

SCHEME OF EXAMINATION

&

SYLLABI

for

**Master of Technology
(Computer Science & Engineering)**



Uttarakhand Technical University, Dehradun

www.uktech.in

Master of Technology (Computer Science & Engineering)

Semester-wise Distribution of Credits

Semester I	Semester II	Semester III	Semester IV	Total Credits
18	18	20	16	72

First Semester

Code No.	Paper	L	T/P	Credits	EVALUATION SCHEME				Total
					SESSIONAL EXAM			Exam ESE	
Theory Papers					CT	TA	Total		
CS181	Algorithm Analysis & Design	4	-	4	30	20	50	100	150
CS182	Software Engineering	4	-	4	30	20	50	100	150
CS183	Advanced Computer Architecture	4	-	4	30	20	50	100	150
CS184	Advanced Computer Networks	4	-	4	30	20	50	100	150
Practical									
CSP180	Software Systems Laboratory	0	4	2		50	50	50	100
Total		16	4	18					700

Master of Technology
(Computer Science & Engineering)

Second Semester

Paper Code	Paper	L	T/P	Credits	EVALUATION SCHEME			Total
					SESSIONAL EXAM		ESE	
					CT	TA	Total	
CS281	Object Oriented Software Engineering	4	-	4	30	20	50	100
CS282	Advanced Data Base Management System	4	-	4	30	20	50	100
Electives (Choose any Two)					30	20	50	100
					30	20	50	100
CS283	Embedded System Design	4	-	4				
CS284	Wireless Mobile Networks	4	-	4				
CS285	Real Time System	4	-	4				
CS286	Neural Networks	4	-	4				
CS287	Network Programming	4	-	4				
CS288	Fuzzy Logic & Design	4	-	4				
CS289	Genetic Algorithms	4	-	4				
CS290	Artificial Intelligence and Applications	4	-	4				
Practical								
CSP280	Software Systems Laboratory II	0	4	2		50	50	50
Total		16	4	18				700

Master of Technology
(Computer Science & Engineering)

Third Semester

Paper Code	Paper	L	T/P	Credits	EVALUATION SCHEME				Total
					SESSIONAL EXAM		ESE		
					CT	TA	Total		
CS381	Distributed Computing	4	-	4	30	20	50	100	150
CS382	Network Management & Security	4		4	30	20	50	100	150
Electives (Choose any Two)					30	20	50	100	150
					30	20	50	100	150
CS383	Digital Image Processing	4		4					
CS384	Data Warehousing and Mining	4	-	4					
CS385	Network Programming	4	-	4					
CS386	Parallel Computing	4	-	4					
CS387	Advanced Software Project Management	4	-	4					
CS388	Data Warehousing & Data Mining	4	-	4					
CS389	Parallel Algorithm	4	-	4					
Practical									
	Minor Project Work	-	8	4		50	50	100	150
	Total	16	8	20					750

Master of Technology
(Computer Science & Engineering)
Fourth Semester

Paper Code	Paper	L / P	Credits	EVALUATION SCHEME		Total
				SESSIONAL EXAM	ESE	
CS481	Thesis	-	16			
	TOTAL	-	16	100	500	600

Introduction to Algorithm, The role of algorithms in computing, Asymptotic notation, asymptotic analysis of recurrence relations, probabilistic analysis and randomized algorithm, the hiring problem, indicator random variables

Divide and conquer paradigm – Merge sort, Inversion counting

Dynamic Programming – Matrix Chain multiplication, Longest Common subsequence, optimal binary search trees

Greedy Algorithm – Activity Selection problem, Theoretical foundation of greedy algorithm, Task Scheduling problem, Comparison of dynamic programming and Greedy algorithm with Knapsack as case study

Graphs: Review of Graphs (Representation, Depth First Search, Breath First search, Kruskal and Prim Algorithm, Dijkstra's Algorithm)

Flow networks: Ford-Fulkerson method, comparison Networks, Zero-one Principle, Bitonic Sorting Network, Merging Network, Sorting Network

Matrix Operation (Properties, Strassen's Algorithm, Solution of linear equation, Matrix inversion)

Polynomial and FFT, Representation of polynomials, The DFT and FFT, efficient FFT implementation

Number-Theoretic Algorithm, Elementary number-theoretic notion, Greatest common divisor, modular arithmetic, solving modular linear equation, the Chinese remainder theorem

NP-Completeness, Polynomial time, Polynomial time verification, NP-completeness and reducibility, NP-Completeness proofs

Approximation Algorithms- the vertex-cover problem, The Traveling-Salesman Problem, The set covering problem

Text Books:

1. T. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein, "Introduction to Algorithms", 2nd Edition, PHI.
2. Ellis Harwitz and Sartaz Sahani, "Fundamentals of Computer Algorithms", Galgotia.

Reference Books:

1. A.V. Aho, J. E. Hopcroft, J.D. Ulman, "The Design & Analysis of Computer Algorithms", Addison Wesley.
2. V. Manber, "Introduction to Algorithms – A Creative Approach", Addison Wesley.

Introduction:

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

Software Requirements analysis & specifications:

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

Software Project Planning:

Size Estimation like lines of Code & Function Count, Cost Estimation Models, Static single & Multivariable Models, COCOMO, COCOMO-II, Putnam resource allocation model, Risk Management.

Software Design:

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

Software Metrics:

Software measurements: What & Why, Token Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics

Software Testing:

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

Software Reliability:

Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Calendar time Component.

Software Maintenance:

Management of Maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Test Books:

1. R. S. Pressman, "Software Engineering – A practitioner's approach", 5th Ed., McGraw Hill Int. Ed., 2001.
2. K. K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2001.

Reference Books:

1. R. Fairley, "Software Engineering Concepts", Tata McGraw Hill, 1997.
2. P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991.
3. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, 1996.

4. James Peter, W. Pedrycz, "Software Engineering", John Wiley & Sons., 1999
5. I. Sommerville, "Software Engineering", Addison. Wesley, 1999

Parallel computer models:

The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers.

Program and network properties:

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

System Interconnect Architectures:

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

Advanced processors:

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

Pipelining:

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

Memory Hierarchy Design:

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

Multiprocessor architectures:

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

Scalable point – point interfaces:

Alpha364 and HT protocols, high performance signaling layer.

Enterprise Memory subsystem Architecture:

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

Text Books:

1. D. A. Patterson and J. L. Hennessey, "Computer organization and design", Morgan Kaufmann, 2nd Ed. 2002
2. Kai Hwang, "Advanced computer architecture"; TMH. 2000

Reference Books:

1. Hwan and Briggs, " Computer Architecture and Parallel Processing"; MGH. 1999
2. Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication. 1998
3. V.Rajaraman & C.S.R.Murthy, "Parallel computer"; PHI. 2002
4. R.K.Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications, 2003
5. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing. 1998
6. D.A.Patterson, J.L.Hennessey, "Computer Architecture :A quantitative approach"; Morgan Kauffmann feb,2002.
7. J.P.Hayes, "computer Architecture and organization"; MGH. 1998

Introduction:

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

Network layer

Internet architecture and addressing, internetworking, IPv4, ICMP, Routing Protocols-RIP, OSPF, BGP, IP over ATM.

IPv6, Next Generation IP protocol, Wireless Networks, GSM, CDMA, Mobility in networks, Mobile IP, Mobile IP multicasting, BSD Sockets,.

Transport layer

Design issues, Connection management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Finite state machine model. TCP extensions for high speed network, TCP/IP programming

Application layer

WWW, DNS, e-mail, SNMP, RMON

Network Security:

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management.

Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET).

System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

Case study

Study of various network simulators, Network performance analysis using NS2

TEXT BOOKS:

1. Behrouz A. Forouzan, "TCP/IP Protocol Suit", TMH, 2000.
2. C.E.Perkins, B.Woolf and S.R.Alpert, "Mobile IP, Design Principles and Practices," Addison Wesley, 1997
- 3 Tananbaum A. S., "Computer Networks", 3rd Ed., PHI, 1999.
- 4 B. Forouzan, "Cryptography and Network Security, TMH

REFERENCES:

1. Black U, "Computer Networks-Protocols, Standards and Interfaces", PHI, 1996.

2. Stallings W., "Data and Computer Communications", 6th Ed., PHI, 2002.
3. Stallings W., "SNMP, SNMPv2, SNMPv3, RMON 1 & 2", 3rd Ed., Addison Wesley, 1999.
3. Laurra Chappell (Ed), "Introduction to Cisco Router Configuration", Techmedia, 1999.
4. B. Forouzan, "Cryptography and Network Security, TMH

CSP180: Software Systems Laboratory

2 credits (0-0-4)

Project oriented assignments which will be announced at the start of semester with definite submission deadlines. The assignments will be designed to develop skills and familiarity with a majority of the following: make, configuration management tools, installation of software, archiving and creation of libraries, version control systems, documentation and literate programming systems and other scripting languages, sockets and RPCs, usage of standard libraries, XML and semi-structured data, simulation environments, testing and validation tools.

Introduction to Software Engineering:

Software Engineering Development, Software Life Cycle Models, Standards for developing life cycle models.

Object Methodology & Requirement Elicitation:

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

Architecture:

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

Modeling with UML:

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

System Analysis:

Analysis Model, Dynamic Modelling & Testing

System Design:

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

Testing Object Oriented Systems:

Introduction, Testing Activities & Techniques, The Testing Process, Managing Testing, State Based testing and Data flow testing for Classes.

Component Based Computing

Fundamentals: Definition and nature of components, components and interfaces, Interfaces as contracts, the benefits of components.

Basic Techniques: component design and assembly, Relationship with the client-server model and with patterns, Use of objects and object lifecycle services, use of object brokers

Case Studies**Text Books:**

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

Reference Books:

1. Stephen R. Scach, "Object Oriented and Classical Software Engineering" 7/E Tata McGraw Hill, 1999
2. Booch, Rumbaugh & Jacobson "The Unified Modeling Language User Guide", Addison-Wesley 2005
3. Bernd Bruegge, Allen H. Dutoit "Object Oriented Software Engineering: Using UML, Patterns and Java" 2/E Pearson Education.
4. Timothy C. Lethbridge, Robert Laganier "Object oriented Software Engineering: Practical Software development using UML and Java" McGraw Hill
5. Edwards Yourdon, Carl Argila "Case Studies in Object Oriented Analysis and Design" Prentice Hall.

CS282	Advanced Database Management Systems	L	T/P	C
		4	0	4

Relational Databases

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

Query Processing and Optimization

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

Deductive Databases

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

Object Oriented and Object Relational Databases

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

Parallel and Distributed Databases

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

Advanced Transaction Processing

Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors.

Active Database and Real Time Databases

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

Image and Multimedia Databases

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

WEB Database

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

Data Mining

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

Data Warehousing

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

Case Study: Oracle Xi

Text Books:

1. Elmars, Navathe, Somayajulu, Gupta, “Fundamentals of Database Systems”, 4th Edition, Pearson Education, 2007
2. Garcia, Ullman, Widom, “Database Systems, The complete book”, Pearson Education, 2007
3. R. Ramakrishnan, “Database Management Systems”, McGraw Hill International Editions, 1998

References:

1. Date, Kannan, Swaminathan, “An Introduction to Database Systems”, 8th Edition Pearson Education, 2007
2. Singh S.K., “Database System Concepts, design and application”, Pearson Education, 2006.
3. Silberschatz, Korth, Sudarshan, “Database System Concepts”, McGraw Hill, 6th Edition, 2006
4. W. Kim, “Modern Database Systems”, 1995, ACM Press, Addison – Wesley,
5. D. Maier, “The Theory of Relational Databases”, 1993, Computer Science Press, Rokville, Maryland
6. Ullman, J. D., “Principals of database systems”, Galgotia publications, 1999
7. Oracle Xi Reference Manual

CS283 Embedded System Design

L	T/P	C
4	0	4

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

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

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

Serial data communication, RS-232, USB, I²C, Interfacing with ADC & sensors, Interfacing with DAC, Interfacing with external ROM, Interfacing with 8255 IEEE 1149.1 (JTAG) testability: Boundary Scan Architecture

Textbook:

1. Sriram V Iyer and Pankaj Gupta, “Embedded Real-time Systems Programming”, TMH 2006
2. Mazidi and Mazidi, “The 8051 Microcontroller”, PHI, 2006

References:

1. Embedded System by Raj Kamal, TMH, 2004
2. The 8051 Microcontroller by Kenneth J. Ayala, Thomson DelMar Learning, 2006
3. Microcontrollers by Deshmukh, TMH, 2006
4. 8051 Microcontroller & Embedded systems by Rajiv Kapadia, Jaico, 2006
5. Computer as components by wayne wolf, Harcourt India Pvt. Ltd, 2002
6. Real time System and Analysis by Philip A. Laplante, Wiley, 2006
7. Microcontrollers and microcomputers by F. M. Cady, Oxford Press, 2006
8. An Embedded Software Primer by David E. Simon, Pearson Education, 2005
9. Designing Embedded Hardware by John Catsoulis, O’reilly 2005
10. Real time System & Software by Alan c. Shaw, Wiley, 2005
11. Programming Embedded System by Michael Barr, O’reilly, 2005
12. Networking and Internetworking with microcontrollers by Fred Eady, elsevier, 2005

Introduction to Personal Communication Services (PCS): PCS architecture, Mobility management, Networks signaling.

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

General Packet Radio Services (GPRS): GPRS architecture, GPRS Network nodes.

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

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, Wireless Markup Languages (WML)

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

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

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

Bluetooth technology and Wi-Max

Text Books:

1. “Wireless and mobile Networks Architecture,” by Yi –Bing Lin & Imrich Chlamatac, John Wiley & Sons, 2001.
2. “Mobile & Personnel communication Systems and Services”, By Raj Pandya, Prentice Hall India, 2001.
3. “Wireless Communication- Principles and practices,” 2nd Ed., Theodore S. Rappaport, Pearson Education Pvt. Ltd, 2003.
4. “Mobile communications,” Jochen Schiller, Pearson Education Pvt. Ltd., 2002.
5. “ The Wireless Application Protocol,” Singhal & Bridgman et. al., Pearson Education, 2004.

References:

1. “Principles of Mobile Computing,” 2nd Ed., Hensmann, Merk, & Stober, Springer International Edition, 2003.
2. “Mobile Computing,” Talukdar & Yaragal, TMH, 2005.
3. “3G Wireless Networks,” Smith & Collins, TMH, 2007.

CS285	Real Time System	L	T/P	C
		4	0	4

Introduction: Concept of Real Time System, Issues in real time computing, Performance measures of Real Time System, Issues in Real Time Computing, Performance measures of Real time Systems, Real Time Application.

Task Assignment and Scheduling: Different task model, Scheduling hierarchy, offline vs Online Scheduling, Clock Drives.

Model of Real Time System: Processor, resources, temporal parameter, Periodic Task Model, Sporadic Task Model, Precedence Constraints and Data Dependencies, Scheduling hierarchy

Scheduling of Periodic Task: Assumptions, fixed versus dynamic priority algorithms, schedulability test for fixed priority task with arbitrary deadlines.

Scheduling of Aperiodic and Sporadic Tasks: Assumptions and approaches, deferrable, sporadic servers, slack stealing in deadline driven and fixed priority systems. Two level scheme for integrated scheduling, Scheduling for applications having flexible constrains.

Resources and Resource Access Control: Assumptions on resources and their usage, resource contention, resource access control(Priority Ceiling Protocol, Priority Inheritance protocol, Slack Based Priority Ceiling Protocol, Preemption Ceiling Protocol).

Multi Processor Scheduling: Model of multi processor and distributed systems, Scheduling algorithms for end to end periodic tasks in homogeneous/heterogeneous systems, Predictability and validation of dynamic multiprocessor system.

Real time Communication: Model of real time Communication, Priority base service For switched network, Weighted Round Robin Service, Medium access Control Protocol, Real Time Protocol.

Books and References:

1. Jane .W. S. Liu “Real Time Systems” Pearson Education.
2. Krishna .C.M “Real Time Systems” Mc-Graw Hill Publication.

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

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

PCA, SOM, LVQ, Adaptive Resonance Networks.

Hopfield Networks, Associative Memories, RBF Networks.

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

Text Book:

1. Haykin S., "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.

References:

1. Anderson J.A., "An Introduction to Neural Networks", PHI, 1999.
2. Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
3. Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
4. Freeman J.A., D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison-Wesley, Reading, Mass, (1992).
5. Golden R.M., "Mathematical Methods for Neural Network Analysis and Design", MIT Press, Cambridge, MA, 1996.
6. Cherkassky V., F. Kulier, "Learning from Data-Concepts, Theory and Methods", John Wiley, New York, 1998.
7. Anderson J.A., E. Rosenfield, "Neurocomputing: Foundations of Research, MIT Press, Cambridge, MA, 1988.
8. Kohonen T., "Self-Organizing Maps", 2nd Ed., Springer Verlag, Berlin, 1997.
9. Patterson D.W., "Artificial Neural Networks: Theory and Applications", Prentice Hall, Singapore, 1995.
10. Vapnik V.N., "Estimation of Dependencies Based on Empirical Data", Springer Verlag, Berlin, 1982.
11. Vapnik V.N., "The Nature of Statistical Learning Theory", Springer Verlag, New York, 1995.
12. Vapnik V.N., "Statistical Learning Theory: Inference from Small Samples", John Wiley, 1998.

Introduction to Systems Programming: Files, System Files, File Formats, Buffered I/O, Directories, File System, Inodes, links,fcntl, links, locks, Device I/O, Terminal I/O, ioctl(), Files and Devices ,Signals, video I/O ,Multi-Tasking

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

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

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

Text Book:

1. Unix Network Programming, W. Richard Stevens, Prentice Hall, 1998

References:

1. Internetworking with TCP/IP, Volume3, Douglas Comer, Prentice Hall, 2000
2. Internetworking with TCP/IP, Volume1, Douglas Comer, Prentice Hall, 2000

Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, α -cuts, Properties of α -cuts, Decomposition Theorems, Extension Principle.

Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Fuzzy Relations: Crisp & Fuzzy Relations, Projections & Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on single set, Equivalence, Compatibility & Ordering Relations, Morphisms, Fuzzy Relation Equations.

Possibility Theory: Fuzzy Measures, Evidence & Possibility Theory, Possibility versus Probability Theory.

Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp sets, Fuzziness of Fuzzy Sets.

Applications of Fuzzy Logic:

Text Book:

1. G.J.Klir , Yuan, "Fuzzy Sets and fuzzy logic, Theory and applications", Prentice Hall India, 1995.

Reference Books:

1. John Yen, Reza Langari, "Fuzzy Logic Intelligence, Control and Information", Pearson Education, 2006.
2. Ross, "Fuzzy Logic with Engineering Applications", 2nd Edition, John Wiley, 2004.
3. H. Zimmermann, "Fuzzy Set Theory and its applications", 2nd Edition, Allied Publishers, 1996.

Introduction

A brief history of evolutionary computation, Elements of Genetic Algorithms, A simple genetic algorithm, Applications of genetic algorithms

Genetic Algorithms in Scientific models

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

Theoretical Foundation of genetic algorithm

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

Computer Implementation of Genetic Algorithm

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

Some applications of genetic algorithms

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

Advanced operators & techniques in genetic search

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

Text Book:

1. David E. Goldberg, "Genetic algorithms in search, optimization & Machine Learning" Pearson Education, 2006

Reference Books:

1. Melanle Mitchell, "An introduction to genetic algorithms", Prentice Hall India, 2002.
2. Michael D. Vose, "The simple genetic algorithm foundations and theory, Prentice Hall India, 1999
3. Masatoshi Sakawa, "Genetic Algorithms & Fuzzy Multiobjective Optimization", Kluwer Academic Publisher, 2001
4. D. Quagliarella, J Periaux, C Poloni & G Winter, "Genetic Algorithms in Engineering & Computer science", John Wiley & Sons, First edition, 1997
5. Pinaki Mzumder, Elizabeth M. Raudnick, "Genetic Algorithms for VLSI design, layout and test automation", Pearson Education, 2006

CS290	Artificial Intelligence and Applications	L	T/P	C
		4	0	4

Introduction:

Introduction to intelligent agents

Problem solving:

Solving problems by searching : state space formulation, depth first and breadth first search, iterative deepening

Intelligent search methods:

A* and its memory restricted variants

Production systems:

Design implementation and limitations, case studies

Game Playing:

Minimax, alpha-beta pruning

Knowledge and reasoning:

Propositional and first order logic, semantic networks, building a knowledge base, inference in first order logic, logical reasoning systems

Planning:

STRIPS partial order planning, uncertain knowledge and reasoning, probabilistic reasoning systems, Bayesian networks

Learning from observations:

Inductive learning, learning decision trees, computational learning theory, Explanation based learning

Applications:

Environmental Science, Robotics, Aerospace, Medical Science etc.

Text Book:

1. "AI" by Rich and Knight, Tata McGraw Hill, 1992

Reference Books:

1. "Neural Networks in Computer Intelligence" by KM Fu, McGraw Hill
2. "AI: A modern approach" by Russel and Norvig, Pearson Education

Fundamentals of Distributed Computing:

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

Basic Algorithms in Message:

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

Distributed Operating Systems:

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

Simulation:

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

Distributed Environments:

Current systems and developments (DCE, CORBA, JAVA).

Advanced Topics:

Randomization, Wait-Free Simulations of Arbitrary Objects, Problems Solvable in Asynchronous Systems, Solving Consensus in Eventually Stable Systems, High Performance Computing-HPF, Distributed and mobile multimedia systems. Adaptability in Mobile Computing. Grid Computing and applications. Fault tolerant Computing Systems.

Parallel Processing:

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

Text Books:

1. Tannenbaum, A, Van Steen. Distributed Systems, Principles and Paradigm , Prentice Hall India, 2002
2. Tannenbaum, A. Distributed Operating Systems, Pearson Education. 2006
3. Attiya, Welch, "Distributed Computing", Wiley India, 2006
4. Singhal and Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill, 1994

Reference Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to parallel computing", 2nd Edition, Pearson Education, 2007
2. Cameron Hughes, Tracey Hughes, "Parallel and distributed programming using C++", Pearson Education, 2005
3. Tanenbaum, A, "Modern Operating Systems", 2nd Edition, Prentice Hall India, 2001.
4. Michael J. Quinn, "Parallel Computing – Theory and Practice, 2nd Edition, McGraw Hill, 1994

CS381 Distributed Computing

L	T/P	C
4	0	4

Fundamentals of Distributed Computing:

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

Basic Algorithms in Message:

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

Distributed Operating Systems:

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

Simulation:

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

Distributed Environments:

Current systems and developments (DCE, CORBA, JAVA).

Advanced Topics:

Randomization, Wait-Free Simulations of Arbitrary Objects, Problems Solvable in Asynchronous Systems, Solving Consensus in Eventually Stable Systems, High Performance Computing-HPF, Distributed and mobile multimedia systems. Adaptability in Mobile Computing. Grid Computing and applications. Fault tolerant Computing Systems.

Parallel Processing:

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

Text Books:

1. Tannenbaum, A, Van Steen. Distributed Systems, Principles and Paradigm , Prentice Hall India, 2002
2. Tannenbaum, A. Distributed Operating Systems, Pearson Education. 2006
3. Attiya, Welch, "Distributed Computing", Wiley India, 2006

Reference Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to parallel computing", 2nd Edition, Pearson Education, 2007
2. Cameron Hughes, Tracey Hughes, "Parallel and distributed programming using C++", Pearson Education, 2005
3. Tanenbaum, A, "Modern Operating Systems", 2nd Edition, Prentice Hall India, 2001.
4. Singhal and Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill, 1994
5. Michael J. Quinn, "Parallel Computing – Theory and Practice, 2nd Edition, McGraw Hill, 1994

Introduction

Classical security Techniques and Computer Network Security Concepts. Confidentiality and Security, Security Policy and Operations Life Cycle, Security System Development and Operations

Secure Networking Threats

The Attack Process. Attacker Types. Vulnerability Types. Attack Results. Attack Taxonomy. Threats to Security: Physical security, Biometric systems, monitoring controls, and Data security and intrusion and detection systems.

Encryption Techniques

Conventional techniques, Modern techniques, DES, DES chaining, Triple DES, RSA algorithm, Key management. Message Authentication and Hash Algorithm, Authentication requirements and functions secure Hash Algorithm, Message digest algorithm, digital signatures. AES Algorithms.

Designing Secure Networks

Components of a Hardening Strategy. Network Devices. Host Operating Systems. Applications. Appliance-Based Network Services. Rogue Device Detection, Network Security Technologies The Difficulties of Secure Networking. Security Technologies. Emerging Security Technologies General Design Considerations, Layer 2 Security Considerations. IP Addressing Design Considerations. ICMP Design Considerations. Routing Considerations. Transport Protocol Design Considerations

Network Security Platform Options

Network Security Platform Options. Network Security Device Best Practices, Common Application Design Considerations. E-Mail. DNS. HTTP/HTTPS. FTP. Instant Messaging.

IPsec VPN Design Considerations

VPN Basics. Types of IPsec VPNs. IPsec Modes of Operation and Security Options. Topology Considerations. Design Considerations. Site-to-Site Deployment Examples.

Secure Network Management and Network Security Management

Organizational Realities. Protocol Capabilities. Tool Capabilities. Secure Management Design Options. Network Security Management, Firewalls, Trusted systems, IT act and cyber laws.

Text Books:

1. Sean Convery, “ Network Security Architectures, Published by Cisco Press, First Ed. 2004
2. William Stallng “Cryptography and Network Security” Fourth Ed., Prentice Hall, 2006

Reference Books:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing” 3rd Edition, Prentice Hall, 2003
2. Jeff Crume “Inside Internet Security” Addison Wesley, 2003

Introduction And Digital Image Fundamentals

The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Image Enhancement in the Spatial Domain

Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothing and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Image Enhancement in the Frequency Domain

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

Image Restoration

A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degrations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

Image Compression

Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards.

Image Segmentation

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

Representation and Description

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

Object Recognition

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

Text Books:

1. Rafael C. Gonzales & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education, 2004
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003

Reference Books:

1. Rosefield Kak, "Digital Picture Processing", 1999
2. W.K. Pratt, "Digital Image Processing", 2000

CS 384 Data Warehousing & Data Mining

L	T/P	C
4	0	4

Data Warehousing:

Introduction to Data Warehousing: Evolution of Data Warehousing, Data Warehousing concepts, Benefits of Data Warehousing, Comparison of OLTP and Data Warehousing, Problems of Data Warehousing.

Data Warehousing Architecture

Architecture: Operational Data and Datastore, Load Manager, Warehouse Manager, Query Manager, Detailed Data, Lightly and Highly summarised Data, Archive/Backup Data, Meta-Data, architecture model, 2-tier, 3-tier and 4-tier data warehouse, end user Access tools.

Data Warehousing Tools and Technology

Tools and Technologies: Extraction, cleaning and Transformation tools, Data Warehouse DBMS, Data Warehouse Meta-Data, Administration and management tools, operational vs. information systems.

OLAP & DSS support in data warehouse.

Distributed Data Warehouse

Types of Distributed Data Warehouses, Nature of development Efforts, Distributed Data Warehouse Development, Building the Warehouse on multiple levels.

Types of Data Warehouses & Data Warehouse Design

Host based, single stage, LAN based, Multistage, stationary distributed & virtual data-warehouses. Data warehousing Design: Designing Data warehouse Database, Database Design Methodology for Data Warehouses, Data Warehousing design Using Oracle, OLAP and data mining: Online Analytical processing, Data mining.

Knowledge discovery

Knowledge discovery through statistical techniques, Knowledge discovery through neural networks, Fuzzy technology & genetic algorithms.

Text:

“Building the Data Warehouse”, W.H.Inmon, 3rd Edition, John Wiley & Sons.

“Developing the Data Warehouse”, W.H.Inmon, C.Kelly, John Wiley & Sons.

Thomas Connolly, Carolyn Begg-“Database Systems-A practical approach to Design, Implementation and management” 3rd Edition Pearson Education

TEXT 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

REFERENCES:

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., 2001

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

Books:

1. J. Schiller, Mobile Communications, Addison Wesley.
2. A. Mehrotra , GSM System Engineering.
3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.
4. Charles Perkins, Mobile IP, Addison Wesley.
5. Charles Perkins, Ad hoc Networks, Addison Wesley

CS386	Parallel Computing	L	T/P	C
		4	0	4

CS387 Advanced Software Project Management	L	T/P	C
	4	0	4

Introduction to Software Project Management:

Software development as a project; Stakeholders in software project; Software product, process, resources, quality, and cost; Objectives, issues, and problems relating to software projects.

Overview of Project Planning:

Steps in project planning; Defining scope and objectives; work breakdown structure; Deliverables and other products; time, cost, and resource estimation; Alternatives in planning

Project Evaluation:

Strategic assessment; Technical assessment; Cost-benefit analysis; Cash flow forecasting; Cost-benefit evaluation techniques; Break-even analysis; Risk evaluation

Selection of Appropriate Project Approach:

Choosing development technology and methodology; choice of process model; Rapid application development; Waterfall model; V-process model; Spiral model; Prototyping;; Incremental delivery.

Software Effort Estimation

Problem in software estimation; Effort estimation techniques; Expert judgement; Estimation by analogy; Delphi technique; Algorithmic methods; Top-down and bottom-up estimation; Function point analysis; Object points; COCOMO model.

Activity Planning

Network planning model; Activity-on-arrow network; Precedence network; Forward pass; Backward pass; Critical path; Slack and float.

Risk Analysis and Management

Nature and categories of risk in software development; risk Identification; Risk assessment; Risk mitigation, monitoring, and management; Evaluating schedule risk using PERT.

Resource Allocation

Nature of project resources; Identifying resource requirement of activities; Allocating and scheduling resources; cost of resources; Standard, planned, and actual cost; Cost variance; time-cost trade-off.

Project Tracking and Control

Measurement of physical and financial progress; Earned value analysis; Status reports; Milestone reports; Change control.

Contact Management

Outsourcing of products and services; Types of contracts; Stages in contract placement; Terms of contract; Contract monitoring; Acceptance testing

Managing People and Organizing Teams

Organizational behaviour; Recruitment and placement; Motivation; Group behaviour; Individual and group decision making; Leadership and leadership styles; forms of organizational structures.

Software Quality Assurance

Planning for quality; Product versus process quality management; Procedural and quantitative approaches; Defect analysis and prevention; Statistical process control; Pareto analysis; Causal analysis; Quality standards; ISO 9000; Capability Maturity Model; Quality audit.

Configuration Management

Configuration management process; Software configuration items; Version control; change control; Configuration audit; Status reporting.

Text:

1. Bob Hughes and Mike Cotterell, "Software Project Management", Third Edition 2002, McGraw-Hill
2. Pankaj Jalote, "Software Project Management in Practice", 2002, Pearson Education Asia.

Reference:

1. Roger S. Pressman, "Software Engineering: A practitioner's Approach", Fifth Edition 2001 McGraw-Hill
2. Robert T. Futrell, Donald F. Shafer, and Linda I. Shafer, "Quality Software Project Management" 2002, Pearson Education Asia.
3. Ramesh Gopalaswamy, "Managing Global Software Projects", 2003, Tata McGraw-Hill

CSP301

Project Work

L	T/P	C
0	4	4

The student will submit a synopsis at the beginning of the semester for the approval to the project committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the University for evaluation purpose at the end of the semester in a specified format.

ITR – 752 Dissertation

L	T/P	C
0	0	24

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

ITR – 754 Seminar & Progress Report

L	T/P	C
0	0	4

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