Punjab Technical University, Jalandhar
Study Scheme
M.Tech Computer Science And Engineering

Schedule of Teaching			**Schedule of Examination**				
Lecture	Tutorials	total		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**
CS-502	Digital image Processing	3	1	-
CS-504	Distributed Systems	3	1	-
CS-506	Compiler Design	3	1	-
CS-	Elective-I	3	1	-
CS-	Elective-II	3	1	-

SEMESTER-III

CS-	Elective-III	3	1	-
CS-	Elective-IV	3	1	-
CS-523	Project			
CS-525	Seminar			

SEMESTER-IV

CS-500	Dissertation

LIST OF ELECTIVES

ELECTIVE-I

CS-508	Natural Language Processing
CS-510	Artificial Intelligence
CS-512	Object Oriented Analysis And Design Using UML

ELECTIVE-II

CS-514	Software Engineering Methodologies
CS-516	Embedded System
CS-518	Neural Networks and Fuzzy Logics

ELECTIVE-III

CS-515	Optimization Techniques
CS-517	Parallel Computing
CS-519	Fundamental Concepts of Bioinformatics
CS-521	VLSI Design

ELECTIVE-IV

CS-520	Quantitative Techniques
CS-522	Robotics
CS-524	Object Oriented Programming With Visual Basics. NET
CS-526	Business Information System

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
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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

CS-502 Digital Image Processing

L	T	P
3	1	-

Fundamentals: Introduction, Origin, Areas of Image Processing, steps in Digital Image Processing, Components of Image Processing System, Image Sensing , Sampling and Quantisation, Neighbouring of Pixels

Image Enhancement and Restoration: Enhancement: Spatial Filtering, Introduction to Fourier Transformation, Restoration: A model of the Image Degradation/ Restoration Process.

Color Image Processing: Color fundamentals, models, transformation and segmentation. Noise in color images.

Wavelets: Wavelet functions, Wavelet transformations in one and two dimensions, fast wavelet transform.

Image Compression: Image compression models, Error free compression, Lossy compression.

Image segmentation: Line detection, edge detection, Edge linking and boundry detection, region based segmentation.

Representation and Description: Representation, Boundry and Regional Descriptors, Relational Descriptors.

Object Recognition: Pattern and pattern classes, recognition based on Decision Theoretic Methods, Structural Methods.

References:

Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods

CS-504 DISTRUBUTED SYSTEMS

L	T	P
3	1	-

1. Characeterization of Distributed Systems: Introduction, system models –Architectural and fundamental models

2. Interprocess communication: API for internet protocol, Marshalling. Client server communication, group communication case study: unix

3. Distributed objects and remote invocation: communication between Distributed objects, RPC, events and notification case study: Java RMI

4. Operating System Support: Operating System layer. Protection , processes ands threads, operating system architecture

5. Distributed File System: File service architecture, network file system, Sun network file system, Andrew file system Case Study: unix

6. Name services: Name services and domain name system . directory and discovery services
Case Study: Global Name service

7. Transaction and concurrency control: transactions, nested transactions, Locks, optimistic concurrency control, time stamp ordering, Comparison of methods for concurrency control

8. Distributed transaction: Flat and nested distributed transactions. Atomic Commit protocol, Distributed dead locks

9. Distributed Multimedia systems; characteristics of multimedia, multimedia data. Quality of service management, resorce management, stream adaptation.
Case study; Tiger video file server.

10. Distributed shared memory: design and implementation issues, sequential consistency and Ivy and Release Consistencyan Munin
Case Study of distributed systems: CORBA

Books :

1. G. Coulouis, et al. Distributed Systems: Concepts and design, Pearson Education Asia,2004
2. A.S. Tanenbaum, Modern operating Systems, Prentience Hall
3. www.cdk3.net/refs
4. www.ietf.org/rfc

CS-506 Compiler Design

L	T	P
3	1	-

Course Contents:

Compiler structure: analysis-synthesis model of compilation, various phases of a compiler, tool based approach to compiler construction.

Lexical analysis: interface with input, parser and symbol table, token, lexeme and patterns. Difficulties in lexical analysis. Error reporting. Implementation. Regular definition, Transition diagrams, LEX.

Syntax analysis: CFGs, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC.

Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions.

Type checking: type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

Run time system: storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.

Intermediate code generation: intermediate representations, translation of declarations, assignments, control flow, boolean expressions and procedure calls. Implementation issues.

Code generation and instruction selection: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peep hole optimization, code generator generators, specifications of machine.

Books and References:

A. V. Aho, R. Sethi, and J. D. Ullman. *Compilers: Principles, Techniques and Tools* , Addison-Wesley, 1988.
C. Fischer and R. LeBlanc. *Crafting a Compiler* , Benjamin Cummings, 1991.
C. Fischer and R. LeBlanc. *Crafting a Compiler in C* , Benjamin Cummings.
A. C. Holub. *Compiler Design in C* , Prentice-Hall Inc., 1993.
Appel. *Modern Compiler Implementation in C: Basic Design* , Cambridge Press.
Appel. *Modern Compiler Implementation in Java: Basic Design* , Cambridge Press.
Fraser and Hanson. *A Retargetable C Compiler: Design and Implementation* , Addison-Wesley.

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

L	T	P
3	1	-

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-512 Object Oriented Analysis and Design using UML

L	T	P
3	1	-

1. Object Oriented Design and Modelling:
   Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modelling, principles of modelling, object oriented modelling.

2. Introduction to UML:
   Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, software development life cycle.

3. Basic Structural Modelling
   Classes, relationships, common mechanisms, class and object diagrams.

4. Advanced structural Modelling
   Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams.

5. 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.

6. Basic behavioral modelling
   Interactions, use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams.

7. Advanced behavioral modelling:
   Events and signals, state machines, process and threads, time and space, state chart diagrams.

8. Architectural Modelling:
   Terms, Concepts, examples, Modelling techniques for component diagrams and deployment diagrams.

books:

1. Grandy Booch, James Rumbough, Ivar Jacobson. ‘ The Unified Modelling Language User Guide. Pearson Edutaion 2002.
2. Ian Sommerville, ‘ Software Engineering Sixth Edition’ 2003.
3. Meilir Page Jones, ‘ Fundamentals of Object Oriented Design in UML’ , Addison Wesley, 2000

CS-514 Software Engineering Methodologies

L	T	P
3	1	-

Software life cycle -- important steps and effort distribution. Aspects of estimation and scheduling. Software evaluation techniques-modular design : coupling and cohesion, Software and complexity measures. Issues in software reliability. System Analysis: Requirement analysis. Specification languages. Feasibility analysis. File and data structure design, Systems analysis tools. Software design methodologies, Data flow and Data Structure oriented design strategies. Software development, coding, verification, and integration. Issues in project management-team structure, scheduling, software quality assurance. Object Oriented methodology: object orineted paradigm, Object Oriented analysis and design, examples of methodologies.

Text/References :

1. R. S. Pressman, Software Engineering - A Practioner"s Approach,3rd Edition, McGrawHill,1992.
2. J. Martin, Rapid Application Development, Maxwell MacMillan, 1991.
3. B. Meyer, Object Oriented Software Construction, Prentice Hall, 1988.
4. G. G. Schulmeyer, Zero Defect Software, McGraw-Hill, 1992.
5. J. Rumbaugh et. al., Object Oriented Modeling and Design, Prentice Hall,1991.

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

L	T	P
3	1	-

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-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-519 Fundamental Concepts of Bioinformatics

L	T	P
3	1	-

MOLECULAR BIOLOGY AND BIOLOGICAL CHEMISTRY:The genetic material,Gene structure and information content,Protein structure and function,The nature of chemical bonds,Molecular biology tools,Genomic information content.

DATA SEARCHES AND PAIRWISE ALIGNMENTS: Dot plots,
Simple alignments,Scoring,Gaps,Scoring matrices,The Needleman and Wunsch algorithm,Local and global alignments, Database searches,Multiple sequence alignments.

SUBSTITUTION PATTERNS: Patterns of substitutions within genes,Estimating substitution numbers,Variations in substitution rates between genes,Molecular clocks,Evolution in organelles.

DISTANCE-BASED METHODS OF PHYLOGENETICS:History of molecular phylogenetics,Advantages to molecular phylogenies, Phylogenetic trees,Distance matrix methods,Maximum likelihood approaches, Multiple sequence alignments.

CHARACTER-BASED APPROACHES TO PHYLOGENETICS:Parsimony,Inferred ancestral sequences,Strategies for faster searches,Consensus trees,Tree confidence,Comparison of phylogenetic methods,Molecular phylogenies.

GENOMICS AND G0ENE RECOGNITION:Prokaryotic genomes, Prokaryotic gene structure.,Prokaryotic gene density,Eukaryotic genomes,Eukaryotic gene structure,Open reading frames,Gene expression,Transposition,Repetitive elements,Eukaryotic gene density.

PROTEIN FOLDING:Polypeptide composition,Secondary structure,Tertiary and quaternary structure,Protein folding,Structure prediction.

PROTEOMICS:Protein classification,Experimental techniques,Inhibitors and drug design,Ligand screening,X-ray crystal structures,Empirical methods and prediction techniques, Postranslational modification prediction.

Bioinformatics Computing(International Edition)
Books: Dan Krane, Michael Raymer,Bryan Bergeron

CS-521 VLSI DESIGN

L	T	P
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- 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.

Elective –IV

CS-520 Quantitative Technique

L T P

3 1 -

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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

L	T	P
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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