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

Schedule of Teaching

Lecture Tutorials total

Schedule of Examination

	Time (Hrs)	Theory Marks	Sessional Marks	Viva	Total
All theory Subjects	3	100	50		150
Projects			50	50	100
Seminar			100		100
Dissertation			Satisfactory/Not Satisfactory		

SEMESTER-I

		L	T	P
CS-501	Advance Software Engineering	3	1	-
CS-503	Network Security	3	1	-
CS-505	Advanced Computer Architecture	3		-
CS-507	Advanced Database Management System	3	1	-
CS-509	Advanced Programming Language	3	1	-
CS-511	Advanced Software Engineering Lab	-	-	4
CS-513	Advanced Database Management System Lab	-	-	4

SEMESTER-II

		L	T	P
IT-502	Advanced Internet Technology	3	1	-
IT-504	Multimedia Systems	3	1	-
IT-506	Research Methodologies	3	1	-
IT-508	Software Project Management	3	1	-
IT-510	Data Warehousing & Datamining	3	1	-
IT-512	Advanced Internet Technology Lab	-	-	4

SEMESTER-III

IT-	Elective-I	3	1	-
IT-	Elective-II	3	1	-
IT-515	Project			
IT-517	Seminar			

SEMESTER-IV

IT-514	Dissertation

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

L	T	P
3	1	-

Introduction: Life cycle models, Requirement Analysis and specification, Formal requirements specification.

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

Unified Modeling Language (UML). Unified design process. User interface design. Coding standards and guidelines. Code walkthrough and reviews.

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:

1. Ian Sommeriele, “Software Engineering” , Addison Wesley.
2. C.Easteal and G.Davis, Software Engineering Analysis and Design, Tata McGraw Hill.
3. Pressman, Software Engineering –A Practitioner’s Approach.
4. Richard Fairley ,Software Engineeering Concepts ,Tata Mcgraw Hill.
5. Pankaj Jalote , An Integrated Approach to Software engineering, Narosa Publication.

CS-503 Network Security

L	T	P
3	1	-

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.

Ipv6: Basic Protocol, extensions and options, support for QoS, security ,etc., neighbour discovery, auto-configuration, routing. Changes to other protocols. Application Programming Interface for IPV6.

Mobility in networks. Mobile IP, Security related issues.

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:

W.R.Stevens. TCP/IP Illustrated, Volume 1: The Protocols, Addison Wesley, 1994.

R.Wright.TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley , 1995.

W.R Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP and the unix domain protocols, Addison Wesley, 1996.

CS- 505 Advance Computer Architecture

L	T	P
3	-	-

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
11. Vector Architecture.
12. Multi threaded Architecture
13. Distributed Memory MIMD Architecture
14. Shared memory MIMD Architecture.

Reference:

1. Dezso Sima , Terence Fountani, Peter Kacsuie , “Advanced Computer Architectures : A Design Space Approach, 1/e , Pearson Eduction.
2. Computer Architecture by Stone

CS-507 Advance Database Management Systems

L	T	P
3	1	-

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:-

1) Elmasri, Navathe, ”Fundamentals of Database Systems”, Pearson Education.
2) Henry F. Korth, A Silberschatz, ”Database Concepts”, Tata Mc Graw Hill.
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.

CS_509 ADVANCED PROGRAMMING LANGUAGES

L	T	P
3	1	-

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 semant

References:

Programming Languages, design and implementation second edition by Terrence W. Pratt Prentice Hall of India pvt.ltd. New Delhi

CS-511 & CS-513 Project Lab
(DBMS & Software Engineering)

L	T	P
-	-	4

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

IT- 502 Advanced Internet Technology

L T P
3 1 -

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

Introduction to the basic Router User Interface, CDP, ARP, Creating a Host Table, Static Routes, RIP, Troubleshooting RIP, IGRP, PPP with CHAP Authentication, Connectivity Tests with Trace route, ISDN, IPX, Introduction to the Switch, Frame Relay Hub and Spoke Topology, Frame Relay Full Mesh Topology, Standard Access List, Telnet, VLAN, VTP, OSPF Routes.

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:

1, K. Prasad, "Principles of Digital Communication Systems and Computer Networks," eBook

2, W.Richard Stevens, "TCP/IP Illustrated, Volume 1: The Protocols," Addison-Wesley, 1994

3, Larry L. Peterson and Bruce S. Davie, "Computer Networks A Systems Approach", 3rd edition, Morgan Kaufmann, 2003.

Additional References

1 Tanenbaum, "Computer Networks," 4th edition

2 Kurose and Ross, "Computer Networks: A Top-Down Approach Featuring the Internet," 2nd edition

3 Comer, "Internetworking with TCP/IP, Volume 1," 4th edition

4 Bertsekas and Gallager, "Data Networks," 2nd edition

IT - 504 MULTIMEDIA SYSTEMS

L T P
3 1 -

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 opportUnit-ies 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

History, Internet working, Connections, Internet Services, The World Wide Web, Tools for the WWW – Web Servers, Web Browsers, Web page makers and editors, Plug-Ins and Delivery Vehicles, HTML, VRML, Designing for the WWW – Working on the Web, Multimedia Applications – Media Communication, Media Consumption, Media Entertainment, Media games.

Advanced Topics in Multimedia

Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing, Assembling and delivering a project-planning and costing, Designing and Producing, content and talent, Delivering, CD-ROM technology.

REFERENCES:

1. Steve Heath, “Multimedia & Communication Systems”, Focal Press, UK.
2. Tay Vaughan, “Multimedia: Making it work”, TMH.
3. K. Andleigh and K. Thakkar, “Multimedia System Design”, PHI, PTR.

Additional Reference:

1. Keyes, “Multimedia Handbook”, TMH.
2. Ralf Steinmetz and Klara Naharstedt, “Multimedia: Computing, Communications & Applications”, Pearson.
3. Steve Rimmer, “Advanced Multimedia Programming”, MHI.

IT -506 _RESEARCH METHODOLOGIES

L	T	P
3	1	-

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:

1. Borth, Wayne C, et.Al., The Craft of Research: Chicago Guides to Writing Edition and Publishing. 2. Johnson, R.A., Probability and Statistics, PHI, New Delhi. 3. Meyer, P.L., Introduction to Probability & Statistical, Applications: Oxford, IBH.

Additional References

1. Hogg, R.V. & Craig, A.T., Introduction to Mathematical Statistics, MacMillan. 2. Goon, A.M., Gupta, M.K. & Dasgupta, Fundamentals of Statistics, Vol.I: World Press. 3. Gupta, S.C. & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons.

IT -508 SOFTWARE PROJECT MANAGEMENT

L T P
3 1 -

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:

1. Tom Demarco, Controlling Software Project Management, Measurement, Prentice Hall, New Jersey.
2. Tom Glib, Finzi Susannah, Principles of Software Engineering Management, Addison Wesley, England.

Additional References:

1. Barbee Mynatt, Software Engineering with student project guidance, Prentice hall, New ersey.
2. Richard Thayer, Tutorial : Software Engineering Project Management, IEEE Inc, CA
3. Mark Norris Peter Rigby, Malcolm Payne, The Healthy Software Project – A Guide to Successful Development, John Willey & Sons, New York.

IT- 510 DATA WAREHOUSING AND DATAMINING

L T P
3 1 -

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:

1. Paul Raj Poonia, “Fundamentals of Data Warehousing”, John Wiley & Sons, 2003.
2. Sam Anahony, “Data Warehousing in the real world: A practical guide for building decision support systems”, John Wiley, 2004

Reference Books:

1. W. H. Inmon, “Building the operational data store”, 2nd Ed., John Wiley, 1999.
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)

IT - 512 Advanced Internet Technology Lab

L	T	P
-	-	4

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

L T P
3 1 -

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:

1. Vipin Kumar, Ananth Grama, Anshul Gupta and George Karypis, Introduction to Parallel Computing, The Benjamin/Cumming Publishing Company, Inc., Masschachusetts
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Addison-Wesley, Masschachusetts
3. Multithreaded, Parallel and Distributed Programming, G. Andrews, Addison-Wesley, 2000.

Additional References:

1. Designing and Building Parallel Programs, I. Foster, Addison-Wesley, 1995. Online text.
2. Introduction to Parallel Computing: Design and Analysis of Algorithms, V. Kumar, A. Grama, A.Gupta, G. Karypis, Benjamin-Cummings, 1994.
3. PRAM Algorithms, S. Chatterjee, J. Prins, course notes, 2005.
4. Parallel Programming in OpenMP, R. Chandra et al., Morgan-Kaufmann, 2001.

IT-521 Object Oriented Analysis and Design using UML

L	T	P
3	1	-

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

Collaboration Diagrams and Sequence Diagrams: Terms, concepts and depicting a message in collaboration diagrams. Terms and concepts in sequence diagrams. Difference between collaboration and sequence. diagram. Depicting synchronous messages with/without priority call back mechanism. Basic behavioral modeling: Interactions, use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams.

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:

1. Grady Booch, James Rum bough, Ivar Jacobson. 'The Unified Modeling Language User Guide. Pearson Edutaion 2002.
2. Ian Summerville, 'Software Engineering Sixth Edition' 2003.

Additional References:

1. Meilir Page Jones, 'Fundamentals of Object Oriented Design in UML', Addison Wesley.
2. The Elements of UML(TM) 2.0 Style, Scott W. Ambler, Cambridge University Press (May 9, 2005)
3. UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design , Jim Arlow & Ila Neustadt, Addison-Wesley Professional; 2 edition (June 27, 2005)
4. Real Time UML Workshop for Embedded Systems, Bruce Powel Douglass, Newnes; Pap/Cdr edition (September 20, 2006)

CS-515 OPTIMIZATION TECHNIQUES

L	T	P
3	1	-

Introduction: Engineering applications of optimization. Design variables. Constraints, objectives function, variable bounds, statement and formulation of an optimization problem, Examples of chemical Engg. Optimization problems, classification of optimization problems, different optimization algorithms.

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 optimiation 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)

Construined 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:

1. Engg. Optimization by S.S. Rao (New Age)
2. Optimization of Chemical Processes by T.I. Edgar & D.M. Himmelblau (McGraw Hill)
3. Process Optimization with Applications to Metallurgy & Chemical Engg. by Ray & Szekely (Wiley)
4. Optimization :Theory & Practice by beveridge & Schecter, (McGraw

CS-517 Parallel Computing

L	T	P
3	1	-

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

Performance Metrices: Laws governing performance measurements. Metrices - speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks.

Parallel Processors: Taxonomy and topology - shared memory mutliprocessors, distributed memory networks. Processor organization - Static and dynamic interconnections. Embeddings and simulations.

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:

M. J. Quinn. *Parallel Computing: Theory and Practice* , McGraw Hill, New York, 1994.
T. G. Lewis and H. El-Rewini. *Introduction to Parallel Computing* , Prentice Hall, New Jersey, 1992.
T. G. Lewis. *Parallel Programming: A Machine-Independent Approach* , IEEE Computer Society Press, Los Alamitos, 1994.
Research articles.

CS-521 VLSI DESIGN

L	T	P
3	1	-

- Introduction To MOS Circuits: MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, MOS Transistor Theory - Introduction MOS Device Design Equations, The Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, The Tri State Inverter, Bipolar Devices.

- Circuit Characterization And Performance Estimation: Introduction, Resistance Estimation Capacitance Estimation, Inductance, Switching Characteristics CMOS-Gate Transistor Sizing, Power Dissipation, Sizing Routing Conductors, Charge Sharing, Design Margining, and Reliability.

- 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.

- Systems Design And Design Method: Design Strategies CMOS Chip Design Options, Design Methods, Design Capture Tools, Design Verification Tools, Design Economics, Data Sheets, CMOS Testing - Manufacturing Test Principles, Design Strategies for Test, Chip Level Test Techniques, System Level Test Techniques, Layout Design for Improved Testability.

- 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

- N. Weste and K. Eshranghian, "Principles of CMOS VLSI Design", Addison Wesley, 1998.
- Jacob Backer, Harry W. Li and David E. Boyce, " CMOS Circuit Design, Layout and Simulation ", Prentice Hall of India, 1998.
- L.Glaser and D. Dobberpuhl, "The Design and Analysis of VLSI, Circuits", Addison Wesley 1993.
- C.Mead and L. Conway, "Introduction to VLSI Systems", Addison Wesley, 1979.
- Randel & Geiger, " VLSI Analog and Digital Circuit Design Techniques" McGraw-Hill,1990.
- Sahib H.Gerez, "Algorithms for VLSI design automation ",1998.
- William M. Penny, Lillian Lau, " MOS Integrated Circuits- Theory, Fabrication, Design and System Applications of MOS LSI", Van Nostrand Reihold Company.
- Sung Ms Kang, Yusuf Lablebici, "CMOS Digital Integrated Circuits Analysis & Design", Tata Mc-Graw Hill.

CS-508 NATURAL LANGUAGE PROCESSING

L	T	P
3	1	-

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.

Computational morphology:lemmatisation, Part-of-Speech Tagging ,Finite-State Analysis.

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 :

Allen, J., *Natural language understanding*. 2nd edition. Redwood City, CA: 1994. Benjamin/Cummings. ISBN 0805303340.

References:

Grosz, B.J., Sparck Jones, K. & Webber, B.L. (eds) *Readings in natural language processing*. Los Altos, CA, 1986: Morgan Kaufmann.

Jurafsky, D. & J. Martin. 2000. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition* Prentice Hall.

CS-510 Artificial Intelligence

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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: Uncertainity, 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:

1. E. Rich ' Artificial Intelligence', McGrawHill, 1983.
2. E. Charniak and D. McDermott, 'Introduction to Artificial Intelligence', Addison Wesley, 1985.
3. Stuart Russell, Peter Noving, ' Artificial Intelligence : A Modern Approach, Pearson Education.
4. George F Luger, 'Artificial Intelligence' Forth Edition, Pearson Education.

CS-516 EMBEDDED SYSTEMS

L T P
3 1 -

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

- Custom Single Purpose Processor Hardware, General-Purpose Processor: Introduction, Basic Architecture, Operation, Super-Scalar And Vlsiiw Architecture, Application Specific Instruction Set Processors (Asips), Microcontrollers, Digital Signal Processors, Selecting A Microprocessor.

- Memory: Introduction, Memory write ability, Storage performance, Tradeoff s, 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".
- David E Simon, " An embedded software primer ", Pearson education Asia, 2001.
- Dreamteach Software team," Programming for Embedded Systems"
- AVR 8515 manual
- J.W. Valvano, "Embedded Microcomputor System: Real Time Interfacing"
- Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.

CS-518 NEURAL NETWORKS AND FUZZY LOGIC

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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
5. Fuzzy Logic: Introduction, fuzzy sets, fuzzy operations, fuzziness in neural networks, neural trained fuzzy system
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. Kohen Self Organizing Map- Competitive learning , lateral inhibition, training law for Kohen network, implementation, applications to pattern recognition
9. Application of fuzzy Logic:
10. Fuzzy databases and quantification, fuzzy control , designing fuzzy logic controller

Books:

1. Rao, Vallinu B.,and Rao, Hayagriva . Neural networks and fuzzy Logic, second edition, BPB Publication
2. Berkan C. Riza, Trubatch L, Sheldon, Fuzzy Systems design Principlea. IEEE Press , standard publishers distributers
3. Freeman A. James, Skapura M. David- neural networks algorithms, applications and programming Techniques, Pearson Education

CS-520 Quantitative Technique

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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.

Dynamic programming, principles of optimality, characteristics of dynamic programming problem, deterministic programming models for solution of investment problem, allocation problem, production scheduling and equipment replacement problem, probabilistic dynamic programming. Games theory, mini max - minimum pure strategies, mixed strategies and expected pay off, solution of 2x2, 2xn, mx2 games, Brown's algorithm.

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:

Quantitative Techniques in Management	Vohra, N.D	Tata McGraw Hill	1995
Principles of Operations Research	Wagner H.M	Prentice Hall	1982
Operations Research	Hira D.S & Gupta P.K	S. Chand & Co.	1995
Operations Research	Taha, H.A	Macmillan Pub. Co.	1972
Quantitative Methods and	Ahuja, K.K	Kalyani Publisher	1990
Operations Research for Business and Economics	Gopikuttan, G.	Himalya Publishers	1994

CS-522 Robotics

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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-Eulor and Lagrange formulation, Trajector generation.

Robotic sensing devices:

Position, velocity and acceleration sensors, proximity and range sensors, touch and slip sensors, tectile sensors, force and torque sensors.

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

Robotics 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.

Eocnomics 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
3. **Robotics engineering :** klafter, Chmielwski and nagirn,Prentice hill.
4. **Robotics for engineering** : Yorem Korem, Mc Graw Hill.
5. **Robotics**:control,sensing vision and intelligence: K.S. Fu, R.C.Gonzalez, C.S.g Lee, McGraw Hill

CS-524 Object-Oriented Programming with Visual Basic.NET

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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

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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