SCHEME OF EXAMINATION

&

SYLLABI

for

Master of Technology
(Information Technology)
Regular

Guru Gobind Singh Indraprastha University
Kashmere Gate, Delhi – 110403 [INDIA]
www.ipu.ac.in
Eligibility Condition

B. Tech / B.E in Electronics & Communication / Electronics / Computer Science / Information Technology or equivalent degree with 60% marks.

M Sc. in Electronics/Informatics with 60% marks.

Admission Procedure

Admission will be made on the basis of GATE score in the relevant field.

If seats remain vacant after admitting the students with valid GATE score, then the admission will be made on the basis of merit of the qualifying marks subject to minimum 60% marks in the qualifying degree.
SCHEME OF EXAMINATION
M.Tech. - Information Technology

FIRST SEMESTER EXAMINATION

<table>
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<th>Paper</th>
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<th>T/P</th>
<th>Credits</th>
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<td>*ITR-601</td>
<td>Algorithm Analysis &amp; Design</td>
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<td>ITR-603</td>
<td>Software Engineering</td>
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<td>*ITR-609</td>
<td>DSD using VHDL</td>
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<td>*ITR-611</td>
<td>Data Base Management systems</td>
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<tr>
<td>ITR-613</td>
<td>Communication Systems</td>
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<td>*ITR-615</td>
<td>Advanced Computer Graphics</td>
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<td>*ITR-617</td>
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**NOTE:** The subject marked with (*) have been coded uniformly across M. Tech (IT) and M. Tech (CSE). Minor modifications have been done in the course contents and syllabi of these subjects.


## SCHEME OF EXAMINATION

**M.Tech. - Information Technology**

### SECOND SEMESTER EXAMINATION

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<td>Embedded System Design using 8051</td>
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SCHEME OF EXAMINATION
M.Tech. - Information Technology

THIRD SEMESTER EXAMINATION

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SCHEME OF EXAMINATION
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FOURTH SEMESTER EXAMINATION

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<td>ITR-754</td>
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*Non University Exam System

NOTE:

1. The total number of credits of the Programme M. Tech. = 104.
2. Each student shall be required to appear for examination in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits.
ITR-601  Algorithm Analysis & Design  L  T/P  C
4  0  4

Unit 1- Introduction to Algorithm, The role of algorithms in computing, Asymptotic notation, asymptotic analysis of recurrence relations, probabilistic analysis and randomized algorithm, the hiring problem, indicator random variables
Divide and conquer paradigm – Merge sort, Inversion counting
Dynamic Programming – Matrix Chain multiplication, Longest Common subsequence, optimal binary search trees
Greedy Algorithm –Activity Selection problem, Theoretical foundation of greedy algorithm, Task Scheduling problem, Comparison of dynamic programming and Greedy algorithm with Knapsack as case study

Unit 2- Graphs: Review of Graphs (Representation, Depth First Search, Breath First search, Kruskal and Prim Algorithm, Dijkstra’s Algorithm)

Unit 3: Matrix Operation (Properties, Strassen’s Algorithm, Solution of linear equation, Matrix inversion)
Polynomial and FFT, Representation of polynomials, The DFT and FFT, efficient FFT implementation
Number-Theoretic Algorithm, Elementary number-theoretic notion, Greatest common divisor, modular arithmetic, solving modular linear equation, the Chinese remainder theorem

Unit 4 - NP-Completeness, Polynomial time, Polynomial time verification, NP-completeness and reducibility, NP-Completeness proofs
Approximation Algorithms- the vertex-cover problem, The Traveling-Salesman Problem, The set covering problem

Text Books:

Reference Books:
ITR-603  Software Engineering  L  T/P  C
4  0  4

Introduction:
Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models, Overview of Quality Standards like ISO 9001, SEI – CMM.

Software Requirements analysis & specifications:
Requirement engineering, requirement elicitation techniques like FAST, QFD & Use case approach, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirements documentation, Nature of SRS, Characteristics & organization of SRS.

Software Project Planning:

Software Design:
Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design.

Software Metrics:

Software Testing:
Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Regression Testing, Testing Tools & Standards.

Software Reliability:

Software Maintenance:

Test Books:

Reference Books:
Parallel computer models:
The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers.

Program and network properties:
Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

System Interconnect Architectures:
Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors:
Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Pipelining:
Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Memory Hierarchy Design:
Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor architectures:
Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization,

Scalable point – point interfaces:
Alpha364 and HT protocols, high performance signaling layer.

Enterprise Memory subsystem Architecture:
Enterprise RAS Feature set: Machine check, hot add/remove, domain partitioning, memory mirroring/migration, patrol scrubbing, fault tolerant system.
TEXT BOOKS:

REFERENCES:
ITR- 607  Advanced Computer Networks  L  T/P  C  
4  0  4  

Introduction:
Introduction to Network models-ISO-OSI, SNA, Appletalk and TCP/IP models. Review of Physical layer and Data link layers, Review of LAN (IEEE 802.3, 802.5, 802.11b/a/g, FDDI) and WAN (Frame Relay, ATM, ISDN) standards.

Network layer
ARP, RARP, Internet architecture and addressing, internetworking, IPv4, overview of IPv6, ICMP, Routing Protocols- RIP, OSPF, BGP, IP over ATM.

Transport layer
Design issues, Connection management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Finite state machine model.

Application layer
WWW, DNS, e-mail, SNMP, RMON

Network Security: Cryptography, Firewalls, Secure Socket Layer (SSL) and Virtual Private Networks (VPN).

Case study
Study of various network simulators, Network performance analysis using NS2

TEXT BOOKS:

REFERENCES:
Gajski’s ‘Y’ chart, Introduction to HDL languages, VHDL, Verilog, key differences, structural, sequential construct, concurrent construct.

VHDL Overview and concept: VHDL object classes, VHDL Design Unit, identifier, operators, Data types, behavioral, and data flow modeling, Concurrent and sequential statements

VHDL for combinational circuits: Assignment statement, selected signal statement, conditional signal assignment, Designing of basic combinational circuit: Multiplexer, Decoders, Encoders, Code converter, Comparator, Structural modeling: component declaration & instantiation, Signal and Variables, Attributes, Block statements, Generics, Generate statement, VHDL Timing: WAIT statements, simulation engine, modeling with delta time delays,

Sequential Circuits: process, if, case, Loop, Designing FF, Mealy state model, Design of FSM using VHDL, VHDL code of moore-type FSMs, synthesis of VHDL code, Specifying the state assignment in VHDL code, Specification in Mealy FSM using VHDL, Mealy-type FSM for serial adder, Moore type FSM for serial adder, State minimization, Design of Counters using sequential circuit approach, Algorithm state Machine,

Testbenches: Testbench modeling, Testbench architecture, Register Transfer Level Design: RTL Design Method, Organization of system, specification of RTL System, Data Subsystem, Control Subsystem, Microprogrammed controller: structure and format, Microinstruction timing, study of FIR filter Design Example

Textbooks:
1. Circuit Design with VHDL by Volnei A. Pedroni, PHI, 2005

References:
3. VHDL Coding Styles and Methodology by Ben Cohen, Springer India, 2005
ITR-611 Data Base Management Systems L T/P C
4 0 4

**Basic concepts:**
Database & database users, characteristics of the database, database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces. data modelling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems.

**Relational model, languages & systems:**
Relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: date definition in SQL, view and queries in SQL, specifying constraints and indexes in sql, a relational database management systems.

Oracle Architecture, Logical Data Structures Physical Data Structure, Instances, Table Spaces, Types of Tablespaces, Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.

**Relational data base design:**
Function dependencies & normalization for relational databases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

**Concurrency control & recovery techniques:**
Concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures.

Concepts of object oriented database management systems, Distributed Data Base Management Systems.

**Text Books:**

**Reference Books:**
ITR-613 Communication Systems

L T/P C
4 0 4

Analog Modulation Methods:

Pulse Analog Modulation:
Sampling theorem, Sampling of Low Pass and Band pass signals, Aliasing, Aperture effect, PAM, PWM and PPM generation and demodulation, TDM.

Pulse Digital Modulation:
Pulse code modulation signal to quantization noise ratio, companding, DPCM, Prediction Filter, DM and ADM modulators and demodulators, Data Modem, Data encoding methods, ASK, FSK, PSK, QAM, M-ary systems, line coding, Inter symbol Interference, Multiplexing methods: time division multiplexing (TDM), STDM, CDMA, FDM.

Introduction to Information Theory:
Discrete messages, The concept of amount of information, Entropy, Information rate, mutual information, Shannon’s source coding Theorem, Huffman code, Lempel –ziv code, channel coding and channel capacity theorem. Coding to increase average information per bit, Shannon’s theorem, Capacity of a Gaussian channel, Bandwidth – S/N tradeoff, use of orthogonal signals to attain Shannon’s limit.

Text Books:

Reference Books:
Advanced Computer Graphics

**Line Drawing and transformation:**
Basic raster graphical algorithm for 2D primitives, Line drawing algorithm, 2D and 3D transformation

**Clipping:**
Window, Viewport, Clipping algorithm,

**Curves and Surfaces:**
Circle drawing algorithm, Ellipse drawing algorithm, Bezier curve, b-spline curve, surfaces, Solid modelling

**Projection:**
Parallel projection, Perspective projection, Computation of vanishing point

**Visible surface determination:**
Z-buffer algorithm, Scan line algorithm, Area subdivision algorithm, Raytracing algorithm

**Shading:**
Illumination mode, Specular reflection model, Shading models for curve surfaces, Radiosity method, Rendering, Recursive ray tracing, Texture mapping

Advanced Modelling Techniques
Procedural Models, Fractal Models, Grammar based models, particle systems.

Animation
3D animation, morphing, simulation of key frames

**Text Books:**

**References:**
ITR-617  Programming Languages     L  T/P  C
4   0  4


Functional programming languages - Lambda calculus- Introduction to pure LISP. Applications of functional programming languages.

Logic programming languages- a brief introduction to predicate calculus - Horn clauses - Logic programming. Introduction to prolog. Applications of Logic programming.

Text Books:

References:
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ITR 602  Object Oriented Software Engineering  L  T/P  C
4  0  4

Introduction to Software Engineering:

Object Methodology & Requirement Elicitation:
Introduction to Object Oriented Methodology, Overview of Requirements Elicitation, Requirements Model-Action & Use cases, Requirements Elicitation Activities, Managing Requirements Elicitation

Architecture:
Model Architecture, Requirements Model, Analysis Model, Design Model, Implementation Model, Test Model

Modeling with UML:
Basic Building Blocks of UML, A Conceptual Model of UML, Basic Structural Modeling, UML Diagrams

System Analysis:
Analysis Model, Dynamic Modelling & Testing

System Design:
Design concepts & activities, Design models, Block design, Testing

Testing Object Oriented Systems:
Introduction, Testing Activities & Techniques, The Testing Process, Managing Testing, State Based testing and Data flow testing for Classes.
Component Based Computing
Fundamentals: Definition and nature of components, components and interfaces, Interfaces as contracts, the benefits of components.
Basic Techniques: component design and assembly, Relationship with the client-server model and with patterns, Use of objects and object lifecycle services, use of object brokers

Case Studies

Text Books:
1. Ivar Jacobson “Object Oriented Software Engineering: A Use Case Driven Approach”, Addison-Wesley, 2002
2. Grady Booch “Object-Oriented Analysis and Design with Applications”, 2/E, Addison-Wesley Professional, 2005

References:
Introduction to Embedded Realtime Systems: Fundamental components of ESD, Preprocessing, Compiling, cross compiling, Linking, Locating, compiler driver, Linker script, Program segments, Type of memory, Memory Management in Embedded realtime systems, Interrupt and ISR

Introduction to Real-time theory: Scheduling theory, Rate Monotonic Scheduling, Utilization bound theorem, RTOS, Task Management, Task management, Race condition, Priority inversion, ISRs and scheduling, Inter-Task communication, Timers

Microcontrollers: Role of processor selection in Embedded System (microprocessor vs microcontroller), 8051 microcontroller: architecture, assembly language programming, instruction set, addressing mode, logical operation, arithmetic operation, interrupt handling, Timing subroutines

Serial data communication, RS-232, USB, \( ^2 \)C, Interfacing with ADC & sensors, Interfacing with DAC, Interfacing with external ROM, Interfacing with 8255 IEEE 1149.1 (JTAG) testability: Boundary Scan Architecture

**Textbook:**

**References:**
1. Embedded System by Raj Kamal, TMH, 2004
3. Microcontrollers by Deshmukh, TMH, 2006
4. 8051 Microcontroller & Embedded systems by Rajiv Kapadia, Jaico, 2006
5. Computer as components by wayne wolf, Harcourt India Pvt. Ltd, 2002
6. Real time System and Analysis by Philip A. Laplante, Wiley, 2006
8. An Embedded Software Primer by David E. Simon, Pearson Education, 2005
9. Designing Embedded Hardware by John Catsoulis, O’reily 2005
10. Real time System & Software by Alan c. Shaw, Wiley, 2005
11. Programming Embedded System by Michael Barr, O’reilly, 2005
12. Networking and Internetworking with microcontrollers by Fred Eady, elsevier, 2005
Introduction to Personal Communication Services (PCS): PCS architecture, Mobility management, Networks signaling.

Global system for Mobile Communication (GSM) system overview: GSM Architecture, Mobility Management, Network signaling.


Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.


Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

Wireless local Loop (WLL): Introduction to WLL architecture, WLL technologies.

Global Mobile Satellite Systems: Case studies of IRIDIUM and GLOBALSTAR systems.

Bluetooth technology and Wi-Max

Text Books:

References:
ITR-608 VLSI Design

Introduction to Transistor Theory: BJT, FET, CMOS

Logic Design with MOSFETs: MOSFET as switches, Complex Logic gates in CMOS, Transmission Gate Circuits, Clocking and Dataflow control. Physical Structure of CMOS Integrated circuits, Fabrication Structure of CMOS Integrated Circuits, Elements of Physical Design: Layout of basic structures, Cell concepts, FET sizing and the unit transistor, Physical design of Logic gates.

Electrical Characteristics of MOSFETs: FET RC Model, Modeling of Small MOSFETs, Electronic analysis of CMOS Logic gates: DC characteristics of the CMOS inverter, inverter switching characteristics, power dissipation, dc characteristics: AND and NOR gates, NAND and NOR transient response, Analysis of Complex Logic gates, gate design for transient performance, transmission gates and pass transistors, gate delays, driving large capacitive loads

System-level physical design: Large scale physical design, Interconnect delay modeling, crosstalk, interconnect scaling, Floorplanning and Routing, Input and Output Circuits, Power distribution and consumption.

VLSI Clocking and System Design: Clocked Flip-flops, CMOS clocking styles, pipelined systems, clock generation and distribution and distribution.

TEXT BOOKS:

REFERENCES:
3. Wayne Wolf, “Modern VLSI Design: system on silicon”, Addison Wesley Longman Publisher
ITR-610  Digital Signal Processing

L  T/P  C
4  0  4

Introduction
Signals and signal Processing, characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signals Processing applications.

Time Domain Representation of Signals & Systems

Transforms
Z-transforms, Inverse Z-transform, properties of Z-transform, & its applications in system analysis & design. Discrete Fourier Transform (DFT) & its properties, computation of the DFT of real sequences, Linear Convolution using the DFT.

Digital Filter Structure

Digital Filter Design

Computation of Discrete Fourier Transform
Complexity of the DFT computation by direct method, Goertzel algorithm, Decimation – in-time FFT algorithms, Decimation-in frequency FFT algorithms.

Text Books:

References:
ITR-612 Real time Systems & Software L T/P C
4 0 4

Real time system: Hard vs Soft, Reference model of RTS, Periodic task model, Resource parameters of Jobs

Scheduling: clock driven, weighted RR approach, Priority approach, Dynamic vs static, EDF and LST algorithm, Clock Driven scheduling in detail

Priority driven scheduling of periodic task in detail: RM and DM algorithm, Scheduling aperiodic and sporadic jobs in priority driven systems in detail

Resource and resource Access Control, Multiprocessor scheduling, Resource access control and synchronization, Real Time Communication, OS

Text Book:

References:
ITR-614 Advanced Database Management Systems L T/P C
4 0 4

Relational Databases
Integrity Constraints revisited, Extended ER diagram, Relational Algebra & Calculus, Functional, Multivalued and Join Dependency, Normal Forms, Rules about functional dependencies.

Query Processing and Optimization
Valuation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information.

Deductive Databases
Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation.

Objected Oriented and Object Relational Databases
Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

Parallel and Distributed Databases
Distributed Data Storage – Fragmentation & Replication, Location and Fragment Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

Advanced Transaction Processing

Active Database and Real Time Databases
Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery

Image and Multimedia Databases
Modeling and Storage of Image and Multimedia Data, Data Structures – R-tree, k-d tree, Quad trees, Content Based Retrieval: Color Histograms, Textures, etc., Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio & Handwritten Data, Geographic Information Systems (GIS)

WEB Database
Accessing Databases through WEB, WEB Servers, XML Databases, Commercial Systems.

Data Mining
Knowledge Representation Using Rules, Association and Classification Rules, Sequential Patterns, Algorithms for Rule Discovery

Data Warehousing
Data Warehousing Architecture, Multidimensional Data Model, Update Propagation OLAP Queries.

Case Study: Oracle Xi

Text Books:

References:
ITR-616 Software Metrics

L T/P C
4 0 4

Introduction:
What is measurement and why do it? Measurement in software engineering, scope of software metrics.

The Basics of Measurement:
Representational theory, Measurement & Models, Measurement Scales and Scale Types, Meaningfulness in Measurement

A Goal Framework for Software Measurement:
Classifying software measures, Determining what to measure, Applying the framework

Empirical Investigation & Data Collection:
Four Principles of Investigation, Planning formal experiments, What is good data, How to define the data, How to collect data, When to collect data.

Analyzing Software Measurement Data:
Analyzing the results of experiments, Analysis Techniques, Overview of statistical tests.

Measuring Internal Product Attributes, Size and Structure:
Aspects of Software Size, Length, Reuse, Functionality, Complexity, Types of Structural Measures, Modularity and information flow attributes, Object Oriented Metrics

Measuring External Product Attributes:
Modeling Software Quality, Measuring aspects of quality

Measurement and Management:
Planning a measurement program, Measurement in practice, empirical research in software engineering.

Text Book:
ITR - 618  Software Requirement & Estimation  L  T/P  C
4  0  4

Introduction to software life cycle, management activities in a software project

Requirements engineering: Requirements Elicitation, Requirement Elicitation techniques, Requirement Analysis, Requirement Analysis Models, Requirement Documentation, Requirement Management

Size Estimation: Function Point Analysis, Mask II FPA, LOC estimation, Conversion between size measures


Tools: Software Estimation Tools

Industry Resources; IFPUG, UQAM-SEMRL, COSMIC, IEEE, COCOMO

Reference Book:
ITR-620  Neural Network  

Biological analogy, Architecture classification, Neural Models, Learning Paradigm and Rule, single unit mapping and the perception.

Feed forward networks – Review of optimization methods, back propagation, variation on Backpropagation, FFANN mapping capability, properties of FFANN’s Generalization.

PCA, SOM, LVQ, Adaptive Resonance Networks.

Hopfield Networks, Associative Memories, RBF Networks.

Applications of Artificial Neural Networks: Regression, applications to function approximation, Classification, Blind Source Separation.

Text Book:

References:
ITR–622 Network Programming


Processes and Inter-Process Communication: timers, polling vs interrupts, environment, fork, exec, wait, environment, exit and wait, pipe, fifos, message queues, semaphore

Network Programming: Sockets, Operation, Socket types, Domains Name Binding, Closing Sockets, I/O Multiplexing, Client/Server Models, Connection Based Services, Handling Out of Band Data, Connectionless Services, Design issues of Concurrent and iterative servers, Socket options

XDR and Remote Procedure Calls, Network Programming at the level of Programming Language (can use Java or Python as case study)

Text Book:

References:
1. Internetworking with TCP/IP, Volume3, Douglas Comer, Prentice Hall, 2000
2. Internetworking with TCP/IP, Volume1, Douglas Comer, Prentice Hall, 2000
ITR-624  Fuzzy Logic & Design  L  T/P  C
4  0  4

Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, \( \alpha \)-cuts, Properties of \( \alpha \)-cuts, Decomposition Theorems, Extension Principle.


Applications of Fuzzy Logic:

Text Book:

Reference Books:
Introduction
A brief history of evolutionary computation, Elements of Genetic Algorithms, A simple genetic algorithm, Applications of genetic algorithms

Genetic Algorithms in Scientific models
Evolving computer programs, data analysis & prediction, evolving neural networks, Modeling interaction between learning & evolution, modeling sexual selection, measuring evolutionary activity.

Theoretical Foundation of genetic algorithm
Schemas & Two-Armed and k-armed problem, royal roads, exact mathematical models of simple genetic algorithms, Statistical- Mechanics Approaches.

Computer Implementation of Genetic Algorithm
Data structures, Reproduction, crossover & mutation, mapping objective functions to fitness form, fitness scaling, coding, a multiparameter, mapped, fixed point coding, discretization and constraints.

Some applications of genetic algorithms
The risk of genetic algorithms, De Jong & function optimization, Improvement in basic techniques, current application of genetic algorithms

Advanced operators & techniques in genetic search
Dominance, duplicity, & abeyance, inversion & other reordering operators. Other micro operators, Niche & speciation, multiobjective optimization, knowledge based techniques, genetic algorithms & parallel processors.

Text Book:

Reference Books:
Information, channel capacity, The concept of amount of information, entropy, Information rate, Conditional and joint entropies.

**Source coding:** Noise less coding, Shannon’s first fundamental theorem, Discrete memory less channel, Mutual information, Sources with finite memory, Markov sources, Shannon’s second fundamental theorem on coding, Huffman coding, Lempel – Ziv algorithm, Shannon-Fano algorithm.

**Channel coding:** Error detecting codes, Hamming distance, Error correcting codes, Repetition codes, Linear block codes, binary cyclic codes, BCH codes, Reed-Soleman codes, Golay codes.

**Convolution Coding:** Code tree, state diagram, Trellis diagram, Maximum-Likelihood decoding – Viterbi’s algorithm, sequential decoding.

Network information theory, introduction to Cryptography

**Text Books:**
Syllabus of M.Tech. (IT), approved by BoS of USIT on 12th January, 09 and 26th Academic Council Meeting on 19th January, 09 w.e.f. Academic Session 2009-2010

ITR - 630  Enterprise Computing in JAVA  L  T/P  C
  4  0  4

J2EE: Introduction to J2EE, Building J2EE Applications, JDBC, Servlets and Web Applications, Java Server Pages and Model/View/Controller, J2EE Web Services Overview, Introduction to EJB, Session EJBs, Entity EJBs, JMS and message driven Beans, Transactions and Security, Application Servers (Case Study of any one of IBM Websphere, BEA Weblogic, JBoss)


Web Services: Introduction to XML, Service-Oriented Architectures SOAP, SOAP message structure, handling errors WSDL, UDDI, Java Web Service implementations JAX-RPC, Web service clients in Java, Introduction to Ajax.

Text Books:

Reference Books:
4. James Cooper, “Java Design Patterns: A Tutorial”, Addison Wesley
ITR - 632  Project Work  L  T/P  C  4  0  4

The student will submit a synopsis at the beginning of the semester for the approval to the school project committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the school for evaluation purpose at the end of the semester in a specified format.
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ITR – 701 Multimedia Technology
L T/P C
4 0 4

Introduction:
Concept of Multimedia, Media & data stream, main properties of multimedia system,
Data stream characteristics & for continuous media Multimedia Applications, Hardware
Software requirements, Storage Technologies: RAID, Optical Media.

Components of multimedia and file formats:
Text, Basic sound concepts, MIDI, Speech, Basic concept of Images, Graphics format,
Basic concepts of Video & animation, Conventional system, Computer based animation,
Authoring Tools, Categories of Authoring Tools.

Compression Techniques
Lossless and Lossy compression, Run length coding, Statistical Coding, Transform
Coding, JPEG, MPEG, Text compression using static Huffman technique, Dynamic
Huffman Technique, Arithmetic Technique.

Animation:
Introduction, Basic Terminology techniques, tweaning & morphing, Motion Graphics 2D
& 3D animation.

Introduction to MAYA (Animating Tool):
Fundamentals, Modeling: NURBS, Polygon, Organic,
Animation: Key frame animation, reactive animation, path animation, Skeleton
animation etc., deformers..
Dynamics: soft bodies, Rigid bodies and its usages in the scene etc.,
Rendering: soft, Hard rendering, IPR rendering, Line and box rendering etc.,
Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.
Working with MEL: Basics & Programming

Text Book:

Reference Books:
3. Maya manuals.


Reliability Prediction: Introduction, Purpose, Classification, Information Sources for Failure Rate Data, General Requirements, Prediction Methodologies, Software Prediction Packages, Role and Limitation of Reliability Prediction.

Reliability Allocation: Introduction, Subsystems Reliability Improvement, Apportionment for New Units, Criticality.


Maintainability and Availability: Introduction, Forms of Maintenance, Measures of Maintainability and Availability, Maintainability Function, Availability Function, Two Unit Parallel System with Repair, Preventive Maintenance, Provisioning of Spares.


Text Book:

Reference Books:
Introduction: Software Reuse success factors

Architecture Style: Object-oriented software engineering, application & component systems, use case components, object components, layered architecture.

Reuse processes: Object oriented business engineering, applying business engineering to define processes & organization, application family engineering, component system engineering, application system engineering

Organizing a reuse business: Its transaction, Management, working

Component based software development: component definition, component metamodel, component engineering vs application engineering

Component based and Model driven development using UML: Component specification, context realization, component realization

Text Books:

Reference Books:
Introduction

Secure Networking Threats

Encryption Techniques

Designing Secure Networks

Network Security Platform Options

IPsec VPN Design Considerations

Secure Network Management and Network Security Management

Text Books:

Reference Books:
**ITR – 709 Subject: Software Quality Management**

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Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits.

Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations.


Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency.

Corrective Action as to Cause: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the Correcting the corrective Action, Periodic Review of Actions Taken.


**Text Books:**

**Reference Books:**
Introduction to design patterns, introduction to java, review of Object Oriented design principles including UML, observer pattern and applying observer, template pattern and refactoring to template method, factory patterns, factory method and abstract factory, iterator pattern.

Facade pattern, refactoring to façade, utilities, and demos, state and strategy patterns, modeling states, refactoring to state, making states constant, refactoring to strategy, comparing strategy and state. Comparing strategy and template method, singleton pattern and the composite pattern: singleton mechanics singletons and threads, recognizing singleton an ordinary composite, recursive behavior in composites.

Command pattern, using command to supply a service, command in relation to other patterns, adapter pattern, adapting in the presence of foresight class and object adapters, Unforeseen adaptation, recognizing adapter, proxy pattern, rmi, dynamic proxies in java, the chain of responsibility pattern, varieties of lookup, refactoring to chain of responsibility, anchoring a chain, chain of responsibility without composite.

Decorator pattern: function decorators, decorating without decorator, bridge pattern, refactoring to bridge, bridge using the list interface, visitor pattern supporting visitor, extending with visitor, visitor cycles, visitor controversy, java idl, jini concurrency patterns.

Text Books:
1. Erich Gamma, “Design Patterns - Elements Of Reusable Object-Oriented Software” Addison-Wesley, 2007
**ITR-713  Software Testing**  

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**Introduction:** What is software testing and why it is so hard?, Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing, No absolute proof of correctness, Overview of Graph Theory.

**Functional Testing:** Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

**Structural Testing:** Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

**Reducing the number of test cases:** Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing


**Object Oriented Testing:** Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing.


**Text Books:**

**Reference Books:**
Matrix algebra, Inversion of Matrices, Rotational groups, matrix representation of coordinate transformation.

Manipulator kinematics: kinematics: Introduction, solvability, algebraic solution by reduction to polynomial, standard frames, repeatability and accuracy, computational considerations.

Manipulator dynamics: introduction, acceleration of rigid body, mass distribution, Newton’s equation, Euler’s equation, Iterative Newton-Euler dynamic formulation, closed dynamic equation, Lagrangian formulation of manipulator dynamics, dynamic simulation, computational consideration.

Trajectory Generation: Introduction, general considerations in path description and generation, joint space schemes, Cartesian space schemes, Path generation in runtime, Planning path using dynamic model.

Linear control of manipulators: Introduction, feedback and closed loop control, second order linear systems, control of second-order systems, Trajectory following control, modeling and control of a single joint.

Robot Programming languages & systems: Introduction, the three level of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

Off-line programming systems: Introduction, central issues in OLP system, cimstation, automating subtasks in OLP systems.

Text Books:

Speech Digitization and transmission: Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, NRZ and RZ Codes, Manchester Coding, Walsh Codes, TDM.


Control of switching systems: call processing functions, common control, stored program control.


**Text Book:**

**Reference Book:**
1. T.Viswanathan, “Telecommunication switching systems and networks” PHI, India, 17th Indian reprint 2003,
Objective: The objective of the course is to introduce basic architecture of mobile and cellular services starting from 1G through to 2G(GSM). The prerequisites are Data communication, Antennas and wave propagation.

Unit I
Introduction to Cellular Mobile Systems
A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, overview of generations of cellular systems.
Elements of Cellular Radio Systems Design and interference
General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems. Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects,

Unit II
Cell Coverage for Signal & antenna structures
General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model-characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation. Characteristics of basic antenna structures, antenna at cell site, mobile antennas.

Frequency Management & Channel Assignment, Hand Off & Dropped Calls
Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment. Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

Unit III
Modulation methods and coding for error detection and correction
Introduction to Digital modulation techniques, modulation methods in cellular wireless systems, OFDM. Block coding, convolution coding and Turbo coding. Multiple access techniques: FDMA, TDMA, CDMA; Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, probability of bit error considerations, CDMA compared with TDMA.

Unit IV
Second generation, digital, wireless systems
GSM, IS_136 (D-AMPS), IS-95, mobile management, voice signal processing and coding.

Text Books:

Reference Books
ITR – 721 Satellite Communication

L T/P C
4 0 4

Introduction:
Origin and brief history of satellite communications, An overview of satellite system engineering, satellite frequency bands for communication.

Orbital theory:
Orbital mechanics, locating the satellite in the orbit w.r.t. earth look angle determination. Azimuth & elevation calculations.

Spacecraft systems:
Attitude and orbit control system, telemetry, tracking and command (TT&C), communications subsystems, transponders, spacecraft antennas.

Satellite link design:
Basic transmission theory, noise figure and noise temperature, C/N ratio, satellite down link design, satellite uplink design.

Modulation, Multiplexing, Multiple access Techniques:
Analog telephone transmission, Fm theory, FM Detector theory, analog TV transmission, S/N ratio Calculation for satellite TV linking, Digital transmission, baseband and bandpass transmission of digital data, BPSK, QPSK, FDM, TDM, Access techniques: FDMA, TDMA, CDMA.

Encoding & FEC for Digital satellite links:
Channel capacity, error detection coding, linear block, binary cyclic codes, convolution codes.

Satellite Systems:
Satellite Earth station Technology, satellite mobile communication, VSAT technology, Direct Broadcast by satellite (DBS).

Reference Books:
ITR-723  Distributed Computing

Fundamentals of Distributed Computing:
Architectural models for distributed and mobile computing systems. Basic concepts in
distributed computing such as clocks, message ordering, consistent global states, and
consensus.

Basic Algorithms in Message:
Passing Systems, Leader Election in Rings, and Mutual Exclusion in Shared Memory,
Fault-Tolerant Consensus, Causality and Time. Message Passing: PVM and MPI.

Distributed Operating Systems:
OS and network operating systems, Distributed File systems. Middleware, client/server
model for computing, common layer application protocols (RPC, RMI, streams),
distributed processes, network naming, distributed synchronization and distributed
object-based systems.

Simulation:
A Formal Model for Simulations, Broadcast and Multicast, Distributed Shared Memory,
Fault-Tolerant Simulations of Read/Write Objects Simulating Synchrony, Improving the
Fault Tolerance of Algorithms, Fault-Tolerant Clock Synchronization.

Distributed Environments:
Current systems and developments (DCE, CORBA, JAVA).

Advanced Topics:
Randomization, Wait-Free Simulations of Arbitrary Objects, Problems Solvable in
Asynchronous Systems, Solving Consensus in Eventually Stable Systems, High
Performance Computing-HPF, Distributed and mobile multimedia systems. Adaptability
Systems.

Parallel Processing:
Basic Concepts: Introduction to parallel processing, parallel processing terminology,
Parallel & Distributed Programming: Parallel Programming environments

Text Books:
1. Tannenbaum, A, Van Steen. Distributed Systems, Principles and Paradigm, Prentice Hall India,
   2002
2. Tannenbaum, A. Distributed Operating Systems, Pearson Education. 2006

Reference Books:
1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, “Introduction to parallel
2. Cameron Hughes, Tracey Hughes, “Parallel and distributed programming using C++”, Pearson
   Education, 2005

ITR – 725  Pattern Recognition

Syllabus of M.Tech. (IT), approved by BoS of USIT on 12th January, 09 and 26th Academic Council Meeting on 19th January, 09
w.e.f. Academic Session 2009-2010
Introduction and Bayesian Decision Theory
Introduction to pattern recognition, Systems, design cycles, learning and adoption, Bayesian decision theory, minimum error-rate classification, classifiers, discriminant functions and decisions surfaces.

Maximum – Likelihood and bayesian parameter estimation

Maximum – Likelihood estimation, bayesian estimation, bayesian parameter estimation, Guarian case and general theory, problems of dimeusability, Hidden marker models.

Nonparameter Techniques

Linear Discriminant functions:
Linear discriminant functions and decision surfaces, generadized linear discriminant functions, The two category uncorly separate case, minimizing the perception criterion function, relaxation procedures, nonrepersable behaviour, Minimum squared-error procedures, The Ho – Kashyap Procedures, support vexter machines, multcategory generatization.

Unit V: Multilayer Neural Networks
Feed forward operations and classifications, back propagation algorithm, error factors, back propagation as feature & mapping, back propagation, bayer theory and probability, practical techniques for improving back propagation, regularizarion, complexity adjustment and pruning.

Unit VI: Stochastic methods: Stochastic search, Boltzman learning, boltzman networks of graphical models, evolutionary methods, genetic progrances.

Unit VII: Unsuperversed learning and clustering mixture densities and identificability, maximum, likelihood estimation, application to normal mixtures, unemerouses, Bayesian Learning, Data descriptions and controls, criterion function for clusterian, interface, optimization, hierarchical clustering, component analysis, low dimensial representation and multidimensional scaling.

Text Books:
Introduction And Digital Image Fundamentals

Image Enhancement in the Spatial Domain
Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Image Enhancement in the Frequency Domain
Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering.

Image Restoration

Image Compression

Image Segmentation
Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Representation and Description
Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.

Object Recognition
Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

Text Books:

Reference Books:
ITR – 729  Information Storage & Management  L  T/P  C
4  0  4

Complexity of Information Management: Proliferation of Data, Data Center Evolution, Managing Complexity, I/O and the five pillars of technology, Storage Infrastructure, Evolution of Storage


Introduction to Networked Storage: Storage Networking Overview, Direct Attached Storage, Storage Area Networks, Case study – Applying SAN concepts, Network Attached Storage, Case study – Applying NAS concepts, IP SAN, CAS, Hybrid Network Storage Based Solutions/ Emerging Technologies, Case study – Applying SAN, NAS, IP SAN concepts

Introduction to Information Availability: Business Continuity Overview, Data Availability, Business Continuity – Local, Case study – Applying local information availability strategies, Business Continuity – Remote, Case study – Applying remote information availability strategies, Disaster Recovery

Managing and Monitoring: Monitoring in the Data Center, Case study – Monitoring exercise, Management in the Data Center, Case study – Managing exercise

Case Studies must be supported by laboratory

Text Book:
Introduction to wireless technologies: WAP services, Serial and Parallel Communication, Asynchronous and synchronous Communication, FDM, TDM, TFM, Spread spectrum technology

Introduction to Bluetooth: Specification, Core protocols, Cable replacement protocol

Bluetooth Radio: Type of Antenna, Antenna Parameters, Frequency hoping

Bluetooth Networking: Wireless networking, wireless network types, devices roles and states, adhoc network, scatternet

Connection establishment procedure, notable aspects of connection establishment, Mode of connection, Bluetooth security, Security architecture, Security level of services, Profile and usage model: Generic access profile (GAP), SDA, Serial port profile, Secondary bluetooth profile


Programming with Java: Java Programming, J2ME architecture, javax.bluetooth package Interface, classes, exceptions, javax.obex Package: interfaces, classes

Bluetooth services registration and search application, bluetooth client and server application.
Overview of IrDA, HomeRF, Wireless LANs, JINI

**Text Books:**

**Reference Book:**
Subject: Cyber Crime Investigations and Cyber Forensics


Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations)

Unit 2: Live Data collection and investigating windows environment: windows Registry analysis, Gathering Tools to create a response toolkit (Built in tools like netstat, cmd.exe, nbtstat, arp, md5sum, regdmp etc and tools available as freeware like Fport, Pslist etc), Obtaining volatile Data (tools like coffee, Helix can be used)

Computer forensics in windows environment, Log analysis and event viewer, File auditing, identifying rogue machines, hidden files and unauthorized access points

Unit 3: Live Data collection and investigating Unix/Linux environment: /Proc file system overview, Gathering Tools to create a response toolkit (Built in tools like losetup, Vnode, netstat, df, md5sum, strace etc and tools available as freeware like Encase, Carbonite etc)

Handling Investigations in Unix/Linux Environment: Log Analysis (Network, host, user logging details), Recording incident time/date stamps, Identifying rogue processes, unauthorized access points, unauthorized user/group accounts

Unit 4: Forensic tools and report generation: Recovery of Deleted files in windows and Unix, Analyzing network traffic, sniffers, Ethical Hacking, Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), Mobile forensic tools and analysis of called data record

Template for computer forensic reports

Text Books:


References:

2. Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Harlan Carvey, syngress Publication
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ITR-751</td>
<td>Lab based on Elective – I</td>
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<td>ITR – 757</td>
<td>Minor Project</td>
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The student will submit a synopsis at the beginning of the semester for approval to the project committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the project committee for evaluation purpose at the end of the semester in a specified format.
ITR – 752  Dissertation  

L  T/P  C  
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The student will submit a synopsis at the beginning of the semester for the approval from the project committee in a specified format. Synopsis must be submitted within two weeks. The first defense, for the dissertation work, should be held with in two months time. Dissertation Report must be submitted in a specified format to the project committee for evaluation purpose at the end of semester.

ITR – 754  Seminar & Progress Report  

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Seminar is required to be given by the student on the topic of the dissertation. Progress of the dissertation will be evaluated based on the seminar given by the student during the semester. Evaluation will be done two times during the semester. Marks will be given based on the performance of the student during the seminar.