

ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABUS

COMPUTER SCIENCE & ENGINEERING

For

M. Tech. (Computer Science & Information Engineering)
(Two Year Full Time Programme)



**JNTUH COLLEGE OF ENGINEERING HYDERABAD
(Autonomous)**

Kukatpally, Hyderabad – 500 085, Telangana, India.

2015

JNTUH COLLEGE OF ENGINEERING HYDERABAD
M.Tech. (Computer Science & Information Engineering)-Full Time w.e.f. 2015-16

I – SEMESTER

S.No.	Subject	L	T	P	Credits
1	Advanced Data Structures and Algorithms	4	0	0	4
2	Information Retrieval Systems	4	0	0	4
3	Elective – 1	4	0	0	4
4	Elective – 2	4	0	0	4
5	Elective – 3	4	0	0	4
6	Elective – 4	4	0	0	4
7	Computing Laboratory-I	0	0	4	2
8	Seminar	0	0	4	2
Total Credits					28

II – SEMESTER

S.No.	Subject	L	T	P	Credits
1	Information Security	4	0	0	4
2	Big Data Analytics	4	0	0	4
3	Elective – 5	4	0	0	4
4	Elective – 6	4	0	0	4
5	Elective – 7	4	0	0	4
6	Elective – 8	4	0	0	4
7	Computing Laboratory-II	0	0	4	2
8	Soft Skills Lab	0	0	4	2
Total Credits					28

III – SEMESTER

S.No.	Subject	L	T	P	Credits
1	Comprehensive Viva Voce				4
2	Project Phase -I				12
Total Credits					16

IV – SEMESTER

S.No.	Subject	L	T	P	Credits
	Project Phase-II & Dissertation				18
Total credits					18

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Department Elective – I

1. Mobile Computing
2. Social Media & Web Mining
3. Information Systems Control & Audit

Department Elective – II

1. Cloud Computing
2. Scripting Languages
3. Soft Computing

Department Elective – III

1. Internet of Things
2. Natural Language Processing
3. Bio-Informatics

Department Elective – IV

1. Software Architecture and Design Patterns
2. Pattern Recognition
3. Operating System Design

Department Elective – V

1. Software Testing Methodologies
2. Information Storage and Management
3. Web Services & Service Oriented Architecture

Department Elective – VI

1. Research Methodologies
2. Software Design and Engineering
3. Speech Processing

Department Elective – VII

1. Ad hoc and Sensor Networks
2. Machine Learning
3. Optimization Techniques

Department Elective – VIII

1. Cryptanalysis
2. Robotics
3. Computer Forensics

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L	T	P	C
4	0	0	4

ADVANCED DATA STRUCTURES AND ALGORITHMS**Prerequisites**

- ✘ A course on “Computer Programming & Data Structures”
- ✘ A course on “ Design & Analysis of Algorithms”

Objectives

- ✘ Introduces the notations for analysis of the complexities of algorithms
- ✘ Introduces the amortized analysis
- ✘ Introduces the heap data structures such as leftist trees, binomial heaps, fibonacci and min-max heaps
- ✘ Introduces the randomized, approximation and non deterministic algorithms
- ✘ Introduces a variety of data structures such as disjoint sets, hash tables, search structures and digital search structures

Outcomes

- ✘ Ability to analyze the performance of algorithms
- ✘ Ability to select the data structures that efficiently model the information in a problem
- ✘ Ability to choose appropriate data structures and algorithm design methods for a specified application
- ✘ Ability to understand how the choice of data structures impact the performance of programs
- ✘ Can Design programs using a variety of data structures, including hash tables, search structures and digital search structures

UNIT-I

Algorithm analysis: Asymptotic notations, Recurrence analysis, Masters Theorem, Amortized analysis, Disjoint sets.

Randomized Algorithms –Introduction, n-queens problem, quick sort.

UNIT-II

Heap Structures- Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.
Hashing.

UNIT-III

Search Structures- OBST, AVL trees, Red-Black trees, Splay trees, B-trees.

UNIT-IV

Digital Search Structures - Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees.

Approximation Algorithms: Planar graph colouring, Job Scheduling, TSP.

UNIT-V

NP-Hard and NP-complete: Non-deterministic algorithms – Searching, Sorting, Knapsack decision problem, Satisfiability problem, NP - Complete Problems- clique problem, Vertex cover problem, TSP.

Text Books:

1. Fundamentals of Data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI.

References:

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press.

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INFORMATION RETRIEVAL SYSTEMS**Prerequisites:**

- ☒ Data Structures

Course Objectives:

- ☒ To learn the important concepts and algorithms in IRS
- ☒ To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

Outcomes:

- ☒ Ability to apply IR principles to locate relevant information large collections of data
- ☒ Ability to design different document clustering algorithms
- ☒ Implement retrieval systems for web search tasks.
- ☒ Design an Information Retrieval System for web search tasks.

UNIT I

Introduction:

Motivation, Basic Concepts, Past-Present and Future, the Retrieval Process

Modeling :

Introduction, A Taxonomy of Information retrieval Models, Retrieval: Ad hoc and Filtering, A Formal Characteristics of IR Models, Classic Information Retrieval, Alternative Set Theory Models, Alternative Probabilistic Models, Structured Text Retrieval Models, Model for Browsing

UNIT II

Retrieval Evaluation

Introduction, Retrieval Performance Evaluation, Reference Collections

Query languages

Introduction, Keyword-Based Querying, Pattern Matching, Structural Queries, Query Protocols

Query Operations

Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic global Analysis

Text Operations

Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing text Compression Techniques

UNIT III

Indexing and Searching

Introduction, Inverted Files, Other Indices for Text, Boolean queries, Sequential Searching, Pattern Matching, Structural Queries, Compression

Searching the Web

Introduction, Challenges, Characterizing the Web, Search Engines, Browsing, Metasearches, Finding the Needle in the Haystack, Searching using Hyperlinks

UNIT IV

User Interfaces and Visualization

Introduction, Human-Computer Interaction, The Information Access Process, Starting Points, Query Specification, Context, User Relevance Judgments, Interface Support for the Search Process

UNIT V

Multimedia IR: Models and Languages

Introduction, Data Modeling, Query Languages

Multimedia IR: Indexing and Searching

Introduction, Background-Spatial Access Methods, A Generic Multimedia Indexing Approach, One Dimensional Time Series, Two dimensional Color Images, Automatic Feature Extraction.

Text Books

1. Modern Information Retrieval By Yates and Neto Pearson Education.

Reference:

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
3. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.

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MOBILE COMPUTING
Elective-I

Prerequisites:

- ✎ Computer Networks
- ✎ Distributed Systems / Distributed Operating Systems

Objectives:

- ✎ To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
- ✎ To understand the typical mobile networking infrastructure through a popular GSM protocol
- ✎ To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
- ✎ To understand the database issues in mobile environments & data delivery models.
- ✎ To understand the ad hoc networks and related concepts.
- ✎ To understand the platforms and protocols used in mobile environment.

Outcomes:

- ✎ Able to think and develop new mobile applications
- ✎ Able to develop new ad hoc network applications and/or algorithms.
- ✎ Able to understand & develop any existing or new protocol related to mobile environment

UNIT I**Introduction**

Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT –II**(Wireless) Medium Access Control (MAC)**

Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

Mobile Network Layer

IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

UNIT –III**Mobile Transport Layer**

Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Database Issues

Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT IV

Data Dissemination and Synchronization

Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols

UNIT V

Mobile Ad hoc Networks (MANETs)

Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.

Protocols and Platforms for Mobile Computing

WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.

Text Books:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

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SOCIAL MEDIA AND WEB MINING

Elective-I

Prerequisites:

- ✎ Web Mining

Objectives:

- ✎ The purpose of this course is to provide the students with knowledge of social media & web mining principles and techniques.
- ✎ This course is also designed to give an exposure of the frontiers of social media web mining (Face book, twitter)
- ✎ To introduce new technology for data analysis

Outcomes:

- ✎ Ability to understand social media and its data.
- ✎ Ability to apply mining technologies on twitter, facebook, LinkedIn and Googlet.
- ✎ Ability to apply web mining technologies, NLP concepts to summarize, mine data on webpage, blogs.
- ✎ Ability to Program using “R” and the tool Twitter ‘R’

UNIT-1: Social media mining, Fundamentals, new challenges, key concepts, Good Data vs Bad Data, understanding sentiments, Sentiment Analysis, Classification, supervised social media mining, unsupervised social media mining, human sensors under honest signals.

UNIT-2: Recommendation in Social Media, Challenges, Classical Recommendation Algorithms, Recommendation Using Social Context, Evaluating Recommendations

UNIT-3: Mining Twitter: Exploring Trending Topics, Discovering What People Are Talking About, Mining Face book: Analyzing Fan Pages, Examining Friendships, Mining LinkedIn: Faceting Job Titles, Clustering Colleagues, Mining Google+: Computing Document Similarity, Extracting Collocations

UNIT-4: Mining Web Pages: web content mining, web structure mining, web usage mining, Natural Language Processing to Understand Human Language, Summarize Blog Posts, Mining Mailboxes, Mining GitHub, Inspecting Software Collaboration Habits, Building Interest Graphs, Mining the Semantically Marked-Up Web: Extracting Micro formats, Inference over RDF.

UNIT-5: Getting started with R:Why R?, Quick start, The basics-Assignment and Arithmetic, Functions, Arguments and help vectors, sequences and combining vectors, creating data frames and importing files, Visualization in Restyle and workflow, Mining Twitter with R:why Twitter data? Obtaining Twitter data, preliminary analyses.

Text Books:

1. **Mining the Social Web, 2nd Edition** Data Mining Face book, Twitter, LinkedIn, Google+, GitHub, and More By Matthew A. Russell Publisher: O'Reilly Media.
2. Social Media Mining with R [Kindle Edition] NATHAN DANNEMAN RICHARD HEIMANN

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INFORMATION SYSTEMS CONTROL & AUDIT
Elective-I

Prerequisites

-NIL-

Objectives

- ☒ Introduces the basic concepts of information system auditing..
- ☒ To understand the management control frameworks and the application control framework.

Outcomes

- ☒ Understand functions of information systems audit and management
- ☒ Acquire skills for the evidence collection & evaluation

Unit -I

Overview of Information System Auditing-Conducting an Information Systems Audit, Overview & steps in an Audit.

Unit-II

The Management Control Framework-I: Introduction, Systems Development Management Controls, Security Management Controls, Operations Management Controls, Quality Assurance Management Controls.

Unit -III

The Application Control Framework-I : Boundary Controls, Input Controls, Processing Controls, Database Controls, Output Controls.

Unit -IV

Evidence Collection & Evaluation: Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools. Evaluating Asset Safeguarding and Data Integrity, Evaluating System Effectiveness, Efficiency.

Unit-V

Information Systems Audit and Management: Managing the Information Systems Audit Function, Introduction, Planning Function, Organising Function, Staffing Function, Leading Function, Controlling Function, Some Features of Information Systems Auditing.

Text Books:

1. Ron Weber: Information Systems Control and Audit, Pearson, 2006.

References:

1. James A.Hall: Information Technology Auditing and Assurance, Cengage. 2008.
2. Davis: IT Auditing, TMH, 2007
3. David Ricchiute: Auditing and Assurance Services, 7/e, Cengage, 2008.
4. Cannon, Bergmann, Pamplin: CICA- Certified Information Systems Auditor, Study Guide, 1/e , Sybex, WILEY- India, 2006.
5. Ronald, Russel: The CISSP prep Guide, 2/e. Wiley, Dreamtech, 2006.
6. Alter: Information Systems, Pearson, 20

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**CLOUD COMPUTING
Elective-II**

Prerequisites

- ✘ A course on “Computer Networks”
- ✘ A course on “Operating Systems”

Objectives

- ✘ This course provides an insight into cloud computing
- ✘ Topics covered include- distributed system models, different cloud service models, service oriented architectures, cloud programming and software environments, resource management.

Outcomes

- ✘ Ability to understand various service delivery models of a cloud computing architecture.
- ✘ Ability to understand the ways in which the cloud can be programmed and deployed.
- ✘ Understanding cloud service providers .

UNIT I: Computing Paradigms, High-Performance Computing, Parallel Computing. Distributed Computing. Cluster Computing. Grid Computing, Cloud Computing. Bio computing, Mobile Computing. Quantum Computing, Optical Computing. Nano computing.

UNIT II: Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics...Four Cloud Deployment Models

UNIT III: Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud application, Migrating, Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

UNIT IV: Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers. Other Cloud Service Models

UNIT V: Cloud Service Providers: EMC, EMC IT, Captiva Cloud Toolkit, Google Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue Service, Microsoft Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft Aneka Platform

TEXT BOOKS:

1. Essentials of Cloud Computing : K.Chandrasekhran , CRC press, 2014

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing , Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

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SCRIPTING LANGUAGES

Elective-II

Prerequisites

- ✘ A course on “Computer Programming and Data Structures”
- ✘ A course on “Object Oriented Programming Concepts”

Objectives

- ✘ This course provides an introduction to the script programming paradigm
- ✘ Introduces scripting languages such as Perl, PHP and Python.
- ✘ Learning TCL

Outcomes

- ✘ Comprehend the differences between typical scripting languages and application programming languages. Acquire programming skills using scripting languages.
- ✘ Gain knowledge of the strengths and weakness of Perl, PHP, TCL and Python; and select an appropriate language for solving a given problem
- ✘ Ability to design web pages using advanced features of PHP.

UNIT – I Introduction to PERL and Scripting

Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT – II Advanced perl

Finer points of looping, pack and unpack, filesystem, eval, datastructures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT – III PHP Basics

PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Datatypes, Variables, Constants, expressions, string interpolation, control structures. Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

PHP and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World.

UNIT - IV TCL

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures , strings , patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface.

Tk

Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.

UNIT – V Python

Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python,Exception Handling.
Integrated Web Applications in Python – Building Small, Efficient Python Web Systems ,Web Application Framework.

TEXT BOOKS:

1. The World of Scripting Languages , David Barron,Wiley Publications.
2. Beginning PHP and MySQL , 3rd Edition , Jason Gilmore,Apress Publications (Dream tech.).
3. Python Web Programming, Steve Holden and David Beazley ,New Riders Publications.

REFERENCE BOOKS:

1. Open Source Web Development with LAMP using Linux Apache,MySQL,Perl and PHP,J.Lee and B.Ware(Addison Wesley) Pearson Education.
2. Programming Python,M.Lutz,SPD.
3. PHP 6 Fast and Easy Web Development ,Julie Meloni and Matt Telles, Cengage Learning Publications.
4. PHP 5.1,I.Bayross and S.Shah,The X Team,SPD.
5. Core Python Programming,Chun,Pearson Education.
6. Guide to Programming with Python,M.Dawson,Cengage Learning.
7. Perl by Example,E.Quigley,Pearson Education.
8. Programming Perl,Larry Wall,T.Christiansen and J.Orwant, O'Reilly, SPD.
9. Tcl and the Tk Tool kit,Ousterhout,Pearson Education.
10. PHP and MySQL by Example,E.Quigley,Prentice Hall(Pearson).
11. Perl Power,J.P.Flynt,Cengage Learning.
12. PHP Programming solutions,V.Vaswani,TMH.

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4	0	0	4

**SOFT COMPUTING
Elective-II**

Prerequisites

-NIL-

Objectives

- ✎ This course explains AI problems and search techniques.
- ✎ To understand the supervised and unsupervised learning networks
- ✎ Introduces classical sets and fuzzy sets.
- ✎ To understand genetic algorithms.

Outcomes

- ✎ Comprehend the differences between classical sets and fuzzy sets
- ✎ Able to provide solutions to general pattern reorganization problem.
- ✎ Get the skill for application of search techniques to solve AI problems
- ✎ Able to design a genetic algorithms based solution for solving real time problems

UNIT-I

AI Problems and Search: AI problems, Techniques, Problem Spaces and Search, Heuristic Search Techniques- Generate and Test, Hill Climbing, Best First Search Problem reduction, Constraint Satisfaction and Means End Analysis. Approaches to Knowledge Representation- Using Predicate Logic and Rules.

UNIT-II

Supervised Learning Networks-perceptron, Back propagation algorithm-Classification Problem-Speech Processing Case study.
Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization,

UNIT-III

Introduction to Classical Sets (crisp Sets)and Fuzzy Sets- operations and Fuzzy sets. Classical Relations -and Fuzzy Relations- Cardinality, Operations, Properties and composition. Tolerance and equivalence relations.
Membership functions- Features, Fuzzification, membership value assignments, Defuzzification.

UNIT-IV

Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning Fuzzy Decision making
Fuzzy Logic Control Systems. Genetic Algorithm- Introduction and basic operators and terminology.Applications: Optimization of TSP, Internet Search Technique

UNIT-V

Genetic Algorithms-Introduction, Biological background, Search space, Basic technologies, Simple and general genetic algorithms, Operations in genetic algorithms, Stopping criteria and constraints in genetic algorithms, Problem solving using genetic algorithms.

Text Books:

1. Principles of Soft Computing- S N Sivanandam, S N Deepa, Wiley India, 2007
2. Soft Computing and Intelligent System Design -Fakhreddine O Karray, Clarence D Silva,. Pearson Edition, 2004.

Reference Books:

1. Artificial Intelligence and SoftComputing- Behavioural and Cognitive Modelling of the Human Brain- Amit Konar, CRC press, Taylor and Francis Group.
2. Artificial Intelligence – Elaine Rich and Kevin Knight, TMH, 1991, rp2008.
3. Artificial Intelligence – Patric Henry Winston – Third Edition, Pearson Education.
4. A first course in Fuzzy Logic-Hung T Nguyen and Elbert A Walker, CRC. Press Taylor and Francis Group.

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L	T	P	C
4	0	0	4

INTERNET OF THINGS
Elective-III

Prerequisites: NIL**Objectives:**

- ☒ To introduce the terminology, technology and its applications
- ☒ To introduce the raspberry PI platform, that is widely used in IoT applications
- ☒ To introduce the implementation of web based services on IoT devices

Outcomes:

- ☒ Understand the new computing technologies
- ☒ Able to apply the latest computing technologies like cloud computing technology and Big Data
- ☒ Ability to introduce the concept of M2M (machine to machine) with necessary protocols
- ☒ Get the skill to program using python scripting language which is used in many IoT devices

Unit I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

Unit II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG-NETCONF, YANG, SNMP NETOPEER

Unit III

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

Unit IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

Unit V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

Text Books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

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L	T	P	C
4	0	0	4

NATURAL LANGUAGE PROCESSING
Elective-III

Prerequisites:

☒ data structures, finite automata and probability theory

Objectives:

☒ Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

Outcomes:

- ☒ Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- ☒ Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- ☒ Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- ☒ Able to design, implement, and analyze NLP algorithms
- ☒ Able to design different language modeling Techniques.

UNIT I**Finding the Structure of Words**

Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents

Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

UNIT II**Syntax**

Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

UNIT III**Semantic Parsing**

Introduction, Semantic Interpretation, System Paradigms, Word Sense
Recourse, Systems, Software.

UNIT IV

Predicate-Argument Structure, Meaning Representation
Recourse, Systems, Software.

UNIT V**Language Modeling**

Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling

Text Books:

1. Multilingual natural Language Processing Applications : From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication

Reference:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

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L	T	P	C
4	0	0	4

BIO-INFORMATICS
Elective-III

Prerequisites

- ✘ A course on “Database Management Systems”
- ✘ A course on “Data Warehousing and Data Mining”
- ✘ A course on “Computer Programming and Data Structures”

Objectives

- ✘ To impart the knowledge of theoretical and practical concepts of bioinformatics.
- ✘ To develop skills in designing biological database and retrieving.
- ✘ To apply appropriate sequence analysis methods for analyzing bio-molecular sequences.

Outcomes

- ✘ Demonstrate the knowledge on concepts of biological databases, Genomes and Proteome.
- ✘ Ability to analyze biological database management system.
- ✘ Ability to select and apply appropriate techniques and tools to manage the biological data.

UNIT I

INTRODUCTION:- Definition – Overview- Major databases in Bio Informatics- Molecular biology – Central Dogma- Data retrieval tools – Data mining of Databases – Gene Analysis – Prokaryotic and Eukaryotic Genomes – Sequence Assembly – Gene mapping – Physical maps – cloning – ORF – amino acids – DNA, RNA sequences – Genetic code.

UNIT II

DNA and PROTEIN SEQUENCES:-DNA: working with single DNA sequence : removing vector sequences- verifying restriction maps – PCR design – GC content – counting words – internal repeats – protein coding regions – ORFing – Genome scan, Protein: predicting properties – primary structure analysis – transmembrane segments – PROSITE patterns – interpreting scanprosite results- finding domains – CD server results – pfsan results.

UNIT III

ALIGNMENT OF PAIR OF SEQUENCES:- Terminology – Global and Local alignment – Dot matrix – dynamic programming – using scoring matrices –PAM matrices – BLOSUM, Working with FASTA – Algorithm – output – E-values – Histogram, Working with BLAST – algorithm – output – services – gapped BLAST- PSIBLAST – comparison of FASTA and BLAST.

UNIT IV

MULTIPLE SEQUENCE ALIGNMENT:- Criteria for Multiple sequence alignment – applications – choosing the right sequences; FASTA, ClustalW, Tcoffee methods – interpreting multiple sequence alignment – getting in right format – converting formats – using Jalview – preparing for publication.

UNIT V

PROTEIN CLASSIFICATION & STRUCTURE PREDICTION:- Structure of amino acids – primary structure – secondary structure – folds and motifs – alpha and beta helix –structure based protein classification – protein structure Data bases – folding problem – PROPSSEARCH –primary structure analysis and prediction – secondary structure analysis and prediction – motifs – profiles –patterns and fingerprints

TEXT BOOKS

1. S.C Rostogi , Mendiratta, P.Rastogi, “ *Bioinformatics: methods and applications*”,second edition, PHI 2006.
2. Jean Mickel Clavere & Cadrienotredom “*Bio Informatics– A beginners guide*” Wiley DreamTech, 2003.

REFERENCE BOOKS

1. T.K. Attwood and D.J Perry Smith, “ *Introduction to Bio Informatics*”, Pearson Education, 1st Edition, 2001.
2. Dan E.Krane, Michael L.Raymer, “*fundamental concepts of Bioinformatics* “, Pearson Education, 2004.

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**SOFTWARE ARCHITECTURE AND DESIGN PATTERNS
Elective-IV**

Pre Requisite:

- ✘ A course On “Software Engineering”

Objectives:

- ✘ To understand the concept of patterns and the Catalog.
- ✘ To discuss the Presentation tier design patterns and their affect on: sessions, client access, validation and consistency.
- ✘ To understand the variety of implemented bad practices related to the Business and Integration tiers.
- ✘ To highlight the evolution of patterns.

Outcomes:

- ✘ Ability to add functionality to designs while minimizing complexity
- ✘ Understand what design patterns really are, and are not
- ✘ Learn specific design patterns.
- ✘ Able to design patterns to keep code quality high without overdesign.

UNIT I**Envisioning Architecture**

The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

Creating an Architecture

Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

UNIT II**Analyzing Architectures**

Architecture Evaluation, Architecture design decision making, ATAM, CBAM.

UNIT III**Moving from one system to many**

Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT IV**Patterns**

Pattern Description, Organizing catalogs, role in solving design problems ,Selection and usage.

Creational and Structural patterns

Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight, Proxy.

UNIT V**Behavioral patterns**

Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

Case Studies

A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development

Text Books:

1. Software Architecture in Practice, second edition, Len Bass, Pau Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

Reference Books:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.

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PATTERN RECOGNITION
Elective-IV

Prerequisites

- ✎ Students are expected to have knowledge basic linear algebra, basic probability theory and basic programming techniques;
- ✎ A course on “Computational Mathematics”
- ✎ A course on “Computer Oriented Statistical Methods”

Objectives

- ✎ This course introduces fundamental concepts, theories, and algorithms for pattern recognition and machine learning.
- ✎ Topics include: Pattern Representation, Nearest Neighbor Based Classifier, Bayes Classifier, Hidden Markov Models, Decision Trees, Support Vector Machines, Clustering, and an application of hand-written digit recognition.

Outcomes

- ✎ Understand the theory, benefits, inadequacies and possible applications of various machine learning and pattern recognition algorithms
- ✎ Identify and employ suitable machine learning techniques in classification, pattern recognition, clustering and decision problems.

UNIT-I: Introduction: What is Pattern Recognition, Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition.

Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature Extraction, Feature Selection, Evaluation of Classifier, Evaluation of Clustering.

UNIT-II: Nearest Neighbor Based Classifier: Nearest Neighbor Algorithm, Variants of the NN Algorithm use of the Nearest Neighbor Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection.

Bayes Classifier: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with the NNC, Naïve Bayes Classifier, Bayesian Belief Network.

UNIT-III: Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, Classification using HMMs.

Decision Trees: Introduction, Decision Tree for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Overfitting and Pruning, Examples of Decision Tree Induction.

UNIT-IV: Support Vector Machines: Introduction, Learning the Linear Discriminant Functions, Neural Networks, SVM for Classification.

Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers.

UNIT-V: Clustering: Why is Clustering Important, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets.

An Application-Hand Written Digit Recognition: Description of the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns, Results.

TEXT BOOK:

1. Pattern Recognition: An Algorithmic Approach: Murty, M. Narasimha, Devi, V. Susheela, Springer Pub, 1st Ed.

REFERENCES:

1. Machine Learning - Mc Graw Hill, Tom M. Mitchell.
2. Fundamentals Of Speech Recognition: Lawrence Rabiner and Biing- Hwang Juang. Prentice-Hall Pub.

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**OPERATING SYSTEM DESIGN
Elective-IV**

Prerequisites

- ✘ A course on “Operating Systems”
- ✘ A course on “Computer Programming and Data Structures”
- ✘ A course on “Computer Organization and Architecture”

Objectives

- ✘ Provide an introduction to operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
- ✘ Introduce the issues to be considered in the design and development of operating system
- ✘ Introduce inter process communication and I/O Devices.

Outcomes

- ✘ Will be able to control access to a computer and the files that may be shared
- ✘ Demonstrate the knowledge of the components of computer and their respective roles in computing.
- ✘ Ability to recognize and resolve user problems with standard operating environments.
- ✘ Gain practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively.
- ✘ Understanding Resource Management and Security.
- ✘ Getting knowledge about Device drivers.

UNIT - I: PROCESSES AND SCHEDULING

Process States and System Call Interface; Life Cycle of a Process: Process Dynamics; Scheduler: working and implementation; Linux Process States and System Calls; Process Groups, Sessions, Foreground and Background Processes.

UNIT - II: INTERPROCESS COMMUNICATION AND SYNCHRONISATION

Signals, Pipes and Named Pipes (FIFOs); Threads and pthread library; Mutexes and Condition Variables; Semaphores; Producer-Consumer Problem and Solutions using mutexes, condition variables and semaphores.

UNIT - III: FILES AND FILE SYSTEMS

File and File Meta-data; File Naming Systems; File System Operations; File System Implementation; File System Structures; Booting an OS; File System Optimisation.

UNIT - IV: DEVICES AND DEVICE DRIVERS

Devices and Types of Devices; Terminal, Disk, SCSI, Tape and CD devices; Unification of Files and Devices; Device Drivers: Concepts and Implementation Details.

UNIT - V: RESOURCE MANAGEMENT AND SECURITY

Resource Management Issues; Types of Resources; Integrated Resource Scheduling; Queuing
Models of Scheduling; Protection of Resources – hardware, software, and attacks; Security Policies.

Text Books:

1. Charles Crowley. *Operating Systems: A Design-Oriented Approach*, Tata McGraw-Hill (2001 or later)
2. Richard Stevens, Stephen Rago. *Advanced Programming in the Unix Environment*, Addison-Wesley (2013). Available for free download in PDF.

Reference Books::

1. Maekawa, M. and Arthur E. Oldehoeft and Oldehoeft, R.R. *Operating Systems: Advanced*
2. *Concepts*, Benjamin Cummings (1987). Available through Google Books.
3. David A. Rusling. *The Linux Kernel*, <http://www.tldp.org/LDP/tlk/tlk.html>

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0 0 4 2**COMPUTING LABORATORY-I****Prerequisites**

- ✎ A course on “Computer Programming & Data Structures”

Objectives

- ✎ Introduces the basic concepts of Abstract Data Types.
- ✎ Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees, sorting and pattern matching algorithms

ADS&A

1. Write a program to implement the Quick sort
2. Write a program to implement the Binary Search
3. Write a program to implement the Merge sort
4. Write a program to implement the Knapsack problem
5. Write a program to implement the Single source shortest path problem
6. Write a program to implement the optimal binary search tree
7. Write a program to implement the Bubble sort
8. Write a program to implement the Selection sort
9. Write a program to implement the Insertion sort
10. Write a program to implement the Heap sort
11. Write a program to implement the tree traversals
12. Write a program to implement the operations of Binary search tree
13. Write a program to implement the operations of AVL tree
14. Write a program to implement the Graph traversals
15. Write a program to implement the Brute Force algorithm
16. Write a program to implement the Boyer Moore algorithm
17. Write a program to implement the KMP algorithm

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SEMINAR

Prerequisites : NIL

Objectives

- ✎ To comprehend the technical topic of the presentation
- ✎ To deliver confidently a technical work to a team of people

Outcomes

- ✎ Ability to analyze the selected topic, organize the content and communicate to audience in an effective manner
- ✎ Ability to practice the learning by self study

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INFORMATION SECURITY**Prerequisites**

- ☒ A Course on "Computer Networks and a course on Mathematics

Objectives

- ☒ To understand the fundamentals of Cryptography
- ☒ To understand various key distribution and management schemes
- ☒ To understand how to deploy encryption techniques to secure data in transit across data networks
- ☒ To apply algorithms used for secure transactions in real world applications

Outcomes

- ☒ Demonstrate the knowledge of cryptography, network security concepts and applications.
- ☒ Ability to apply security principles in system design.

UNIT I

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.

Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

UNIT II

Public key Cryptography Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

UNIT III

Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service.

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

UNIT IV

IP Security:

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

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

UNIT V

Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

TEXT BOOKS:

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.

REFERENCE BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

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BIG DATA ANALYTICS**Prerequisites**

- ✗ Data Mining

Objectives

- ✗ The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
- ✗ This course is also designed to give an exposure of the frontiers of Big data Analytics

Outcomes

- ✗ Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
- ✗ Ability to program using HADOOP and Map reduce, NOSQL
- ✗ Ability to understand importance of Big Data in Social Media and Mining.

Unit I

Big Data Analytics : What is big data, History of Data Management ; Structuring Big Data ; Elements of Big Data ; Big Data Analytics; Distributed and Parallel Computing for Big Data; Big Data Analytics:What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools;

Unit- II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

Unit III

Understanding MapReduce Fundamentals and HBase : The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFC Files, File system types, commands, org.apache.hadoop.io package, HDF, HDFS High Availability; Introducing HBase, Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS;

Unit IV

Big Data Technology Landscape and Hadoop : NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFC (Hadoop Distributed File System), HDFC Daemons, read,write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

Unit V

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets; Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

TEXT BOOKS

1. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. BIG DATA, Black Book™, DreamTech Press, 2015 Edition.
3. BUSINESS ANALYTICS 5e, BY Albright |Winston

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra- Fernandez,” Business Intelligence –Practice, Technologies and Management”, John Wiley 2011.
2. Lariss T. Moss,ShakuAtre, “ Business Intelligence Roadmap”, Addison-Wesley It Service.
3. Yuli Vasiliev, “ Oracle Business Intelligence : The Condensed Guide to Analysis and Reporting”, SPD Shroff, 2012.

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SOFTWARE TESTING METHODOLOGIES
Elective-V

Prerequisites

- ✎ A course on “Software Engineering”

Objectives

- ✎ To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- ✎ To develop skills in software test automation and management using latest tools.

Outcomes

- ✎ Ability to design and develop the best test strategies in accordance to the development models
- ✎ Acquire skills to perform dataflow testing, domain testing, logic testing.

UNIT-I:

Introduction:- Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs

Flow graphs and Path testing:- Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT-II:

Transaction Flow Testing:- transaction flows, transaction flow testing techniques.

Dataflow testing:- Basics of data flow testing, strategies in data flow testing, application of dataflow testing.

Domain Testing:- domains and paths, nice & ugly domains, domain testing, domains and interfaces’ testing, domain and interface testing, domains and testability.

UNIT-III:

Paths, Path products and Regular expressions:- path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing:- overview, decision tables, path expressions, kv charts, specifications.

UNIT-IV:

State, State Graphs and Transition testing:- state graphs, good & bad state graphs, state testing, Testability tips.

UNIT-V:

Graph Matrices and Application:- Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

Text Books:

1. Software Testing techniques - Boris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech.

References:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

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**INFORMATION STORAGE AND MANAGEMENT
Elective-V**

Prerequisite: NIL

Objectives:

- ✎ To make students well verse in the concepts of storage networks.
- ✎ To enable the students in perceiving storage as an infrastructure
- ✎ To handle the transition from storage infrastructure planning and design to store operations.
- ✎ To prepare the students for handling rapid changes in business processes and in the applications and technical infrastructure that enable them.

Outcomes:

- ✎ Ability to plan, install and manage a successful storage network
- ✎ Ability to analyze network file systems, volume managers, and database storage challenges used in storage networks
- ✎ Ability to integrate storage networking solutions with structured and unstructured data using data center models
- ✎ Ability to learn I/O workload planning and estimate storage networking capacities and requirements.

UNIT – I

Concepts of storage networking: the data storage and data access problem, storage networking, business applications, benefits of storage networks on business applications, the effects of storage networks on IT organizations.

Decoupling the storage component: NAS -Data-centric world, distributing computer processing, distributing I/O processing, SAN - idea, evolution and development , operational overview, caveats.

UNIT – II

Storage Architectures: storage elements, storage systems, peripheral connectivity components and concepts, host adapter, controller, magnetic disk storage, disk systems, magnetic tape storage

Connectivity options: connections, bus evolution, bus operations, PCI, SCSI bus, Fibre channel, USB and Firewire, creative connection strategies;Data organizational methods.

UNIT – III

Network Attached Storage: architecture – hardware, software architectures, network connectivity, NAS as a storage system; NAS hardware devices; NAS software components; NAS connectivity options.

Storage Area Network: architecture; hardware devices; software components; configurations for SANs

UNIT – IV

Defining the I/O workload: storage planning and capacity planning, definition and characterization of workloads, I/O content and workloads, consideration for I/O workloads in storage networking.

Applying the SAN solution: workload characterization, OLTP workloads, Web transactional workloads, data warehouse workloads, conclusions.

Applying the NAS solution: workload characterization, Departmental workloads, Web workloads, specialized workloads, conclusions.

Integrating SAN and NAS: similarities, differences, need to integrate, future storage connectivity, storage integration.

UNIT – V

Storage Management: Planning business continuity; Managing availability; Maintaining serviceability.

Capacity planning, security considerations: overview, security methods, storage security - technology, challenges, Fibre channel SAN security, NAS security, Best practices for security.

TEXT BOOK:

1. Storage Networks: The Complete Reference by – Robert Splading (TMH 2003).

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WEB SERVICES & SERVICE ORIENTED ARCHITECTURE
Elective-V

Pre-requisites:

- ✘ The course assumes a reasonable comfort and background about Information Technology and Management Information Systems.

Objectives:

- ✘ To gain understanding of the basic principles of service orientation
- ✘ To learn service oriented analysis techniques
- ✘ To learn technology underlying the service design
- ✘ To learn the concepts such as SOAP, registering and discovering services.

Outcomes:

At the end of this course, students are expected to gain the following learning:

- ✘ Get the foundations and concepts of service based computing
- ✘ Advocate the importance and means of technology alignment with business
- ✘ Understanding the basic operational model of web services,
- ✘ Gain the knowledge of key technologies in the service oriented computing arena
- ✘ Apply and practice the learning through a real or illustrative project/case study.

UNIT- I

Evolution and Emergence of Web Services – Evolution of distributed computing. Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

UNIT -II

Web Service Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services. Describing Web Services – WSDL introduction, non functional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

UNIT III

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP : Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP.

UNIT – IV

Registering and Discovering Services : The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model,

Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

UNIT - V

SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.

Text Books:

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

Reference Books:

1. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
2. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
4. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann Publishers, 2005.
5. J2EE Wer Services, Richard Monson-Haefel, Pearson Education.

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RESEARCH METHODOLOGIES
Elective-VI

Prerequisite: NIL**Objective:**

- ☒ Introduces research paper writing and publication skills.

Outcome:

Gain the sound knowledge of the following important elements:

- ☒ Ability to distinguish research methods
- ☒ Ability to write and publish a technical research paper.
- ☒ Ability to review papers effectively

UNIT I

Introduction, Technical Research Paper Writing and Publication

UNIT II

Research Paper Search

UNIT III

Research Ethics, Research Methods in Computer Science and Engineering, Research Methods for Software Engineering, Research Methods (deductive methods and proofs)

UNIT IV

Paper Publishing and Reviewing, Measured-based research methods in Computer Engineering

UNIT V

Preparation & Presentation of a scientific paper

Reference

Web Resources

1. A Computer Scientist's Guide to Writing and Publishing Technical Articles, Paul Martin, Technical Report, CS-TR-95-4, Dept of CS, Victoria University of Wellington, New Zealand, 1995.
2. Marcia Martens Pierson, Bion L. Pierson, Beginnings and Endings: Keys to Better Engineering Technical Writing, IEEE Transactions on Professional Communication (IEEE T-PC), Vol. 40, No. 4, pp 299 - 304 December 1997

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SOFTWARE DESIGN AND ENGINEERING
Elective-VI

Prerequisite:

- ✘ Software Engineering

Objectives:

- ✘ To develop in students the knowledge, understanding, skills and values to solve problems through the creation of software solutions
- ✘ To design and experiment with software prototypes
- ✘ To elicit, analyze and specify software requirements through a productive working relationship with project stakeholders.
- ✘ To build solutions using different technologies, architectures and life-cycle approaches.
- ✘ The context of different organizational structures.

Outcomes:

- ✘ Understanding of the historical developments that have led to current practices in software design and development, and of emerging trends and technologies in this field.
- ✘ Acquiring and applying the skills in designing and developing software solutions.
- ✘ Acquiring and using the skills required to schedule a software project.

UNIT I

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, legacy software, Software myths.

A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

Process models: The waterfall model, Incremental process models, Evolutionary process models, Specialized process models, The Unified process.

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

UNIT II**Software Design**

The nature of the design process, transferring design knowledge, constraints upon the design process and product, recording design decisions, designing with others, context for design, economic factors, assessing design qualities, quality attributes of the design product, assessing the design process. Representing abstract ideas, design view points, the architecture concept, design methods, design patterns, design representations, rationale for design methods.

Design Processes and Strategies : The role of strategy in design methods, describing the design process – The D – Matrix, design by top-down decomposition, design by composition, organizational influences upon design.

UNIT III**Designing with objects and components**

Designing with objects : Design practices for object-oriented paradigm, Object-oriented paradigm, Object-oriented frame works, Hierarchical object oriented design process and heuristics, the fusion method, the unified process.

Component - based design:

The component concept, designing with components, designing components, COTS.

User Interface design

The Golden rules, Interface analysis and design models, user and task analysis, analysis of display content and work environment, applying interface design issues, design evaluation.

UNIT IV**Concepts Of Software Projects**

Project Management : The management spectrum: people, product, process and project, W5HH principle, Critical practices

Metrics for Process and Projects : Process metrics, project metrics, size-oriented metrics, function-oriented metrics, Object-oriented and use-case metrics, metrics for software quality, integrating metrics with in software process.

UNIT V**Project Scheduling and Management**

Project Scheduling: Basic concepts, project scheduling , defining a task set and task network, timeline charts, tracking the schedule, tracking the progress for an OO project, Earned value analysis.

Risk Management: Reactive Vs. Proactive risk strategies, software risks, risk identification, risk projection,risk refinement, risk mitigation and monitoring, the RMMM plan.

Text Books:

1. Software design, David Budgen, second edition, Pearson education,2003
2. Software Engineering:A practitioner's Approach, Roger S Pressman, sixth edition. McGrawHill International Edition, 2005

Reference Books:

1. Applying domain- driven design and patterns, jimmy Nilsson, Pearson education,2006
2. Software Engineering Foundations, Ian Sommerville, seventh edition, Pearson education,2004.
3. Software Project Management , Bob Hughes & Mike Cotterell, Fourth edition, Tata Mc Gr aw Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
4. The Art of Project Management, Scott Berkun, O'Reilly, 2005.
5. Software Engineering, Project Management , Richard H. Thayer & Edward Yourdon, second edition, Wiley india, 2004.
6. Software Engineering foundations,Yingxu Wang Auerbach publications, 2008.
7. Applied Software Project Management , Andrew Stellman & Jennifer Greene, O'Reilly, 2006.

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**SPEECH PROCESSING
Elective-VI**

Prerequisites

- ✘ A course on “Computer Oriented Statistical Methods”
- ✘ Generally, a basic knowledge of linear algebra, and probability and statistics and programming experience in one high-level language is required.

Objectives

- ✘ The aim of the course is to make the students to understand the basic characteristics of the speech signal with regard to the production and perception of speech by humans.
- ✘ To describe the basic techniques and practical aspects of speech analysis.
- ✘ To make the students to understand different speech processing applications such as speech recognition and speaker recognition.

Outcomes

- ✘ Ability to understand and describe the mechanisms of speech production.
- ✘ Ability to determine the speech sounds from the acoustic characteristics.
- ✘ Ability to analyze the speech signal in time and frequency domains, and in terms of the parameters of a source-filter model.
- ✘ Ability to design a simple speech processing system that recognizes a limited number of isolated words; and a simple speaker recognition system.

UNIT I: Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform Lossless Tube Model, Effect of Losses In Vocal Tract, Effect of Radiation at Lips, Digital Models for Speech Signals.

UNIT II: Time Domain Models for Speech Processing: Introduction, Window Considerations, Short-Time-Energy and Average Magnitude Short Time Average Zero Crossing Rate, Speech Vs Silence Discrimination Using Energy and Zero Crossing, Pitch Period Estimation using a Parallel Processing Approach, The Short Time Autocorrelation Function, The Short Time Average Magnitude Difference Function, Pitch Period Estimation using The Autocorrelation Function.

UNIT III: Linear Predictive Coding (LPC) Analysis: Basic Principles of Linear Predictive Analysis, The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin’s Recursive Solution For the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection Using LPC Parameters, Formant Analysis Using LPC Parameters.

UNIT IV: Automatic Speech & Speaker Recognition: Basic Pattern Recognition Approaches, Parametric Representation of Speech, Evaluating the Similarity of Speech Patterns, Isolated Digit Recognition System, Continuous Digit Recognition System

Hidden Markov Model (HMM) For Speech: Hidden Markov Model (HMM) for Speech Recognition, Viterbi algorithm, Training and Testing using HMMS.

UNIT V:

Speaker Recognition: Recognition techniques, Features that Distinguish Speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System. Overview of speech enhancement and speech synthesis.

TEXT BOOKS:

1. Digital Processing of Speech Signals: **L.R Rabinar and R W Jhaung**, 1978, Pearson Education.
2. Digital Processing of Speech Signals: **L.R. Rabiner and S. W. Schafer**, Pearson Education.
3. Speech Communications: **Human & Machine - Douglas O'Shaughnessy**, 2nd Ed., Wiley India, 2000.

REFERENCE BOOKS:

1. Discrete Time Speech Signal Processing: Principles and Practice - **Thomas F. Quateri**, 1st Ed., PE.
2. Speech & Audio Signal Processing: **Ben Gold & Nelson Morgan**, 1st Ed., Wiley.

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ADHOC AND SENSOR NETWORKS

Elective-VII

Prerequisites

- ✘ Computer Networks
- ✘ Distributed Systems / Distributed Operating Systems / Advanced Operating Systems
- ✘ Mobile Computing

Objectives

- ✘ To understand the concepts of sensor networks
- ✘ To understand the MAC and transport protocols for adhoc networks
- ✘ To understand the security of sensor networks
- ✘ To understand the applications of adhoc and sensor networks

Outcomes

- ✘ Understanding the state of the art research in emerging subject of ad hoc and wireless sensor networks (ASN)
- ✘ Ability to solve the issues in real-time application development based on ASN
- ✘ Ability to conduct further research in the ASN domain

UNIT I

Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, *Topology-based* routing algorithms-**Proactive**: DSDV, WRP; **Reactive**: DSR, AODV, TORA; Hybrid: ZRP; *Position-based* routing algorithms-**Location Services**-DREAM, Quorum-based, GLS; **Forwarding Strategies**: Greedy Packet, Restricted Directional Flooding-DREAM, LAR; **Other routing algorithms**-QoS Routing, CEDAR.

UNIT II

Data Transmission - Broadcast Storm Problem, **Rebroadcasting Schemes**-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbour Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting**: **Tree-based**: AMRIS, MAODV; **Mesh-based**: ODMRP, CAMP; **Hybrid**: AMRoute, MCEDAR and **Geocasting**: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR.

UNIT III

TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

Basics of Wireless, Sensors and Applications

Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

UNIT IV**Data Retrieval in Sensor Networks**

Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

UNIT V

Security - Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

Text Books:

1. Ad Hoc and Sensor Networks – Theory and Applications, *Carlos Corderio Dharma P. Aggarwal*, World Scientific Publications, March 2006, ISBN – 981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman)

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**MACHINE LEARNING
Elective-VII**

Prerequisites

- ✎ Data Structures
- ✎ Knowledge on statistical methods

Objectives

- ✎ This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- ✎ To understand computational learning theory.
- ✎ To study the pattern comparison techniques.

Outcomes

- ✎ Understand the concepts of computational intelligence like machine learning
- ✎ Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- ✎ Understand the Neural Networks and its usage in machine learning application.

UNIT -I

Introduction - Well-posed learning problems, designing a learning system Perspectives and issues in machine learning

Concept learning and the general to specific ordering – Introduction, A concept learning task, concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias.

Decision Tree Learning – Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

UNIT -II

Artificial Neural Networks Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Networks and the Back propagation Algorithm.

Discussion on the Back Propagation Algorithm, An illustrative Example: Face Recognition

Evaluation Hypotheses – Motivation, Estimation Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses, Comparing Learning Algorithms.

UNIT -III

Bayesian learning - Introduction, Bayes Theorem, Bayes Theorem and Concept Learning Maximum Likelihood and Least Squared Error Hypotheses, Maximum Likelihood Hypotheses for Predicting Probabilities, Minimum Description Length Principle , Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief Networks, EM Algorithm.

Computational Learning Theory – Introduction, Probably Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for Infinite Hypothesis Spaces, The Mistake Bound Model of Learning.

Instance-Based Learning – Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

UNIT -IV

Pattern Comparison Techniques, Temporal Patterns, Dynamic Time Warping Methods, Clustering, Codebook Generation, Vector Quantization

Pattern Classification: Introduction to HMMS, Training and Testing of Discrete Hidden Markov Models and Continuous Hidden Markov Models, Viterbi Algorithm, Different Case Studies in Speech Recognition and Image Processing

UNIT -V

Analytical Learning – Introduction, Learning with Perfect Domain Theories : PROLOG-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operations.

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis.

Text Books:

1. Machine Learning – Tom M.Mitchell,-MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

Reference Books:

1. Machine Learning : An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

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**OPTIMIZATION TECHNIQUES
Elective-VII**

Prerequisites

✎ A course on “Mathematics”

Objectives

- ✎ This course explains various optimization problems and the techniques to address those problems.
- ✎ To study Linear Programming, dynamic programming and optimization Techniques etc.
- ✎ To understand the theory of games.

Outcomes

- ✎ Gain the knowledge of optimization techniques
- ✎ Get the skill to apply Optimization techniques to address the real time problems .

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

ALLOCATION: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT – II

TRANSPORTATION PROBLEM – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT – III

SEQUENCING – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through ‘m’ machines

REPLACEMENT: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

UNIT – IV

THEORY OF GAMES: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

INVENTORY: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

UNIT – V

WAITING LINES: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

DYNAMIC PROGRAMMING:

Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

TEXT BOOK :

1. Operation Research /J.K.Sharma/MacMilan.
2. Introduction to O.R /Taha/PHI

REFERENCE BOOKS :

1. Operations Research: Methods and Problems / Maurice Saseini, Arthur Yaspan and Lawrence Friedman
2. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hillier & Libermann (TMH).

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CRYPTANALYSIS
Elective-VIII

Prerequisites

- ☒ A Course on “Computer Networks, Mathematics”

Objectives

- ☒ To understand the importance of cryptanalysis in our increasingly computer-driven world.
- ☒ To understand the fundamentals of Cryptography
- ☒ To understand the Lattice- based cryptanalysis and elliptic curves and pairings
- ☒ To understand birthday- based algorithms for functions and attacks on stream ciphers
- ☒ To apply the techniques for secure transactions in real world applications

Outcomes

- ☒ Ability to apply cryptanalysis in system design to protect it from various attacks.
- ☒ Ability to identify and investigate vulnerabilities and security threats and the mechanisms to counter them.
- ☒ Ability to analyze security of cryptographic algorithm against brute force attacks, birthday attacks.

UNIT-I

A bird’s – eye view of modern Cryptography: Preliminaries, Defining Security in Cryptography

Monoalphabetic Ciphers: Using Direct Standard Alphabets, The Caesar Cipher, Modular arithmetic, Direct Standard alphabets, Solution of direct standard alphabets by completing the plain component, Solving direct standard alphabets by frequency considerations, Alphabets based on decimations of the normal sequence, Solution of decimated standard alphabets, Monoalphabets based on linear transformation.

Polyalphabetic Substitution: Polyalphabetic ciphers, Recognition of polyalphabetic ciphers, Determination of number of alphabets, Solution of individual alphabets if standard, Polyalphabetic ciphers with a mixed plain sequences, Matching alphabets, Reduction of a polyalphabetic cipher to a monoalphabetic ciphers with mixed cipher sequences

UNIT- II

Transposition : Columnar transposition, Solution of transpositions with Completely filled rectangles, Incompletely filled rectangles, Solution of incompletely filled rectangles – Probable word method, Incompletely filled rectangles general case, Repetitions between messages; identical length messages.

Sieve algorithms: Introductory example: Eratosthenes’s sieve, Sieving for smooth composites

UNIT- III

Brute force Cryptanalysis: Introductory example: Dictionary attacks, Brute force and the DES Algorithm, Brute force as a security mechanism, Brute force steps in advanced cryptanalysis, Brute force and parallel computers.

The birthday paradox: Sorting or not?: Introductory example: Birthday attacks on modes of operation, Analysis of birthday paradox bounds, Finding collisions, Application to discrete logarithms in generic groups.

UNIT- IV

Birthday- based algorithms for functions: Algorithmic aspects, Analysis of random functions, Number-theoretic applications, A direct cryptographic application in the context of blockwise

Security, Collisions in hash functions.

Attacks on stream ciphers: LFSR- based key stream generators, Correlation attacks, Noisy LFSR model, Algebraic attacks, Extension to some non- linear shift registers, The cube attack.

UNIT-V

Lattice- based cryptanalysis: Direct attacks using lattice reduction, Coppersmith's small roots attacks.

Elliptic curves and pairings: Introduction to elliptic curves, The Weil pairing, the elliptic curve factoring method.

Text Books:

1. "Elementary Cryptanalysis A Mathematical Approach" by Abraham Sinkov, The mathematical Association of America (Inc).
2. "Algorithmic Cryptanalysis" by Antoine Joux, CRC Press'

References:

1. Algebraic Cryptanalysis, Bard Gregory, Springer, 2009
2. Cryptanalysis of Number Theoretic Ciphers, Sameul S. Wag staff, Champan & Hall/CRC
3. Cryptanalysis: A Study of Cipher and Their Solution, Helen F. Gaines, 1989

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ROBOTICS
Elective-VIII

Prerequisites:

- ✎ A course on object oriented programming

Objectives:

- ✎ covers the theory of AI and robotics from the hierarchical to the hybrid deliberative/reactive paradigm for organizing intelligence.
- ✎ Includes sensing and programming techniques for reactive behaviors, in order to permit a class to get covers, the coordination and control of teams of multi-agents.
- ✎ Covers architectures that provide examples of how to transfer the principles of the paradigm into a coherent, reusable implementation on a single robot or teams of robots.
- ✎ Focuses on navigation, a critical ability for a robot that claims to be mobile

Outcomes:

- ✎ Enables students to embark on a serious robot project.
- ✎ Ability to integrate the sensor with robots.
- ✎ Ability to design an appropriate path planning and navigation of Robot.

UNIT-I:

From Teleoperation To Autonomy: How Can a Machine Be Intelligent? What Can Robots Be Used For? A Brief History of Robotics, Teleoperation, The Seven Areas of AI.
The Hierarchical Paradigm: Attributes of the Hierarchical Paradigm, Closed World Assumption and the Frame Problem, Representative Architectures, Advantages and Disadvantages, Programming Considerations.

UNIT-II:

Biological Foundations of the Reactive Paradigm :What Are Animal Behaviors? Coordination and Control of Behaviors , Perception in Behaviors , Schema Theory, Principles and Issues in Transferring Insights to Robots.
The Reactive Paradigm: Attributes of Reactive Paradigm, Subsumption Architecture, Potential Fields Methodologies, Visualizing potential fields, Evaluation of Reactive Architectures.
Designing a Reactive Implementation : Behaviors as Objects in OOP, Steps in Designing a Reactive Behavioral System, Case Study.

UNIT-III:

Common Sensing Techniques for Reactive Robots : Logical sensors, Behavioral Sensor Fusion, Designing a Sensor Suite, Proprioceptive Sensors, Proximity Sensors, Computer Vision, Range from Vision.
The Hybrid Deliberative/Reactive Paradigm: Attributes of the Hybrid Paradigm, Architectural Aspects, Managerial Architecture, State-Hierarchy Architectures, Model-Oriented Architectures, Other Robots in the Hybrid Paradigm, Evaluation of Hybrid Architectures, Interleaving Deliberation and Reactive Control.
Multi-agents: Heterogeneity, Control, Cooperation, Goals, Emergent Social Behavior.

UNIT-IV:

Topological Path Planning: Landmarks and Gateways, Relational Methods, Associative Methods, Case Study of Topological Navigation with a Hybrid Architecture.
Metric Path Planning, Configuration Space, Cspace Representations, Graph Based Planners, Wavefront Based Planners, Interleaving Path Planning and Reactive Execution.

UNIT-V:

Localization and Map Making: Sonar Sensor Model, Bayesian, Dempster-Shafer Theory, HMM, Comparison of Methods, Localization, Exploration.
On the Horizon: Shape-Shifting and Legged Platforms , Applications and Expectations.

Text Books:

1. Introduction to AI Robotics, Robin R. Murphy, 2000

Reference Books:

1. The Robotics Primer By Maja J. Mataric, MIT Press.
2. A Mathematical Introduction to Robotic Manipulation by Richard M. Murray, Zexiang Li and S. Shankar Sastry, CRC Press.

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COMPUTER FORENSICS
Elective-VIII

Prerequisites: Nil

Objectives:

- ☒ To understand the cyberspace
- ☒ To gain knowledge on fundamentals of computer forensics
- ☒ To understand the evidence capturing process
- ☒ To understand the preservation of digital evidence

Outcomes:

- ☒ Ability to understand the computer forensics evidence, capture and data recovery
- ☒ Ability to understand the current computer forensics tools
- ☒ Ability to apply forensics tools in the event of cyber crime.

UNIT I : Computer Forensics Fundamentals: Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps Taken by Computer Forensics Specialists, Who Can Use Computer Forensic Evidence?. **Types of Computer Forensics Technology :** Types of Military Computer Forensic Technology, Types of Law Enforcement Computer Forensic Technology, Types of Business Computer Forensics Technology.

UNIT II : Computer Forensics Evidence and Capture: Data Recovery: Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Case Histories. **Evidence Collection and Data Seizure:** Why Collect Evidence?, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collecting and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody.

UNIT III: Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene, Computer Evidence Processing Steps, Legal Aspects of Collecting And Preserving Computer Forensic Evidence. **Computer Image Verification and Authentication :** Special Needs of Evidential Authentication, Practical Considerations, Practical Implementation.

UNIT IV: Computer Forensics Analysis: Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool, **Identification of Data:** Timekeeping, Time Matters, Forensic Identification and Analysis of Technical Surveillance Devices. **Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files. **Networks:** Network Forensics Scenario, A Technical Approach, Destruction of Email, Damaging Computer Evidence, International Principles Against Damaging of Computer Evidence, Tools Needed for Intrusion Response to the Destruction of Data, Incident Reporting and Contact Forms.

UNIT V: Current Computer Forensics Tools: Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software.

TEXT BOOKS:

1. "Computer Forensics : Computer Crime Scene Investigation", JOHN R. VACCA, Firewall Media.
2. "Guide to Computer Forensics and Investigations"4e, Nelson, Phillips Enfinger, Steuart, Cengage Learning.

REFERENCES:

1. "Computer Forensics and Cyber Crime", Marjie T Britz, Pearson Education.
 2. "Computer Forensics", David Cowen, Mc Graw Hill.
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COMPUTING LABORATORY-II**Prerequisites:** Information security and Big data analytics**Objective:**

- ✎ to get practical exposure of Cryptography algorithms
- ✎ to implement Big data analytics techniques

Outcome:

- ✎ get the skill to provide security services like authentication confidentiality to the real systems.
- ✎ get the knowledge to solve security issues in day to day life.
- ✎ can apply big data analytics.

INFORMATION SECURITY LAB

1. Write a program that can encrypt and decrypt using Ceaser Cipher. Assume the key value $K = 5$.
2. Write a program to encrypt and decrypt using a 2 X 2 Hill Cipher.
3. Write a program that can encrypt and decrypt using a transposition technique, key value $k = 4312567$.
4. Write a program that can encrypt and decrypt using simple DES.
5. Using any one of the key management technique, write a program so that the sender and the receiver have the same secret key (Symmetric key encryption).
6. Write an RSA program for generating the public and private key, and for encrypting and decrypting the given plain text.
7. Write a Diffie-Hellman key exchange program for generating the public and private key.

Bigdata Analytics Lab

1. Implement a simple map-reduce job that builds an inverted index on the set of input documents (Hadoop)
2. Perform Social media analysis using cassandra
3. Buyer event analytics using Cassandra on suitable product sales data.
4. Using Power Pivot (Excel) Perform the following on any dataset
 - a) Big Data Analysis
 - b) Big Data Charting
5. Use R-Project to carry out statistical analysis of big data
6. Use R-Project for data visualization of social media data

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SOFT SKILLS LAB (Activity-based)

Course Objectives

- ✎ To improve the fluency of students in English
- ✎ To facilitate learning through interaction
- ✎ To illustrate the role of skills in real-life situations with case studies, role plays etc.
- ✎ To train students in group dynamics, body language and various other activities which boost their confidence levels and help in their overall personality development
- ✎ To encourage students develop behavioral skills and personal management skills
- ✎ To impart training for empowerment, thereby preparing students to become successful professionals

Learning Outcomes

- ☞ Developed critical acumen and creative ability besides making them industry- ready.
- ☞ Appropriate use of English language while clearly articulating ideas.
- ☞ Developing insights into Language and enrich the professional competence of the students.
- ☞ Enable students to meet challenges in job and career advancement.

INTRODUCTION

Definition and Introduction to Soft Skills – Hard Skills vs Soft Skills – Significance of Soft/Life/Self Skills – Self and SWOT Analysis **and**

1. Exercises on Productivity Development

- Effective/ Assertive Communication Skills (Activity based)
- Time Management (Case Study)
- Creativity & Critical Thinking (Case Study)
- Decision Making and Problem Solving (Case Study)
- Stress Management (Case Study)

2. Exercises on Personality Development Skills

- Self-esteem (Case Study)
- Positive Thinking (Case Study)
- Emotional Intelligence (Case Study)
- Team building and Leadership Skills (Case Study)
- Conflict Management (Case Study)

3. Exercises on Presentation Skills

- Netiquette
- Importance of Oral Presentation – Defining Purpose- Analyzing the audience- Planning Outline and Preparing the Presentation- Individual & Group Presentation- Graphical Organizers- Tools and Multi-media Visuals
- One Minute Presentations (Warming up)
- PPT on Project Work- Understanding the Nuances of Delivery- Body Language – Closing and Handling Questions – Rubrics for Individual Evaluation (Practice Sessions)

4. Exercises on Professional Etiquette and Communication

- Role-Play and Simulation- Introducing oneself and others, Greetings, Apologies, Requests, Agreement & Disagreement....etc.

- Telephone Etiquette
- Active Listening
- Group Discussions (Case study)- Group Discussion as a part of Selection Procedure- Checklist of GDs
- Analysis of Selected Interviews (Objectives of Interview)
- Mock-Interviews (Practice Sessions)
- Job Application and Preparing Resume
- Process Writing (Technical Vocabulary) – Writing a Project Report- Assignments

5. Exercises on Ethics and Values

Introduction — Types of Values - Personal, Social and Cultural Values - Importance of Values in Various Contexts

- Significance of Modern and Professional Etiquette – Etiquette (Formal and Informal Situations with Examples)
- Attitude, Good Manners and Work Culture (Live Examples)
- Social Skills - Dealing with the Challenged (Live Examples)
- Professional Responsibility – Adaptability (Live Examples)
- Corporate Expectations

☞ Note: Hand-outs are to be prepared and given to students.

☞ Training plan will be integrated in the syllabus.

☞ Topics mentioned in the syllabus are activity-based.

SUGGESTED SOFTWARE:

☞ The following software from 'train2success.com'

- Preparing for being Interviewed
- Positive Thinking
- Interviewing Skills
- Telephone Skills
- Time Management
- Team Building
- Decision making

SUGGESTED READING:

1. Alex, K. 2012. *Soft Skills*. S. Chand Publishers
2. *Management Shapers*. 2011. Collection of 28 Books by different Authors. Universities Press.
3. Sheffield, Robert M. 2005. *et al Cornerstone: Developing Soft Skills*. Pearson
4. Suresh Kumar,E; Sreehari, P. & Savithri, J. 2011. *Communication Skills and Soft Skills- An Integrated Approach*. New Delhi: Pearson
5. The ACE of Soft Skills by Gopaldaswamy Ramesh & Mahadevan Ramesh. 2013. Pearson Publishers. New Delhi.
6. Patnaik, P. 2011. *Group Discussion and Interview Skills*. New Delhi: Foundation
7. Sudhir Andrews. 2009. *How to Succeed at Interviews*. New Delhi: Tata McGraw Hill
8. **Sasikumar, V & Dhamija, P.V. 1993. *Spoken English - A Self-Learning Guide to Conversation Practice*. New Delhi: Tata McGraw-Hill**
9. *Dixon, Richard J. Everyday Dialogues in English*. Prentice Hall India Pvt Ltd
10. Mukhopadhyay. L *et al*. 2012. *Polyskills*. New Delhi: CUP India Pvt Ltd
11. Rizvi, M. A. 2005. *Effective Technical Communication*. New Delhi: Tata McGraw Hill
12. *The Hindu Speaks on Education* by the Hindu Newspaper
13. Naterop, B. Jean and Revell, Rod. 2004. *Telephoning in English*. Cambridge: CUP

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PROJECT PHASE-II & DISSERTATION

Prerequisites

☒ None.

Objectives

- ☒ To identify a problem, analyse, design and code
- ☒ To demonstrate with sufficient case studies

Outcomes

At the end of the course the student will be able to:

- ☒ Ability to Synthesize and apply prior knowledge to designing and implementing solutions to open-ended computational problems while considering multiple realistic constraints.
- ☒ Ability to design and develop the software with SE practices and standards
- ☒ Ability to analyze database, network and application design methods
- ☒ Ability to evaluate the various validation and verification methods
- ☒ Ability to practice CASE tools for solving case studies
- ☒ Ability to analyzing professional issues, including ethical, legal and security issues, related to computing projects.