MAHAMAYA TECHNICAL UNIVERSITY

NOIDA

Syllabus

For

M.TECH.

Computer Science, Information Technology and Software Engineering Courses

[Effective from the Session: 2012-13]

Study and Evaluation Scheme

Computer Science, Information Technology & Software Engineering
Year - I, Semester - I

SN	Course Code	Subject	Periods			Evaluation scheme						Subject Total	Credits
						SESSIONAL				EXTERNAL			
			L	T	P	CT	AT+TA	TOT	P	Th	P		
	SEMESTER I												
1	CS910/ IT910/ SW910	Discrete Mathematics and Theory of Computation	3	1	0	40	15+15	70	0	130	0	200	4
2	CS911/ IT911/ SW911	Design Analysis and Algorithm	3	0	2	30	10+10	50	20	100	30	200	4
3	CS912/ IT912/ SW912	Advanced Computer Architecture	3	1	0	40	15+15	70	0	130	0	200	4
4	CS913/ IT913/ SW913	Operating Systems and Distributed Systems	3	0	2	30	10+10	50	20	100	30	200	4
5	CS914/ IT914/ SW914	Programming Practices	2	0	3	10	5+5	20	50	50	80	200	4
		Total	14	2	7			260	90	510	140	1000	20

NOTE: Wherever the question paper is of 130 marks, 15 short answer questions of 2 marks each shall be asked in the question paper.

Study and Evaluation Scheme

Computer Science, Information Technology & Software Engineering
Year - I, Semester –II

SN	Course Code	Subject	Periods			Evaluation scheme						Subject Total	Credits
						SESSIONAL				EXTERNAL			
			L	T	P	CT	AT+TA	TOT	P	Th	P		
	SEMESTER II												
1	CS9ssn/ IT9 ssn / SW9 ssn	Elective-I	3	1	0	40	15+15	70	0	130	0	200	4
2	CS9 ssn / IT9 ssn / SW9 ssn	Elective-II	3	1	0	40	15+15	70	0	130	0	200	4
3	CS9 ssn / IT9 ssn / SW9 ssn	Elective-III	3	1	0	40	15+15	70	0	130	0	200	4
4	CS9 ssn / IT9 ssn / SW9 ssn	Elective-IV	3	1	0	40	15+15	70	0	130	0	200	4
5	AS-920	Research Methodology	2	0	0	30	10+10	50	0	50	0	100	2
6	CS920/IT 920/ SW920	Seminar	0	0	3				50	-	50	100	2
		Total	14	4	3							1000	20

NOTE: 1. Wherever the question paper is of 130 marks, 15 short answer questions of 2 marks each shall be asked in the question paper.

2. 'ssn' in course code stands for:

First ‘s’: Current semester.

Second ‘s’: Stream number.

'n' stands for serial number within the stream.

Study and Evaluation Scheme

Computer Science, Information Technology & Software Engineering
Year - II, Semester – III

SN	Course Code	Subject	Periods			Evaluation scheme						Subject Total	Credits
						SESSIONAL				EXTERNAL			
			L	T	P	CT	AT+TA	TOT	P	Th	P		
	SEMESTER III												
1	CS9ssn/ IT9 ssn / SW9 ssn	Elective-V	3	1	0	40	15+15	70	0	130	0	200	4
2	CS9 ssn / IT9 ssn / SW9 ssn	Elective-VI	3	1	0	40	15+15	70	0	130	0	200	4
3	CS930/ IT930 / SW930	*Pre- dissertation	0	0	10				250	0	250	500	10
4	CS9931 / IT9931/ SW931	Seminar Course Design	0	0	3				50	0	50	100	2
		Total	6	2	13							1000	20

NOTE:

1. Wherever the question paper is of 130 marks, 15 short answer questions of 2 marks each shall be asked in the question paper.

2. 'ssn' in course code stands for:

First ‘s’: Current semester.
Second ‘s’: Stream number.
'n' stands for serial number within the stream.

3. * : Pre-dissertation (Critical literature Survey with comparative evaluation of earlier works (prototype systems may have to be developed for this purpose), tools availability and design to facilitate investigation, data collection and its analysis, plan for completion of the dissertation, open seminar and report to be submitted that will also form part of the final dissertation)

Note: One of the electives will be an open elective slot where a student be allowed to credit any outside PG level course.

Study and Evaluation Scheme

Computer Science, Information Technology & Software Engineering
Year - II, Semester – IV

Course Code	Course Name	L-T-P	Credit	Theory Sessional marks	Theory Question Paper marks	Lab sessional marks	Lab external evaluation marks	Total Marks
CS940 /IT940/ SW940	Dissertation	0-0-20	14			300	400	700
CS941/IT941 /SW941	Comprehensive	---	6				300	300
Total		0-0-20	20					1000

M.TECH. (CS/IT/SW) – ELECTIVES FOR II SEMESTER

Stream	Course Title	Course No	Semester	L-T-P
Stream 01:-AI, Machine Learning and Soft Computing • *Students may select only one course out of 9211, 9212 and 9213.* • *Students may select only one course from 9341 and 9313.*	Pattern Recognition	CS 9211/IT 9211/SW 9211	II	3-1-0
	Neural Networks	CS 9212/ IT 9212/ SW 9212	II	3-1-0
	Machine Learning	CS 9213/ IT 9213/ SW 9213	II	3-1-0
	Natural Language Processing	CS 9214/IT 9214/SW 9214	II	3-1-0
Stream 02: Distributed Systems and Cloud Computing Architecture	Mobile Computing	CS 9221/IT 9221/SW 9221	II	3-1-0
	Introduction to Cloud Computing	CS 9222/IT 9222/SW 9222	II	3-1-0
Stream 03: Software Engineering	Software Requirements and Estimation	CS 9231/IT 9231/SW 9231	II	3-1-0
	Software Quality Assurance	CS 9232/IT 9232/SW 9232	II	3-1-0
	Advanced Object Oriented Software Engineering	CS 9233/IT 9233/SW 9233	II	3-1-0
Stream 04: Data Management • *Students may select only one course from 9341 and 9313*	Advanced Database Management Systems	CS 9241/IT 9241/SW 9241	II	3-1-0
	Information Organization and Retrieval	CS 9242/IT 9242/SW 9242	II	3-1-0
	Statistics and Data Analysis	CS 9243/IT 9243/SW 9243	II	3-1-0
Stream 05: Theoretical Computer Science	Parallel Algorithms	CS 9251/IT 9251/SW 9251	II	3-1-0
	Logic for Computer Science	CS 9252/IT 9252/SW 9252	II	3-1-0
Stream 06: Computer Networks and Security	Advanced High Speed & Computer Networks	CS 9261/IT 9261/SW 9261	II	3-1-0
	Advanced Network Security	CS 9262/IT 9262/SW 9262	II	3-1-0
	Network Design and Management	CS 9263/IT 9263/SW 9263	II	3-1-0
Stream 07: Image Processing, Virtual Reality, Multimedia and Computer Graphics	Digital Image Processing	CS 9271/IT 9271/SW 9271	II	3-1-0
	Advanced Computer Graphics	CS 9272/IT 9272/SW 9272	II	3-1-0
	Multimedia Systems	CS 9273/IT 9273/SW 9273	II	3-1-0

- *CS and IT students may select at most (total of semester-II & III electives) two courses from each stream*
- *CS students must select at least one course each from Stream 01 and Stream 05*
- *IT students must select at least one course each from Stream 03, Stream 04 and Stream 06*
- *SW students must select at least three courses (total of semester-II & III electives) from Stream 03 and one course from Stream 04*

M.TECH. (CS/IT/SW) – ELECTIVES FOR III SEMESTER

Stream	Course Title	Course No	Semester	L-T-P
Stream 01:-AI, Machine Learning and Soft Computing • *Students may select only one course from 9341 and 9313.*				
	Evolutionary Computation	CS 9311/IT 9311/SW 9311	III	3-1-0
	Fuzzy Systems	CS 9312/IT 9312/SW 9312	III	3-1-0
	Advanced Data Mining	CS 9313/IT 9313/SW 9313	III	3-1-0
Stream 02: Distributed Systems and Cloud Computing Architecture				
	Building Applications in Cloud using JAVA and Python	CS 9321/IT 9321/SW 9321	III	3-1-0
	Client Server Computing	CS 9322/IT 9322/SW 9322	III	3-1-0
Stream 03: Software Engineering				
	Software Reliability and Testing	CS 9331/IT 9331/SW 9331	III	3-1-0
	Component Based Software Engineering	CS 9332/IT 9332/SW 9332	III	3-1-0
Stream 04: Data Management • *Students may select only one course from 9341 and 9313*				
	Data Warehousing and Data Mining	CS 9341/IT 9341/SW 9341	III	3-1-0
	Distributed DBMS	CS 9342/IT 9342/SW 9342	III	3-1-0
Stream 05: Theoretical Computer Science				
	Introduction to the theory of NP Completeness	CS 9351/IT 9351/SW 9351	III	3-1-0
Stream 06: Computer Networks and Security				
	Ethical Hacking and Computer Forensics	CS 9361/IT 9361/SW 9361	III	3-1-0
Stream 07: Image Processing, Virtual Reality, Multimedia and Computer Graphics				
	Computer Vision	CS 9371/IT 9371/SW 9371	III	3-1-0
	Virtual Reality	CS 9372/IT 9372/SW 9372	III	3-1-0

- *CS and IT students may select at most (total of semester-II & III electives) two courses from each stream*
- *CS students must select at least one course each from Stream 01 and Stream 05*
- *IT students must select at least one course each from Stream 03, Stream 04 and Stream 06*
- *SW students must select at least three courses (total of semester-II & III electives) from Stream 03 and one course from Stream 04*

DISCRETE MATHEMATICS AND THEORY OF COMPUTATION
(CS910/IT910/SW910)

L T P
3 1 0

Objective: To gain an understanding of the mathematics that underlies the theory of computation. At the end of the course, the student should be able to formalize mathematical models of computations and use these formalisms to explore the inherent limitations of computations.

Unit I **8 hrs**

Algebraic structures:
Semigroups, Monoids, groups, Substructures and Morphisms, Rings, Fields; Lattices, Distributive, Modular and Complemented; Boolean Algebra, Normal Forms (Conjunctive and Disjunctive), Simplification of Boolean Expressions Using Laws and K-Map.

Logic and Proofs:
Basic Logic: Propositional Logic: Logical Connectives; Truth Tables; Converse, Inverse, Contra Positive, Negation, and Contradiction, Validity; Predicate Logic; Limitations of Predicate Logic, Universal and Existential Quantifier; Modus Ponens and Modus Tollens.

Unit II **8 hrs**

Proof techniques:
Notions of Implication, The Structure of Formal Proofs; Direct Proofs; Proof by Counter Example; Contraposition; Contradiction; Mathematical Induction; Simple Induction, Strong Induction. The Stable Marriage Problem.

Counting:
Counting Arguments; Pigeonhole Principle; Permutations and Combinations, Combinatories and Combinatorial Proofs, Inclusion-Exclusion, Recursive Mathematical Definitions; Well Orderings, Recurrence Relations, Generating Functions.

Unit III **8 hrs**

Discrete & Continuous Probability:
Probability Spaces and Events, Conditional Probability and Bayes' rule , Random variables (Discrete and Continuous) and Expectation and Variance of Distributions- Uniform, Binomial, Exponential, Poisson & Normal distributions. Sampling and Law of Large Numbers (Central Limit Theorem), Estimation ,Bayesian Estimation and Inference.

Introduction to Automata Theory:
Alphabets, Languages & Grammars, Classification of Automata, Chomsky Hierarchy of Grammars.

Finite State Automata:
Finite state Automata - Non Deterministic and Deterministic FSA, NFSA with ε- moves, Equivalence of Deterministic and Non-Deterministic Automata

Unit IV **8 hrs**

Regular Languages:
Regular Expressions, Regular Grammars, Equivalence of Regular Expression, FSA and Regular Grammars. Closure Properties, Minimality of Automata, Decision Algorithms. Pumping Lemma, Myhill Nerode Theorem

Context Free Languages:
Context Free Grammars, Derivation Trees and Ambiguity, Normal Forms, Push Down Automata, Acceptance by Empty Stack and Final State, Equivalence Between CFG and PDA. Self Embedding Property and Pumping Lemma. Closure Properties, Decision Algorithms

Unit V **8 hrs**

Recursive and recursively enumerable Languages:
Turing Machines, Grammars, Variations in Turing Machines. Recursive Functions, Church's Thesis. Universal Turing Machine, Closure Properties, Context Sensitive Languages and Linear Bounded Automata

Undecidability.
Decidability, Undecidablity/Non-Computability, Reductions. Halting Problem, Post Correspondence and Modified Post Correspondence Problems, Unsolvable Problems about Turing Machines, Unsolvable Problems about Grammars

Discrete Mathematics:-

Text Books:-

1. Kenneth Rosen, *Discrete Mathematics and its Applications*, 6th ed., McGraw-Hill, New York, 2007
2. C.L. Liu, *Elements of Discrete Mathematics*, 2nd Edition, McGraw Hill, 1985.

Reference Books:-

1. Ralph P. Grimaldi and B.V.Ramana, *Discrete and Combinatorial Mathematics (An Applied Introduction),* Pearson 5^{th} Edition
2. Jean-Paul Tremblay, R Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, McGraw-Hill computer science series, Edition 1997
3. Richard .A. Johnson, *Miller & Freund's Probability and Statistics for Engineers,* Eastern Economy Edition.

Theory of Computation:-

Text Books:-

1. J.E. Hopcroft and J.D. Ullman. *Introduction to Automata Theory, Languages of Computations* , Addison-Wesley, 1979. (Indian edition available from Narosa.)
2. Peter Linz, *An Introduction to Formal Languages and Automata,* Jones and Bartlett Publishers, Inc. , USA ©2006

Reference Books:-

1. Daniel I. A. Cohen, *Introduction to Computer Theory*, John Wiley & Sons, Inc. New York
2. K.Krithivasan and R.Rama; *Introduction to Formal Languages, Automata Theory and Computation,* Pearson Education, 2009.
3. J.E.Hopcroft, R.Motwani and J.D.Ullman , *Introduction to Automata Theory Languages and Computation,* Pearson Education Asia , 2001

DESIGN ANALYSIS AND ALGORITHM
CS911/IT911/SW911

L T P
3 0 2

Pre-requisites Programming in C, Data Structures

Objectives The objective of this course is to study paradigms and approaches used to design and analyze algorithms and to appreciate the impact of algorithm design in practice.

Unit I **8 hrs**

Introduction to Algorithms: Algorithms and their Performance Analysis, Space Complexity, Time Complexity, Asymptotic Notations

Divide and Conquer Algorithms: General Method, Analyzing Divide and Conquer Algorithms, Applications - Binary Search, Merge Sort, Heap Sort, Priority Queues, Quick Sort, Strassen's Matrix Multiplication.

Unit II **8 hrs**

Advanced Analysis Techniques: Probabilistic Analysis, Amortized Analysis.

Review of Data Structures: Stacks, Queues, Trees, Binary Trees, Binary Search Trees, Graphs – Representation and Traversal, B-Trees, Data Structures for Disjoint Sets

Unit III **8 hrs**

Advanced Data Structures: Splay Trees, Binomial Heaps, Fibonacci Heaps

Greedy Programming: Fractional Knapsack Problem, Minimum Spanning Tree, Task Scheduling, Activity Selection Problem, Single Source Shortest Path.

Unit IV **8 hrs**

Dynamic Programming: Longest Common Subsequence, 0-1 Knapsack Problem, Shortest Path Problems (Single-Source and All-Pair), Travelling Salesperson problem.

Backtracking: General Method, N-queens Problem, Sum of Subset Problem, Graph Colouring , Longest Common Subsequence.

Unit V **8 hrs**

Branch and Bound Technique: General Method, 0/1 Knapsack problem, Travelling Salesperson problem.

Max-flow: Flow Networks, Ford-Fulkerson Method, Bipartite Matching

Polynomials and FFT: Representation of Polynomials, DFT and FFT, Efficient FFT implementations

Text Books:-

1. T H Cormen, C E Leiserson, and R L Rivest, *Introduction to Algorithms*, 2nd Edn, Pearson Education

2. Ellis Horowitz and Sartaj Sahani, *Fundamental of Computer Algorithm*, Galgotia Publications.

Reference Books:-

1. Aho, Ullman and Hopcroft, *Design and Analysis of Algorithms*, Pearson Education
2. Michael T Goodrich & Roberto Tamassia, *Algorithm Design: Foundations, Analysis & Internet Examples*, Wiley Student Ed., 2002.

CS911P/IT911P/SW911P : Design and Analysis of Algorithms Lab

Implementation of the following using C, C++ or JAVA

1) Elementary Sorting Algorithms and Searching Algorithms
2) Divide and Conquer: Heap Sort, Priority Queues, Quick Sort
3) Binary Search Trees
4) Graph Traversal
5) Minimum Spanning Tree: Prim's and Kruskal's Algorithms
6) Dijkstra's Shortest Path Algorithm
7) Dynamic Algorithms: LCS, Bellman Ford Shortest Path Algorithm
8) Backtracking Algorithms: N Queens, Sum of Subsets
9) Max Flow: Ford Fulkerson
10) FFT Algorithm

ADVANCED COMPUTER ARCHITECTURE

CS912/IT912/SW912

L T P
3 1 0

Pre-requisites This course has a requirement that students have under gone topics of Computer Organization, process and thread in operating system and compilers in their under graduation.

Objective Computer architecture course aims towards study of problem specific advanced computer architecture in detail. In particular Advanced Computer Architecture includes parallel architectures. The coarse includes broadly parallel architecture using ILP, Data Parallel and Thread & Process Level Parallel architecture. Apart from that, the coarse objective is to learn parallel programming skills using Pragmatic and Non-pragmatic approach.

Unit-I: Introduction & Fundamentals: 8 hrs

The concept of computer Architecture: Interpretation of concept of computer architecture at different level abstraction, Multi level hierarchical frame work, description of computer architecture,

Introduction to parallel processing: Basic concept, types of level of parallelism, classification of parallel architecture, Basic parallel techniques, relationship between language and parallel architecture.

Principles of scalable performance: Performance Metrics and Measures, Speedup Performance Law, Scalability Analysis & approaches

Processor and memory hierarchy: Design Space of Processor, ISA, CISC & RISC, Memory Hierarchy Technology, Virtual Memory Technology

Unit-II: Instruction Level Parallel Processor (Parallelism) 8 hrs

Pipelined Processors: Basic concept, ILP: Basics, Exploiting ILP, Limits on ILP, design space of pipelines, performance of pipeline, reservation table, And DLX Case Study.

VLIW architecture, Superscalar Processor: Super Scalar and super-pipeline Design

Unit-III: Data parallel Architecture 8 hrs

SIMD Architecture: Design space, fine grain SIMD architecture, coarse grain SIMD architecture

Associative and Neural Architecture, Systolic Architecture, Vector Architectures: Word length, vectorization, pipelining, and vector instruction format

Unit-IV: Thread and Process Level Parallel Architecture (MIMD Architecture) 8 hrs

Multi-threaded Architecture: Design space, computational model, Data flow architecture, hybrid multi shared architecture

Distributed memory MIMD Architecture: Design space, interconnection networks, topology, fine grain system, medium grain system, coarse grain system, Cache Coherence and Synchronization Mechanism

Shared memory MIMD Architecture.

Unit-V: Parallel Algorithm and Programming **8 hrs**

MPI: Basics of MPI

Open MP: OpenMP Implementation in 'C', Directives: Conditional Compilation, Internal Control Variables, Parallel Construct, Work Sharing Constructs, Combined Parallel Work-Sharing Constructs, Master and Synchronization Constructs

POSIX thread: IEEE POSIX Threads: Creating and Exiting Threads, Simultaneous Execution of Threads

Text Books:

1. Advanced Computer Architectures, DEZSO SIMA, Pearson Education
2. Advanced Computer Architecture, Kai Hwang, TMH
3. Parallel Programming in C with MPI and Open MP, Quinn, TMH

Reference Books:

1. Beginning Linux Programming, Neil Matthew, Richard Stones, WROX
2. Computer Architecture and Organization, John P. Hayes, TMH
3. Computer Architecture :A Quantitative Approach, Hennessy and Patterson, Elsevier

Web References:

1. Open MP Specification and Usage (www.openmp.org)
2. ACM Special Interest Group on Computer Architecture, SIGARCH, (www.sigarch.org)

OPERATING SYSTEMS AND DISTRIBUTED SYSTEMS
CS913/IT913/SW913

L T P
3 0 2

Pre-requisites: Computer Organization

Objectives : To study the concepts of Operating Systems and Distributed Systems

Unit I: Process Synchronization **8 hrs**

- Critical Section Problem. Requirements of an Ideal Critical Section Solution. Peterson's Algorithm, Dekker's Algorithm, Lamport's Bakery Algorithm and Eisenberg McGuire Algorithm, Semaphore based critical section solutions to Producer Consumer, Reader Writer, Dining Philosopher and Sleeping Barber problems
- Mutual Exclusion and Process Coordination in Distributed Systems, Requirements of ideal mutual exclusion algorithm in Distributed Systems, Token based (Suzuki Kasami Broadcast Algorithm and Raymond's Tree based Algorithm) and Non Token based (Lamport Algorithm, Ricart Agrawala Algorithm and Maekawa's Algorithm) and their comparative performance analysis.

Unit II: CPU Scheduling **8 hrs**

- CPU Scheduling in UNIX and RTOS. CPU Scheduling in Distributed and Multi-Processor Systems, Load Distribution Algorithms, Load Balancing and Process Migration.
- Deadlock handling strategies in Distributed Systems, Phantom Deadlocks, Centralized, Distributed and Hierarchical Deadlock Detection Algorithms.

Unit III: Memory Management **8 hrs**

- Paging, Segmentation, Segmentation with paging, Virtual Memory, Demand Paging, Page Replacement Algorithms, Thrashing.
- Distributed Shared Memory: Architecture, The Central Server Algorithm, The Migration Algorithm, The Read Replication Algorithm and Full Replication Algorithm for implementing Distributed Shared Memory, Memory Coherence and Design Issues.

Unit IV: Distributed Transaction Management and Concurrency Control **8 hrs**

- Distributed Transaction Processing: Concurrency Control, Classification of Failures, Backward and Forward Error Recovery, Recovery in Concurrent Systems, Consistent set of Checkpoints, Synchronous Checkpoints, Commit Protocols, Non Blocking Commit Protocols and Voting Protocols.

Unit V: Protection and Security **8 hrs**

- Resource Security: The Security Environment, Attacks from inside and outside the system, Protection Mechanisms, Access Matrix Model, Implementation of Access Matrix, Advanced Model of Protection.

Case study: LINUX concepts

Text Books:-

1. Deitel, Deitel & Choffnes, " Operating System " Pearson
2. Galvin, Silberschatz & Gagne, "Operating System Principles", Wiley
3. Singhal & Shivratri, "Advance Concepts in Operating System", McGraw Hill

Reference Books:-

1. Gerald Tel, " Introduction to Distributed Algorithms", Cambridge Press
2. Tanenbaum Andrew S. " Modern Operating system", Pearson
3. Coulouris, Dollimore & Kindberg," Distributed System Concepts & Design:, Pearson
4. Pradeep K. Sinha, "Distributed Operating System Concepts & Design," PHI
5. Joel M. Crichlow, " Distributed Systems", PHI
6. Stalling William, "Operating System Internals & Design Principles", Pearson
7. Ceri, Pelagati, "Distributed Database", TMH

CS913P/IT913P/SW913P: Operating Systems and Distributed Systems Lab

General Concepts:

1) Simulation of MUTEX and Counting Semaphores
2) Implementation of Process Synchronization
   a) Producer Consumer Problem b) Reader-Writer Problem c) Dining Philospher's Problem d) Sleeping Barber Problem
3) Simulation of CPU Scheduling Algorithms
   a) FCFS b) SJF c)SRTF d) Round Robin e) Priority Preemptive
4) Simulation of Bankers Deadlock Avoidance Algorithm
5) Simulation of Page Replacement Algorithms
   a) FIFO b) LRU c) Optimal

Linux:

1) Commands for general purpose utilities and handling files and its attributes
2) Simple Filters - head, tail, cut, paste, sort, uniq, tr
3) Filters using Regular Expression – grep and sed
4) Shell Programming
5) Basic System Administration – Maintaining Security, User Management, Providing Backup

PROGRAMMING PRACTICES
CS914/IT914/SW914

L T P
2 0 3

Objective: To prepare students for rapid prototyping of project work.

Unit-I: **4hours**
Scilab: Introduction to Scilab, Matrix operations, Scripts & Functions, if-then and while loops, plotting, Ordinary differential equations,

Unit-II: **4hours**
Scilab: Polynomials, Least square fit, read/write data from files, simulation, optimization

Unit-III: **4hours**
Scilab: Artificial Neural Network, Image Processing Toolbox, Signal Processing, Wavelets

Unit-IV: **4hours**
Python: Python Basics: Code Structure, Variables, Basic data types, Decision making and iterations, if-else control structure, String handling, Functions: Passing arguments and returning a value, scope of variables, predicate and recursive functions.

Unit-V: **4hours**
Python: Compound data structures: List comprehensions, tuples and dictionaries, Object Oriented Constructs: Classes and Objects in Python, Constructors and Static methods, controlling attribute access, inheritance and overloading, iterators, Modules: Standard modules, dir() function and Packages.

Books on SCILAB

1. SCILAB- A hands on introduction by Satish Annigeni E-book downloadable from www.lulu.com / items/ volume-34/419000
2. Claude Gomaz, Engineering and scientific computing with SCILAB ISBN 978-0-8176-4009-5
3. Stephen Campbell, Jean-Philippe Chancelier and Ramine Nikoukhah, Modeling and Simulation in SCILAB / SCICOS

Web resource:
http://www.scilab.org/products/scilab http://www.scilab.in/

Books on Python:

1. Learning Python by Mark Lutz (O'Reilly & Associates)
2. Core Python Programming by Wesley J. Chun (Pearson Education)

Web resource

www.python.org

CS914P/IT914P/SW914P: Programming Practices Lab

The lab will be that of 6 hours per week out of which 2 hours is for lab on SciLab/Python and 4 hours for the mini-project .

The mini-project will be allocated by the concerned faculty teaching the course. The students have the choice to implement it any language of their choice. The report of the mini-project will consist of an analysis of problem statement, requirement analysis, system design, justification of the choice of programming language/environment and complete code with results. The mini-project will be evaluated by an external examiner.

SEMESTER-II

Course Code	CS 9211/ IT 9211/ SW 9211	**Stream-01**
Course Title	Pattern Recognition	
L-T-P	3-1-0	
Credits	4	
Pre-requisites	Knowledge of programming, programming language concepts, discrete mathematics (set theory, graph theory, logic), calculus, linear algebra, basic probability theory and statistics, and data structures and algorithms (design and analysis).	
Objectives	To equip students with basic mathematical and statistical techniques commonly used in pattern recognition and to introduce a variety of pattern recognition algorithms.	

Unit-I

Introduction: Basics of pattern recognition, data sets for Pattern Recognition, Different Paradigms of Pattern Recognition, Representations of Patterns and Classes, Metric and non-metric proximity measures

Bayesian decision theory : Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, Discrete features

Unit-II

Parameter estimation methods: Maximum-Likelihood estimation, Gaussian mixture models, Expectation-maximization method, Bayesian estimation,

Hidden Markov models for sequential pattern classification: Discrete hidden Markov models, Continous density hidden Markov models

Unit – III

Dimension reduction methods: Principal Component Analysis (PCA), Fisher Linear discriminant analysis.

Nonparametric Techniques for Density Estimation: Parzen Windows, K-Nearest Neighbor Estimation, Fuzzy classification.

Unit – IV

Linear discriminant function based classifiers: Perceptron, Support vector machine *Non-metric methods for pattern classification:* Non-numeric data or nominal data, Decision trees

Unit - V

Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.

Text Books:-

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.
2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2009.

Web References:-

1. http://ocw.mit.edu/courses/media-arts-and-sciences/mas-622j-pattern-recognition-and-analysis-fall-2006/index.htm
2. http://www.cs.nccu.edu.tw/~whliao/pr2008/

Course Code	CS 9212/ IT 9212/ SW 9212	**Stream-01**
Course Title	Neural Networks	
L-T-P	3-1-0	
Credits	4	
Pre-requisites	Knowledge of programming, programming language concepts, discrete mathematics, calculus, linear algebra, basic probability theory and statistics, and design and analysis of algorithms.	
Objectives	To teach the mathematical concepts and various types of neural networks along with their applications such as in discriminators, classifiers, computation, etc along with the training algorithms	

UNIT – I

Introduction to artificial neural networks :

Biological neural networks, Pattern analysis tasks: Classification, Regression, Clustering, Computational models of neurons, Structures of neural networks, Learning principles, Perceptron, The Perceptron Convergence Theorem, XOR Problem, Pattern classification using perceptron

UNIT-II: *Feedforward neural networks*

Single layer and Multilayer feed forward neural networks (MLFFNN), Error backpropagation learning, Heuristics for Making the Back-Propagation Algorithm Perform Better, Pattern classification using MLFFNNs, Practical considerations, Cross-validation, Network pruining, Virtues and Limitations of Back-Propagation Learning, Accelerated convergence

UNIT-III: ***Kernel Methods and Radial basis function networks***

Cover's Theorem on the Separability of Patterns, Interpolation Problem, Regularization theory, Radial-Basis-Function (RBF) Networks, Properties of RBF networks, Estimation of Regularization Parameters, RBF networks vs MLFFNs, Kernel Regression and Its Relation to RBF Networks

UNIT-IV

Support Vector Machine

Introduction, Support Vector Machine (SVM) as a kernel method, SVMs for Pattern Recognition

Principal Component Analysis

Principles of Self-Organization, Self-Organized Feature Analysis, Principal-Components Analysis: Perturbation Theory, Hebbian-Based Maximum Eigen filter, Hebbian-Based Principal-Components Analysis, Kernel Hebbian Algorithm

UNIT-V

Self-organizing maps

Introduction, Feature mapping Models, Kohonen's self-organizing map

Neurodynamics

Dynamic Systems, Stability of Equilibrium States, Neurodynamic Models, Recurrent Network, Hopfield Model

Text Books:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
2. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998

Reference Books:

1. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2003

Web Resource:

http://nptel.iitm.ac.in/syllabus/117105028/

Course Code	CS 9213/ IT 9213/ SW 9213	**Stream-01**
Course Title	Machine Learning	
L-T-P	3-1-0	
Credits	4	
Pre-requisites	Knowledge of programming, programming language concepts, discrete mathematics, calculus, linear algebra, basic probability theory and statistics, and design and analysis of algorithms .	
Objectives	To understand basic theory underlying machine learning and a range of machine learning algorithms along with their strengths and weaknesses.	

Unit-I

Machine Learning Foundations: Overview, applications; Mathematical Foundations; Calculus, linear algebra, probability theory, statistics, Curse of dimensionality, Curve fitting, Decision theory, Information theory

Unit-II

Supervised Learning: Linear Methods-: Regression; Linear Basis Function Models, Bayesian Linear Regression, Classification; Discriminant Functions, Generative vs. discriminative models; Naive Bayes and Logistic Regression

Unit-III

Supervised Learning: Non-Linear Methods- Max-margin classification and optimization; Support Vector Machines, Kernel Methods; Dual optimization, kernel trick, Radial Basis Function Networks, Instance based learning; Nearest-neighbors, Neural Networks; Neural Network models, Feed-forward Network Functions, Network Training, Error Backpropagation, Regularization in Neural Networks, Mixture Density Networks, Bayesian Neural Networks

Unit-IV

Unsupervised Learning: Clustering; Expectation-Maximization and k-means, EM and Clustering; Gaussian mixture models, The EM Algorithm

Unit-V

Graphical Models: Bayesian networks and conditional independence, Markov Random Fields and Exact inference, Sequential graphical models; Max Sum and Max Product, Hidden Markov Models and Conditional Random Fields

Text Books:

1. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

Reference Books:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.
2. Tom Mitchell, Machine Learning. McGraw-Hill, 1997.

Web References:

http://www.cs.nyu.edu/~mohri/ml12/

Course Code	CS 9214/ IT 9214/ SW 9214	**Stream-01**
Course Title	Natural Language Processing	
L-T-P	3-1-0	
Credits	4	
Pre-requisites	Knowledge of CS's Core and System Courses on Programming, Data Structure, Algorithms, Artificial Intelligence.	
Objectives	To expose the students to NLP applications and the challenges in processing of natural languages. The course will provide an insight into methodologies for dealing with natural language in textual form for different applications.	

Unit 1

Introduction: NLP applications; Ambiguities: sense, pronoun reference & structural/attachment; basic issues in speech and language processing; Role of syntax, semantics, context, world-knowledge & pragmatics, Corpus-unilingual, bilingual; Zipf's law, corpus text analysis- sentence & word boundary; tokenization; named-entities; Rule-based approach, vs. Statistical approach to analysis;, Fundamental aspects of English grammar; Contrastive examples from Hindi.

Unit 2

Linguistic resources: machine readable dictionary, lexical data base, semantic tree, ontology, Wordnet, Treebank, verb sub-categorization; evaluation measures: Precision & Recall.

Morphological Analysis and synthesis: Types of Morphology, Approaches to Morphological Analysis, Morphological Processing, Morphological synthesis, examples from Hindi.

Unit 3

Syntactic Analysis:

*U*se of transition network for basic language analysis, recursive transition network, augmented transition network, shallow parsing

Context Free Grammars for English Language Syntax, basic parsing techniques - top down parsing, bottom up parsing, comparison of top down and bottom up parsing, Augmenting CFG with features, Introduction to Probabilistic CFG.

Collocations, Multi-word expressions.

Unit 4

Language modeling, Markov models, Hidden Markov Models,

Parts of speech tagging: rule based and stochastic part of speech tagging.

Semantic Analysis:

Representation of knowledge for language analysis Syntax driven semantic analysis, lexical semantic approach

Word Sense Disambiguation, Pronoun reference disambiguation, text similarity

Unit 5

Applications:

Text categorization, Text Summarization, Sentiment Analysis, Information Retrieval, Question Answering, Dialogues and Conversational Agents, Natural Language Generation, Machine Translation- RBMT. EBMT, SMT, hybridization.

Text Books:

1. Daniel Jurafsky & James H.Martin, " Speech and Language Processing", Pearson Education (Singapore) Pte. Ltd., 2002.
2. James Allen, "Natural Language Understanding", Pearson Education, 2003

Reference Book:

C.D. Manning and H. SWchulz, "Foundations of Statistical Natural Language Processing", MIT Press

Web-resource: http://www.scism.lsbu.ac.uk/inmandw/tutorials/nlp/

CS9221/IT9221/SW9221: MOBILE COMPUTING (Stream: 02)

3-1-0

Credits : 4

Pre-requisite: Introduction to Computer Networks

Unit I **08 Hrs**

Issues and Challenges of Wireless Networks – Location Management, Resource Management, Power Management, Security, Wireless Media Access Techniques, Mobility Management and Handover Technologies.

Architecture: Relationship of Wireless Computing, Ubiquitous Computing, Internet Computing and Ambient Computing. Elements of Pervasive Architecture, Requirements of Computational Infrastructure, Failure Management, General Issues: Security, Performance and Dependability, Web Architectures: Local Networks, Store and Forward Multi-network Architectures (e.g. Wireless LAN to LAN to Internet, Hand Held synchronized to PC to LAN).

Unit II 08 Hrs

Types of Wireless Networks: Mobile Networks, Ad-hoc Networks: Ad-hoc Routing, Sensor Networks and Peer-Peer Networks, Mobile Routing Protocols – DSR, AODV, Reactive routing, Location Aided Routing, Mobility Models – Entity Based, Group Mobility, Random Way-Point Mobility Model.

Unit III 08 Hrs

Databases and Software: Principles of Disconnected Operation- Caching, Hoarding, etc. Software Adaptation and OS Support. Resource-Sharing, OS for Embedded Devices: PalmOS, WindowsCE, Embedded LINUX, WAP/WML, J2ME, Windows Mobile and .Net Framework, BREW, Mobile Agents, Resource and Service Discovery, Mobile Java, Mobile Grid and Collaborative Processing with Jini.

Unit IV 08 Hrs

Protocols and its Applications

Protocols: Networking Protocols, Packet Switched Protocols, Routing Protocols for Sensor Networks, Data Centric Protocols, Hierarchical Protocols, Location-based protocols, Multimedia Messaging Service (MMS) Protocols, Wireless Application Protocol (WAP).

Applications: Mobile Access to Patient Information in a Hospital, Sales Support, Retailing, Services Support, Tracking Applications, Designing for Small Screen Devices, Search Interfaces, Context-Awareness and Determining locality.

Unit V 08 Hrs

Concepts and Applications:

Mobile Positioning Techniques: GIS, LBS Architecture and Protocols.

Mobility Management: Handoff and Location Management. Concepts- Mobility Management in PLMN, Mobility Management in Mobile Internet, Mobility Management in Mobile Agent.

Mobile Ad hoc Networks (MANETs) and Applications: Concepts and Applications, Routing Protocols, Clustering, Mobile P2P Systems, Mobile Computing Middleware- Functionalities of Mobile Computing Middleware, Tuple-Space Middleware, Context-Aware Middleware, Reflective Middleware, Publication/Subscription Middleware, Service Discovery and Disconnected Operations.

Recommended Books :

W. Stallings, Wireless Communications & Networks, Prentice Hall, 2001. J. Schiller, ”Mobile Communications", Addison Wesley, 2000.

F. Adelstein, S.K.S. Gupta, “Fundamentals of Mobile and Pervasive Computing”. The McGraw-Hill, 2005.

Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff, Thomas Schack, “Pervasive Computing: Technology and Architecture of Mobile Internet Applications”, 2002, Addison-Wesley, ISBN: 0201722151.

Reference Books:

Uwe Hansmann, L. Merk, M. Nicklous, T. Stober, U. Hansmann, “Pervasive Computing (Springer Professional Computing) ”, 2003, Springer Verlag, ISBN:3540002189.

Charles E.Perkins, Ad-Hoc Networking, Addison-Wesley, December 2000

Wireless Internet, Applications and Architecture, Mark Beaulieu, ISBN: 0-201- 73354-4, Addison-Wesley, 2002.

Reza B’Far, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, Cambridge University Press, 2005.

Evaggelia Pitoura and George Samaras, Data Management for Mobile Computing, Kluwer Academic Publishers, 1998.

R. Riggs, A. Taivalsaari, M. VandenBrink, Programming Wireless Devices with Java2 Platform, Micro Edition, Addison-Wesley, 2001.

H.M. Deitel, P.J. Deitel, T.R. Nieto, and K. Steinbuhler, Wireless Internet & Mobile Business – How to Program, Prentice Hall, 2002.

CS9222/IT9222/SW9222: INTRODUCTION TO CLOUD COMPUTING (Stream: 02)

3-1-0

Credits : 4

Pre-requisite: Basics of computer Networks and Web Technology

Unit I **08 Hrs**

Evolution of cloud computing: Trends of computing, Introduction to distributed computing, cloud computing, Cloud Based Application Development Approach Vs Traditional Application Development Approach, What's cloud computing, Properties & Characteristics, Service models, Deployment models, SLA(Service Level Agreements), SLA at various levels, SOA(Service oriented Architecture), SOA characteristics

Unit II **08 Hrs**

Cloud Computing Architectural Framework : Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), cloud computing vendors, Cloud Computing threats, Cloud Reference Model, The Cloud Cube Model, issues in Cloud Computing ,Managing and administrating the cloud services and cloud resources,

Virtualization -Hypervisor Architecture, Hardware Virtualization, Software Virtualization, Memory Virtualization, Storage Virtualization, Data Virtualization, Network Virtualization, Virtualization Security Recommendations

Unit III **08 Hrs**

Security in Cloud: Infrastructure security – Network Level, Host Level and Application Level

Security and Storage: Aspects of Data Security, Data control, Network Security, Host Security, Data Security Mitigation, Encryption, storage- confidentiality, integrity, availability.

Security Management in the Cloud: Security Management Standards, Availability Management - PaaS, SaaS, IaaS, Access Control, Security Vulnerability, Patch and Configuration Management.

Unit IV **08 Hrs**

Privacy in Cloud: Data Life-Cycle, Key Privacy Concerns in the Cloud, Responsibility for Protecting Privacy, Risk Management and Compliance in relation to Cloud Computing, Legal and Regulatory Implications.

Disaster Recovery: Disaster recovery planning, Disaster in Cloud, Disaster Management,

Unit V **08 Hrs**

Case study : Hadoop- architecture, Hadoop Distributed file system, map- reduce model, getting started with the Hadoop, Amazon EC2 / S3 and EC2 Commands. Introduction of MS Windows Azure, Google Apps / Google Docs.

Text Books:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, " Cloud Security and Privacy," O Reilly

2. George Reese, "Cloud Application Architectures," O Reilly

Reference Books:

1. David S. Linthicum, " Cloud Computing and SOA Convergence in your Enterprise, A Step by Step Guide, " Pearson

2. Dr. Gautam Shroff ,"Enterprise Cloud Computing Technology, Architecture, Applications",

Cambridge University Press.

Reference Links:

1. https://www.cloudsecurityalliance.org/guidance/csaguide.v2.1.pdf
2. https://www.cloudsecurityalliance.org/guidance/csaguide.v3.1.pdf
3. https://www.cloudsecurityalliance.org/guidance/csaguide.v1.0.pdf
4. http://cs5421.sslab.cs.nthu.edu.tw/home/Materials
5. http://developer.yahoo.com/hadoop/tutorial/index.html
6. http://hadoop.apache.org/docs/r0.16.4/index.html

CS9231/IT9231/SW9231 SOFTWARE REQUIREMENTS AND ESTIMATION

(Stream: 03)

OBJECTIVE:

1. To understand the importance and knowledge of software requirement and management.
2. Describe how to calculate estimation of project
3. Different ways of quickly estimating an effort (Cost Estimation)
4. Describe the critical factors we must consider when estimating software projects

Pre-requisite: Basic concept of Software Engineering and Object Modeling

UNIT 1: INTRODUCTION

Software Requirements: Essential Software requirement, Object model ,data flow model ,Behavioral Modeling, State Diagram, System Diagram, Data Dictionary, Improving requirements processes. IEEE standards for Software requirement specification,

UNIT 2: SOFTWARE REQUIREMENT ENGINEERING

Requirements Engineering Tasks, Elicitation requirements, analysis documentation, review analysis models, Software quality attributes, Risk management, Risk reduction through prototyping, setting requirements priorities, verifying requirements quality.

UNIT 3: SOFTWARE REQUIREMENT MANAGEMENT

Software Requirements Management, Requirements management Principles and practices, Requirements attributes, Change Management Process, Requirements Traceability Matrix, Links in requirements chain.

Tools for Requirements Management and Estimation Requirements Management

UNIT 4: SOFTWARE MODELING

Software Requirements Modeling Use Case Modeling, Analysis Models, , state transition diagram, class diagrams, Object analysis, Problem Frames.

UNIT 5: SOFTWARE ESTIMATION

Components of Software Estimations, Estimation methods, Problems associated with estimation, Key project factors that influence estimation

Size Estimation Two views of sizing, Function Point Analysis, Mark II FPA, Full Function Points, LOC Estimation, Conversion between size measures,

Effort, Schedule and Cost Estimation , Estimation Factors, Approaches to Effort and Schedule Estimation, Cost Estimation, Empirical estimation Models, Estimation for agile Development, Estimation for Web Engineering Projects ,Putnam Estimation Model, Algorithmic models,

REFERENCES:

1. Software Requirements and Estimation by Rajesh Naik and Swapna Kishore, published by Tata Mc Graw Hill .
2. Software Engineerng , Roger s. Pressman, published by Tata Mc Graw Hill .
3. Head First Sofware Developmen, Dan Pilone & Russ Miles, O'Reilly.
4. Jones, C. *Estimating Software Costs*, McGraw-Hill
5. http://www.stsc.hill.af.mil/crosstalk/2002/06/jones.pdf
6. Software Requirements by Karl E. Weigers,Microsoft Press.

7. Managing Software Requirements, Dean Leffingwell & Don Widrig, Pearson Education,2003.

8. Mastering the requirements process, second edition, Suzanne Robertson & James Robertson, Pearson Education, 2006.

9. Estimating Software Costs, Second edition, Capers Jones, Tata McGraw-Hill, 2007.

10. Practical Software Estimation, M.A. Parthasarathy, Pearson Education, 2007.

11. Measuring the software process, William A. Florac & Anita D. Carleton, Pearson

CS 9232/IT 9232/SW 9232: SOFTWARE QUALITY ASSURANCE

(Stream: 03)

OBJECTIVE:

1. To describe the need and knowledge of Software Quality.
2. Describe Software Quality Assurance.
3. Explain Software Quality factors
4. To describe elements of Software Quality Assurance
5. Development and quality plans
6. Process Maturity models

Pre-requisite: Basic Concept of Software Engineering

UNIT I

Software Quality, Software Quality Control, Software Quality Assurance, Cost of Quality, Framework and Standards SQA Framework, Formal Inspection and technical review, Inspection Role and steps, Software Reliability, Statistical Quality Assurance, SQA Plan, IEEE standards for SQA Plan,

Software Quality Assurance, Components of Software Quality Assurance, Software Quality Assurance Plan, Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcolm Bridge, Three- Sigma, Six- Sigma

UNIT II

Software Quality Assurance Metrics and Measurement Software Quality Metrics: Product Quality metrics, In Process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs. Software Quality metrics methodology. Establish quality requirements, Identify Software quality metrics. Implement the software quality metrics, analyze software metrics results, and validate the software quality metrics, Software quality indicators.

UNIT III

Quality Assurance Clarification: QA as Dealing with Defects, Defect Prevention- Education and Training, Formal Method, Other defect prevention techniques, Defect Reduction- Inspection Direct fault detection and removal, Testing failure observation and fault removal, other techniques and risk identification, Defect Containment.

UNIT IV

Quality Assurance in Context- Handling Discovered defect during QA activities, QA Activities in Software Processes, Verification and Validation Perspectives, Reconciling the Two Views, Quality Engineering in Software Process, Software Inspection, and Formal Verification.

Quality Assurance Techniques and Activities, Cost Comparison,

UNIT V

Feedback loop and activities for quantifiable Quality Improvement, Quality Models and Measurements, Defect Classification and Analysis, Risk Identification for Quantifiable Quality Improvement, Software Reliability Engineering.

References

1. Effective Methods for Software Testing, 2nd Edition by William E. Perry , Second Edition, published by Wiley

2. Software Quality, by Mordechai BenMenachem/Garry S. Marliss, by Thomson Learning publication.
3. Software Quality Engineering, Jeff Tian, Wiley India Pvt. Ltd.
4. Software Engineering, David Gustafson, Tata McGraw Hill.
5. Software Quality, Martin Wieczorek & Dirk Meyerhoff, Springer
6. Metrics and Models for Software Quality Engineering, by Stephen H. Kan, by Pearson Education Publication

CS9233/IT9233/SW9233 **(Stream: 03)**

ADVANCED OBJECT ORIENTED SOFTWARE ENGINEERING

OBJECTIVE:

This course teaches advanced object-oriented software engineering concepts. The entire software lifecycle is discussed: requirements analysis, design, implementation, testing, and maintenance. Structured analysis and design is covered as a comparison for object-oriented techniques.

- Specify a feasible software system,
- Create a clean object-oriented design for it,
- Implement it with readable, reusable, modular,
- Test it for correctness and completeness.

Students in the course form themselves into small groups for a group project and also for class presentations.

Pre-requisite: Basic concept of Software Engineering, object-oriented C++

UNIT I OBJECT-ORIENTED SOFTWARE ENGINEERING
OOSE, object-orientation paradigm, object-oriented analysis, basic concepts, use cases, analysis, stereotypes and objects, analysis patterns, object modelling languages, object-oriented design: basic concepts, design stereotypes and objects, design patterns; object-oriented programming: basic concepts, idioms, object-oriented programming languages, application frameworks, object-oriented case tools, state transition and interaction diagrams, testing of object-oriented programs.

UNIT II ADVANCED OBJECT-ORIENTED ANALYSIS AND DESIGN
Frameworks and design patterns, design for reusability, advanced object-oriented programming techniques, design using object-oriented databases and distributed object architectures, design of software agents, project involving object-oriented analysis, design, and implementation.

UNIT III DESIGNING SOFTWARE USING PATTERNS
Process of design, principles, techniques, software architecture, architectural patterns, abstraction occurrence pattern, hierarchy pattern, player-role pattern, singleton pattern, observe pattern, delegation pattern, adapter pattern, facade pattern, immutable pattern, read only interface pattern, proxy pattern.

UNIT IV OBJCET-ORIENTED METRICS
Measure, metrics and indicators, software measurement, metrics for object-oriented software Development environments, characteristic of object-oriented metrics, Chidamber & Kemerers metrics suite: Weighted Methods Per Class (WMC), Depth of Inheritance Tree (DIT), Number of Children (NOC), Coupling Between Object Classes (CBO), Response For a Class (RFC), Lack of Cohesion in Methods (LCOM), Lorenz and Kidds metrics, metrics for object-oriented metrics projects: management process, development process, application size, staffing size, scheduling.

UNIT V DESIGN METRICS AND OBJCET-ORIENTED TESTING
Design metrics overview, method size, method internals, class size, class inheritance, method inheritance, class internals, MOOD (Metrics for Object-Oriented Design): Method Hiding Factor (MHF), Attribute Hiding Factor (AHF), Method Inheritance Factor (MIF), Attribute Inheritance Factor (AIF), Polymorphism Factor (PF), Coupling Factor (CF), object-oriented testing, test case design for object oriented software, testing methods at class level: random testing of object-

oriented class; interclass test case design: multiple class testing, test derived from behaviour models.

Reference Books:

1. Object-Oriented Software Engineering, Bernd Bruegge, Allen H. Dutoit, PHI, 2003.
2. Object-Oriented Software Engineering, Timothy C. Lethbridge, Robert Laganiere, TMH, 2008.
3. Object-Oriented Modeling and Design, J. Rumbaugh, M. Blaha, W. Premerlani, PHI, 1991.
4. Object-Oriented Design, Grady Booch, 1991.
5. Software Engineering: Practitioner‟s Approach, Pressman Roger S., TMH, 2004.
6. Software Engineering: Software Reliability, Testing & Quality Assurance, N. S. Gill, KBP, 2002.

CS9241/IT9241/SW9241: ADVANCED DATABASE MANAGEMENT SYSTEMS

(Stream: 04) 3 1 0

Pre req.: DBMS concepts

OBJECTIVE

Objective of this subject is to have a clear understanding of query Processing and optimization along with to have an idea of latest advancement in the domain of DBMS.

UNIT I **(9 Hours)**

QUERY EXECUTION AND COMPILER

Introduction to Physical-Query-Plan Operators, One-Pass Algorithms, Nested-Loop Joins, Two-Pass Algorithms Based on Sorting and Hashing, Index-Based Algorithms, Buffer Management, Parallel Algorithms for Relational Operations, Using Heuristics in Query Optimization, Basic Algorithms for Executing Query Operations.

Query Parsing, Algebraic Laws for Improving Query Plans, From Parse Trees to Logical Query Plans, Estimating the Cost of Operations, Introduction to Cost-Based Plan Selection, Completing the Physical-Query-Plan, Coping With System Failures, Issues and Models for Resilient Operation, Redo Logging, Undo/Redo Logging, Protecting Against Media Failures

UNIT II **(8 Hours)**

DISTRIBUTED DATABASES

Centralized versus non centralized Databases, Homogeneous and Heterogeneous DDBMS and their comparison, Functions and Architecture, Distributed database design, query processing in DDBMS, Distributed concurrency management, deadlock management, Distributed Commit Protocols: 2 PC and 3 PC, Concepts of replication servers.

DEDUCTIVE DATABASES

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

UNIT III **(8 Hours)**

OBJECTED ORIENTED AND OBJECT RELATIONAL DATABASES

Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, ODL and OQL, Implementing O-R Features, Architecture of Object Oriented and Object Relational Databases,

UNIT IV **(7 Hours)**

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)

DATA WAREHOUSING

Characteristics of Data warehouses, Data modeling of data warehouses, typical functionality of data warehouses.

UNIT V **(8 Hours)**

ADVANCED TRANSACTION PROCESSING

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

Databases on the Web and Semi–Structured Data

Web interfaces to the web, Overview of XML, Structure of XML data, Document Schema, Querying XML data, Storage of XML data, XML applications, The semi–structured data model, Implementation issues, Indexes for text data,

Case Study: Oracle Xi

Text Books:

1. Elmarsi, 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. Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
4. W. Kim, "Modern Database Systems", 1995, ACM Press, Addision – 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

CS9242/IT9242/SW9242: INFORMATION ORGANIZATION AND RETRIEVAL

(Stream: 04) 310

Prerequisite: Data Base Management System, Data Structure

OBJECTIVE

This course examines information organization and retrieval within the context of full-text dataset. This course will introduce students to traditional methods as well as recent advances in information organization, retrieval, handling and querying of textual data.

UNIT I **(8 Hours)**

Introduction to information storage, organization and retrieval system, information life cycle, Concept, resource types and formats of information organization, introduction to data structures and algorithms related to information retrieval, file structures- inverted files, signature files, PAT trees and PAT arrays.

UNIT II **(10 Hours)**

Information Representation-concepts and categories, indexing and content analysis. Study of different classification system, indexing languages and their theoretical basis. Trees and hierarchies, categories and facets.

IR Models- Boolean Model, Vector Space Model, Relational DBMS, Probabilistic Models, language Models.

UNIT III **(8 Hours)**

Term indexing-Zipfs Law, term weighting, searching and data structures, term and query operations- Lexical analysis, stemming algorithms. Thesaurus algorithms, string searching algorithms, Boolean operation and vector models.

UNIT IV **(6 Hours)**

Tools, Formats and standards organizing information and information items- metadata and other frameworks. Vocabulary control, Codes, formats and standards for data representation and transfer.

UNIT V **(8 Hours)**

Clustering- Non-hierarchical methods – Single Pass, Reallocation, Hierarchical Methods- Agglomerative, String Searching, Trees, Binary trees, Binary Digital Trees, Suffix Trees, etc.

Retrieval Effectiveness Evaluation- recall, precision, Fallout. Comparing system using Average precision.

Text Books:

1. Introduction to Information Retrieval" Christopher D.Manning, Prabhakar Raghavan and Hinrich Schutze, Cambrige University press.
2. Gerard Salton "Automatic Information Organization and Retrieval." McGraw Hill.
3. Sevnonius, Elane. The intellectual foundation of information organization. London: MIT press.

Reference Books:

1. Jennifer Rowley & John Farrow, organizing Knowledge- An introduction to managing Access to information, 3rd ed, Grower house Poul,

2. “Modern information Retrieval” Ricardo Baeza-Yates and Berthier Ribeiro-neto.

Web References:

1. http://www.ischool.berkeley.edu/courses/202
2. http://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf
3. http://www.alsatil.edu.ly/alsatilj/issues/issue32007/e-n32007-4.pdf
4. http://www.clemson.edu/catlab/wp-content/uploads/2010/02/pak-pautz-iden-2007.pdf

CS9243/IT9243/SW9243: STATISTICS AND DATA ANALYSIS (Stream: 04)

3 1 0

Pre-requisite: B.Tech. (Subject: Basic Mathematics and its use computer science domain)

Objectives:

By the end of the semester, you should be able to make quantitative statements about a data set in terms of statistics with uncertainties from Monte-Carlo and develop statistical models from data with parametric and non-parametric techniques, quantify spatially distributed data in terms of spatial statistics, estimate and model variogram, estimate values in unsampled locations using basic spatial interpolation/extrapolation and geostatistical methods

UNIT I: **(9 Hours)**

Probability: Definition and interpretation, Baye's theorem, random variables, probability density functions, expectation values, transformation of variables, error propagation.

Examples of probability functions: Binomial, multinomial, Poisson, uniform, exponential, Gaussian, chi-square, Cauchy distributions.

UNIT II: **(8 Hours)**

The Monte Carlo method: Random number generators, the transformation method, the acceptance-rejection method.

Statistical tests: Significance and power of a test, choice of the critical region. Constructing test statistics: the Fisher discriminate, neural networks, etc. Testing goodness-of-fit, chi^2-test, P-values.

UNIT III: **(9 Hours)**

Parameter estimation: general concepts, Samples, estimators, bias, Estimators for mean, variance, covariance.

The method of maximum likelihood: The likelihood function, ML estimators for parameters of Gaussian and exponential distributions. Variance of ML estimators, the information inequality, extended ML, ML with binned data.

UNIT IV: **(7 Hours)**

The method of least squares: Relation to maximum likelihood, linear least squares fit, LS with binned data, testing goodness-of-fit, combining measurements with least squares.

Interval estimation: Classical confidence intervals: with Gaussian distributed estimator, for mean of Poisson variable. Setting limits, limits near a physical boundary.

UNIT V: **(7 Hours)**

Nuisance parameters, systematic uncertainties: Connection between systematic uncertainty and nuisance parameters, Profile likelihood, Bayesian treatment, marginalization with MCMC.

Examples of the Bayesian approach: Bayesian treatment of non-Gaussian systematic errors, Model selection using Baye's factors.

Text Book:

1. Mathematical Statistics and Data Analysis 3rd Edition by John A. Rice
2. A first Course in Probability, Sixth Edition, Pearson Education Asia,.By Sheldon Ross.

References:

1. Introduction to Statistics and Data Analysis, Fifth Edition, By Roxy Peck, Chris Olsen, Jay DeVore

Web References:

1. http://www.math.uiuc.edu/~r-ash/BPT.html
2. http://stattrek.com/probability-distributions/probability-distribution.aspx
3. http://www.cs.nyu.edu/courses/fall06/G22.2112-001/MonteCarlo.pdf
4. http://www.math.uconn.edu/~valdez/math3632s10/M3632Week10-S2010.pdf
5. http://socserv.mcmaster.ca/jfox/Courses/SPIDA/mle-mini-lecture-notes.pdf
6. http://www.physics.ucdavis.edu/~conway/teaching/252C/lectures/L11.pdf

CS9251/IT9251/SW9251: PARALLEL ALGORITHMS (Stream: 05)

3-1-0

Prerequisites: Design and Analysis of Algorithms

Objective: The goal is to study various design techniques and representative algorithms on shared memory and network models of parallel computation. Topics may include algorithms for sorting, searching, selection, trees, graphs, data structures, etc., and new and emerging models and applications.

Course Outcome: On completion of this course, student should be able to-

1. Understand parallel computing
2. Define the structure of, and cost models associated with, the PRAM, mesh and hypercube models of parallel computation.
3. define the metrics of cost, speed-up and efficiency
4. Explain and understand well known parallel algorithms
5. Apply a range of parallel algorithm design techniques to previously unseen problems

1. Introduction to Parallel Model of Computing- (8 Hours)

Introduction to parallel Computing, Need for parallel model, Models of Parallel Computing, PRAM and Basic Algorithms, Comparison between RAM and PRAM models, PRAM Sub-models, Performance evaluation of parallel algorithm, Cost Optimal Algorithms.

2. Interconnection Networks , Parallel Selection and Merging- (8 Hours)

Interconnection Networks (Linear Array, Meshes, Hypercube, Tree Model, Fully Connected), Parallel Selection Algorithm, Parallel Merging (Merging on CREW, Merging on EREW)

3. Parallel Searching and Sorting - (8 Hours)

Parallel Searching(Searching a sorted sequence -EREW, CREW, CRCW , Searching a random sequence - EREW, CREW, CRCW, Tree, Mesh) .

Parallel Sorting, Network for sorting, and sorting on a linear array, Sorting on the CRCW model, Sorting on the CREW model, Sorting on the EREW model.

4. Parallel Matrix Operation and Numerical Problems- (8 Hours)

Matrix Operations (Transposition and Multiplication Algorithm on PRAM, MCC), Vector-Matrix Multiplication, Solution of Linear Equation, Root finding, Fourier Transform.

5. Parallel Graph Algorithms and Combinatorial Algorithms - (8 Hours)

Graph Algorithms- Connected Component, Minimum Spanning trees, Search and traversal, parallel algorithms for path problems.

Combinatorial Algorithms- Permutation, Combination, Derangements

Textbooks

- M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, McGraw-Hill.
- S.G. Akl, “Design and Analysis of Parallel Algorithms”, Prentice Hall

Reference Books

- S.G. Akl, "Parallel Sorting Algorithm" , Academic Press
- Heneri Casanova, Arnaud Legrand and Yves Robert, "Parallel Algorithm", CRC Press
- Joseph Jaja, "An Introduction to Parallel Algorithms", Addison Wesley, 1992.

Web References

- www.staff.science.uu.nl/~bisse101/Education/PA/pa.html
- www.eli.sdsu.edu/courses/spring96/cs662/notes/
- *origin-www.computer.org/csdl/trans/td/1998/08/l0705.pdf*
- www.mcs.anl.gov/dbpp/text/node45.html
- *www.cs.cmu.edu/~scandal/nesl/algorithms.html*

CS9252/IT9252/SW9252: LOGIC FOR COMPUTER SCIENCE (Stream: 05)

3-1-0

Prerequisite: NIL

Objective: To introduce the main notions of mathematical logic: logical notations (syntax) and how to assign meaning to them (semantics). Studying some deductive and understanding the correctness and completeness of these deductive systems and introduction to logic programming language-Prolog.

Course Outcome: On completion of this course, student should be able to-

1. Familiar with Mathematical Logic principles and Logic Programming
2. Carry out and understand mathematical reasoning and proofs
3. Understand fundamental terminology and notation, and some basic results in theoretical computer science.
4. Able to do programming with Prolog

1. Introduction (8 hours)

Review of The Principle of Mathematical Induction; The Principle of Structural Induction, Review of Boolean Algebras, Introduction to Propositional Logic, Semantics of Propositional Logic, Notions of Satisfiability, Validity, Inconsistency.

2. Natural Deduction (8 Hours)

Natural Deduction, Rules of Inference, Rules of Replacement, Deductive Systems for Propositional Logic, Completeness of Deduction Systems, Resolution Method for Propositional Logic, Predicate Logic, Need of Predicate Logic.

3. Predicate Logic (8 Hours)

Predicate Logic As Formal Language, Free and Bounded Variables, Substitution, Conversion to Normal-Forms , Semantics, Undecidability and Expressiveness of Predicate Logic, Resolution in First Order Logic, Unification, Skolemization, Proof Theory of Predicate Logic , Conversion to Horn-Clauses.

4. Prolog Programming Techniques (8 Hours)

Prolog Programming Techniques: Composition, Termination of Programs, Recursive Programming, Tail Recursive Programs, Cuts and Negation As Failure.

5. Advanced Prolog Programming (8 Hours)

Advanced Prolog Programming- Nondeterministic Programming, Generate and Test, Difference-Lists, Parsing With Definite Clause Grammars, Meta Level Programming, Meta-Interpreter.

Text Books

- *The Essence of Logic.* John Kelly. Prentice-Hall International, 1997. ISBN 81-203-1190-6.

Reference Books

- Saroj Kaushik, "Logic and Prolog Programming", New Age Publication, 2002.
- *Huth & Ryan, Logic in Computer Science, Second Edition, Cambridge university press.*
- Leon Sterling, Ehud Shapiro, "*Art of Prolog*", MIT Press, 1999.
- *Leon Sterling, "The Practice of Prolog", MIT Press 1990.*

Web References

- Jean H. Gallier. Harper and Row , *"Logic for Computer Science"*, New York, 1986. Free online version of book (http://www.cis.upenn.edu/~jean/gbooks/logic.html)
- http://www.cse.iitd.ernet.in/~sak/courses/index.html.
- http://www.cse.iitd.ernet.in/~sak/courses/ilcs/logic.pdf

Logic for Computer Science Programming Assignments

The following is the recommended list for programming assignment.

1. Find the absolute value of a number for a number
2. Program to use simple operator
3. Create and manipulate a family database in prolog (define different family relationships such as father, mother, sister, uncle, grandfather, grandmother, sibling, brother, wife, brother-in-law, ancestor etc).
4. Define natural numbers, less than and greater than relations and other arithmetic operations.
5. Compute factorial of a number, minimum of two numbers.
6. Simulate Ackermann's function.
7. Manipulate lists in prolog
    a. Create a list
    b. Check the membership of given element in list
    c. Append a new element to list
    d. Appending two list
    e. Reversing a list
    f. Find length of a list
    g. Deleting an element from the list
    h. Deleting all occurrences of elements from the list
    i. Searching an element in the list
8. Simulating sets using prolog lists
9. Program to sort
    a. Insertion sort
    b. Quicksort
10. Solve crypt-arithmetic problems
11. Simulate rational arithmetic in prolog

CS9261/IT9261/SW 9261: ADVANCED HIGH-SPEED & COMPUTER NETWORKS

(Stream: 06) 3 1 0

Credits: 4

Pre-requisite: B.Tech.(Subject: Computer Networks) ,Knowledge of Computer Networks & Data Communication Networks

Course Objective:

The objective of the course is to introduce the students with the various upcoming technologies in the area of Computer Networks computing including GSM, GPRS and WSN etc. The Advanced Computer Networks provides a structured environment to develop critical understanding of relevant, modern theories associated with practical expertise in networking technologies and applications in a wide range of contexts, preparing students for employment in the network industry.

UNIT-1 8 hrs

Introduction to the computer networks

Review of layered Architecture, Interconnection of different network connecting devices

Introduction to Packet Switching Networks

Asynchronous Transfer Technology (ATM),Introduction to TCP/IP architecture (IP,ARP,RARP and ICMP protocols),Transport Protocols (TCP,UDP),SCTP

UNIT-2 8 hrs

High Speed Networks

Frame Relay, ATM, SONET, SDH, Gigabit Ethernet & High Speed LANs

Introduction to Wireless Networks

Wireless LANs:-Infrared Vs Radio Transmission, Infrastructure & ad-hoc n/ws, IEEE 802.11 HIPERLAN, blue tooth

Wireless WANs: -GSM & TDMA technology, CDMA technology, IS-95, IMT-2000, Mobile data networks

Wireless ATMs: -Motivation for WATM, WATM services, Reference Model, Functions, Radio Access layers, Handover, Location Management, Addressing, Mobile QOS, Access Point Control Protocol

UNIT-3 8 hrs

Introduction to Wireless Sensor Networks (WSN) and its applications (hardware and physical layer)

Wireless Application Protocol:-Architecture, WDP, WTP, WSP, WML, WML Script, Wireless Telephone Applications, Examples Stacks with WAP.

Wireless Sensor Networks Application Protocols

WSNs MAC Layer Protocols, WSNs Transport Protocol and Reliability

UNIT-4 8 hrs

Routing

Ad-hoc routing: DSR, DSDV, AODV, Fisheye state routing, Hierarchical routing, Signaling: ICMP, LDP, Multi-Protocol Label Switching (MPLS), MPLS Label, Distribution Protocols and Traffic Engineering, Multicast routing: IGMP, , Multicast Trees, MBONE, Multicast Routing Protocols: DVMRP, MOSPF, CBT, PIM,WSNs Routing Protocols

UNIT-5 8 hrs

Congestion Control and Active Queue Management (AQM)

Open loop and Closed loop congestion control, Congestion control in packet networks, ECN and RED Algorithm, TCP and SCTP congestion control, Congestion Control in Frame Relay

Quality of Services (QoS) Principles (Integrated Services and Differentiated Services)

IP traffic models, Classes and subclasses, Integrated services architecture, Differentiated Service Architecture

Text & Reference Books:

Text:

- Kurose and Ross, "Computer Networking: A top-down approach", 4th edition, Addison Wesley.
- Murthy, "Ad Hoc Wireless Networks: Architectures And Protocols", Pearson
- William Stallings, "High Speed Networks and Internets, 2/e", Pearson

References:

- Waltenegus Dargie, Christian Poellabauer,"Fundamentals of Wireless Sensor Networks: Theory and Practice", Willey Publication
- William Stallings, "ISDN and broadband ISDN with frame relay and ATM", Pearson Education Asia, Fourth Edition, 2001.
- Jean Walrand and Pravin Varaiya, "High Performance Communication networks", HARCOURT Asia PTE Ltd., 2nd edition, 2001.

Web Resources:

http://www.buzzle.com/articles/computer-networking-tutorial.html

http://computerstuff7090.blogspot.in/2012/12/advance-computer-networks-video-tutorial_26.html

http://www.networktutorials.info/

CS9262/IT9262/SW9262: ADVANCED NETWORK SECURITY (Stream: 06)

3 1 0

Credits: 4

Pre-requisite: B.Tech.(Subject: Network security & Cryptography)/Knowledge of Computer Networks & Security

Course Objective: This subject is very important for students because Security of data in transit over the Internet becomes increasingly necessary because of steadily growing data volume and importance. Nowadays, every user of a public network sends various types of data, from email to credit card details daily, and he would therefore like them to be protected when in transit over a public network. To this end, a practical SSL protocol has been adopted for protection of data in transit that encompasses all network services that use TCP/IP to support typical application tasks of communication between servers and clients. In this subject student will learn advance topic in network security such as Elliptic Curve Cryptography (ECC), Wireless Security, and Web Security etc.

Unit-1 8 hrs

Introduction to Cryptography

An overview of Cryptology, Primality test, Perfect security, Stream Cipher: The one time pad. Pseudorandom key streams - properties and generation, Finite Fields, differential and Linear Cryptanalysis, Block Cipher Cryptography, Symmetric Block Cipher Schemes, Cryptographic hash functions, Digital signatures

Unit-2 8 hrs

Elliptic Curve Cryptography (ECC)

Elliptic Curves in Cryptography, EC Prime Fields, EC Mathematics, EC Binary Fields, EC Polynomial Arithmetic, EC Discrete Logarithm Problem, EC-based Encryption/ Decryption and its strength analysis, EC-based Diffie-Hellman Key Exchange, EC Digital Signature Algorithm (ECDSA).

Unit-3 8 hrs

Quantum Cryptography

Fundamentals of Quantum Theory, Introduction to Quantum Cryptography, Quantum Key Distribution, Attacks on Quantum Key Distribution, Introduction to the concepts of Position-Based Quantum Cryptography and Post-Quantum Cryptography, Concept of Secret-Key Distillation, Privacy Amplification using Hash Functions, Reconciliation.

Unit-4 8 hrs

Hardware & Software Security

Hardware security, Smart Cards, Biometrics, Attacks and Countermeasures of Software System Security, Trusted Operating system, Security Breaches, Kerberos

Information System Security

Distributed System Security, System vulnerability & abuse, Technology and tools for safeguarding information resources, E-commerce Security: Services & Protocols

Unit-5 8 hrs

Network Security

Security problems in network protocols: TCP, DNS, SMTP, Network defense tools: Firewalls, VPNs, Intrusion Detection, and filters, Network security testing, Malware: Computer viruses, Spyware, and key-loggers, bot-nets: attacks and defenses, Unwanted traffic: denial of service attacks

Wireless Security

Security Issues in a Mobile Agent System, WAP Security, Wireless LAN Security

Web Security

Basic web security model, User authentication and session management, Web application security, HTTPS: goals and pitfalls, SSL/TLS for secure web services, SET(Secure Electronic Transaction), IPSec

Text & Reference Books:

Text:

1. W. Stallings, Networks Security Essentials: Application & Standards, Pearson Education, 2000
2. Cryptography and network security: Principles and Practices, W. Stallings, Prentice Hall
3. Network Security, C. Kaufman, R. Perlman, M. Speciner, Prentice Hall

References:

1. Network Security and Management, Bijendra Singh, Prentice Hall
2. Cryptography & Network Security, Forouzan, McGraw-Hill
3. Network Security: The Complete Reference by Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, et al - Tata McGraw-Hill presents
4. Network Security: The Complete Reference by Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, et al - Tata McGraw-Hill presents
5. Advances in Elliptic Curve Cryptography, Ian F. Blake (Editor), Gadiel Seroussi, Nigel P. Smart, Cambridge University Press. ISBN-10: 052160415X | ISBN-13: 978-0521604154 | Edition: 2nd
6. Implementing Elliptic Curve Cryptography, Michel Rosing, Manning Publication Co. ISBN: 1884777694
7. Quantum Cryptosystems and Secret Key Distribution, Gilles Van Assche, Cambridge University Press. ISBN-10: 0521864852 | ISBN-13: 9780521864855

Web Links:

http://freevideolectures.com/Course/3027/Cryptography-and-Network-Security

http://www.windowsecurity.com/whitepapers/cryptography/

http://nptel.iitm.ac.in/courses/106105031/

CS9263/IT9263/SW9263: NETWORK DESIGN AND MANAGEMENT (Stream: 06)

Credit: 4 3 1 0

Pre-requisite: B.Tech.(Subject: Computer Networks)/ Basic knowledge of data communications and networking

Course Objective:

This subject will give students knowledge about network analysis and delay and loss in networks, designing data network, Bottleneck path problem. The stress will be given to the case studies. Network management means different things to different people. In some cases, it involves a solitary network consultant monitoring network activity with an outdated protocol analyzer. In general, network management is a service that employs a variety of tools, applications, and devices to assist human network managers in monitoring and maintaining networks, so this subject will make students perfect in all these concepts of network management.

Unit 1: Introduction to Network Planning 8hrs

Network Design: What is network design; Major steps of network design; Major challenges in network design; Types of network (centralized and distributed); Criteria to evaluate different design alternatives; Network design process; Data collection; Technical requirement specification; Network topology; Routing strategy

Network Management Introduction

Unit 2: 8hrs

Queuing Theory: Performance Analysis; Queing essentials; Analysis and delay and loss in network; M/M/1 Model; M/M/C model; Erlang B model; Analysis of network reliability.

Network Design and Graph theory: Graphs; Minimum spanning three (MST); Kruskal's Algorithm; Prim's algorithm; Trees; Tree design; Drawback of MST's; Shortage path trees and tours; Bottleneck path problem.

Unit 3: 8hrs

Capacity Assignment in centralized network: Network problem; Network performance criteria; Network design objectives.

Traffic and cost generation: Structure of a network design problem; Sites table for network generator; Traffic generator; Realistic traffic models; Normalization of traffic matrices; Asymmetric traffic flow and its traffic models; Link costs (Tariffs); Factors affecting tariffs; Tariff taxonomy; Fixed pipes; Tariff generator ; Network generator and design tools.

Unit 4: 8hrs

SNMP and Network Management

Basic Foundations: Standards, Models, and Language, SNMPv1 Network Management: Organization and Information Models, SNMPv1 Network Management: Communication and Functional Models, SNMP Management: SNMPv2, SNMP Management: SNMPv3, SNMP Management: RMON, Network Management Tools, Systems, and Engineering

Unit 5: 8hrs

IP Network Management

IPBased Service Implementation and Network Management, Network Management Architecture, SLA and Network Monitoring, MPLS Network Management An Introduction, MPLS Management Interfaces

Text & Reference Books:

Text:

1. Network Management: Principles and Practice, Mani Subramanian, Addison Wesley
2. Network Management Fundamentals, Alexander Clemm, CISCO press
3. Top-Down Network Design (3rd Edition), Priscilla Oppenheimer, CISCO press

References:

4. Network management: know it all, Sebastian Abeck, Adrian Farrel, The Morgan Kaufmann
5. *Network Management: Concepts and Practice A Hands-On Approach, J. Richard Burke, Prentice Hall*
6. *Network Analysis, Architecture, and Design, Third Edition, James D. McCabe, The Morgan Kaufmann*
7. *Network Planning & Designing in Windows, Todd lammale*
8. *Managing and Maintaining a Microsoft Windows Server 2003 Environment-Dan holme ,Orin thomas*
9. *Network Management System, Mani Subramaniam, PHI*

Web Links:

http://www.2000trainers.com/cisco-ccna/ccna-cisco-network-design-model/

http://www.dpstele.com/layers/l2/snmp_l2_tut_part1.php

http://www.airlinx.com/index.cfm/id/1-11.htm

http://searchnetworking.techtarget.com/tutorial/IP-network-design-guide-Managing-an-IP-based-network

http://www.2000trainers.com/tutorials/network-design/

CS9271/IT9271/SW9271: DIGITAL IMAGE PROCESSING (Stream: 07)

3-1-0

Credits : 4

Course Objective:

The goal of the subject is to familiarize students with the concepts and implementation issues of how the image is processed digitally using the various image processing operations namely, image enhancement techniques (like contrast stretching, smoothing etc.), image restoration techniques, feature extraction etc. Students will gain an understanding of how to compress the image so that the number of bits required storing the image gets reduced.

Pre-requisite: Basics of computer graphics & statistical methods

UNIT 1 **8hrs**

Introduction to Image Processing

What is an image? What are computer graphics, image processing, and computer vision? How do they relate to one another? Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Processing, Communication, Display. Storage of images in memory, and double buffering.

Digital Image Formation

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform. Image capture. Resolution and quantisation. Colour and colour spaces.

Mathematical Preliminaries

Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Convolution and Correlation. Two dimensional Fourier transforms, Discrete fourier transform, fast fourier transforms, Hadamard transform, Discrete cosine transforms, wavelet transforms, applications of image transforms

UNIT 2 **8hrs**

Image Enhancement

Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering

Image Analysis

Morphological operations, Histogram based operations, Mathematics-based Operations,

Convolution-based Operations, Smoothing Operations, Derivative-based Operations,

Dilation and Erosion, Boolean Convolution, Opening and Closing, hit and Miss operation

UNIT 3 **8hrs**

Image Restoration

Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.

Wavelet and Multi Resolution Processing

Image Pyramid, Subband Coding, Haar Transform, Multi resolution Expansion, Wavelet Transform in 1Dimensions, Fast Wavelet Transform, Wavelet Transform in 2Dimensions , Wavelet Packet.

Unit 4 **8hrs**

Image Segmentation

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Threshold - Foundation, Simple Global Threshold, Optimal Threshold; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging. Edge based segmentation, region growing segmentation, Advanced optimal border and surface detection approaches, Matching, Edge image thresholding, Edge relaxation, Border tracing, Edge following as graph searching, Edge following as dynamic programming, Border detection using border location information, Region construction from border

Feature Extraction

Optimal features; Optimal linear transformations; Linear and nonlinear principal components; Feature subset selection; Feature Extraction and classification stages, Unsupervised learning and clustering

Unit 5 **8hrs**

Image compression

Fundamentals. Image compression models, error free compression, lossy compression, Various Compression Methods. Real Time Image Processing, Image data properties, discrete image transforms in image data compression, Predictive compression methods, Vector quantization, Hierarchical and progressive compression methods, Comparison of compression methods, Coding, JPEG & JPEG-2000 and MPEG-2/4 image compression. Digital Image Watermarking.

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd Edition (DIP/3e), Prentice Hall, 2008.

2. A. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1995.

Reference Books:-

1. Digital Image Processing, Jahne, Springer India

2. Computer Graphics,Zhigang Xiang and Roy Plastock,Shaums Outline Series

3. Introduction to Real Time Imaging, Edward R,Dougherty,Philip A Laplante.

4. Digital Image Processing, R.C. Gonzalez and R.E. Woods ,Addison Wesley, 1993.

5. Digital Image Processing and Computer Vision, R.J. Schalkoff, John Wiley, 1989.

Note: Assignments should cover any problem related to theory taught.

CS9272/IT9272/SW9272: ADVANCED COMPUTER GRAPHICS (Stream: 07)

3-1-0

Credits: 4

Pre-requisite: Basics of computer graphics & statistical methods

Unit 1 **8Hrs**

Basic component and devices of computer graphics

Introduction: Display of entities, Geometric computation and representation, Graphics Environments; Working Principles of display devices: refreshing raster scan devices, vector devices, Cathode Ray Tube Terminals, Plotters; Display of colors: Look Up Tables, display of gray shades, Half toning; Display and drawing of graphics primitives: point, line, polygon, circle, curves and text; Coordinate Conventions: world coordinates, device coordinates, normalized device coordinates, view-port and window, zooming and panning by changing coordinate reference frames;

UNIT2 **8Hrs**

Two Dimensional Geometric Transformations and Two Dimensional Viewing

Basic Transformation, Matrix Representation And Homogeneous Points, Window- To-Viewport Coordinate Transformation, Need For Clipping And Windowing, Line Clipping Algorithms, The Midpoint Subdivision Method, Other Clipping Methods, Cohen-Sutherland Algorithm, Viewing Transformations

Graphical Input Techniques

Graphical Input Techniques, Positioning Techniques, Positional Constraints, Rubber band Techniques

UNIT 3 **8Hrs**

Three Dimensional Geometric and Modeling Transformation

Need For 3-Dimensional Imaging, Three Dimensional Display Methods, Techniques For 3-Dimesional Displaying, Parallel Projections, Perspective Projection, Intensity Cues, Stereoscope Effect, Kinetic Depth Effect, Shading, Solid Area Scan Conversion, Scan Conversion Of Polygons, Algorithm Singularity, Three Dimensional Transformations, Translations, Scaling, Rotation, Viewing Transformation, The Perspective, Algorithms, Three Dimensional Clipping, Perspective View Of Cube

UNIT 4 **8Hrs**

Curve & Surface Generation

Representing Curves & Surfaces: Polygon Meshed, Hemite & Bezier Cubic Curves, B-Spline

Uniform, Non Uniform , Open and non open B-splines Bicubic surface,patches, Conditions for smooth joining of curves and surface patches

UNIT 5 **8Hrs**

Hidden Surface Removal & Rendering

Hidden line/ surface elimination algorithms, Z buffer algorithms, Depth sort algorithm,

Area subdivision method, Floating horizon algorithm

Rendering Techniques for Line Drawings, Rendering Techniques for Shaded Images,

Aliasing and Anti-aliasing, Illumination Models local models like Phong, CookTorrance

and global models like ray tracing and radiosity, shading detail like textures, their

generation and mapping, bump mapping and similar techniques.

Text Books:

1. Foley - Computer Graphics Principles & Practice, 2nd ed. Pearson Education., 2000
2. Hearn & Baker - Computer Graphics C version, 2nd ed. Pearson Education., 1986
3. Roger and Adams - Mathematical Element for Computer Graphics, 2nd ed., Tata McGraw Hill, 1989
4. David F. Rogers, "Procedural Element for computer graphics", McGraw Hill Book Company, 1985.

Reference Books:-

1. Computer Graphics, F. S. Hill Jr., Macmillan Pub,
2. Curves and Surfaces for Computer Aided Geometric Design, 4th Edn., G. Farin, Academic Press,
3. The Mathematical Structure of Raster Graphics, E. Fiume, Academic Press, Graphics Gems , Vol. 15, Academic Press
4. The Rendering Equation, J. Kajiya, SIGGRAPH 1986, 143'150

Note: Assignments should cover any problem related to theory taught.

CS9273/IT9273/SW9273: MULTIMEDIA SYSTEM (Stream: 07)

3-1-0

Credits: 4

Pre Requisites

Desirable:
Knowledge of CS's Core and System Courses on Programming, Data Structure, Algorithms, Operating System, Database and Networking.

Unit 1 **8Hrs**

Introduction to Multimedia System: An overview of multimedia system and media streams architecture and components, synchronization & quality of service (QOS).

Audio and Speech: Data acquisition, sampling and quantization, human speech, digital model of speech production, analysis and synthesis, psycho-acoustics, low bit rate speech compression, MPEG audio compression.

Images and Video: Image acquisition and representation, bilevel image compression standards: ITU (formerly CCITT) Group III and IV standards, JPEG image compression standards, MPEG, H.264/AVC video compression standards, Transcoding.

Unit 2 **8Hrs**

Operating System: Real-Time Processing-Scheduling-Interprocess Communication-Memory and ManagementServer Architecture-Disk Management.

Multimedia Communication: Fundamentals of data communication and networking, Bandwidth requirements of different media, Real time constraints: latency, video data rate, multimedia over LAN and WAN, Multimedia conferencing, video-on-demand broadcasting issues.

Multimedia Information Systems: Operating system support for continuous media applications: Media stream protocol, file system support for continuous media, data models for multimedia and hypermedia information, multimedia servers, databases and content management.

Unit 3 **8Hrs**

Hypermedia Presentation: Authoring and publishing, Linear and non-linear presentation, Structuring Information, Different approaches of authoring hypermedia documents, Hyper-media data models and standards.

File Systems and Networks: Traditional and Multimedia File Systems-Caching Policy-Batching-Piggy backing-EthernetGigabit Ethernet-Token Ring-100VG Any LAN-Fiber Distributed Data Interface (FDDI)-ATM Networks-MAN-WAN.

Unit 4 **8Hrs**

Animation:

Introduction, Basic Terminology techniques, tweaning & morphing, Motion Graphics

2D & 3D animation.

Synchronization: Synchronization in Multimedia Systems-Presentation-Synchronization Types-Multimedia Synchronization Methods-Case Studies-MHEG-MODE-ACME.

Unit 5 **8Hrs**

Introduction Animating Tool (Ex: Maya), Fundamentals, Modeling: NURBS, Polygon, Organic,

Animation: Key frame animation, reactive animation, path animation, Skelton animation etc., deformers.

Dynamics: soft bodies, Rigid bodies and its usages in the scene etc.,,Rendering: soft, Hard renering. IPR rendering, Line and box rendering etc., Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.Working with MEL: Basics & Programming

Text Book:

1. Ralf Steinmetz and Klara Nahrstedt, “Multimedia Systems”, Springer, I Edition 2004.
2. David Hillman, “Multimedia Technology & Applications”, Galgotia Publications, 2000
3. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh and Richard L. Baker Digital Compression for Multimedia: Principles and Standards Elsevier, 2006.

Reference Books:

1. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications, and Application, Prentice Hall, 2002
2. Nigel Chapman & Jenny Chapman, “Digital Multimedia”, Wiley Publications, 2000
3. D.P. Mukherjee, “Fundamentals of Computer Graphics and Multimedia”, PHI, 2000
4. Khalid Sayood, Introduction to Data Compression 3rd Edition, Elsevier, 2006.
5. Asit Dan and Dinkar Sitaram, Multimedia Servers Elsevier, 2006.
6. Maya manuals.
7. Vaughan T, Multimedia, Tata McGraw Hill, 1999.
8. Mark J.B., Sandra K.M., Multimedia Applications Development using DVI technology, McGraw Hill, 1992.
9. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovacovic, D. A. Milovacovic , Multimedia Communication Systems: Techniques, Standards, and Networks, Prentice Hall, 1stEdition, 2002
10. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson, 2004.

Note: Assignments should cover any problem related to theory taught.

AS-920: RESEARCH METHODOLOGY

2-0-0

Credits : 2

Course Objectives

- Understand some basic concepts of research and its methodologies
- Select and define appropriate research problem and parameters
- Understand issues involved in planning, designing, executing, evaluating and reporting research
- Understand the technical aspects of how to do empirical research using some of the main data collection and analysis techniques used by researchers

UNIT - I

Introduction: Research objective and motivation, Types of research, Research approaches, Significance, Research method vs. methodology, Research process

UNIT - II

Formulating a research problem: Literature review, Formulation of objectives, Establishing operational definitions, Identifying variables, Constructing hypotheses

UNIT - III

Research design and Data Collection: Need and Characteristics, Types of research design, Principles of Experimental research design, Method of data collection, Ethical issues in collecting data

UNIT - IV

Sampling and Analysis of data: Need of Sampling, Sampling distributions, Central limit theorem, Estimation: mean and variance, Selection of sample size Statistics in research, Measures of Central tendency, Dispersion, asymmetry and relationships, Correlation and Regression analysis, Displaying data

UNIT - V

Hypothesis Testing: Procedure, Hypothesis testing for difference in mean, variance limitations, Chi-square test, Analysis of variance (ANOVA), Basic principles and techniques

Writing a Research proposal

Text Books:

1. R. C. Kothari, Research Methodology: Methods and Techniques, 2nd edition, New Age International Publisher, 2009
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005

References:

1. Trochim, William M. The Research Methods Knowledge Base, 2nd Edition. Internet WWW page, at URL: <http://www.socialresearchmethods.net/kb/> (version current as of October 20, 2006).
2. (Electronic Version): StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/.

   (Printed Version): Hill, T. & Lewicki, P. (2007). STATISTICS: Methods and Applications. StatSoft, Tulsa, OK.

CS920 /IT920/SW920: SEMINAR GUIDELINES

0-0-2

Credits : 2

The seminar course will be taken by the M.Tech students independently with the faculty supervisor in order to enhance knowledge in an area of interest. Following are guidelines for seminar course-

- The first step in this course is the selection of topic. The student must submit a written proposal for seminar and get it approved from the concerned supervisor before starting the work. The proposal includes-
    - Candidate's full name,
    - Enrolment number,
    - Rationale for Seminar.
    - Statement regarding topic to be studied during the semester.
    - Supervisor Name (With his/her consent).
- The next step is to identify and review the relevant literature on selected topic. Candidate should identify work that has been done on selected topic by the researchers. A good way to begin is to use scholarly journals to identify recent trends on selected topic.
- After reading the relevant literature, candidate is expected to prepare a technical review of the literature (10-15 pages) in IEEE two column format, which can be downloaded from- (http://www.ieee.org/conferences_events/conferences/publishing/templates.html).
- Candidate should begin the paper with brief statement of their topic and a description of its importance. The goal is then to describe what is already known about the topic, how it has been researched by others, and what are the major issues and challenges which needs further considerations along with list of references.
- Students are expected to meet at least weekly with the supervisor and spend at least the same amount of time for seminar as he/she would spend for a regular course.
- Supervisor will be reviewing the student's progress through regular meetings, periodic presentations (at least twice in the semester) and technical report in above mentioned format.
- External Evaluation will be based on a presentation and technical report at the end of semester.

SEMESTER-III

Course Code	CS9311/ IT9311/ SW9311	Stream: 01
Course Title	Evolutionary Computation	
L-T-P	3-1-0	
Credits	4	
Pre-requisites	A background of Artificial Intelligence, Knowledge of programming, programming language concepts, basic data structure and algorithms.	
Objectives	Objective of the course is to provide students an insight of how to find approximate solutions to various scientific and engineering problems in polynomial time.	

Unit-I

Introduction to Evolutionary Computing (EC)

Introduction, Darwinian's Evolution(Biological Background, Natural Selection), Terminology, Brief History of Emergence of EC , Evolutionary Search Techniques, Paradigms of Evolutionary Computing (Genetic Algorithm, Genetic Programming, Evolutionary Strategies, Evolutionary Programming) , Advantages of EC, Applications of EC.

Unit-II

Introduction to Genetic Algorithm(GA)

Overview, Advantages and Limitations of GA, Elements of GA(Gene, Chromosome, Fitness , Population, Encoding, Breeding/Reproduction-Selection, Crossover, Mutation, Replacement), Convergence Criteria (Best Individual, Worst Individuals ,Sum of fitness, Median fitness), Constraint Handling, GA and traditional search methods, Classification of Genetic Algorithms(Simple GA, Parallel and Distributed GA, Hybrid GA, Adaptive GA, Fast Messy GA), GA Applications –Combinatorial Optimization Problems.

Unit-III

Genetic Programming

Introduction, Primitives of Genetic Programming, Steps of Genetic Programming, Example of Genetic Programming, Applications of Genetic Programming.

Unit-IV

Particle Swarm Optimization (PSO)

Background, Operations of Particle Swarm Optimization, Basic Flow of Particle Swarm Optimization, Early Variations of PSO, Further refinements of PSO, Comparison between GA and Particle Swarm Optimization, Applications of PSO.

Unit-V

Ant Colony Optimization (ACO)

Ant Colony Optimization Algorithm, Ant System, Ant Colony System, Basic Flow of Ant colony Optimization, Applications of ACO.

Textbooks

- S. N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Wiley-India, 2008

Book References

- Melanie Mitchell, An introduction to genetic algorithm, PHI, India, 1996.
- Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
- Kenneth A. De Jong, "Evolutionary Computation-A Unified Approach", PHI, 2006.

Web References

- www.lcc.uma.es/~ccottap/semEC/
- www.cs.colostate.edu/~genitor/MiscPubs/tutorial.pdf
- www.swarmintelligence.org/tutorials.php

Course Number	CS9312/ IT9312/SW9312	Stream: 01
Course Title	Fuzzy Systems	
L-T-P	3-1-0	
Credits	4	
Pre-requisites	Knowledge of programming, discrete mathematics (set theory, logic)	
Objectives	Objective of the course is to provide the students with basic understanding of fuzzy logic fundamentals and its applications.	

Unit-I

Introduction

Introduction To Fuzzy Logic, History of Fuzzy Logic, Need For Fuzzy Logic, Linguistic Variables, Probability Versus Possibility , Fuzzy Sets(Basic Definitions and Terminology, Operations On Fuzzy Sets, Properties of Fuzzy Union, Intersection and Complement), Fuzzy Relations(Some Basic Definitions and Terminology ,Operations On Fuzzy Relations , Composition of Fuzzy Relation ,Properties of Fuzzy Relation, Fuzzy Tolerance and Equivalence Relation) , Fuzzy Proposition(The Theory of Approximate Reasoning, Fuzzy Implication), Triangular Norms (T-Norm and S-Norm/T-Conorm).

Unit-II

Membership Functions

Fuzzy Membership Functions (Triangular MF, Trapezoidal MF, Gaussian MF, Generalized Bell-Shaped MF, Sigmoidal MF ,User Defined Functions), Features of Fuzzy Membership Functions, Fuzzification, Defuzzification, Membership Value Assignment(Intuition, Inference, Rank , Rdering, Neural Network, Angular Fuzzy Set, Inductive Reasoning).

Unit-III

Fuzzy Rules and Fuzzy Systems

Extension Principle, Linguistic Variable -Hedges (Concentration and Dilation of Linguistic Values, Contrast Intensification ,orthogonality), Fuzzy If Then Rules (Multiple Conjunctive Antecedents, Multiple Disjunctive Antecedents, Aggregation of Fuzzy Rule), Defuzzification Methods (Lambda-Cut or Alpha Cut Sets, Height Method or Maximum Membership Method, Centroid Method, Weighted Average Method -Mean Max Method or Middle of Maxima Method (Mom), Center of Sum Method- Center of Largest Area), Fuzzy Inference System(Why FIS? , Mamdani Fuzzy Inference System, Examples of Mamdani FIS), Sugeno Fuzzy Inference System, Comparison of Sugeno and Mamdani Method.

Unit-IV

Fuzzy system simulation

Fuzzy Relational Equation, Non Linear Simulation Using Fuzzy Systems, Fuzzy Backpropogation Network, Fuzzy Associative Memories.

Unit-V

Applications of fuzzy logic

Clustering (Cluster Analysis, Cluster Validity, C-Mean Clustering, Fuzzy C-Mean Clustering), Pattern Recognition (Feature Analysis, Partitioning of Feature Space, Single Sample Identification, Multi-Feature Pattern Recognition, Image Processing), Fuzzy Optimization.

Text Books:

- Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley-India Edition, 2007.

Book References

- Hung T. Nguyen, Elbert A. Walker, "A First Course in Fuzzy Logic", Chapman& Hall/CRC Taylor and Francis Group, 2009.
- Klir & Yuan, "Fuzzy sets and fuzzy logic – theory and applications, PHI, 1996.
- J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.

Web References

- *en.wikipedia.org/wiki/Fuzzy_set*

- www.abo.fi/~rfuller/fuzs.html
- Zadeh, L.A. (1965). "Fuzzy sets", *Information and Control* 8 (3): 338–353.
- http://www.sfu.ca/~jeffpell/papers/ReviewHajek.pdf

Course Number	CS9313/ IT9313/SW9313	Stream: 01
Course Title	Advanced Data Mining	
L-T-P	3-1-0	
Credits	4	
Pre-requisites	Knowledge of Mathematics, Statistics and Database Management System	
Objectives	To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining.	

Unit – I

Introduction : Introduction to Data Mining, Its motivation and Importance, Basic data mining tasks-classification, Regression, Time Series Analysis, Prediction, Clustering, Summarization, Association Rules, Sequence Discovery, Data Mining versus Knowledge Discovery in databases, Data Mining issues, Data Mining Metrics, Social implications of data mining.

Statistical Perspective on data mining: Point Estimation, Model based on summarization, Baye's theorem, Hypothesis testing, Regression and Correlation.

Statistical based algorithm for classification-Regression, Bayesian classification 8 hrs.

Unit – II

Classification- Distance based algorithm-simple approach, K-Nearest Neighbors, Decision Tree based algorithm-ID3, C4.5, Neural Network based algorithm-Propagation, NN supervised Learning, Perceptrons, Rule based algorithm- generating rules from decision tree, generating rules from neural network. Support vector Machines, support vector classifiers. 8 hrs.

Unit – III

Clustering- Introduction, similarity and distance measures, outliers, Hierarchical algorithm-agglomerative algorithm, divisive clustering, minimum spanning tree, squared error clustering, K-Means clustering, Nearest neighbor algorithm, Genetic Algorithm-Introduction, cross-over and mutation operation, clustering with genetic algorithm, clustering with neural network. 8 hrs.

Unit – IV

Association Rule Mining-Market Basket Analysis-A motivating example for association rule mining, basic concept, Apriori algorithm: Finding frequent itemsets using candidate generation, generating association rules from frequent itemsets, improving the efficiency of apriori. Mining frequent itemsets without candidate generation.

Web Mining : Introduction, web content mining, web structure mining, web usage mining, 8 hrs.

Unit – V

Text mining- introduction, text mining process, Spatial mining-introduction, spatial data overview, spatial data mining primitives, spatial rules- spatial association rules, temporal mining-introduction, time series-time series analysis, trend analysis, transformation, similarity, prediction, pattern detection-string matching, sequences, temporal association rules. **8 hrs**

Text Books:

1. Margaret H Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education

2. Alex Berson,Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", THM

3.Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Kaufmann Harcourt India

References:

1. *Daniel T, Larose, " Data Mining Methods and Models", Wiley India Edition*

2. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, The Elements of Statistical Learning. Springer-Verlag, 2001

Web resources:

http://www.autonlab.org/tutorials/
http://www.itu.dk/people/pagh/ADBT05/classification.pdf
http://twocrows.com/data-mining/dm-booklet/
http://www.zentut.com/data-mining/
http://www.stat.ncsu.edu/people/dickey/courses/st610g/Powerpoints/Data%20Mining%20Tutorial.ppt
http://www.cs.sunysb.edu/~cse634/presentations/TextMining.pdf

CS9321/IT9321/SW9321: BUILDING APPLICATION IN THE CLOUD USING JAVA AND PYTHON (Stream: 02) 3-1-0

Credits : 4

Pre-requisite: Introduction to cloud computing

Unit I **08 Hrs**

Fundamental of Cloud Services: Cloud Computing, Origins of cloud computing, Cloud service, Consistency, Availability and Partition Tolerance.

Making software a service: Signing up for Amazon Web Services, Installing **boto**, Setting up the Environment. Data Layer: Introducing AWS Databases. Application Layer: Load Balancing. HTTP. Authorization Layer. Client Layer: Browser Based Clients, Native Applications.

Introduction to Cloud Based Services: Amazon Web Services- EC2, S3, SQS, EBS, ELB, SimpleDB, RDS, SNS and VPC. Google Cloud- AppEngine, Google Storage. Rackspace Cloud: CloudFiles, CloudServers and CloudSites.

Unit II **08 Hrs**

Designing an Image: Prepackaged Images, Singleton Instances and Prototype Images-Overview, Reasons for Usage, Description, Implementation and Examples.

Designing and Architecture: Adapters, Facades, Proxies and Balancers-Overview, Reasons for Usage, Description, Implementation and Examples.

Unit III **08 Hrs**

Executing Actions on Data: Queuing, Command, Iterator and Observer- Overview, Reasons for Usage, Description, Implementation and Examples

Clustering: n-Tier Web Pattern, Semaphores and Locking, Map/Reduce: Overview, Reasons for usage, Description, Implementation and Examples

Unit IV **08 Hrs**

Programming Google App Engine with Python: A Basic Cloud Application, Managing Data in the Cloud, Google App Engine for Login Authentication, Organizing Code: Separating UI and Logic, Making the UI Pretty: Templates and CSS, Getting Interactive.

Unit V **08 Hrs**

Programming Google App Engine with Java: Google App Engine and Java, Managing Server-Side Data, Building User Interfaces in Java, Building the Server Side of a Java Application.

Recommended Books:

1. Christopher M. Moyer, " Building Applications in the Cloud, Concepts, Patterns and Projects", Pearson
2. Mark C.Chu-Carroll, "Code in the Cloud, Programming Google App Engine", SPD
3. Christopher Moyer, "Building Applications in the Cloud: Concepts, Patterns, and Projects", Addison-Wesley Professional.

Reference Links:

Fundamentals:
http://www.thegeekstuff.com/2010/06/vmware-server-and-vmware-esxi-introduction/
For Hypervisor Installation:
http://www.thegeekstuff.com/2010/06/vmware-esxi-installation-guide/

For Configuration of Hypervisor:
http://www.thegeekstuff.com/2010/06/how-to-assign-ip-address-to-vmware-esxi/
http://www.thegeekstuff.com/2010/06/change-password-on-vmware-esxi/
For VSPHERE CLIENT Installation:
http://www.thegeekstuff.com/2010/06/vmware-vsphere-client-install/
Create VM using VSphere:
http://www.thegeekstuff.com/2010/07/vmware-create-virtual-machine/
Add VMFS Datastore:
http://www.thegeekstuff.com/2010/08/vmware-add-datastore/
Add Virtual Disk:
http://www.thegeekstuff.com/2010/09/vmware-esxi-add-virtual-disk/
VMWare Server:
http://www.thegeekstuff.com/2010/06/how-to-install-vmware-server-2-on-linux/
Adding HDD:
http://www.thegeekstuff.com/2010/09/vmware-esxi-add-virtual-disk/
RAID Explained:
http://www.thegeekstuff.com/2010/08/raid-levels-tutorial/
http://www.thegeekstuff.com/2011/11/raid2-raid3-raid4-raid6/

Sample Assignment:

Deployment of HPC Cloud with VMware

Study about the deployment of cloud Computing using HP Blade system in server administration to manage the network. Use of the Blade servers stripes down server computer with a modular design optimized to minimize the use of physical space and energy.

Configure the NFS server and client using the Blade servers Hypervisor ESXi 4.1(which forms the managing layer between hardware and user) and then install the Hypervisor in some of the blade servers and manage them through the Vcenter Server. Also manage the two virtual machine showing how they will migrate to another host or cloud server when one of them stops working.

Also study the use of VM ESXi Hypervisor, VSphere Client, VCenter Orchestrator, Active Directory Services (ADS), and Network File System (NFS) for successfully implementing the given task.

CS9322/IT9322/SW9322: CLIENT SERVER COMPUTING (Stream: 02)

3-1-0

Credits : 4

Pre-requisite: Computer Networks and Web Technology

Unit I **08 Hrs**

Introduction to TCP/IP

The Client Server Model and Software Design, Concurrent Processing in Client Server Software, Program Interface to Protocols, The Socket Interface.

Unit II **08 Hrs**

Algorithm and Issues in Client Software & Server Software Design, Iterative Connection Oriented (TCP) Servers, Iterative Connectionless Servers (UDP), Concurrent Connection Oriented Servers (TCP), Single Process Concurrent Servers (TCP).

Unit III **08 Hrs**

Multiprotocol Servers(TCP,UDP) & Multiservice Servers (TCP, UDP), Uniform and Efficient Management of Server Concurrency, Concurrency in Clients, Tunneling at the Transport and Application levels, Application Level Gateways.

Unit IV **08 Hrs**

External Data Representation (XDR), Remote Procedure Call Concept (RPC), Distributed Program Generation (RPCGEN Concept), Distributed Program Generation (Rpcgen Example).

Unit V **08 Hrs**

Network File System: Concepts (NFS) & Protocol (NFS, Mount), Telnet Client: Program Structure & Implementation, Deadlock and Starvation in Client Server Systems.

Recommended Books:

1. Douglas E. Comer, David L. Stevens, " Internetworking with TCP/ IP Vol III, " PHI
2. David L. Stevens," Socket Programming" PHI

Reference Books:

1. Dawna Travis Dewire, "Client/server computing" , McGraw-Hill
2. Joel P. Kanter, "Understanding Thin-Client/Server Computing", Microsoft Press

CS9331/IT9331/SW9331: SOFTWARE RELIABILITY AND TESTING

(Stream: 03) 3 1 0

Credits: 4

OBJECTIVE:

Software Reliability Testing requires checking features provided by the software, the load that software can handle and regression testing.

- To explain how system reliability can be measured and how reliability growth models can be used for reliability prediction
- To describe software Metrics and how these are used
- To describe web tests

Pre-requisite: Knowledge of web application and basic concept of Software Engineering

UNIT 1:

Introduction

Definition – Reliability terminologies – Classification of failures – Reliability metrics – Reliability growth modeling - Reliability measurement process. Software & System Reliability, Software Reliability Models, Prediction Analysis

UNIT 2:

Software Reliability Concepts

Defining failure for the product, common measure for all associated systems, setting system failure intensity objectives, determining develop software failure intensity objectives, software reliability strategies, failures, faults and errors, availability, system and component reliabilities and failure intensities, predicting basic failure intensity.

UNIT 3:

Software Metrics for Reliability Assessment

Introduction, Static Program Complexity, Dynamic Program Complexity, Software Complexity and Software Quality, Software Reliability Modeling

Software Reliability and Testing

Introduction, Overview of Software Testing, Operational profiles, Time/Structure Based Software Reliability Estimation

UNIT 4:

Software Testing Process and Tools:

Taxonomy of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, JMetra, JUNIT and Cactus.

Eleven Step Testing Process: Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report test results, testing software installation, Test software changes, Evaluate Test Effectiveness.

UNIT 5:

Testing Specialized Systems and Applications

Testing Client/Server – Web applications, testing off the Shelf Components, Testing Security, Testing a Data Warehouse

Testing Concept for WEB application: Testing process, Content Testing, User Interface Testing, Component level testing, Navigation Testing, Configuration Testing, Performance Testing

Text Books: Software Reliability

1. Handbook of Software Reliability Engineering Edited by Michael R. Lyu, published by IEEE Computer Society Press and McGraw-Hill Book Company.

2. Software Reliability Engineering John D. Musa, second edition Tata McGraw-Hill.

TEXT BOOKS: Software Testing

1. Effective Methods for Software Testing, 2nd Edition, William E. Perry , Second Edition, Wiley India, 2006.
2. Software Quality, Mordechai Ben-Menachem/Garry S. Marliss, Thomson Learning publication,1997

Reference Books

1. Practical Reliability Engineering, Patrick D. T. O Connor 4th Edition, John Wesley & Sons, 2003.

2. Fault tolerance principles and Practice, Anderson and PA Lee, PHI, 1981.

3. Reliability Engineering E. Balagurusamy, Tata McGrawHill, 1994.

4. Testing and Quality Assurance for Component-based Software, by Gabo, Tsao and Wu, Artech House Publishers

5. Managing the Testing Process, by Rex Black, Wiley

6. Handbook of Software Quality Assurance, by G. Gordon Schulmeyer, James I. McManus, Second Edition, International Thomson Computer Press

7. Metrics and Models for Software Quality Engineering, by Stephen H. Kan, by Pearson Education Publication

8. Practical Software Testing, Ilene Burnstein, Springer, 2003.

9. Software Testing, Srinivasan Desikan & Gopalaswamy Ramesh, Pearson Education,2006.

CS9332/IT9332/SW9332

COMPONENT BASED SOFTWARE ENGINEERING (CBSE) Stream: 03)

Credits: 4 **3 1 0**

OBJECTIVE:

This course focuses on an approach to software development based on extensive use of pre-existing standard (or customizable) components. It also illustrates how a repository of reusable candidate components can be integrated into a typical evolutionary process model. The Component-based Software Engineering process involves identifying candidate components; qualify each component interface, and adapting components

1. Describe the role of Component Based Software Engineering (CBSE) within the software life cycle.
2. Apply key elements and common methods for CBSE.
3. Describe, Compare, contrast and evaluate structured, Object Oriented, data Oriented and formal approaches to component modeling.
4. Do some develop CBSE.
5. Conduct a review of CBSE requirements and using best practices to determine the quality of the a CBS.
6. Demonstrate the capacity to use a range of software tools in support of CBS.

Pre-requisite: Elementary Knowledge of Programming and Software Engineering

UNIT I INTRODUCTION TO CBSE

Component-Based Software Engineering (CBSE), CBSE vs. Object-Oriented Software Engineering, CBSE methodology, CBSE processes, domain engineering, component engineering, component-based software life cycle, component vs. object, CBSE project management, measurement and metrics for CBSE, challenge CBSE, advantages and disadvantages of CBSE, economics of CBSE.

UNIT II COMPONENT-ORIENTED PROGRAMMING

Component-oriented programming, object-oriented programming to component-oriented programming, component-oriented programming vs. object-oriented programming, principle and infrastructure of component-oriented programming.

UNIT III COMPONENT AND COMPONENT MODEL

Component, component technology, software component, specification of software component, component architecture, component framework, component interface, component abstraction, component services, components model, component selection, component adaptability, component certification, component composition, component and interface modeling, domain modeling, patterns and frameworks.

UNIT IV COMPONENT-BASED DESIGN AND REUSE

Principles of component design and reuse, design prototyping, design production, design refactoring, design documentation, component-based software reuse, reusable component, component-based reuse metrics.

UNIT V COMPONENT TECHNOLOGIES

Component technologies: Component Object Model (COM), Distributed Component Object Model (DCOM), Common Object Requesting Broker Architecture (CORBA), Enterprise Java Beans (EJB), Software Agents as Next Generation Software Component.

Text Books:

1. George T. Heineman, William T. Councill, Component-Based Software Engineering: Putting the Pieces Together, Addision Wesley, 2001.

2. Andy Ju An Wang, Kai Qian, Component-Oriented Programming, Willey Interscience, 2005

Reference Books:

3. Clemens Szyperski, Component Software: Beyond Object-Oriented Programming, Addison Wesley, 1997.

4. Alan W. Brown, Component-Based Software Engineering, Wiley-IEEE Computer Society, 1996.

5. Sudha Sadasivam, Component-Based Technology, G. Willy, 2008.

6. Pressman Roger S., Software Engineering: Practitioner's Approach, McGraw-Hill Inc., 2004.

7. N. S. Gill, Software Engineering: Software Reliability, Testing and Quality Assurance, Khanna Book Publishing Co. (P) Ltd., New Delhi, 2002.

CS9341/IT9341/SW9341: DATA WAREHOUSING AND DATA MINING (Stream: 04)

3 1 0

Credits: 4

Pre req.: Understanding of database concepts

Objective

Students will learn the basic concepts and technologies for storing large databases as data warehouse along with retrieval of useful information through data mining techniques.

Unit-I **(7 Hours)**

Introduction to Data Warehousing: Overview, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Schema, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Mart, Query Facility, OLAP operations, OLAP Servers, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Data Mining: Overview, Motivation & Evolution, Functionalities, KDD, Architecture, Applications, Classification, Issues.

Unit-II **(9 Hours)**

Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept hierarchy generation, Online Data Storage.
Data Mining Primitives, Data Mining Query Languages, Designing Graphical User Interfaces Based on a Data Mining Query Language
Concepts Description: Characterization and Comparison, Data Generalization and Summarization, Analytical Characterization, Analysis of Attribute Relevance, Mining Class Comparisons.

Unit-III **(9 Hours)**

Mining Descriptive Statistical Measures in Large Databases. Mining Association Rules in Large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

Unit-IV **(8 Hours)**

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

Unit-V **(7 Hours)**

Cluster Analysis Introduction: Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

Introduction to Data Mining Tools, Case studies, Web Mining, Text Mining Text Databases

Text Books:

1. Data Warehousing, Data mining and OLAP, Berson & Smith, TMH
2. Data Mining: Introductory and Advanced Topics, M. H. Dunham, Pearson Education.
3. Data Mining Techniques – Arun K Pujari, University Press
   Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.
4. Data Mining: Introductory And Advanced Topics- Margaret H Dunham, Pearson Education India
5. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers.

Reference Books:

1. Data Warehousing in the Real World – Sam Anahory & Dennis Murray, Pearson Education Asia.
2. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley Student Edition
3. Introduction to **Data Mining** with Case Studies-G.K. Gupta, PHI India

Web References:

1. http://forum.jntuworld.com/showthread.php?3818-Data-Warehousing-and-Data-Mining-(DWDM
2. http://www.itu.dk/people/pagh/ADBT05/classification.pdf
3. http://www.nptel.iitm.ac.in/
4. http://www.mhprofessional.com/downloads/products/0071610391/0071610391_chap01.pdf
5. http://knowledgeputeri.wordpress.com/2010/02/23/an-introduction-to-data-mining-and-data-warehousing/
6. http://www.thearling.com/text/dmwhite/dmwhite.htm

CS9342/IT9342/SW9342: DISTRIBUTED DBMS (Stream: 04)

3 1 0

Credits: 4

Pre req: Basic Concepts of DBMS and Distributed Systems

Objective:

The objective of this subject is to examine the underlying components within distributed database architecture, Understanding the task of a distributed database management system, and to analyze the importance of security issues that may arise and possibly compromise the integrity of the system.

UNIT I: Basic Concepts (8 Hours)

Review of computer networks and centralized DBMS, basic principles of DDBMS, distribution, heterogeneity, autonomy, DDB architecture: client-server, peer-to-peer, federated, multidatabase.

UNIT II: Design (6 Hours)

DDB design and implementation: fragmentation (Vertical, Horizontal and Hybrid), replication (active and passive) and allocation techniques.

UNIT III: Query Processing & Optimization (10 Hours)

Query Processing: Problem, objectives, Complexity of Relational Algebra operations, Characterization of query processing (Language, Types of Optimization, Optimization timing, Statistics, Decision sites, Exploitation of network topology & Replicated fragments, Use of semi joins), Layers of Query processing (Query decomposition, Data localization, Global & Local query optimizations).

UNIT IV: Concurrency Control Techniques (8 Hours)

Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanism, Locking based concurrency control algorithm (centralized 2pl, primary copy 2pl, distributed 2pl), Timestamp based concurrency control algorithm (conservative & multi-version TO algorithm), Optimistic concurrency control algorithm, Deadlock management, prevention, avoidance, detection & resolution.

UNIT V: Reliability (8 Hours)

Distributed DBMS Reliability: Reliability concepts & measures (system, state & failures, reliability & availability, mean time between failures/repair), Failures & fault tolerance in distributed system (reason for failures, fault tolerance approaches & techniques), Failures in Distributed DBMS (transaction, system, media & communication failure), Local reliability protocols (architectural considerations, recovery, information execution of LRM commands, check pointing, handling media failure), Distributed Reliability Protocols (Components, Two- Phase commit protocol, Variation of 2PC).

Text Book:

1. S Ceri, G Pelagatti; ""Distributed Databases: Principles and Systems"; Tata McGraw-Hill
2. M Tamer Ozsu, P Valduriez; "Principles of Distributed Database Systems"; Pearson Education

References:

1. Distributed Database Systems, Chhanda ray, Pearson Education
2. Ozsu,Valduriez, “Distributed Data Base Systems”, Pearson

Web References:

1. http://www.cse.iitb.ac.in/~sudarsha/db-book/slide-dir/ch22.pdf
2. http://docs.oracle.com/cd/B19306_01/server.102/b14231/ds_concepts.htm
3. http://nptel.iitm.ac.in/video.php?subjectId=106106093
4. http://infolab.stanford.edu/~ullman/cs345-notes.html
5. http://besser.tsoa.nyu.edu/howard/imaging/
6. http://www.utdallas.edu/~bxt043000/Publications/Journal-Papers/DS-DM/J77_Managing_and_Mining_Multimedia_Databases.pdf
7. http://www.academictutorials.com/data-warehousing/

CS9351/IT9351/SW9351: INTRODUCTION TO THE THEORY OF NP-COMPLETENESS

(Stream: 05) 3-1-0

Credits: 4

Prerequisite: Design and Analysis of Algorithms

Objective: To learn what NP-complete problems are, to be able to recognize NP-complete problems, and to be able to formally prove that certain problems are NP-complete and to learn techniques to deal with NP-complete problems, such as polynomial-time approximation algorithms and sophisticated exponential-time algorithms, and to be able to analyze these algorithms.

Course Outcome: On completion of this course, student should be able to-

1. Define and explain the significance of the NP-completeness,
2. Describe concrete examples of NP complete problems from various fields.
3. Analyze and deal with NP Complete problems.

1. Introduction to NP Completeness (8 Hours)

Polynomial time reductions, Polynomial time and the complexity class P, Polynomial verification and the complexity class NP, NP-Hard, NP-completeness and reducibility, The Satisfiability problem SAT, Cook's Theorem.

2. NP-completeness of various problems (8 Hours)

Satisfiability, CLIQUE, vertex-cover, subset-sum, Circuit Hamiltonian cycle, the travelling salesman problem , 3-dimentional matching problem, Graph Colouring Problem, co-NP and the Asymmetry of NP, A Taxonomy of Hard Problems.

3. The complexity class PSPACE (8 Hours)

Introduction to PSPACE, Some hard problems in PSPACE –planning, quantification, games, solving quantification and planning problems in polynomial space. Proving problems PSPACE, Exhaustive algorithms (backtracking)- SAT, generating all clique.

4. Approximation algorithms for NP-complete problems (8 Hours)

An introduction to approximation algorithm, polynomial time approximation scheme, designing and analyzing an approximation algorithm, a 2-approximation of vertex cover, approximation algorithm for travelling salesman problem, limits of approximation algorithm.

5. Randomized Algorithms for NP-complete problems (8 Hours)

An introduction to randomized algorithm, designing and analyzing an randomized algorithm , random variables and their expectations, randomized approximation algorithm for max 3-SAT.

Text Book

- Jon Kleinberg and Éva Tardos, *Algorithm Design*, Pearson, 2006.

Reference Books

- Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman, *The Design and Analysis of Computer Algorithms*, Addison-Wesley, 1974.
- Introduction to Algorithms, Cormen, Leiserson and Rivest, McGraw-Hill, 2001

Web Reference

- *http://www.site.uottawa.ca/~lucia/courses/4105-02/np.pdf*
- www.cs.berkeley.edu/~vazirani/algorithms/chap8.pdf
- *en.wikipedia.org/wiki/Category:NP-complete_problems*
- www.ics.uci.edu/~eppstein/161/960312.htm
- *web.eecs.utk.edu/courses/fall2012/cs302/Notes/NP/*

CS9361/IT9361/SW9361: ETHICAL HACKING & COMPUTER FORENSICS

(Stream: 06) 3 1 0

Credits: 4

Pre requisite : B.Tech.(Subject: Network security & Cryptography)/M.Tech(CS/IT/SW 0602-Advanced Network Security)

Course Objective:

Computer hacking forensic investigation is the process of detecting hacking attacks and properly extracting evidence to report the crime and conduct audits to prevent future attacks. Computer forensics is simply the application of computer investigation and analysis techniques in the interests of determining potential legal evidence. The objective of this course is to enables students to basic Hacking Techniques and gives overview of various forensic investigation techniques and standard forensic tools necessary to successfully carryout a computer forensic investigation leading to prosecution of perpetrators.

Course Description

Unit – I Introduction to Hacking 8 hrs

Basics of Hacking Techniques, Ethics of Hacking, Hacking techniques, Information War, Introduction to Ethical Hacking.

Password Cracking: Introduction, Password Stealing, Password Crackers

Unit – II Sniffers 8 hrs

Introduction to Sniffers, Working of a Sniffer, Sniffer Programs, Detecting a Sniffer, Protecting Against a Sniffer

Buffer Overflows: Introduction, Types of Buffer Overflow, Methods to Cause a Buffer Overflow, Buffer Overflows: Detection and Prevention

Unit – III Denial-of-Service Attacks 8 hrs

Denial-of-Service Attacks, Flood Attacks, Software Attacks, Distributed Denial-of-Service, Prevention of DoS Attacks

Scanning Tools: Introduction, Scanners

Unit – IV Introduction to Computer Forensics & Investigations 8 hrs

Computer Forensics & Investigations as a profession, understanding computer investigations, data acquisition, processing crime and incident scenes, Network forensics, cell phone and mobile device forensics.

Unit – V 8 hrs

Searching and Seizing Computer Related Evidence; Processing Evidence and Report Preparation;

Current Computer Forensics Tools:

Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software

Text & Reference Books

Text:

1. Hacking tools & Technique for incident Handling-NIIT-PHI Learning
2. Computer Forensics and investigations- Nelson, Phillips Enfinger, Steuart- CENGAGE Learning

References:

1. Computer Forensics and Cyber Crime: An Introduction- Marjie T Britz- Pearson
2. Ethical Hacking and Network Defense – Michael T.Simpson- CENGAGE Learning

Web Links:

http://www.securityhunk.com/search/label/Forensic

http://www.ethicalhacker.net/component/option,com_smf/Itemid,54/board,20.0/

CS9371/IT9371/SW9371: COMPUTER VISION (Stream: 07)

3-1-0

Credits : 4

Prerequisites: Knowledge of programming, programming language concepts, discrete mathematics (set theory, graph theory, logic), calculus, linear algebra, basic probability theory and statistics, and data structures and algorithms (design and analysis).

Unit 1 **08 Hrs**

Introduction : What is it, why study it and how ? The eye and the camera, vision as an information processing task. A geometrical framework for vision. 3D interpretation of 2D images. Applications.

Image Formation Models

• Monocular imaging system

• Orthographic & Perspective Projection

• Camera model and Camera calibration

• Binocular imaging systems

Case study: 3D models from uncalibrated images using PhotoBuilder.

UNIT 2 **08 Hrs**

Image Processing and Feature Extraction

• Image representations (continuous and discrete)

• Edge detection

Case study: tracking edges and corners for robot hand-eye coordination and man-machine interfaces.

UNIT 3 **08 Hrs**

Motion Estimation

• Regularization theory

• Optical computation

• Stereo Vision

• Motion estimation

• Structure from motion

Case study: 3D stereograms.

UNIT 4 **08 Hrs**

Shape Representation and Segmentation

• Deformable curves and surfaces

• Snakes and active contours

• Level set representations

• Fourier and wavelet descriptors

• Medial representations

• Multiresolution analysis

Case study: intelligent automotive vision system.

UNIT 5 **08 Hrs**

Video processing , Motion descriptors, Tracking, Background subtraction, Activity recognition

Case study

Texts Books

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall

   Robot Vision, by B. K. P. Horn, McGraw-Hill.

2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

Reference Books

1. The Computer Vision Homepage, CMU
2. Compendium of Computer Vision A tremendous amount of information, including image processing, camera calibration, geometry, mathematics. If you find something especially useful, let me know, and I'll mirror it locally.
3. Robotvis, the robotics and vision group at INRIA, Sophia Antipolis. There are some impressive demos, check out the one on Epipolar Geometry

Note: Assignments should cover any problem related to theory taught.

CS9372/IT9372/SW9372: VIRTUAL REALITY (Stream: 07)

3-1-0

Credits : 4

UNIT I **08 Hrs**

Introduction to Virtual Reality building upon the fields of Computer Graphics, Human Computer Interfaces and Simulation Introduction : The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Introduction to Theoretical Aspects & Design Issues, Different Types of Virtual Reality: Immersive Virtual Reality, Augmented Reality, Projected Reality (Mirror Worlds), Desktop Virtual Reality, First person Simulators, Virtual Actors, 3D Projection theater, Cyberspace, Tele presence and Tele operation.

UNIT II **08 Hrs**

Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.
Output Devices: Graphics displays, sound displays & haptic feedback.

UNIT III **08 Hrs**

Modelling Complex phenomena, Project planning & design, design of interactive learning tools. VR Tools and equipment: 3D Interfaces and Interaction; Visual, haptic, tactile and auditory devices; Position tracking; 3D displays, Head Mounted Displays, Tiled Displays, Stereo displays.

UNIT IV **08 Hrs**

Review of 3D Graphics & Geometric Modelling, Collision Response.VR Open Source Software; C / C++ and Open GL Programming, Color Models and Systems, Mathematics of Virtual Environments, Rendering Equation, Radiosity, Texture Mapping, Shadowing Techniques.Collaborative & networked virtual environments. Groupware.

UNIT V **08 Hrs**

Virtual Reality Applications: Telepresence Surgery, Educational Applications, Creating prototype VR learning environments e.g. exploring dangerous workplaces as part of health and safety training programme, Intelligent city Tour, Optimal site selection for different purposes. Human Factors: Methodology and terminology, user performance studies, VR health and safety issues.

Textbooks

1. Bill Sherman & Alan Craig, Understanding Virtual Reality: Interface, Application & Design, Morgan Kaufmann, 2002.
2. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc.,
3. Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan Craig, Elsevier(Morgan Kaufmann).

Reference Books :

1. Burdea & Coiffet, Virtual Reality Technology, John Whiley, 2003 Alan Watt, 3D Computer Graphics, Addison-Wesley, 1999.
2. Killer Game Programming in Java, Andrew Davison, Oreilly-SPD, 2005.
3. Woo, Nieder & Davis, OpenGL Programming Guide: Addison-Wesley, 1997.
4. 3D Modeling and surfacing, Bill Fleming, Elsevier(Morgan Kauffman).
5. 3D Game Engine Design, David H.Eberly, Elsevier.
6. Virtual Reality Systems, John Vince, Pearson Education.
7. Angel, Open GL: A Primer, Addison-Wesley, 2002.

Note: Assignments should cover any problem related to theory taught.

Assignments
VR Programming-I : Introducing Java 3D, loading and manipulating external models, using a lathe to make shapes.
VR Programming-II : 3D Sprites, animated 3D sprites, particle systems.