## Punjab Technical University, Jalandhar
### Study Scheme
**M.Tech (Information Technology)**

<table>
<thead>
<tr>
<th>Schedule of Teaching</th>
<th>Schedule of Examination</th>
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<tr>
<td>Lecture</td>
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<tr>
<td>All theory Subjects</td>
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<tr>
<td>Projects</td>
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<tr>
<td>Seminar</td>
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<td>Dissertation</td>
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### SEMESTER-I

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CS-501</td>
<td>Advance Software Engineering</td>
<td>3</td>
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<tr>
<td>CS-503</td>
<td>Network Security</td>
<td>3</td>
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<td>CS-505</td>
<td>Advanced Computer Architecture</td>
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<tr>
<td>CS-507</td>
<td>Advanced Database Management System</td>
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<td>CS-509</td>
<td>Advanced Programming Language</td>
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<td>CS-511</td>
<td>Advanced Software Engineering Lab</td>
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<tr>
<td>CS-513</td>
<td>Advanced Database Management System Lab</td>
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### SEMESTER-II

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<tr>
<td>IT-502</td>
<td>Advanced Internet Technology</td>
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<td>IT-504</td>
<td>Multimedia Systems</td>
<td>3</td>
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<tr>
<td>IT-506</td>
<td>Research Methodologies</td>
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<td>IT-508</td>
<td>Software Project Management</td>
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<tr>
<td>IT-510</td>
<td>Data Warehousing &amp; Datamining</td>
<td>3</td>
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<td>IT-512</td>
<td>Advanced Internet Technology Lab</td>
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### SEMESTER-III

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<tr>
<td>IT-515</td>
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<tr>
<td>IT-517</td>
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### SEMESTER-IV

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<td>IT-514</td>
<td>Dissertation</td>
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ELECTIVE-I, II *

IT-519    Distributed Systems
IT-521    Object Oriented Analysis And Design Using UML
CS-515    Optimization Techniques
CS-517    Parallel Computing
CS-521    VLSI Design
CS-508    Natural Language Processing
CS-510    Artificial Intelligence
CS-516    Embedded System
CS-518    Neural Networks and Fuzzy Logics
CS-520    Quantitative Techniques
CS-522    Robotics
CS-524    Object Oriented Programming With Visual Basics. NET
CS-526    Business Information System

* The student will have to opt any two subjects from the above list of electives.
CS-501  Advance Software Engineering

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Fundamental issues in software design: Goodness of design, cohesions, coupling. Function-oriented design: structured analysis and design. Overview of object –oriented concepts.


Unit testing. Black box and white box testing. Integration and system testing. Software quality and reliability.

SEI CMM and ISO 9001. PSP and Six Sigma. Clean room technique.

Software maintenance issues and techniques. Software reuse. Client-Server software development.

Reference:

Introduction:
Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, etc.

MAC protocols for high-speed LANS, MANS and wireless LANs. (For Example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.)

Fast access technologies (For Example, ADSL, Cable Modem, etc.)


IP Multicasting, Multicast routing protocols, address assignments, session discovery, etc.

TCP extension for high-speed networks, transaction-oriented applications. Other new options in TCP.

Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, key distribution protocols., Digital signatures, digital certificates.

References:
1. Computational model
2. The concept of Computer Architecture
3. Introduction to Parallel Processing
4. Introduction to ILP Processors
5. Pipelined Processors
6. VLIW Architecture
7. Super Scalar Processors
8. Processing of Control transfer instruction
9. Code Scheduling for ILP-processors
10. Introduction to Data Parallel Architecture, SIMD Architecture, MIMD Architecture
12. Multi threaded Architecture
13. Distributed Memory MIMD Architecture

Reference:

2. Computer Architecture by Stone
CS-507 Advance Database Management Systems

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Introduction of DBMS, Types of DBMS and their advantages and disadvantages
Introduction of RDBMS, Types of relational query language, Normalization, Query optimization
Database protection in RDBMS – Integrity, Concurrency control, Recovery
Distributed Databases :- concepts, structure, trade-offs
  Methods of data distribution – fragmentation, replication, design & advance concepts of DDBMS
Introduction to object oriented databases , Deductive databases
Data warehousing Concepts: Architecture, Dataflows, Tools & Technologies, Data Marts
Data Mining & Online Analytical Processing
Spatial & Multimedia databases
Mobile Computing & Mobile Databases

Textbooks:-
3) Thomas Conolly, Carolyn Begg, "Database Systems", Pearson Education.
4) Alexis Lcon, Mathews Leon, "Database Management Systems".
5) C.J.Date, "An Introduction to DBMS", Narosa Publishing House.
Introduction: Brief history of Programming Language, Characteristics of programming language.

Programming Language Processors: The structure and operation of a computer, Hardware and firmware computers, Translator and simulator computers, Syntax, semantics and virtual computers, hierarchies of computers, binding and binding time

Elementary Data Types: Data object, variable and constants, data types, specification of elementary data types, declarations, type checking and type conversion, assignment and initialization, numeric data types, enumerations, Boolean, characters

Structured Data Types: Structured data object and data types, specification of data structure types, implementation of data structure types, declarations and type checking for data structures, vector and arrays, record, character strings, variable sized data structures, pointers and programmer-constructed data objects, sets, file and input/output

Subprogram And Programmer-Defined Data Types: Evolution of the data type concept, Abstraction, encapsulation, and information hiding, subprogram, type definitions, abstract data types

Sequence Control: Implicit and explicit sequence control, sequence control within expression, sequence control between statements, subprogram sequence control, recursive subprogram, exceptions and exception handlers, Co-routines, scheduled subprograms, tasks and concurrent execution, data structures and sequence control.

Data Control: names and referencing environments, static and dynamic scope, block structure, local data and local referencing environments, shared data, task and shared data.

Storage Management: Major Runtime elements requiring storage, programmer and system controlled storage management, storage management phases, static storage management, stack based storage management, heap storage management

Syntax And Translation: General syntactic criteria, syntactic elements of language, stages in translation, formal definition of syntax.

Operating And Programming Environment: Batch processing environment, interactive environments, embedded system environments, programming environments

Theoretical Models: Problem in syntax and translation, problem in semantics

References:
Programming Languages, design and implementation second edition by Terrence W. Pratt Prentice Hall of India pvt.ltd. New Delhi
The Students are required to implement the applications based on

1. Fuzzy databases
2. Expert databases
3. Object-oriented Databases
4. Distributed databases
5. Library management system
6. Crop management system
7. On-line sharing of computer systems
8. Highway systems
9. Hospital management system
10. Hotel management system
11. University management system
12. Inventory control
13. Railway management system
14. Any other similar database system
PREREQUISITES: Computer Networks & Data Communication.

OBJECTIVES: After this course students should have general knowledge on how the Internet works and have basic network programming skills. They will be able to understand technical papers in this area. More importantly, they will think like network people.

Introduction

Transmission Control Protocol, User Datagram Protocol, and selected topics on Internet infrastructure and applications such as: Internet Quality of Service (eg Integrated Services Model, Resource Reservation Protocol, Differentiated Services);

Routing Technology


Internet Application

Datagram Congestion Control Protocol; Electronic commerce (the Internet Open Trading Protocol); Web services; Mobile IP; Mobile Data (eg the Wireless Application Protocol, Multimedia Messaging Service); Real Time Protocol; Multimedia over Packet Networks (ITU-T Recommendations H.323, H.245);

Selected Topics

Hypertext Transfer Protocol (HTTP); Electronic Mail; Domain Name Service; File Transfer; Middleware: Object Management Architecture, object request brokers (CORBA, OLE/COM), services (trading, naming, event, transaction, security), interorb protocols (eg the Internet Interorb protocol). IPv6 Infrastructure Architecture

REFERENCES:


Additional References

1 Tanenbaum, "Computer Networks," 4th edition
3 Comer, "Internetworking with TCP/IP, Volume 1," 4th edition
4 Bertsekas and Gallager, "Data Networks," 2nd edition
IT - 504 MULTIMEDIA SYSTEMS

REREQUISITES: Computer Graphics.

OBJECTIVES: Interface with basic and advanced concepts of Multimedia & its application in various areas including, but not limited to, advertisements, art, education, entertainment, engineering, medicine, mathematics, business, scientific research and spatial temporal applications.

Introduction

Multimedia Highway, Uses of Multimedia, Introduction to making multimedia – The Stages of project, the requirements to make good multimedia, Multimedia skills and training, Training opportunities in Multimedia. Motivation for multimedia usage, Frequency domain analysis, Application Domain & ODA etc. Multimedia-Hardware and Software: Multimedia Hardware – Macintosh and Windows production Platforms, Hardware peripherals – Connections, Memory and storage devices, Media software – Basic tools, making instant multimedia, Multimedia software and Authoring tools, Production Standards.

Working with Multimedia

Multimedia – making it work – multimedia building blocks – Text, Sound, Images, Animation and Video, Digitization of Audio and Video objects, Data Compression: Different algorithms concern to text, audio, video and images etc., Working Exposure on Tools like Dream Weaver, 3D Effects, Flash etc.

Multimedia and the Internet


Advanced Topics in Multimedia


REFERENCES:

2. Tay Vaughan, “Multimedia: Making it work”, TMH.

Additional Reference:

OBJECTIVES: Provides in depth knowledge about the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon with which we are concerned or interested.

Nature and Objectives of research

Methods of research: historical, descriptive and experimental. Study and formulation of research problem. Scope of research and formulation of hypotheses; Feasibility, preparation and presentation of research proposal.

Introduction to statistical analysis

Measures of central tendency and dispersion: mean, median, mode, range, mean deviation and standard deviation.

Regression and correlation analysis.

Probability and probability distributions; Binomial, Poisson, Geometric, Negative binomial, Uniform, Exponential, Normal and Log-normal distribution. Basic ideas of testing of hypotheses; Tests of significance based on normal, t and Chi-square distributions. Analysis of variance technique.

Design of experiments

Basic principles, study of completely randomized and randomized block designs. Edition and tabulation of results, presentation of results using figures, tables and text, quoting of references and preparing bibliography. Use of common softwares like SPSS, Mini Tab and/or Mat Lab. For statistical analysis.

REFERENCES:


Additional References

PREREQUISITES: Software Engineering.

OBJECTIVES: The course will stress on basic concepts of scheduling, cost control and budget management, resource allocation, collaboration software, communication, quality management and documentation or administration systems, which are used to deal with the complexity of large projects.

Introduction to Software Project Management

Need & significance of software Project Management. Role of the software project manager. Specific features of software production, common myths prevailing in software industry, Key objectives of effective management: quality, productivity, risk reduction;

Planning the Project

Business Planning: determining objectives, forecasting demand for product, proposal writing, requirement analysis, legal issues (patent, copyright, liability, warranty); Technical planning: Life cycle models, types of plans, plan documentation methods: PERT and CPM, Gantt charts, work breakdown structures, standards, planning for risk management and control: entry and exit criteria, intermediate checkpoints, performance prediction and analysis people, prototyping and modelling, inspections and reviews, process and process assessment, development methods, metrics, configuration management, testing and quality assurance, capacity planning, estimating - what it takes to do the job: cost (direct and indirect), resources, time, size and complexity of product risk determination, role of requirements and design in estimating, financial planning-budgeting, resource allocation, organizational considerations (teams, hierarchies, etc), technology, human factors and usability, tools and environments, transition of product to the user.

Managing and Evaluating the Project

Managing the task: project control, managing the plan, reviews, feedback and reporting mechanisms, configuration management, quality control and quality assurance, managing change, readjusting goals and milestones, risk management, testing phases, formalized support activities; Managing the team: Team organizations, recruiting and staffing-picking the right people, technical leadership, avoiding obsolescence-training etc.; Managing the context: Communication skill, decision theory, business management, assessing the organization’s ability to perform the process, probability and statistics; Managing product support and maintenance, Evaluation of the project.

CASE STUDIES.

REFERENCES:


Additional References:

PREREQUISITES: RDBMS.

OBJECTIVES: The course focus on developing strategies to enhance end-user access to a variety of data along with gaining expertise in developing seamless commercial business applications, specifically concentrating on customer relationship management systems.

UNIT – I

The Compelling Need for data warehousing: Escalating Need for strategic information, Failures of past decision-support systems, operational versus decision-support systems, data warehousing – the only viable solution, data warehouse defined Data warehouse – The building Blocks: Defining Features, data warehouses and data marts, overview of the components, and metadata in the data warehouse. Defining the business requirements: Dimensional analysis, information packages – a new concept, requirements gathering methods, requirements definition: scope and content

UNIT – II

Principles of dimensional modeling: Objectives, From Requirements to data design, the STAR schema, STAR Schema Keys, Advantages of the STAR Schema, Dimensional Modeling: Updates to the Dimension tables, miscellaneous dimensions, the snowflake schema, aggregate fact tables, families of STARS.

UNIT – III

OLAP in the Data Warehouse: Demand for Online analytical processing, need for multidimensional analysis, fast access and powerful calculations, limitations of other analysis methods, OLAP is the answer, OLAP: definitions and rules, OLAP characteristics, major features and functions, general features, dimensional analysis, what are hyper cubes? Drill-down and roll-up, slice-and-dice or rotation, OLAP models, overview of variations, the MOLAP model, the ROLAP model, ROLAP versus MOLAP, OLAP implementation considerations

UNIT – IV

Data Mining Basics: What is Data Mining, Data Mining Defined, The knowledge discovery process, OLAP versus data mining, data mining and the data warehouse, Major Data Mining Techniques, Cluster detection, decision trees, memory-based reasoning, link analysis, neural networks, genetic algorithms, moving into data mining, Data Mining Applications, Benefits of data mining, applications in retail industry, applications in telecommunications industry, applications in banking and finance.

Recommended Books:

Reference Books:
2. Kamber and Han, “Data Mining Concepts and Techniques”, Hartcourt India P. Ltd.,
3. A Guide to Data Warehousing - Hocht
4. Data Warehousing in Real World - Anahory
5. Data Mining - Addsiaans (Addison Wesley)
Hands on Experience on Deploying, Configuring & Managing LANs & WANs may be expected.

Specific Tasks may include:

- Introduction to the basic Router User Interface
- Using CDP
- Router Extended Basics
- Router Banner MOTD
- Introduction to Router Interfaces
- Introduction to IP Internet Protocols
- Configuring ARP
- Creating a Host Table
- Static Routes
- RIP Management & Troubleshooting
- IGRP
- Connectivity Tests with Trace route
- Saving & Loading Router Configurations
- Deploying ISDN
- Using IPX
- Introduction to basic Switch commands
- Configuring Frame Relay
- Verify Standard Access List
- Configuring Telnet & OSPF Routes
- Deploying VLAN & VTP
IT-519 DISTRIBUTED SYSTEMS

Prerequisites: Operating Systems and Computer Architecture and Organization.

Objective: On completion, students will attain specialized competence to be able to design and analyze parallel algorithms for a variety of problems and computational models, will get familiar with the fundamentals of the architecture and systems software of parallel and distributed systems, and gain experience with the implementation of parallel applications on several platforms, and be able to measure, tune, and report on their performance.

Unit I
Basic framework of Parallel and Distributed Computing Based Systems. Methodologies and Models of Parallel and Distributed Computing.

Unit II
Shared Memory Models, PRAM and Work-Time Models, algorithm design and analysis techniques, relative power and limitations of PRAM models. Memory Models: cache-hierarchies and computational intensity, UMA, NUMA and CC-NUMA shared memory architectures. Loop-Level Parallelism: iteration distribution and scheduling, performance measurement and tuning, OpenMP and Brook. Nested parallelism and load balancing. Thread-Level Parallelism: abstractions for exclusion and synchronization: locks, monitors and conditions, Java threads. Memory Consistency Models: coherence and consistency, implementation of synchronization and mutual exclusion operations in cache-coherent

Unit III
Distributed Memory Models, Bulk Synchronous Processing Model: communication cost measures, algorithm design, performance prediction and measurement, cost parameters. Message Passing Model: SPMD programming, Message Passing, Interface (MPI), collective communication, UPC. Interconnection Networks: topology and performance metrics, routing, congestion, and flow control; implementation of collective communication operations.

Unit IV
Distributed Computing Models, Client-server computing, peer-to-peer computing, and Grid computing: organization, capabilities, and limitations.

REFERENCES:
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Addison-Wesley, Massachusetts

Additional References:
1. Designing and Building Parallel Programs, I. Foster, Addison-Wesley, 1995. Online text.
PREREQUISITES: Software Engineering.

OBJECTIVES: The course will bring into play Object oriented modeling strategies together with interface with basic concepts of UML for business process modeling, systems engineering modeling, and representing organizational structures.

UNIT I

Object Oriented Design and Modeling: Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modeling, principles of modeling, object oriented modeling. Introduction to UML: Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, software development life cycle.

UNIT II

Basic Structural Modeling Classes, relationships, common mechanisms, class and object diagrams. Advanced structural Modeling: Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams.

UNIT III


UNIT IV

Advanced behavioral modeling: Events and signals, state machines, process and threads, time and space, state chart diagrams. Architectural Modeling: Terms, Concepts, examples, Modeling techniques for component diagrams and deployment diagrams.

REFERENCES:


Additional References:

2. The Elements of UML(TM) 2.0 Style, Scott W. Ambler, Cambridge University Press (May 9, 2005)
4. Real Time UML Workshop for Embedded Systems, Bruce Powel Douglass, Newnes; Pap/Cdr edition (September 20, 2006)
CS-515 OPTIMIZATION TECHNIQUES


Optimal Point: Local optimal point, global optimal point and inflection point.

Single Variable Optimization Techniques:

- Optimality criterion.
- Bracketing method (Bounding phase method)
- Region elimination methods (Internal halving method, Golden section search method)
- Point estimation method (successive quadratic estimation methods)
- Gradient-based methods (Newton-Raphson method, Bisection method, secant, Cubic search method)
- Root finding using optimization techniques.

Multivariable Optimization Techniques:

- Optimality criterion
- Unidirectional search method
- Direct Search method (Hooke-Jeeves Pattern Search method, Powell’s conjugate direction method)
- Gradient-based methods (Steepest descent method, Newton’s method, Marquardt’s methods)

Constrained Optimization Algorithms:

- Kuhn-Tucker conditions.
- Transformation method (Penalty function method)
- Direct search for constrained minimization (variable elimination method, complex search method)

Linear Programming:

Linear programming problems, Simplex method of linear programming techniques.

Text Book:

1. Optimization for engg. design by Kalyanmoy Deb. (PH)

Reference Books:

4. Optimization :Theory & Practice by beveridge & Schecter, (McGraw
CS-517 Parallel Computing

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Course Contents:

Introduction: Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm.

Hardware taxonomy: Flynn's classifications, Handler's classifications.

Software taxonomy: Kung's taxonomy, SPMD.

Abstract parallel computational models: Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism


Parallel Programming: Shared memory programming, distributed memory programming, object oriented programming, data parallel programming, functional and dataflow programming.

Scheduling and Parallelization: Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs. Parallel programming support environments.

Books and References:


Research articles.
CS-521 VLSI DESIGN


- CMOS Circuit And Logic Design: CMOS Logic Gate Design, Basic Physical Design of Simple Gate, CMOS Logic Structures, Clocking Strategies, I/O Structures, Low Power Design.


- CMOS Sub System Design: Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements, Control-FSM, Control Logic Implementation.

Texts / References
Goals of NLP: Survey of applications, Levels of linguistic processing: morphology, syntax, semantics, Language processors: recognisers, transducers, parsers, generators, Language as a rule-based system, Language understanding as an inferential activity.

Resources for NLP: lexicons and knowledge bases.

Elements of formal language theory: alphabet, string, language, grammar, productions, symbol vocabulary, generator, recogniser, procedure.

Types of grammar: the Chomsky Hierarchy.


Parsing: definition of a parser; derivations, basic parsing strategies for context free grammars, determinism and non-determinism; decidability, data structures and algorithms for parsing, unification based grammar formalisms.

Ambiguity and its resolution: Syntactic ambiguities and heuristics, lexical ambiguities and selectional restrictions, indeterminacy of reference

Generation and Dialogue: Syntactic generation algorithms and reversibility, text planning, modelling dialogue agents.

Text Book:


References:


CS-510  Artificial Intelligence

Introduction, Intelligent agents

Problem Solving: Solving problems by searching, Informed search and exploration, constraint satisfaction problems, adversarial search.

Knowledge and Reasoning: Logical agents, first order logic, Inference in first order logic, knowledge representation.

Planning: Planning and acting in real world.

Uncertain Knowledge and reasoning: Uncertainty, Probabilistic Reasoning, Probabilistic Reasoning over time, Making Simple decisions.

Learning: Learning from observations, knowledge in learning, Reinforcement learning.

Communication, Perceiving and acting: Communication, Perception, Probabilistic language processing

References:

Introduction And Examples Of Embedded Systems, Concept Of Embedded System Design: Design challenge, Processor technology, IC technology, Design technology, Trade-offs


Memory: Introduction, Memory write ability, Storage performance, Tradeoffs, Common memory types Memory hierarchy and cache

AVR 8515 microcontroller: Architecture and Programming in assembly and C.

Interfacing Analog and digital blocks: Analog-to-Digital Converters (ADCs), Digital-to-Analog Converters (DACs), Communication basics and basic protocol concepts, Microprocessor interfacing: I/O addressing, Port and Bus based, I/O, Memory mapped I/O, Standard I/O interrupts, Direct memory access, Advanced communication principles parallel, serial and wireless, Serial protocols I^2C, Parallel protocols PCI bus, Wireless protocol IrDA, blue tooth.

Different peripheral devices: Buffers and latches, Crystal, Reset circuit, Chip select logic circuit, timers and counters and watch dog timers, Universal asynchronous receiver, transmitter (UART), Pulse width modulators, LCD controllers, Keypad controllers.

Design tradeoffs due to thermal considerations and Effects of EMI/ES etc.

Software aspect of embedded systems: Challenges and issues in embedded software development, Co-design

Embedded software development environments: Real time operating systems, Kernel architecture: Hardware, Task/process control subsystem, Device drivers, File subsystem, system calls, Embedded operating systems, Task scheduling in embedded systems: task scheduler, first in first out, shortest job first, round robin, priority based scheduling, Context switch: Task synchronization: mutex, semaphore, Timers, Types of embedded operating systems, Programming languages: assembly languages, high level languages

Development for embedded systems: Embedded system development process, Determine the requirements, Design the system architecture, Choose the operating system, Choose the processor, Choose the development platform, Choose the programming language, Coding issues, Code optimization, Efficient input/output, Testing and debugging, Verify the software on the host system, Verify the software on the embedded system

Text Reference
Frankvahid/Tony Givargis, "Embedded System Design- A unified Hardware/software Introduction".
Dreamteach Software team," Programming for Embedded Systems"
AVR 8515 manual
J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing"
1. Neural networks: introduction, neural networks, supervised or unsupervised learning, feed forward network, Hopfield network
2. Neural network models: neural network models, layers in neural network and their connections, Instar, outstar, weights on connections, threshold function, application - Adaline and madaline
3. Backpropagation: feed forward back propagation network-mapping, layout, training, BPN applications
4. Learning and training: objectives of learning, Hebb’s rule, delta rule, supervised learning, unsupervised networks, learning vector quantizer, associative memory models, one-shot learning, resonance, stability, training and convergence
6. BAM- bidirectional associative memory, inputs and outputs, weights and training, FAM-fuzzy associative memory, association, FAM neural networks, encoding
7. Adaptive Resource theory-network for ART, processing in ART
8. Kohonen Self Organizing Map- Competitive learning, lateral inhibition, training law for Kohonen network, implementation, applications to pattern recognition
9. Application of fuzzy Logic:
10. Fuzzy databases and quantification, fuzzy control, designing fuzzy logic controller

Books:
3. Freeman A. James, Skapura M. David- neural networks algorithms, applications and programming Techniques, Pearson Education
Role of quantitative methods in decision making. Probability and decision making, decision making under uncertainty, the value of additional information, Bay’s theorem. Probability models and decision making. Sample survey methods. Methods of measuring and forecasting business changes, index numbers, time series analysis. Markov Analysis.

Background of Operations Research, classification of problems in operations research, phases of operations research study.

Linear programming, formulation of mathematical models, solution of linear programming problems involving design of product mix, resource allocation, transportation and assignment by graphical, simplex and dual simplex methods, Duality theorem and applications, use of computer to solve linear programming problems.


Queuing theory notation and assumptions, Poisson’s queuing models, non-Poisson queuing models, queues in series, queuing decision models. Application to scheduling and maintenance problems.

Reference Books:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Publisher</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative Methods and Operations Research for Business and Economics</td>
<td>Ahuja, K.K</td>
<td>Kalyani Publisher</td>
<td>1990</td>
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<tr>
<td></td>
<td>Gopikuttan, G.</td>
<td>Himalya Publishers</td>
<td>1994</td>
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Introduction: Classification of robots, basic robot components, manipulator end effectors, controller, power unit, sensing devices, specification of robot systems, accuracy precision and repeatability.

Robot Motion Analysis:
Manipulator Kinematics, Inverse Manipulator Kinematics, Manipulator Dynamics-newton-Euler and Lagrange formulation, Trajectory generation.

Robotic sensing devices:
Position, velocity and acceleration sensors, proximity and range sensors, touch and slip sensors, tactile sensors, force and torque sensors.

Robotic vision system: imaging components, picture coding, object recognition, training and vision systems, review of existing vision systems.

Robotic programming:
Methods of robot programming, types of programming, robotics programming languages, artificial intelligence.

Robot applications: material transfer and machine loading/unloading, processing applications, welding and painting assembly and inspection, future robotic applications and related technologies developments.

Economics analysis of robotics: Robotics project analysis, life cycle costs, data required for economic analysis, methods of economics analysis.

Books recommended:
1. Fundamentals of Robotics Analysis and control : Robert J. Schiling
2. Industrial robotics: Groover, weiss nagel and odrey, Mc Graw Hill
CS-524 Object-Oriented Programming with Visual Basic.NET

An overview of the object-oriented paradigm, The .NET environment, Structures and abstract data types, Using classes, Class member scoping and access modifiers, Inheritance and derived classes, Using abstract base classes, Using interfaces, Implementing the IEnumerable and IComparable interfaces, Designing and implementing exception classes, Design patterns and refactoring in VB.NET, Object internals: reflection and attributes, Object persistence: serialization, Building a Windows application, Building a Web services application, Building a Windows services application, Building an ASP.NET application, Building an ADO.NET application.

Books: Michael McMillan

CS-526 Business Information System

Basic concepts - understanding information and information systems, Hardware, Software, Networks, telecommunications and the Internet, E-business applications, Acquiring and developing BIS, Initiating systems development, BIS project management, Systems analysis, Systems design, System build, implementation and maintenance, BIS strategy, Managing e-business, Managing information security, End-user computing - providing end-user services, Ethical, legal and moral constraints on information systems.

Books:

Business Information Systems
Technology, development and management for the e-business
2nd Edition
Paul Bocij, Dave Chaffey, Andrew Greasley, Simon Hickie