Trees: The Search Tree ADT -Binary Search Trees, AVL Trees, Splay Trees, B-Trees.

Hashing and Priority Queues: Hashing: General Idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing.

Priority Queues: Implementations, Binary Heap, Applications of Priority Queues, d-Heaps, Leftist Heaps, Skew Heaps, Binomial Queues.

Sorting: Simple Sorting Algorithms, Shellsort, Heapsort, Mergesort, Quicksort, Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting.

The Disjoint Set Class: Equivalence Relations, the Dynamic Equivalence Problem, Basic Data Structure, Smart Union Algorithms, Path Compression, Worst Case for Union-by-Rank and Path Compression, an Application.

Graph Algorithms: Definitions, Topological Sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, Introduction to NP-Completeness.

Algorithm Design Techniques: Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms.

Amortized Analysis: An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees.

Advanced Data Structures and Implementation: Top-Down Splay Trees, Red-Black Trees, Deterministic Skip Lists, AA-Trees, Treaps, k-d Trees, Pairing Heaps.

TEXT & REFERENCE BOOKS:

1. C & Data structures, N.B. Venkateswarulu, EV Prasad, S.Chand.
2. Data Structures and Algorithm Analysis in C++, 3/e, Mark Allen Weiss, PEA , 2007.
3. Data Structures Algorithms and Applications, 2/e, Sartaj Sahni, Universities Press, 2007.
4. Fundamentals of computer Algorithms, 2/e, Ellis Horowitz, Sartaj Sahni, Rajasekharan, Universities Press, 2008.
5. Data Structures and Algorithms, Aho, Ullman, PEA.
6. Data Structures and Algorithms in JAVA, Adam drozdek, Cengage .
7. Data Structures with JAVATM, Hubbard, Huray, PHI,2009.

8. Data Structures, Gilberg, Forouzan, Thomson.
9. Fundamentals of Data structures algorithms and application, Sahni, University Press.

IT 7018 ADVANCED UNIX PROGRAMMING

Review of Unix Utilities and Shell Programming: File handling utilities, security by file permissions, process utilities, disk utilities, networking commands, backup utilities, text processing utilities, Working with the Bourne shell, What is a shell, shell responsibilities, pipes and input redirection, output redirection, here documents, the shell as a programming language, shell meta characters, shell variables, shell commands, the environment, control structures, shell script examples.

Unix Files: Unix file structure, directories, files and devices, System calls, library functions, low level file access, usage of open, creat, read, write, close, lseek, stat, fstat, octl, umask, dup, dup2. The standard I/O (fopen, fclose, fflush, fseek, fgetc, getc, getchar, fputc, putc, putchar, fgets, gets), formatted I/O, stream errors, streams and file descriptors, file and directory maintenance (chmod, chown, unlink, link, symlink, mkdir, rmdir, chdir, getcwd), Directory handling system calls (opendir, readdir, closedir, rewinddir, seekdir, telldir)

Unix Process: Threads and Signals: What is process, process structure, starting new process, waiting for a process, zombie process, process control, process identifiers, system call interface for process management, fork, vfork, exit, wait, waitpid, exec, system, Threads, Thread creation, waiting for a thread to terminate, thread synchronization, condition variables, cancelling a thread, threads vs. processes, Signal functions, unreliable signals, interrupted system calls, kill, raise functions, alarm, pause functions, abort, sleep functions.

Data Management: Management Memory (simple memory allocation, freeing memory) file and record locking (creating lock files, locking regions, use of read/ write locking, competing locks, other commands, deadlocks). Interprocess Communication: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pipes, FIFOs, streams and messages, namespaces, introduction to three types of IPC (systemV) message queues, semaphores and shared memory.

Message Queues: IPC, permission issues, Access permission modes, message structure, working message queues, Unix systemV messages, Unix kernel support for messages, Unix APIs for messages, client/server example.

Semaphores: Unix systemV semaphores, Unix kernel support for semaphores, Unix APIs for semaphores, file locking with semaphores. Shared Memory: Unix systemV shared memory, working with a shared memory segment, Unix kernel support for shared memory, Unix APIs for shared memory, semaphore and shared memory example.

Sockets: Berkeley sockets, socket system calls for connection oriented protocol and connectionless protocol, example client/server program, advanced socket system calls, socket options.

Remote Procedure Calls: RPC Model, transparency issues, sun RPC: Sun's portmap/rpcbind, RPC Authentication, Secure RPC: Secure RPC Authentication, Setting Up Secure RPC with NIS, Using Secure RPC, Limitations of RPC.

TEXT & REFERENCE BOOKS:

1. Advanced Programming in the UNIX Environment, Stevens, PEA/PHI.
2. Unix Network Programming, Stevens PEA/PHI.
3. Advanced Unix programming, N.B. Venkateswarlu, BSP.
4. Unix Concepts and Applications, 3/e, Sumitabha Das, TMH.
5. Practical UNIX and Internet Security, 2/e, Simson Garfinkel, Gene Spafford, O'Reilly.

IT 7019 ADVANCES IN COMPUTING

Grid Computing: Data & Computational Grids, Grid Architectures and its relations to various Distributed Technologies, Autonomic Computing, Examples of the Grid Computing Efforts (IBM).

Cluster Computing: Cluster setup & its Administration, Performance Models & Simulations; Networking, Protocols & I/O, Lightweight Messaging systems, Active Messages. Distributed shared memory, parallel I/O Clusters, Jib and Resource management system, scheduling parallel jobs on clusters. Load sharing and Fault tolerance manager, parallel programming scheduling techniques, Dynamic load balancing Example Cluster System – Beowlf, COMPaS and NanOS.

Pervasive Computing: Pervasive Computing concepts & Scenarios, Hardware & Software, Human -machine interface Device connectivity, Java for Pervasive devices, Application examples.

Cloud Computing: History, Working of cloud computers, pros and cons of cloud computing, developing cloud services, cloud computer web based applications.

Quantum Computing: Introduction to Quantum Computing, QUbits, Quantum Mechanics, Quantum gates, Applications of quantum computing.

TEXT & REFERENCE BOOKS:

1. J. Joseph & C. Fellenstein, Grid Computing, PEA.
2. Raj Kumar Buyya, High performance cluster computing, PEA.
3. J.Burkhardt et .al, Pervasive computing, PEA.
4. Vishal Sahni, Quantum computing, TMH.
5. Marivesar, Approaching quantum computing, PEA.
6. Neilsen & Chung L, Quantum computing and Quantum Information, Cambridge University Press.
7. A networking approach to Grid Computing , Minoli, Wiley.

IT 7020 BIO-INFORMATICS

Introduction: The Central Dogma, The Killer Application, Parallel Universes – Watson's Definition – Top Down Versus Bottom up – Information Flow, Convergence Databases, Data Management, Data Life Cycle, Database Technology, Interfaces, Implementation.

Network: Networks, Geographical Scope, Communication Models, Transmissions Technology, Protocols, Bandwidth, Topology, Hardware, Contents, Security, Ownership, Implementation, Management.

Search Engines: The search process, Search Engine Technology, Searching and Information Theory, Computational methods, Search Engines and Knowledge Management.

Data Visualization: Data Visualization, sequence visualization, structure visualization, user Interface, Animation Versus simulation, General Purpose Technologies.

Statistics: Statistical concepts, Microarrays, Imperfect Data, Randomness, Variability, Approximation, Interface Noise, Assumptions, Sampling and Distributions, Hypothesis Testing, Quantifying Randomness, Data Analysis, Tool selection statistics of Alignment.

Data Mining: Clustering and Classification, Data Mining, Methods, Selection and Sampling, Preprocessing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Machine Learning, Text Mining, Tools.

Pattern Matching: Pairwise sequence alignment, Local versus global alignment, Multiple sequence alignment, Computational methods, Dot Matrix analysis, Substitution matrices, Dynamic Programming, Word methods, Bayesian methods, Multiple sequence alignment, Dynamic Programming, Progressive strategies, Iterative strategies, Tools, Nucleotide Pattern Matching, Polypeptide pattern matching, Utilities, Sequence Databases.

Modeling and Simulation: Drug Discovery, components, process, Perspectives, Numeric considerations, Algorithms, Hardware, Issues, Protein structure, AbInitio Methods, Heuristic methods, Systems Biology, Tools, Collaboration and Communications, standards, Issues, Security, Intellectual property.

TEXT & REFERENCE BOOKS:

1. Bio Informatics Computing, Bryan Bergeron, PHI, 2003.
2. Introduction to Bio Informatics, Attwood, Smith, Longman, 1999.
3. Bio Informatics Computing, Bergeron, PHI
4. Bio Informatics, Managing scientific Data, Lacroix, Terence Critchlow, Elsevier
5. Bio Informatics Methods and Applications, Rastogi, Mendiratta, Rastogi, PHI

IT 7021 COMPUTATIONAL GEOMETRY

Basic Geometric Concepts: Points, lines, polygons; subdivisions; arrangements; polytopes; cell complexes.

Projective Geometry: Projective Geometry-geometric transformations.

Geometric Searching: Fractional cascading; segment tree; interval tree, range tree; priority search tree. Non-orthogonal range searching, k-d trees –applications.

Point Location: Slab method; trapezoid method; chain method; bridged chain method.

Plane-Sweep Algorithms: Intersection of segments; intersection of rectangles; trapezoidation.

Proximity: Closest pair; furthest pair; Voronoi diagrams; triangulations. Voronoi diagrams and Delaunay Triangulations -Constructing voronoi diagram-Applications.

Graph Drawing: Planar drawings; straight-line drawings; orthogonal drawings; polyline drawings; upward drawings; hierarchical drawings; visibility representations.

Convex hulls: Preliminaries, algorithms for convex hulls-grahams scan-Jarvis march, quick hull techniques, divide and conquer methods, dynamic convex hull algorithms, convex hulls in multi-dimensions, applications Applications of computational geometry in web applications.

TEXT & REFERENCE BOOKS:

1. Computational Geometry, an Introduction", 2/e, Franco P. Preparata, Michael Ian Shamos, Springer-Verlag 1988 (ISBN: 0-387-96131-3)
2. Computational Geometry Algorithms and Applications, 2/e., de Berg, van Kreveld, Overmars, and Schwarzkopf (Springer-Verlag, 2000).
3. Graph Drawing, Algorithms for the Visualization of Graphs, Giuseppe Di Battista, Peter Eades, Roberto Tamassia, Ioannis G. Tollis, Prentice-Hall 1999 (ISBN: 0-13-301615-3)
4. Computational Geometry in C , 2/e, Joseph O'Rourke, Cambridge University Press

IT 7022 COMPUTER COMMUNICATIONS

Introduction: Network Hardware reference model – Transmission media – Narrowband ISDN – Broad band ISDN – ATM.

Data Link Layer: The data Link layer – Design Issues – Error detection and correction – Elementary Data Link Protocols – Sliding window protocols – Data link layer in HDLC, Internet and ATM.

Channel Allocation Methods and Standards: Channel allocation methods – TDM, FDM, ALOHA, Carrier sense Multiple access protocols, Collision Free protocols – IEEE standard BO2 for LANS – Ethernet, Token Bus, Token ring – Bridges.

Network Layer: NETWORK LAYER Routing Algorithms – Shortest path, Flooding, Flow based Distance vector, Link state, Hierarchical, Broadcast routing, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Choke packets and Load shedding.

Internetworking : Tunneling, internetworking, Fragmentation, network layer in the internet – IP protocols, IP address, Subnets, Internet control protocols, DSPF, BOP, Internet multicasting, Mobile IP. Network layer in the ATM Networks – cell formats, connection setup, routing and switching, service categories, and quality of service, ATM LANs.

Transport Layer: The Transport Layer Elements of transport protocols – addressing, establishing a connection, releasing connection, flow control and buffering and crash recovery, end to end protocols – UDP, reliable Byte Stream (TCP) end to end format, segment format, connection establishment and termination, sliding window revisited, adaptive retransmission, TCP extension, Remote Procedure Call – BLAST, CHAN, SELECT, DCE.

Application Layer: Application Layer – Network Security – Cryptographic Algorithms – DES, RSA. Security Mechanisms – Authentication Protocols, Firewalls, Name service (DNS), Domains Hierarchy, Name servers, Traditional Applications – SMTP, MIME, World Wide Web – HTTP, Network Management – SNMP.

TEXT & REFERENCE BOOKS:

1. Computer Networks, Andrew Tanenbaum, 3/e, PHI.
2. Computer Networks –A System Approach, Larry L. Peterson, Bruce S. Davie, 2/e, Harcourt Asia PTE LTD.
3. Data Communication and Networking, 4/e, Forouzan, TMH
4. Data and Computer Communications, 8/e, Stallings, PHI
5. Computer communication and networking technologies, Gallo, Hancock, Cengage
6. Understanding data communications, 7/e, Held, PEA
7. Communication Networks, 2/e, Leon-Garcia, TMH

IT 7023 FAULT TOLERANT SYSTEMS

Preliminaries: Fault Classification, Types of Redundancy, Basic Measures of Fault Tolerance, Hardware Fault Tolerance, The Rate of Hardware Failures, Failure Rate, Reliability, and Mean Time to Failure, Canonical and Resilient Structures , Other Reliability Evaluation Techniques.

Information Redundancy: Information Redundancy, Coding, Resilient Disk Systems, Data Replication, Voting: Hierarchical Organization, Primary-Backup Approach, Algorithm-Based Fault Tolerance.

Fault-Tolerant Networks: Measures of Resilience, Common Network Topologies and Their Resilience, Fault-Tolerant Routing.

Software Fault Tolerance: Acceptance Tests, Single-Version Fault Tolerance, N-Version Programming, Recovery Block Approach, Preconditions, Postconditions, and Assertions, Exception-Handling, Software Reliability Models, Fault-Tolerant Remote Procedure Calls.

Checkpointing: What is Checkpointing? , Checkpoint Level, Optimal Checkpointing-An Analytical Model, Cache-Aided Rollback Error Recovery (CARER), Checkpointing in Distributed Systems, Checkpointing in Shared-Memory Systems, Checkpointing in Real-Time Systems.

Case Studies: NonStop Systems, Stratus Systems, Cassini Command and Data Subsystem, IBM G5, IBM Sysplex, Itanium.

Fault Detection in Cryptographic Systems: Overview of Ciphers, Security Attacks Through Fault Injection, Countermeasures.

Simulation Techniques: Writing a Simulation Program, Parameter Estimation, Variance Reduction Methods, Random Number Generation, Fault Injection.

TEXT & REFERENCE BOOKS:

1. Fault Tolerant Systems, Israel koren, Mani Krishna, Elsevier, 2007
2. Reliablity of Computer systems and networks(Fault Tolerance, analysis and Design), Martin L Shooman, Willey
3. FaultTolerant computer system Design, DK Pradhan(Ed), PHI, 1996
4. Software Fault tolerance Techniques and implementation, LL Pullam, Architect House
5. Reliable computer systems: Design and evaluation, siewiorek, swarz,AK Peters
6. Probability and statistics with reliability queuing and computer science applications, John wiley.
7. An Introduction to reliability and maintainability Engineering, Ebeling, MGH

IT 7024 ADVANCED MACHINE LEARNING

Introduction: Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

Decision Tree learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Artificial Neural Networks: Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks Evaluation Hypotheses : Motivation, Estimation hypothesis accuracy, Basics of

sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm.

Computational learning theory: Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning -Instance-Based Learning-Introduction, k -Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

Genetic Algorithms: Motivation, Genetic Algorithms, An Illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms.

Learning Sets of Rules: Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution.

Analytical Learning: Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge.

Combining Inductive and Analytical Learning: Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators, Reinforcement Learning: Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

TEXT & REFERENCE BOOKS:

1. Machine Learning ,Tom M. Mitchell, MGH
2. Machine Learning, An Algorithmic Perspective, Stephen Marsland, Taylor & Francis(CRC)
3. Introduction to Machine Learning, Ethem Alpaydin, PHI, 2004

IT 7025 ADVANCED MOBILE COMPUTING

Introduction to Mobile Communications and Computing: Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

(Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Protocols and Tools: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

TEXT & REFERENCE BOOKS:

1. Mobile Communications, 2/e, Jochen Schiller, 2004, Addison-Wesley.
2. Handbook of Wireless Networks and Mobile Computing, Stojmenovic, Cacute, Wiley.
3. Mobile Computing Principles, Designing and Developing Mobile Applications with UML and XML, Reza Behravanfar, Cambridge, University Press, 2004.
4. Fundamentals of Mobile and Pervasive Computing, Adelstein, Frank, Gupta, Sandeep KS. Richard Golden, Schwiebert, Loren, TMH, 2005.
5. Principles of Mobile Computing, 2/e, Hansmann, Merk, Nicklous, et al., Springer, 2003.
6. Mobile and Wireless Design Essentials, Martyn Mallick, Wiley DreamTech, 2003
7. Mobile Computing, Rajkamal, Oxford, 2008
8. Adhoc Wireless Networks, 2/e, Sivaram murthy, manoj, PEA, 2009

IT 7026 PARALLEL COMPUTING & ALGORITHMS

Introduction: Computational demand in various application areas, advent of parallel processing, terminology, pipelining, Data parallelism and control parallelism-Amdahl's law. Basic parallel random access Machine Algorithms-definitions of P, NP and NP-Hard, NP-complete classes of sequential algorithms-NC –class for parallel algorithms.

Organizational features of Processor Arrays, Multi processors and multicomputers. Mapping and scheduling aspects of algorithms. Mapping into meshes and hyper cubes-Load balancing-List scheduling algorithm Coffman-graham scheduling algorithm for parallel processors.

Elementary Parallel algorithms on SIMD and MIMD machines, Analysis of these algorithms. Matrix Multiplication algorithms on SIMD and MIMD models.

Fast Fourier Transform algorithms. Implementation on Hyper cube architectures. Solving linear file system of equations, parallelizing aspects of sequential methods back substitution and Tri diagonal. Parallel sorting methods---Odd-even transposition Sorting on processor arrays. Biotonic –merge sort on shuffle –exchange ID –Array processor, 2D-Mesh processor and Hypercube Processor Array.

Parallel Quick-sort on Multi processors. Hyper Quick sort on hypercube multi computers. Parallel search operations. Ellis algorithm and Manber and ladner's Algorithms for dictionary operations.

Parallel algorithms for Graph searching - All shortest paths and minimum cost spanning tree.

Parallelization aspects of combinatorial search algorithms with Focus on Branch and Bound Methods and Alpha-beta Search methods.

TEXT & REFERENCE BOOKS:

1. Parallel computing theory and practice, MICHAEL J.QUINN
2. Programming Parallel Algorithms, Guy E. Blelloch, Communications of the ACM
3. Algorithms for Parallel processing, Michael T Heath, Abhiram Ranade, Schreiber(Ed), Springer.
4. Handbook of Parallel Computing Models, algorithms and applications, Samgithevar Rajasekharan, John Reif(Ed), Taylor and Franics group.
5. Parallel Processing and Parallel Algorithms: Theory and Computation, Seyed H. Roosta, Springer

IT 7027 PATTERN RECOGNITION

Introduction: Basic concepts, Applications, Fundamental problems in pattern Recognition system design, Design concepts and methodologies, Examples of Automatic Pattern recognition systems, Simple pattern recognition model.

Decisions and Distance Functions: Linear and generalized decision functions, Pattern space and weight space, Geometrical properties, implementations of decision functions, Minimum-distance pattern classifications.

Probability -Probability of events: Random variables, Joint distributions and densities, Movements of random variables, Estimation of parameter from samples.

Decision Making: Introduction, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal cost of error, estimation of error rates, the leaving-one-out-techniques, characteristic curves, estimating the composition of populations. Baye's

classifier for normal patterns.

Non Parametric Decision Making: Introduction, histogram, kernel and window estimation, nearest neighbour classification techniques. Adaptive decision boundaries, adaptive discriminant functions, Minimum squared error discriminant functions, choosing a decision making techniques.

Clustering and Partitioning: Hierarchical Clustering: Introduction, agglomerative clustering algorithm, the single-linkage, complete-linkage and average-linkage algorithm. Ward's method Partition clustering-Forg's algorithm, K-means's algorithm, Isodata algorithm.

Pattern Preprocessing and Feature selection: Introduction, distance measures, clustering transformation and feature ordering, clustering in feature selection through entropy minimization, features selection through orthogonal expansion, binary feature selection.

Syntactic Pattern Recognition and Application of Pattern Recognition: Concepts from formal language theory, formulation of syntactic pattern recognition problem, syntactic pattern description, recognition grammars, automata as pattern recognizers, Application of pattern recognition techniques in bio-metric, facial recognition, IRIS scon, Finger prints, etc.

TEXT & REFERENCE BOOKS:

1. Pattern recognition and Image Analysis, Gose. Johnsonbaugh Jost, PHI.
2. Pattern Recognition Principle, Tou. Rafael. Gonzalez, Pea.
3. Pattern Classification, Richard duda, Hart., David Strok, Wiley.

IT 7028 SCALABLE PARALLEL COMPUTING ARCHITECTURES

Parallel Computer Models, Program and Network Properties: Parallel Computer Models: Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks Program and Network Properties: Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

Processors and Memory Hierarchy: Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Backplane Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models.

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design Superscalar and Superpipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers, Message-Passing Mechanisms.

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, SIMD Computer Organizations: BSP and CM2 Architectures, The Connection Machine CM-5: CM5 Architecture and Inter process communication.

Parallel Models, Languages, and Compilers: Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays, Code Optimization and Scheduling, Loop Parallelization and Pipelining.

TEXT & REFERENCE BOOKS:

1. Advanced computer Architecture,Parallelism, Scalability, Programmability. Kai Hwang, TMH
2. Computer Architecture,A quantitative approach, 4/e, John L. Hennessey , David A. Patterson, Morgan Kaufmann / Elsevier, 2007.
3. Computer Organization and Architecture, Designing for Performance, 7/e, William Stallings, Pearson, 2006.
4. Computer Organization and Design, 4/e, Patterson, Hennessy Elsevier India, 2008.
5. Computer Architecture & Parallel Processing, Kai Hwang, Faye A. Briggs, TMH.

IT 7029 SECURED DATABASE APPLICATIONS DEVELOPMENT

Security Architecture: Introduction, Security, Information Systems, Database management systems, Information security, Information security Architecture, database security, Asset types and their value, Security methods.

Operating System Security Fundamentals: Introduction, operating systems overview, security environment, components, Authentication methods, user administration, password policies, Vulnerabilities of operating systems, E-Mail security.

Administration of Users: Introduction, user authentication, operating system authentication, creating/removing/modifying users, default/remote users, Database links, Linked servers, remote servers.

Profiles, Password Policies, Privileges, and Roles: Introduction, Defining and using profiles, Designing and implementing password policies, Granting and revoking user privileges, creating, Assigning and revoking user roles.

Database Application Security Models: Introduction, Types of users, security models, application types, application security models and Data encryption.

Virtual Private Databases (VPD): Introduction, Overview, implementing a VPD using views and application context. Implementing oracle VPD, Viewing VPD policies and application context using: data dictionary, policy manager, implementing row and column level security with SQL server.

Database Auditing Models, Application Data Auditing: Database Auditing Models: Introduction, Auditing overview, environment, process, objectives, classification and types, benefits and side effects of auditing. Application Data Auditing: Introduction, DML auction auditing architecture. Triggers, fine grained auditing, DML statement audit trail and auditing application errors with Oracle.

Auditing Database Activities, Security and Auditing Project Cases: Auditing Database Activities: Introduction, usage of database activities, creating DLL triggers, auditing database activities with oracle Security and Auditing project cases: Introduction, case study for developing an online database, taking care of payroll, tracking database changes and developing a secured authentication repository

TEXT & REFERENCE BOOKS:

1. Database Security and Auditing, Hassan Afyouni, Cengage Learning, 2007
2. Database Security, Castano, M. Fugini, G. Martella, P. Samarati, Addison-Wesley, 1994.
3. Implementing Database Security and Auditing, RonBen Natan: Elsevier, 2006.
4. Principles of Distributed Database Systems, M.Tamer Özsu, Patrick Valdureiz, Springer.
5. Database Security, Castano, Fugini, Addison Wesley.
6. The security Audit and control of Databases, Clark, Holloway, List, UK:Ashgate.
7. Security and Audit of Database System, Douglas, Blackwell (UK)
8. Database security and Integrity, Fernandez, Summers, Wood, Addison Wesley

IT 7030 WIRELESS NETWORKS AND MOBILE COMPUTING

Introduction to Mobile and Wireless Landscape: Definition of Mobile and Wireless, Components of Wireless Environment, Challenges, Overview of Wireless Networks, Categories of Wireless Networks, Wireless LAN: Infrared Vs radio transmission, Infrastructure and Ad-hoc Network, IEEE 802.11, HIPERLAN, Bluetooth.

Global System for Mobile Communications (GSM): GSM Architecture, GSM Entities, Call Routing in GSM, PLMN Interfaces, GSM Addresses and Identifiers, Network Aspects in GSM, GSM Frequency Allocation, Authentication and Security.

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP), Mobile Ad-hoc networks: Routing, destination Sequence Distance Vector, Dynamic Source Routing.

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.

Broadcast Systems: Overview, Cyclical repetition of data, Digital audio broadcasting: Multimedia object transfer protocol, Digital video broadcasting: DVB data broadcasting, DVB for high-speed internet access, Convergence of broadcasting and mobile communications.

Protocols and Tools: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers),

Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

Wireless Language and Content – Generation Technologies: Wireless Content Types, Markup Languages: HDML, WML, HTML, cHTML, XHTML, VoiceXML. Content-Generation Technologies: CGI with Perl, Java Servlets, Java Server Pages, Active Server Pages, XML with XSL Stylesheets, XML Document, XSL Stylesheet

Mobile and Wireless Security Mobile and Wireless Security: Creating a Secure Environment, Security Threats, Security Technologies, Other Security Measures, WAP Security, Smart Client Security

TEXT & REFERENCE BOOKS:

1. Mobile Communications, 2/e, Jochen Schiller, PEA, 2008.
2. Mobile and Wireless Design Essentials, Martyn Mallick, Wiley, 2008.
3. Mobile Computing, Asoke K Talukder, et al,, MGH, 2008.
4. Mobile Computing,Raj Kamal,Oxford .
5. Wireless Communications & Networks, 2/e, William Stallings, PEA, 2007.
6. Fundamentals of Mobile and Pervasive Computing, Frank Adelstein et al, TMH, 2005.
7. Wireless Networks first-step, Jim Geier, PEA, 2005.
8. Handbook of Wireless Networks and Mobile Computing, Ivan Stojmenovic, Wiley, 2007.
9. 802.11 Wireless Networks,2/e, Matthew S.Gast, O'Reilly, 2006.

IT 7031 BIOPHYSICS

Body fluid: Properties of body fluid, determination of conduction of body fluid, measurement of EMF of cells, temperature and reaction rates: Arrhenius equation. Photochemical reaction, the law of photochemistry, fluorescence and phosphorescence, Principles of colorimeter, Beer-Lambert's law, biometrics.

Biophysical activity of heart: electrical activity of the heart, monophonic and biphasic recordings, original and propagation of excitation & contraction, refractoriness, regular and ectopic pace makers, electrocardiography, waveform and measurement, ECG in diagnosis, arrhythmia's, flutter, fibrillation, vulnerable period, phonocardiography, ballistocardiography.

Biophysical activity of brain and other organs: electrical activity of brain, waveforms & measurements, electrogastrography, electroneurography, nerve conduction studies, electroretinography, electroocculography, recording electrodes, interfaces, skin contact impedance, biological transducers, receptor potentials.

Introduction to electrical simulation: impedance & current distribution, dielectric properties of biological materials, skin impedance, total body impedance, impedances at high frequencies, high voltage & transient properties, patient safety, electrical shocks and hazards, leakage currents, types & measurements, protection against shock, burn & explosion hazards.

Radioactivity: Radio emission, radioisotopes, law of radioactive decay, half life period, production of radio isotopes for medical use, electromagnetic radiation, interaction of radiation with matter, exponential attenuation, half value thickness, photo electric, Compton and pair production process and their significance in radiology, radiation units, detection and measurements of radiation.

Introduction of ultrasonic wave: Ultrasonic wave motion, wave characteristics, intensity, and ultrasound properties in body (velocity, attenuation, reflection, refraction and absorption). Use of ultrasound in biological field.

Introduction of magnetic field: Optical activity and magnetic rotation of substances, dipole moments, magnetic properties of substances. Useful and harmful effects of magnetic fields, radio waves, micro waves, ultra violet radiation and infrared radiation on human beings - Applications. Effect of hypothermia and hyperthermia. Production of ultra low and low temperature for medical use.

Standards: BIS standards, ISO regulations, Electrical safety and regulation to keep the hospital environment safe, medical ethics.

TEXT & REFERENCE BOOKS:

1. Medical Imaging Physics (4/eds), W.R.Hendee & E.R.Ritenour, Wiley.
2. Medical Physics, Massey and Meredeth.
3. Principles of Biomedical Engineering, David Cooney

4. Bio Physical Principles of Structure and functions, F Snell et al., 1965.

IT 7032 BIOMECHANICS

Use of statics, kinetics – rigid and non rigid bodies – Forces and motion – Newtons laws – Moment of force – Static equillibrum – Centre of gravity – Stability of equilibrium - Steps in analyzing a biomechanical problem – Graphical methods – contact forces – resolution of forces.

Bone structure & composition mechanical properties of bone, cortical and cancellous bones - Electrical properties of bone, fracture mechanism and crack propagation in bones, fracture fixators, repairing of bones. Pseudo elasticity, nonlinear stress-strain relationship, viscoelasticity, structure, function and mechanical properties of skin, ligaments and tendons.

Skeletal joints, skeletal muscles, basic considerations, basic assumption and limitations, forces and stresses in human joints, mechanics of the elbow, shoulder, spinal column, hip, knee and ankle. Human locomotion, gait analysis and goniometry, Ergonomics, Foot Pressure measurements – Pedobarograph, Force platform, mechanics of foot. Total Hip Prosthesis: requirements, different types of components, Stress analysis & instrumentation, Knee Prosthesis.

Alveoli mechanics, interaction of blood and lung, P-V curve of lung, breathing mechanism, airway resistance, physics of lung diseases.

Mechanical properties of blood vessels – arteries, arterioles, capillaries, veins, physics of cardio vascular diseases, prosthetic heart valves and replacement. Fluids – density – pressure – blood pressure and gravity – buoyancy – moments of force and stability – movement in water - Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow.

TEXT & REFERENCE BOOKS:

1. Frank Bell, Principles of Mechanics and Biomechanics, Stanley Thorne (Publishers) Ltd., 1998
2. Donald R. Peterson and Joseph D. Bronzino, Biomechanics Principles and applications, CRC press, Taylor & Francis Group, LLC, 2008
3. Duane Knudson, Fundamentals of Biomechanics, Second Edition, Springer publication , 2007

IT 7033 BIOMEDICAL INSTRUMENTATION

Analytical equipments used in clinical environment - Beer-Lambert's Law in spectrometry. UV, visible and infra-red spectrophotometers. Blood cell counters- methods - Coulter Counters- automatic recognition and differential counting- audiometers – Automated Biochemical Analyzer – components – sampler control units – Sampling mechanisms – Flow injection analysis technique.

ECG Machines . Holter monitoring. Exercise systems. Measurement and application of average auditory evoked potential, visual evoked potential - magneto encephalogram - principles and measurements - Myoelectric control - Clinical applications of electrotherapy, short wave diathermy, ultrasonic diathermy, microwave diathermy, surgical diathermy unit, IR lamps, UV lamps.

X-Ray – Fluoroscopy - Computed tomography - Principles of sectional imaging - scanner configuration - data acquisition system - image formation principles - 2D image reconstruction techniques. Radio isotope imaging - Rectilinear scanners, linear scanners - SPECT - PET - Gamma Camera Radio nuclides for imaging, Emission Computed Tomography.

Physics of Ultrasound – Ultrasound Instrumentation – Doppler, Magnetic Resonance Imaging - Principles of MRI – pulse sequence- image acquisition and reconstruction techniques – MRI instrumentation – Functional MRI - Application of MRI. Introduction to Fusion imaging.

Physiological effects of electrical currents, macroshock and microshock, preventive measures to reduce shock hazards, Leakage current, isolation of patient circuits, safety of electrically susceptible patients, radiation hazards and safety, shielding, open ground problem and earthing methods.

TEXT & REFERENCE BOOKS:

1. R. S. Khandpur, Biomedical Instrumentation Technology and Applications, McGraw-Hill Professional, 2004
2. Raja Rao, C; Guha, S.K, Principles of Medical Electronics and Biomedical Instrumentation, Orient Longman Publishers (2000)

IT 7034 BIOMEDICAL SIGNAL PROCESSING

Simple signal conversion systems – conversion requirement for biomedical signals – signal conversion circuits. Discrete Fourier Transform (DFT) – Properties – circular and sectioned convolution – Filtering long duration sequences - FFT computation using DIT and DIF

algorithms.

FIR design: Windowing techniques – Need and choice of Windows – Linear phase characteristics. IIR design: Analog filter design – Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation – Warping, prewarping – Frequency transformation.

Adaptive filters – Principle noise canceller model – 50 Hz adaptive cancelling using a sine wave model – Maternal ECG cancellation in fetal electrocardiography – ECG cancellation in EMG recording – High frequency noise cancellation in Electro surgery. Signal averaging – Basics and limitations.

EEG signal characteristics – EEG analysis - time and frequency domain methods – Parametric model – Phenomenological model – linear prediction theory – Autoregressive method.

ECG QRS detection Techniques – Estimation of R-R interval – Estimation of ST segment inclination – Arrhythmia analysis monitoring – Long term ECG recording – Basics of ECG data reduction techniques.

Extracellular signal analysis – LFP Event detection, Latency calculation, single LFP classification.

TEXT & REFERENCE BOOKS:

1. DC Reddy, Biomedical Signal Processing – Principles and Techniques, Tata McGraw Hill Publishing company Ltd., 2005
2. P.Ramesh Babu, "Digital Signal Processing", Second Edition, Scitech publications, Chennai, 2003
3. Willis J.Tompkins, Biomedical Digital signal processing, Prentice Hall of India Pvt. Litd., 2000
4. Biomedical Signal Analysis A case study approach by Rangaraj M.Rangayyan, John Wiley publications.

IT 7035 ADVANCES IN NEURAL ENGINEERING

Introduction, Fundamentals of Neurophysiology, Neuron, membrane, Broad definition of a neural prosthesis: development; market; history, Design criteria for a prosthetic device: bottlenecks. Brainstorming with students: why "Neural Engineering". Charge passage to and from the brain. Metals for use in implants. Fundamentals of data analysis for implanted materials (electrochemistry and histology). Applications: cochlear implant. Interfacing electronics to the body. High pass and low pass electrodes. Drug delivery and neurochemical analysis. Fabrication methods for implantable prosthesis. Sieve probes, shank probes, brain slice applications (non implantable). Brain-machine interfaces. Practical implementations and modeling. Neurorobotics. Electrical Stimulation of neurons. Effects of electric fields on transmembrane potentials. Neural signal processing. Learning, Plasticity. Artificial neural networks. Modeling neurons. Hodgkin Huxley. Timestamps. Firing rates. Neuronal system identification, Seizure prediction. Neural implant examples: retinal and cochlear.

TEXT & REFERENCE BOOKS:

1. Neural Engineering, ed. Bin He, Bioelectric Engineering Series, vol. 3, 2005. ISBN 0-306-48609-1.
2. Kandel, E.R., Principles of Neural Science, McGraw-Hill, 2000, ISBN 0838577016.
3. Purves, D, Augustine, G.J, et al. (eds), Neuroscience, Sinauer Assoc., 1997 (or newer edition). ISBN 0878937471.
4. Khandpur, R.S., Biomedical Instrumentation, McGraw-Hill, 2005. ISBN 0071447849.

IT 7036 MULTIMEDIA COMMUNICATION SYSTEMS

Definition of Multimedia: General Description and Standards, Transmission and Switching, System Technology, Services offered by Multimedia Communications.

Multimedia Support in Shared Media LAN and MAN: The original IEEE 802 Local Area Networks, ANSI Fiber Distributed Data Interface.

Quality of Service: Generalized QoS Framework, QoS Principles and Specifications, QoS in Networked Multimedia System.

Video and Audio Coding Techniques and Standards: Discrete Cosine Transform (DCT), Coding of Still Images (JPEG, JPEG2000), Coding of Moving Pictures (MPEG 1, MPEG 2, MPEG 4, MPEG21).

Multimedia Operations, Administration, Management and Services: Network Element and Network-Level OA&M, OA&M System Technologies.

TEXT & REFERENCE BOOKS:

1. K. R. Rao, Z. S. Bojkovic, Dragorad A. Milovanović, Multimedia communication systems: techniques, standards, and networks, Prentice Hall PTR, 2002
2. JR Ohm, Multimedia Communication Technology: Representation, Transmission and Identification of Multimedia Signals, Springer, 2004
3. Jerry D. Gibson, Multimedia communications: directions and innovations, Academic Press, 2001
4. Atul Puri, Tsuhan Chen, Multimedia systems, standards, and networks, CRC Press, 2000

IT 7037 SATELLITE COMMUNICATION

Radio Wave Propagation: Introduction, Ground wave propagation, free space propagation, ground reflection, surface wave, diffraction.
Troposphere Wave Propagation: Troposcopic scatter, Ionosphere propagation, electrical properties of the ionosphere, effects of earth's magnetic field.
Over view of Satellite Systems: Introduction, frequency allocation, INTEL Sat.
Orbits: Introduction, Kepler laws, definitions, orbital element, apogee and perigee heights, orbit perturbations, inclined orbits, calendars, universal time, sidereal time, orbital plane, local mean time and sun synchronous orbits, Geostationary orbit: Introduction, antenna, look angles, polar mix antenna, limits of visibility, earth eclipse of satellite, sun transit outage, leandiag orbits.
Propagation impairments and space link: Introduction, atmospheric loss, ionospheric effects, rain attenuation, other impairments.Space link: Introduction, EIRP, transmission losses, link power budget, system noise, CNR, uplink, down link, effects of rain, combined CNR.
Space Segment: Introduction, power supply units, altitude control, station keeping, thermal control, TT&C, transponders, antenna subsystem.
Earth Segemnt: Introduction, receive only home TV system, out door unit, indoor unit, MATV, CATV, Tx – Rx earth station.
Interference and Satellite access: Introduction, interference between satellite circuits, satellite access, single access, pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA, down link analysis, comparison of uplink power requirements for TDMA & FDMA, on board signal processing satellite switched TDMA.
TEXT & REFERENCE BOOKS:

1. Satellite Communications – Dennis Roddy, 4th Edition, McGraw-Hill International edition, 2006.
2. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, , 2nd Edition, John Wiley & Sons, 2003.
3. Satellite Communication Systems engineering – W.L. Pitchand, H.L. Suyderhoud, R.A. Nelson, 2nd Ed., Pearson Education., 2007.

IT 7038 CELLULAR NETWORK PLANNING

Introduction: Objectives of Radio Network Planning, The Impact of User Environment, Cellular Network Planning Approaches, Starting Points for The Planning Procedure: Desired Grade of Service, System Specification, Equipment Specifications, Available Frequency Band, Service Area Topography, Traffic Distribution, Existing Infrastructure, Phases of The Planning Procedure.
Radio Network Definition including Capacity planning: Starting Points and Objectives, Frequency Reuse, Prediction of Offered Traffic, Capacity Planning Example.
Propagation Analysis and Coverage Planning: Starting Points and Goals of Coverage Planning, Multipath Propagation: Path Loss, Hata Model, Walfish-Ikegami Model, Path Loss Corrections, Slow and Fast Fading, Connection Between Coverage and Quality of Service, Radio Link Power Budget: Antenna Feeder Loss, Antenna Gain, Application Example.
Frequency Allocation: Starting Points and Objectives, Regular Frequency Reuse Patterns, Methods Applied in Frequency Planning: Interference Levels, Minimum Reuse Distances, Allocation of Frequencies, Adjacent Channel Interference Avoidance, Application Example: Simple Frequency Planning Method Using Regular Reuse Patterns, Advanced Frequency Planning Method Using Pairwise Interference Analysis.
Cellular Network Planning Tools: Digital Maps, Capacity Planning in Radio Network Definition, Propagation Analysis and Coverage Planning: Hata Model and Walfish-Ikegami Model, Morphography, Antenna Height and Topography Corrections, Frequency Allocation, Route Calculations: Comparison of Predicted and Measured Data, Simulation of Calls Along Routes, Cellular Network Measurement: NMS/X, TIM and SAM of Nemo Technologies.
TEXT & REFERENCE BOOKS:

1. Ajay R. Mishra, Fundamentals of Cellular Network Planning and Optimisation: 2G/2.5G/3G... Evolution to 4G, Wiley, 2004
2. Ajay R. Mishra, Advanced Cellular Network Planning and Optimisation: 2G/2.5G/3G...Evolution to 4G, John Wiley, 2007

IT 7039 FIBER – OPTIC COMMUNICATION

Overview of Optical Fiber Communication: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.
Transmission characteristics of optical FIBERS: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra modal dispersion, Inter modal dispersion.
Optical Sources and Detectors: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors.
Fiber Couplers and Connectors: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.
Optical Receiver: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver operation, Analog receivers.
Analog and Digital Links: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.
Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

WDM Concepts and Components: WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

Optical Amplifiers and NETWORKS: optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

TEXT & REFERENCE BOOKS:

1. Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008.
2. Optical Fiber Communications– John M. Senior, Pearson Education. 3rd Ed., 2007.
3. Fiber optic communication – Joseph C Palais: 4th Edition, Pearson Education.

IT 7040 SWITCHING SYSTEMS

Evolution of Switching Systems: The Role of Switching Systems in Telecommunication Networks, Step By Step and Crossbar, Stored Program Control (SPC), Digital Switching, ATM Switching.

Switching System Architecture: Subscriber and Line Interface, Switching Network: Matrix and Channel Graph Representations, Blocking, Non-Blocking , and Rearrangeable Networks, Control Unit, Operation and Maintenance, Switching Process: Call Detecting, Number Analysis, Call Routing, Supervision, and Metering.

Hardware and Software Structure of the Digital Switch: Time Switches and Space Switches, Path Searching, Processor Systems Architecture and Functions, Reliability and Fault Recovery, Man Machine Interface, Examples of the Present Digital Switching Systems.

ATM Switching Architectures and Performance: ATM Switch Architectures, Full-and Partial-Connection Multistage Networks, Self – Routing Networks, ATM Switching Structures: Minimum-Depth Blocking Networks, Non-Blocking Single-, and Multiple-Queuing Networks, Arbitrary-Depth Blocking Networks, Fault-Tolerant ATM Switching Architectures.

New Trends in Switching: Photonic Switching, IP Switching.

TEXT & REFERENCE BOOKS:

1. Telecommunication and Switching, Traffic and Networks - J E Flood: Pearson Education, 2002.
2. Digital Switching Systems, Syed R. Ali, TMH Ed 2002.
3. Digital Telephony - John C Bellamy: Wiley India 3rd Ed, 2000.

IT 7041 WIRELESS NETWORKS

PCS Architecture, Cellular telephony, Cordless telephony and low tier PCS, Third and Fourth generation wireless systems; Mobility management, handoff, roaming management for SS& and CT2, handoff Detection, strategies for handoff detection, channel assignment, link transfer types, hard Handoff soft handoff; IS-41 signaling, IS-41 handoff and authentication, CDPD architecture, CDPD air Interface, radio resource allocation.; GSM architecture, location tracking, data services, HSCPD, GPRS, OSM network signaling, GSM mobility management, GSM short message service, International Roaming for GSM, VoIP for GSM networks.; GPRS functional groups, architecture, network nodes, interfaces, procedures, billing, evolving from GSM to GPRS,WAP protocols, W-CDMA and cdma 2000, QOS in 3G, paging network architectures, wireless local loop architectures, Bluetooth core Protocols; Introduction to wireless LANS, 802.11 WLANs, physical and MAC layers, Wireless ATM and HIPERLAN, 802.15 WPAN, Bluetooth, interference between Bluetooth and 802.11, wireless geolocation system architecture, standards, performance measures, introduction other wireless LAN standards 802.lle, 802.16, 802.17, 802.19, 802.20

TEXT & REFERENCE BOOKS:

1. Yi-Bing Lin, Imrich Chlamtac, Wireless and mobile network architectures, John Wiley, 2001
2. Kaveh Pablavan, P. Krishnamurthy, Principles of wireless networks, Pearson education, 2002
3. P. Venkataram, S. S. Manvi, B. P. Vijaykumar, WLANs: Architectures, Protocols and Applications, Pearson education (In Press), 2005
4. Marlyn Mallick, Mobile and wireless design essentials, Wiley, 2003

IT 7042 ADVANCED DIGITAL COMMUNICATION

Digital Modulation Techniques: QPSK, DPSK, FQPSK, QAM, M-QAM, OFDM, Optimum Receiver for Signals Corrupted by AWGN, Performance of the Optimum Receiver for Memory-less Modulation, Optimum Receiver for CPM Signals, Optimum Receiver for Signals with Random Phase in AWGN Channel.

Coding Techniques: Convolutional Codes, Hamming Distance Measures for Convolutional Codes; Various Good Codes, Maximum Likelihood Decoding of Convolutional codes, Error Probability with Maximum Likelihood Decoding of Convolutional Codes, Sequential Decoding and Feedback Decoding, Trellis Coding with Expanded Signal Sets for Band-limited Channels, Viterbi decoding.

Communication through band limited linear filter channels: Optimum receiver for channels with ISI and AWGN, Linear equalization, Decision-feedback equalization, reduced complexity ML detectors, Iterative equalization and decoding-Turbo equalization.

Adaptive equalization: Adaptive linear equalizer, adaptive decision feedback equalizer, adaptive equalization of Trellis- coded signals, Recursive least squares algorithms for adaptive equalization, self recovering (blind) equalization.

Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals, Frequency-Hopped Spread Spectrum Signals, CDMA, time-hopping SS, Synchronization of SS systems.

Digital Communication through fading multi-path channels: Characterization of fading multi-path channels, the effect of signal characteristics on the choice of a channel model, frequency-Nonselective, slowly fading channel, diversity techniques for fading multi-path channels, Digital signal over a frequency-selective, slowly fading channel, coded wave forms for fading channels, multiple antenna systems.

TEXT & REFERENCE BOOKS:

1. John G. Proakis, “Digital Communications," 4th edition, McGraw Hill, 2001.
2. Stephen G. Wilson, “Digital Modulation and Coding,” Pearson Education (Asia) Pte. Ltd, 2003.

3. Kamilo Feher," Wireless Digital Communications: Modulation and Spread Spectrum Applications," Prentice-Hall of India, 2004.
4. Andrew J. Viterbi, CDMA: Principles of Spread Spectrum Communications, Prentice Hall, USA, 1995.

IT 7043 MODELING OF DATA NETWORKS

Delay Models in Data Networks: Queuing Models, M/M/1, M/M/m, M/M/∞, M/M/m/m and other Markov System, M/G/1 System, Networks of Transmission Lines, Time Reversibility, Networks of Queues.

Multi-access Communication: Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing, Multi-access Reservations, Packet Radio Networks.

Routing in Data Networks: Introduction, Network Algorithms and Shortest Path Routing, Broadcasting.

Routing Information: Coping with Link Failures, Flow models, Optimal Routing, and Topological Design, Characterization of Optimal Routing, Feasible Direction Methods for Optimal Routing, Projection Methods for Optimum Routing, Routing in the Codex Network.

Flow Control: Introduction, Window Flow Control, Rate Control Schemes, Overview of Flow Control in Practice, Rate Adjustment Algorithms.

TEXT & REFERENCE BOOKS:

1. Dimitri Bertsekas and Robert Gallager, "Data Networks," 2nd edition, Prentice Hall of India, 2003.
2. William Stallings, "High-Speed Networks and Internets," Pearson Education (Asia) Pte. Ltd, 2004.
3. J. Walrand and P. Varaya,"High Performance Communication Networks," 2nd edition, Harcourt India Pte. Ltd. & Morgan Kaufman, 2000.

IT 7044 TELECOMMUNICATION NETWORK MANAGEMENT

Introduction: Network management standards, network management model, organization model, information model abstract syntax notation 1 (ASN.1), encoding structure, macros, functional model.

Network management application functional requirements: Configuration management, fault management, performance management, Error correlation technology, security management, accounting management, common management, report management, polity based management, service level management, management service, community definitions, capturing the requirements, simple and formal approaches, semi formal and formal notations.

Telecommunication management network (TMN) architecture: Terminology, functional architecture, information architecture, physical architecture, TNN cube, TMN and OSI .

Common management information service element (CMISE): CMISE model, service definitions, errors, scooping and filtering features, synchronization, functional units, association services, common management information protocol (CMIP) specification.

Information Modeling for TMN: Rationale for information modeling, management information model, object oriented modeling paradigm, structure of management information, managed object class definition, management information base (MIB).

Simple network management protocol (SNMP): SNMPv1: managed networks, SNMP models, organization model, information model, SNMPv2 communication model, functional model, major changes in SNMPv2, structure of management information (SMI), MIB, SNMPv2 protocol, compatibility with SNMPv1, SNMPv3, architecture, applications, MIB security, remote monitoring (RMON) SMI and MIB, RMQN1 and RMON2; Network management examples: ATM integrated local management interface, ATM MIB. M1, M2,M3, M4, interfaces, ATM digital exchange interface management, digita1 subscriber loop (DSL) and asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management. Network management tools: Network statistics management, network management system, management platform case studies: OPENVIEW, ALMAP.

TEXT & REFERENCE BOOKS:

1. Network Management: Principles and Practice - Mani Subramanian, Addison Wesley, Pearson Education Asia publication.
2. Fundamentals of Telecommunication Network Management - Lakshmi Raman IEEE Communication Society.
3. Telecommunication Network Management: Technologies and Implementations - Airdarous Salah, Plevyak Thomas. Prentice Hall
4. Telecommunication Network Management - Haojin Wang, Mc- Graw Hill Professional Publication.

IT 7045 ADVANCED DIGITAL SIGNAL PROCESSING

Parametric Methods For Power Spectrum Estimation: Relationship between the auto correlation and the model parameters – The Yule – Walker method for the AR Model Parameters – The Burg Method for the AR Model parameters – unconstrained least-squares method for the AR Model parameters – sequential estimation methods for the AR Model parameters – selection of AR Model order.

Adaptive Signal Processing: FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

Multirate Signal Processing: Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

Speech Signal Processing: Digital models for speech signal : Mechanism of speech production – model for vocal tract, radiation and excitation – complete model – time domain processing of speech signal:- Pitch period estimation – using autocorrelation function – Linear predictive Coding: Basic Principles – autocorrelation method – Durbin recursive solution.

Wavelet Transforms: Fourier Transform : Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition – Haar Wavelet – Daubechies Wavelet.

TEXT & REFERENCE BOOKS:

1. John G.Proakis, Dimitris G.Manobakis, Digital Signal Processing, Principles, Algorithms and Applications, PHI.
2. Monson H.Hayes – Statistical Digital Signal Processing and Modeling, Wiley, 2002.
3. Roberto Crist, Modern Digital Signal Processing, Thomson Brooks/Cole (2004)
4. Raghuveer. M. Rao, Ajit S.Bopardikar, Wavelet Transforms, Introduction to Theory and applications, Pearson Education, Asia, 2000.

IT 7046 ERROR CONTROL CODING TECHNIQUES IN COMMUNICATIONS

Introduction; The channel coding problem; Vector spaces; Groups, rings and fields; Primitive and irreducible polynomials; Hamming Codes and the Hamming bound; Code bounds; Polynomial rings and cyclic codes; Encoding and decoding of cyclic codes; BCH and Reed-Solomon codes; Decoding BCH and Reed-Solomon codes; Convolutional codes; Decoding convolutional codes; the Viterbi algorithm.

TEXT & REFERENCE BOOKS:

1. Error Control Systems for Digital Communication and Storage, Stephen B. Wicker, Prentice-Hall, 1995.
2. Error Control Coding: An Introduction, P. Sweeney, Prentice-Hall, Englewood Cliffs, NJ, 1991.
3. Error-Correcting Codes and Finite Fields, O. Pretzel, Oxford University Press, Oxford, 1992.
4. Introduction to the Theory of Error-Correcting Codes V. Pless, 3rd Ed., Wiley, 1998.

IT 7047 STOCHASTIC SIGNALS AND SYSTEMS

Probability space, sigma fields; probability axioms, conditional probability, random variables; Probability distributions and density functions; independent and conditional random variables; Two or more random variables; functions of random variables expectations, moments; characteristic functions; Correlation; covariance; parameter estimation; multivariate normal variables random sequences and stochastic convergence; Central Limit Theorem; Stochastic processes; Gaussian, exponential, random phase sinusoids in continuous and discrete time; Strict and wide-sense stationary processes; correlation functions and expected values; Linear transformations on random variables; linear system response to stochastic processes; ergodicity; power spectral density.

TEXT & REFERENCE BOOKS:

1. Probability, random variables, and stochastic processes, by A. Papoulis and S. Unnikrishna Pillai. McGraw Hill, New York, 2002
2. Probability and Random Processes with Applications to Signal Processing, by H. Stark & J.W.Woods. Prentice Hall, 2001

IT 7048 SIGNAL PROCESSING FOR WIRELESS SYSTEMS

Wireless Topics: Introduction, Wireless Standards Overview, Reasons behind Convergence of Wireless Services, Stochastic and Signal Processing Review, Representing Band Pass Signals and Subsystems, Receiver Sensitivity Definitions.

Modulation Theory: Modulation Impairments, Modulation Scheme Migration, Modulation Scheme Comparisons.

Wireless Multipath Channel: Additive White Gaussian Noise, Rayleigh Multipath Fading Phenomenon, Rician Multipath Fading Phenomenon, Frequency Selective Fading, Man-Made System Interference, Propagation Path Loss, Shadowing Discussion, Multipath Fading Simulation Models, Multipath Birth / Death Discussion.

Modulation Detection Techniques: Difference between Practice and Theory, Coherent Detection, Noncoherent Detection of DQPSK, Noncoherent Detection of MSK.

Performance Improvement Techniques: Forward Error Correction Codes, Receive Spatial Antenna Diversity Combining Techniques, Transmit Spatial Antenna Diversity Techniques, Link Budget Discussion.

Receiver Digital Signal Processing: Temporal Equalization (EQ), Space-Time Equalization (STE), Frequency Domain Equalization, Symbol Timing Recovery, Channel Quality Estimation (CQE), Automatic Frequency Control, Overall Receiver Block Diagram.

3G Wideband CDMA: Introduction, Rake Receiver Principle, 2G IS-95 CDMA Discussion, Rake Finger Architecture and Performance, PN Code Properties, WCDMA Physical Layer Overview, High Speed Downlink Packet Access (HSDPA) Overview, High Speed Uplink Packet Access (HSUPA), Capacity Improvement in a Multipath Environment.

Computer Simulation Estimation Techniques: Introduction to Simulation, Monte Carlo Method, Modified Monte Carlo or Importance Sampling Method, Improved Importance Sampling Method, Tail Extrapolation Method (TEM), Semi-Analytic Method, General Discussion.

3G and Beyond Discussion: Introduction, Multimedia and Mobile TV Services, Some Sampled 3G Terminal (UE) Statistics, High Speed Packet Access Evolution, MIMO Techniques.

TEXT & REFERENCE BOOKS:

1. Signal Processing for Wireless Communication, by - Joseph Boccuzzi, McGraw Hill.
2. Wireless Communications: Signal Processing Perspectives, by - Vincent Poor, Gregory W. Wornell, Prentice Hall Signal Processing Series

IT 7049 ADVANCED MATHEMATICAL MODELING FOR BIOLOGICAL SYSTEMS

Introduction to Modeling : modeling process, overview of different kinds of models, Qualitative Modeling with Functions, Modeling with Dimensional Analysis, Modeling with Differential Equations: overview of basic concepts concerning matrices, eigenvalues and eigenvectors; fixed points, stability and iterative processes; Modeling with Ordinary Differential Equations: overview of basic concepts in ODE and stability of solutions: existence and uniqueness for 1st order IVPs, Picard iteration, numerical methods, higher order IVPs; linear operators, coupled linear systems, phase plane, stability analysis; some applications: growth of cells, market growth, enzyme reactions, examples in mechanics and electric circuits; Empirical Modeling with Data Fitting: error function, least squares method; fitting data with polynomials and splines; Modeling with Partial Differential Equations: overview of the key properties of some particular kinds of PDEs: advection, diffusion, advection-diffusion; separation of variables, equilibrium solutions, stability and linear stability; travelling waves, spatially periodic solutions (patterns); some applications: stripes on the skin of the Marine Angelfish, analysis of temperature from the Greenland Ice Sheet .

Introduction: Why Model?; discrete time models for population dynamics; Introduction to nonlinear discrete dynamical systems: graphical analysis, fixed points, linear stability analysis, bifurcation, chaotic dynamics, systems of difference equations, Applications of nonlinear difference equations; density-dependent population models; Introduction to continuous time models: logistic equation for single species population dynamics, Some techniques for ordinary differential equations: equilibrium points, stability, linearization; Introduction to continuous dynamical systems: geometric (phase plane) analysis of 2-dim systems, linear systems; Nonlinear systems, periodic solutions; Continuous time models for single species population dynamics: harvesting, metapopulations (patchy environments); Interacting populations: predator and prey models, competition, infectious disease models, Biochemical kinetics; Hodgkin-Huxley model for nerve conduction; Poincaré-Bendixon theory, oscillations in simplified nerve models (FitzHugh-Nagumo equations); Hopf bifurcations; cable

equation; Introduction to partial differential equations and diffusion; Introduction to reaction-diffusion equations, traveling wave solutions; Spatial patterns.

TEXT & REFERENCE BOOKS:

1. A First Course in Mathematical Modeling, by F. R. Giordano, M.D. Weir and W.P. Fox, Brooks/Cole.
2. Mathematical Models in Biology, by Edelstein-Keshet, L. SIAM.

IT 7050 MATHEMATICAL MODELING FOR FINANCE

Introduction to Modeling : modeling process, overview of different kinds of models, Qualitative Modeling with Functions, Modeling with Dimensional Analysis, Modeling with Differential Equations: overview of basic concepts concerning matrices, eigenvalues and eigenvectors; fixed points, stability and iterative processes; Modeling with Ordinary Differential Equations: overview of basic concepts in ODE and stability of solutions: existence and uniqueness for 1st order IVPs, Picard iteration, numerical methods, higher order IVPs; linear operators, coupled linear systems, phase plane, stability analysis; some applications: growth of cells, market growth, enzyme reactions, examples in mechanics and electric circuits; Empirical Modeling with Data Fitting: error function, least squares method; fitting data with polynomials and splines; Modeling with Partial Differential Equations: overview of the key properties of some particular kinds of PDEs: advection, diffusion, advection-diffusion; separation of variables, equilibrium solutions, stability and linear stability; travelling waves, spatially periodic solutions (patterns); some applications: stripes on the skin of the Marine Angelfish, analysis of temperature from the Greenland Ice Sheet .

Introduction to mathematical modeling, Disciplines and their historical development, Models and their applications in economy; Operational research, Definition, Mathematical programming - review of disciplines; Linear programming, Basic terms, Typical linear programming applications and model formulations; Graphical solution of linear programming problem, interpretation of results, Special cases of linear programming models; Special linear programming applications, distribution problems; Methods and software products used for solving linear programming problems; Network models. Basic terminology and typical optimization applications; Shortest path problem, minimal spanning tree, maximal flow problem; Project management; Basic terminology, Critical path method; Inventory models, Basic terminology, Deterministic inventory model - economic order quantity model; Waiting lines models, Basic terminology, Classification of waitng line models (Kendall); Standard single-server exponential model; Principle of computer simulation; Decision theory, Basic terminology, Classification of problems, Multicriteria decision making models, Discrete multicriteria decision making models, Weighted sum method, Econometrics, Basic terminology, Standard linear regression model, Least squares method, Time series, production function.

TEXT & REFERENCE BOOKS:

1. A First Course in Mathematical Modeling, by F. R. Giordano, M.D. Weir and W.P. Fox, Brooks/Cole.
2. Introduction to Operations Research, by Frederick S. Hillier, Gerald J. Lieberman, McGraw Hill.