

# **ACADEMIC REGULATIONS & COURSE STRUCTURE**

**For**

## **COMPUTER SCIENCE & TECHNOLOGY**

*(Applicable for batches admitted from 2016-2017)*



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA  
KAKINADA - 533 003, Andhra Pradesh, India**

## I Semester

S.No.	SUBJECT	L	P	C
1	ADVANCED DATA STRUCTURES	4	--	3
2	WEB TECHNOLOGIES	4	--	3
3	PARALLEL ALGORITHMS	4	--	3
4	DATA MINING AND KNOWLEDGE DISCOVERY	4	--	3
5	CYBER SECURITY	4	--	3
6	DISTRIBUTED SYSTEMS	4	--	3
7	CST LAB 1	--	3	2
<b>Total Credits</b>				<b>20</b>

## II Semester

S.No.	SUBJECT	L	P	C
1	BIG DATA ANALYTICS	4	--	3
2	PYTHON PROGRAMMING	4	--	3
3	ADVANCED UNIX PROGRAMMING	4	--	3
4	COMPILER DESIGN	4	--	3
5	<b>Elective – 1</b> 1. ADVANCED GRAPH THEORY 2. SOFT COMPUTING 3. INFORMATION RETRIEVAL SYSTEMS 4. ADVANCED COMPUTER ARCHITECTURE	4	--	3
6	<b>Elective - 2</b> 1. ADVANCED DATA BASES 2. INTERNET OF THINGS 3. MACHINE LEARNING 4. CLOUD COMPUTING	4	--	3
7	CST LAB 2	--	3	2
<b>Total Credits</b>				<b>20</b>

## III Semester

S. No.	Subject	L	P	Credits
1	Comprehensive Viva-Voce	--	--	2
2	Seminar – I	--	--	2
3	Project Work Part - I	--	--	16
<b>Total Credits</b>				<b>20</b>

## IV Semester

S. No.	Subject	L	P	Credits
1	Seminar – II	--	--	2
2	Project Work Part - II	--	--	18
<b>Total Credits</b>				<b>20</b>

## **ADVANCED DATA STRUCTURES**

### **UNIT I:**

Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists- Algorithms. Stacks and Queues: Algorithm Implementation using Linked Lists.

### **UNIT II:**

Searching-Linear and Binary Search Methods.

Sorting-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort.

Trees- Binary trees, Properties, Representation and Traversals (DFT,BFT),Expression Trees(Infix,prefix,postfix).

Graphs-Basic Concepts, Storage Structures and Traversals.

### **UNIT III:**

Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, Open Addressing-Linear Probing, Double Hashing.

### **UNIT IV:**

Priority queues- Definition, ADT, Realising a Priority Queue Using Heaps, Definition, Insertion, Deletion .

Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations-Searching, Insertion, Deletion.

### **UNIT V:**

Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching.

Search Trees- Introduction to Red-Black and Splay Trees, B-Trees, , Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

### **TEXT BOOKS:**

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A.Forouzan, Cengage.
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press.

### **REFERENCES BOOKS:**

1. Data Structures And Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures And Algorithms, 3/e, Adam Drozdek, Cengage.

## WEB TECHNOLOGIES

### UNIT-I:

**Java script :** The Basic of Java script: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions

### UNIT-II:

**XML:** Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches,

**AJAX A New Approach:** Introduction to AJAX, Integrating PHP and AJAX.

### UNIT-III:

**PHP Programming: Introducing PHP:** Creating PHP script, Running PHP script.

**Working with variables and constants:** Using variables, Using constants, Data types, Operators

**.Controlling program flow:** Conditional statements, Control statements, Arrays, functions. Working with forms and Databases such as MySQL.

### UNIT-IV:

**PERL:** Introduction to PERL, Operators and if statements, Program design and control structures, Arrays, Hashes and File handling, Regular expressions, Subroutines, Retrieving documents from the web with Perl.

### UNIT-V:

**RUBY:** Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, Classes, Iterators, Pattern Matching. Overview of Rails.

### TEXT BOOKS:

1. Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrell, Gosselin, Zak, Karparhi, MacIntyre, Morrissey, Cengage

### REFERENCE BOOKS:

1. Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly ( 2006)
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
3. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
5. <http://www.upriss.org.uk/perl/PerlCourse.html>

## **PARALLEL ALGORITHMS**

### **UNIT1: Introduction :**

Computational demand in various application areas, advent of parallel processing, terminology-pipelining, Data parallelism and control parallelism-Amdahl's law.

### **UNIT II: Scheduling:**

Organizational features of Processor Arrays, Multi processors and multi-computers. Mapping and scheduling aspects of algorithms. Mapping into meshes and hyper cubes-Load balancing-List scheduling algorithm Coffman-graham scheduling algorithm for parallel processors.

### **UNIT III: Algorithms :**

Elementary Parallel algorithms on SIMD and MIMD machines, Analysis of these algorithms. Matrix Multiplication algorithms on SIMD and MIMD models. Fast Fourier Transform algorithms. Implementation on Hyper cube architectures. Solving linear system of equations, parallelizing aspects of sequential methods back substitution and Tri diagonal.

### **UNIT IV: Sorting:**

Parallel sorting methods, Odd-even transposition Sorting on processor arrays, Biontic ,merge sort on shuffle -exchange ID , Array processor,2D-Mesh processor and Hypercube Processor Array. Parallel Quick-sort on Multi processors. Hyper Quick sort on hypercube multi computers. Parallel search operations. Ellis algorithm and Manber and Ladner's Algorithms for dictionary operations.

### **UNIT V: Searching**

Parallel algorithms for Graph searching, All Pairs shortest paths and minimum cost spanning tree. Parallelization aspects of combinatorial search algorithms with Focus on Branch and Bound Methods and Alpha-beta Search methods.

### **TEXT BOOKS:**

1. Parallel computing theory and practice, Michel J.Quinn
2. Programming Parallel Algorithms, Guy E. Blelloch, Communications of the ACM

## **DATA MINING AND KNOWLEDGE DISCOVERY**

### **UNIT- 1:**

Introduction to Data mining, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, OLAP and multi dimensional data analysis.

### **UNIT- II:**

Classification: Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.

### **UNIT- III:**

Association Analysis: Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential , Sub graph patterns

### **UNIT IV:**

Clustering: Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm

### **UNIT - V:**

Web data mining: Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of WebPages, Enterprise search

### **TEXT BOOKS:**

1. Introduction to Data Mining: Pang-Ning tan, Michael Steinbach, Vipin kumar, Addison- Wesley.
2. Introduction to Data Mining with Case Studies: GK Gupta; Prentice Hall.

### **REFERENCE BOOKS:**

1. Data Mining: Introductory and Advanced Topics, Margaret H Dunham, Pearson, 2008.
2. Fundamentals of data warehouses, 2/e, Jarke, Lenzerini, Vassiliou, Vassiliadis, Springer.
3. Data Mining Theory and Practice, Soman, Diwakar, Ajay, PHI, 2006.
4. Data Mining, Concepts and Techniques, 2/e, Jiawei Han, MichelineKamber, Elsevier, 2006.

## CYBER SECURITY

### UNIT I:

#### **Introduction:**

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

### UNIT II:

#### **Conventional Encryption:**

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC

### UNIT III:

**Number Theory:** Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder theorem, Discrete logarithms

**Public key:** Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service

### UNIT IV:

**IP Security:** IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management

**Transport Level Security:** Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET)

**Email Privacy:** Pretty Good Privacy (PGP) and S/MIME.

### UNIT V:

**Intrusion Detection:** Intruders, Intrusion Detection systems, Password Management.

**Malicious Software:** Viruses and related threats & Countermeasures.

**Fire walls:** Firewall Design principles, Trusted Systems.

### TEXT BOOKS:

1. Network Security & Cryptography: Principles and Practices, William Stallings, PEA, Sixth edition.
2. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech

### REFERENCE BOOKS:

1. Network Security & Cryptography, Bernard Menezes, Cengage,2010

## DISTRIBUTED SYSTEMS

### UNIT-I:

**Characterization of Distributed Systems:** Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges.

**System Models:** Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

### UNIT-II:

**Interprocess Communication:** Introduction, The API for the Internet Protocols- The Characteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

### UNIT-III:

**Distributed Objects and Remote Invocation:** Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

### UNIT-IV:

**Operating System Support:** Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

### UNIT-V:

**Distributed File Systems:** Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

**Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication.

### UNIT-VI:

**Transactions & Replications:** Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication- Introduction, Passive (Primary) Replication, Active Replication.

### TEXT BOOKS:

1. Ajay D Kshemkalyani, Mukesh Sigal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems- Concepts and Design”, Fourth Edition, Pearson Publication



**CST LAB 1**

- 1) By using Data mining tool Demonstration of preprocessing on dataset student.arff?
- 2) By using Data mining tool Demonstration of classification rule process on dataset employee.arff using j48 algorithm
- 3) By using Data mining tool Demonstration of Association rule process on dataset test.arff using apriori algorithm?
- 4) By using Data mining tool Demonstration of classification rule process on dataset employee.arff using naïve baye's algorithm?
- 5) By using Data mining tool Demonstration of clustering rule process on dataset iris.arff using simple k-means algorithms.
- 6) To perform various Recursive & Non-Recursive operations on Binary Search Tree
- 7) To implement BFS & DFS for a Graph
- 8) To implement Merge & Heap Sort of given elements
- 9) To perform various operations on AVL trees
- 10) To implement Krushkal's algorithm to generate a min-cost spanning tree
- 11) To implement Prim's algorithm to generate a min-cost spanning tree
- 12) To implement functions of Dictionary using Hashing.
- 13) Write Ruby program reads a number and calculates the factorial value of it and prints the Same.
- 14) Write a Ruby program which counts number of lines in a text files using its regular Expressions facility.
- 15) Write a Ruby program that uses iterator to find out the length of a string.
- 16) Write perl program takes set names along the command line and prints whether they are regular files or special files
- 17) An example perl program to connect to a MySQL database table and executing simple commands.
- 18) Explain PHP program for cotactus page.

**BIG DATA ANALYTICS****UNIT-I**

Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization

**UNIT-II**

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

**UNIT-III**

Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner

**UNIT-IV**

Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators

**UNIT-V**

Pig: Hadoop Programming Made Easier

Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

Applying Structure to Hadoop Data with Hive:

Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data

**TEXT BOOKS:**

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3<sup>rd</sup> Edition, O'reilly
3. Hadoop in Action by Chuck Lam, MANNING Publ.
4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss

**REFERENCE BOOKS:**

1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook, Srinath Perera, Thilina Gunarathne

**SOFTWARE LINKS:**

1. Hadoop: <http://hadoop.apache.org/>
2. Hive: <https://cwiki.apache.org/confluence/display/Hive/Home>
3. Piglatin: <http://pig.apache.org/docs/r0.7.0/tutorial.html>

## PYTHON PROGRAMMING

### UNIT – I:

**Introduction:**History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

### UNIT – II:

**Types, Operators and Expressions:** Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass

### UNIT – III:

**Data Structures** Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

### UNIT – IV:

**Functions** - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

**Modules:** Creating modules, import statement, from ..import statement, name spacing,

**Python packages,** Introduction to PIP, Installing Packages via PIP, Using Python Packages

### UNIT – V:

**Object Oriented Programming OOP in Python:** Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Datahiding,

**Error and Exceptions:** Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

### TEXT BOOKS

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly

**Reference Books:**

1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W.Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage

## **ADVANCED UNIX PROGRAMMING**

### **UNIT-I**

Introduction to unix-Brief History-What is Unix-Unix Components-Using Unix-Commands in Unix-Some Basic Commands-Command Substitution-Giving Multiple Commands.

### **UNIT-II**

The File system –The Basics of Files-What’s in a File-Directories and File Names-Permissions-I Nodes-The Directory Hierarchy, File Attributes and Permissions-The File Command knowing the File Type-The Chmod Command Changing File Permissions-The Chown Command Changing the Owner of a File-The Chgrp Command Changing the Group of a File.

### **UNIT-III**

Using the Shell-Command Line Structure-Met characters-Creating New Commands-Command Arguments and Parameters-Program Output as Arguments-Shell Variables- -More on I/O Redirection-Looping in Shell Programs.

### **UNIT-IV**

Filters-The Grep Family-Other Filters-The Stream Editor Sed-The AWK Pattern Scanning and processing Language-Good Files and Good Filters.

### **UNIT-V**

Shell Programming-Shell Variables-The Export Command-The Profile File a Script Run During Starting-The First Shell Script-The read Command-Positional parameters-The \$? Variable knowing the exit Status-More about the Set Command-The Exit Command-Branching Control Structures-Loop Control Structures-The Continue and Break Statement-The Expr Command: Performing Integer Arithmetic-Real Arithmetic in Shell Programs-The here Document(<<)-The Sleep Command-Debugging Scripts-The Script Command-The Eval Command-The Exec Command.The Process-The Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background processes-Internal and External Commands-Process Creation-The Trap Command-The Stty Command-The Kill Command-Job Control.

### **TEXT BOOKS:**

1. The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
2. Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson.

### **REFERENCE BOOKS:**

2. Unix and shell programmingby B.M. Harwani, OXFORD university press.

**COMPILER DESIGN****UNIT – I**

Introduction Language Processing, Structure of a compiler the evaluation of Programming language, The Science of building a Compiler application of Compiler Technology. Programming Language Basics.

Lexical Analysis:- The role of lexical analysis buffering, specification of tokens. Recognitions of tokens the lexical analyzer generator lexical

**UNIT –II**

Syntax Analysis -: The Role of a parser, Context free Grammars Writing A grammar, top down passing bottom up parsing Introduction to Lr Parser.

**UNIT –III**

More Powerful LR parser (LR1, LALR) Using Armigers Grammars Equal Recovery in Lr parser Syntax Directed Transactions Definition, Evolution order of SDTS Application of SDTS. Syntax Directed Translation Schemes.

**UNIT – IV**

Intermediated Code: Generation Variants of Syntax trees 3 Address code, Types and Deceleration, Translation of Expressions, Type Checking. Canted Flow Back patching?

**UNIT – V**

Runtime Environments, Stack allocation of space, access to Non Local date on the stack Heap Management code generation – Issues in design of code generation the target Language Address in the target code Basic blocks and Flow graphs. A Simple Code generation.

**TEXT BOOKS:**

1. Compilers, Principles Techniques and Tools. Alfred V Aho, Monical S. Lam, Ravi Sethi  
Jeffery D. Ullman, 2<sup>nd</sup> edition, pearson, 2007
2. Compiler Design K.Muneeswaran, OXFORD
3. Principles of compiler design, 2<sup>nd</sup> edition, Nandhini Prasad, Elsebier.

**REFERENCE BOOKS:**

1. Compiler Construction, Principles and practice, Kenneth C Louden ,CENGAGE
2. Implementations of Compiler, A New approach to Compilers including the algebraic methods,  
Yunlinsu, SPRINGER

**ADVANCED GRAPH THEORY****(Elective -1)****UNIT I:**

Basic Concepts: Graphs and digraphs, incidence and adjacency matrices, isomorphism, the automorphism group;

Trees: Equivalent definitions of trees and forests, Cayley's formula, the Matrix-Tree theorem,

**UNIT II:**

Connectivity: Cut vertices, cut edges, bonds, the cycle space and the bond space, blocks, Menger's theorem;

Paths and Cycles: Euler tours, Hamilton paths and cycles, theorems of Dirac, Ore, Bondy and Chvatal, circumference, the Chinese Postman Problem, the Traveling Salesman problem, diameter and maximum degree

**UNIT III:**

Matchings: Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, algorithms for matching and weighted matching (in both bipartite and general graphs), factors of graphs (decompositions of the complete graph), Tutte's f-factor theorem;

Extremal problems: Independent sets and covering numbers, Turan's theorem, Ramsey theorems;

**UNIT IV:**

Colorings: Brooks theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number, Vizing's theorem;

Graphs on surfaces: Planar graphs, duality, Euler's formula, Kuratowski's theorem, toroidal graphs, 2-cell embeddings, graphs on other surfaces;

**UNIT V:**

Directed graphs: Tournaments, directed paths and cycles, connectivity and strongly connected digraphs

Networks and flows: Flow cuts, max flow min cut theorem

Selected topics: Dominating sets, the reconstruction problem

**TEXT BOOKS:**

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.

**REFERENCE BOOKS:**

1. Frank Harary, Graph Theory, Narosa.
2. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall.



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## **SOFT COMPUTING**

### **(Elective -1)**

#### **UNIT- I**

**FUZZY SET THEORY:** Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

#### **UNIT- II**

**OPTIMIZATION:** Derivative based Optimization, Descent Methods, The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, Random Search – Downhill Simplex Search.

#### **UNIT -III**

**ARTIFICIAL INTELLIGENCE:** Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Propositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification  
State Space Search: Strategies Implementation of Graph Search Search based on Recursion Patent-directed Search Production System and Learning.

#### **UNIT -IV**

**NEURO FUZZY MODELING:** Adaptive Neuro-Fuzzy Inference Systems, Architecture – Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

#### **UNIT- V**

**APPLICATIONS OF COMPUTATIONAL INTELLIGENCE:** Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.

#### **TEXT BOOKS:**

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006.

#### **REFERENCES:**

1. Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

# **INFORMATION RETRIEVAL SYSTEM**

## **(Elective -1)**

### **UNIT I: Introduction to Information storage and retrieval systems:**

Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation

**Introduction to Data structures and algorithms related to Information Retrieval:** Basic Concepts, Data structures, Algorithms.

### **UNIT II: Inverted Files and Signature Files:**

Introduction, Structures used in Inverted Files, Building an Inverted file using a sorted array, Modifications to the Basic Techniques.

Signature Files: Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

### **UNIT III: New Indices for Text, Lexical Analysis and Stop lists:**

**PAT Trees and PAT Arrays:** Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays. Stop lists.

### **UNIT IV: Stemming Algorithms and Thesaurus Construction:**

Types of Stemming algorithms, Experimental Evaluations of Stemming, Stemming to Compress Inverted Files.

Thesaurus Construction: Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.

### **UNIT V: String Searching Algorithms:**

Introduction, Preliminaries, The Naive Algorithm, The Knutt-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm.

### **TEXT BOOKS**

1. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA, 2007.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.

# ADVANCED COMPUTER ARCHITECTURE

## (Elective -1)

### UNIT I:

Introduction to High Performance Computing: Overview, Pipeline vs Parallel Processing Parallel Architectures: Classification and Performance.

Pipeline Processing: Pipeline Performance, design of arithmetic pipelines, multifunction pipes, concept of reservation table, collision vector and hazards.

### UNIT II:

Instruction Processing Pipes: Instruction and data hazard, hazard detection and resolution, delayed jumps, delayed execution. RISC Philosophy.

### UNIT III:

Pipeline scheduling Theory: Greedy pipeline scheduling algorithm, state diagram, modified state diagram, Latency cycles, Optimal cycles, scheduling of static & dynamic Pipelines.

### UNIT IV:

Implementation of pipeline schedulers Interconnection Networks: Interconnection network classification, Single stage/ Multistage Networks, crossbars, close Networks, Benes Networks, Routing algorithms. Omega, Cub-connected and other networks.

### UNIT V:

Introduction to Neurocomputing Architectures Topics from the current literature as self study and presentations by students.

### TEXTBOOKS:

1. M. R. Bhujade, "Parallel Computing", Newage International Pvt. Ltd., 1995.
2. Stallings, William, "Computer organization and architecture, designing for performance", Prentice Hall of India, 1997

### REFERENCE BOOKS:

1. J. L. Hennessy and D. A. Patterson, "Computer architecture: a quantitative approach", Harcourt Asia, Singapore 1996
2. Kain, "Advanced Computer Architecture: a system Design approach", PHI.

## **ADVANCED DATABASES**

### **(Elective-2)**

#### **UNIT I: DISTRIBUTED DATABASES**

Distributed DBMS Concepts and Design – Introduction – Functions and Architecture of DDBMS – Distributed Relational Database Design – Transparency in DDBMS – Distributed Transaction Management – Concurrency control – Deadlock Management – Database recovery – The X/Open Distributed Transaction Processing Model – Replication servers – Distributed Query Optimisation - Distribution and Replication in Oracle.

#### **UNIT II: OBJECT ORIENTED DATABASES**

Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS – Postgres - Comparison of ORDBMS and OODBMS.

#### **UNIT III: WEB DATABASES**

Web Technology And DBMS – Introduction – The Web – The Web as a Database Application Platform – Scripting languages – Common Gateway Interface – HTTP Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform – Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages

#### **UNIT IV: INTELLIGENT DATABASES**

Enhanced Data Models For Advanced Applications – Active Database Concepts And Triggers – Temporal Database Concepts – Deductive databases – Knowledge Databases.

#### **UNIT V : CURRENT TRENDS**

Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining.

**TEXT BOOKS:**

1. Thomas M. Connolly, Carolyn E. Begg, “Database Systems - A Practical Approach to Design , Implementation , and Management”, Third Edition , Pearson Education, 2003

**REFERENCES:**

1. Ramez Elmasri & Shamkant B.Navathe, “Fundamentals of Database Systems”, Fourth Edition , Pearson Education , 2004.
2. M.Tamer Ozsü , Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, Pearson Education, 2003.
3. C.S.R.Prabhu, “Object Oriented Database Systems”, PHI, 2003.
4. Peter Rob and Corlos Coronel, “Database Systems – Design, Implementation and Management”, Thompson Learning, Course Technology, 5th Edition, 2003.

**INTERNET OF THINGS  
(Elective -2)****UNIT I:**

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples OF IoTs, Design Principles For Connected Devices

Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

**UNIT II:**

Business Models for Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

**UNIT III:**

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

**UNIT IV:**

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

**UNIT V:**

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology ,Sensing the World.

**TEXTBOOKS:**

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

**REFERNCE BOOKS:**

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things CunoPfister , Oreilly.

# MACHINE LEARNING

(Elective -2)

**UNIT -I: The ingredients of machine learning, Tasks:** the problems that can be solved with machine learning, Models: the output of machine learning, Features, the workhorses of machine learning. **Binary classification and related tasks:** Classification, Scoring and ranking, Class probability estimation

**UNIT- II: Beyond binary classification:** Handling more than two classes, Regression, Unsupervised and descriptive learning. **Concept learning:** The hypothesis space, Paths through the hypothesis space, Beyond conjunctive concepts

**UNIT- III: Tree models:** Decision trees, Ranking and probability estimation trees, Tree learning as variance reduction. **Rule models:** Learning ordered rule lists, Learning unordered rule sets, Descriptive rule learning, First-order rule learning

**UNIT -IV: Linear models:** The least-squares method, The perceptron: a heuristic learning algorithm for linear classifiers, Support vector machines, obtaining probabilities from linear classifiers, Going beyond linearity with kernel methods. **Distance Based Models:** Introduction, Neighbours and exemplars, Nearest Neighbours classification, Distance Based Clustering, Hierarchical Clustering.

**UNIT- V: Probabilistic models:** The normal distribution and its geometric interpretations, Probabilistic models for categorical data, Discriminative learning by optimising conditional likelihood Probabilistic models with hidden variables. **Features:** Kinds of feature, Feature transformations, Feature construction and selection. Model ensembles: Bagging and random forests, Boosting

## TEXT BOOKS:

1. Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.
2. Machine Learning, Tom M. Mitchell, MGH.

## REFERENCE BOOKS:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge.
2. Machine Learning in Action, Peter Harington, 2012, Cengage

# CLOUD COMPUTING

(Elective -2)

## UNIT I:

**Introduction:** Network centric computing, Network centric content, peer-to-peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing

**Parallel and Distributed Systems:** introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

## UNIT II:

**Cloud Infrastructure:** At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Intercloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing

**Cloud Computing :** Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research

## UNIT III:

**Cloud Resource virtualization:** Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades

**Cloud Resource Management and Scheduling:** Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feed back control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling

## UNIT IV:

**Storage Systems:** Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system., Apache Hadoop, BigTable, Megastore ( text book 1), Amazon Simple Storage Service(S3) (Text book 2)

**Cloud Security:** Cloud security risks, security – atop concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks

## UNIT V:

**Cloud Application Development:** Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming ( Text Book 1)

**Google:** Google App Engine, Google Web Toolkit (Text Book 2)

**MicroSoft:** Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

## TEXT BOOKS:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH

## REFERNCE BOOK:

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH



**CST LAB 2**

1. 1) a) Running instructions in Interactive interpreter and a Python Script  
b) Write a program to purposefully raise Indentation Error and correct it
  
2. a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem) b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
  
3. 3) a) Write a Program for checking whether the given number is a even number or not.  
b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . , 1/10  
c) Write a program using a for loop that loops over a sequence. What is sequence?  
d) Write a program using a while loop that asks the user for a number, and prints a  
4. Countdown from that number to zero.  
a) Find the sum of all the primes below two million. Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89,  
b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.
  
5. a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure  
b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.
  
6. a) Write a program combine lists that combines these lists into a dictionary.  
b) Write a program to count frequency of characters in a given file. Can you use character?
  
7. frequency to tell whether the given file is a Python program file, C program file or a text file?

- a) Write a program to print each line of a file in reverse order.
  - b) Write a program to compute the number of characters, words and lines in a file.
8. a) Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius. If (distance between two balls centers)  $\leq$  (sum of their radii) then (they are colliding)

- b) Find mean, median, mode for the given set of numbers in a list.
9. Write a Program to count the number of words and lines supplied at standard input using
10. UNIX shell programming?
11. Write a shell script to find the factorial of a number entered through keyboard?
12. 11) Write a shell script to find the gross salary given that if the basic salary is less than 1500 then HRA =10% of basic salary and DA=90% if the basic salary is greater than or equal to 1500 then HRA=500 and DA=98% of basic salary. The employee's basic salary is the input through keyboard?
13. Write a shell script to display following information using case statement?
- 14. a. List users
  - 15. b. Show date
  - 16. c. Display file
  - 17. d. Change working directory
  - 18. e. Return to original directory
  - 19. f. Quit