



**CURRICULUM
FOR
MASTER OF TECHNOLOGY
IN
COMPUTER SCIENCE AND ENGINEERING**



**SRI SAI UNIVERSITY
PALAMPUR H.P. (INDIA)
2019**



STUDY AND EVALUATION SCHEME (FIRST TO FOURTH SEMESTER)

FIRST SEMESTER

Course Code	Course Title	Study Scheme			Lecture Hours	Tutorial Hours	Practical Hours	Credits
		L	T	P				
CS501	Advanced Computer Architecture	3	1	0	3	2	0	4
CS502	Advanced Software Engineering	3	1	0	3	2	0	4
CS503	Network Security Techniques	3	1	0	3	2	0	4
CS504	Advanced Data Structure	3	1	0	3	2	0	4
CS505	Advanced Database Management System	3	1	0	3	2	0	4
CS506	Advanced Database Management System Laboratory	0	0	2	0	0	4	2
Total		15	5	2	15	10	4	22

**SECOND SEMESTER**

Course Code	Course Title	Study Scheme			Lecture Hours	Tutorial Hours	Practical Hours	Credits
		L	T	P				
CS507	Image Processing Techniques	3	1	0	3	2	0	4
CS508	Advanced Operating System	3	1	0	3	2	0	4
CS527	Research Methodology	3	1	0	3	2	0	4
	Elective – I	3	1	0	3	2	0	4
	Elective – II	3	1	0	3	2	0	4
CS526	Image Processing Techniques Laboratory	0	0	2	0	0	4	2
	Total	15	4	2	15	8	4	22

Elective – I

- CS510 Network Management
- CS511 Data Warehouse and Data Mining
- CS512 Object Oriented Analysis and Design using UML

Elective – II

- CS513 Cyber Crime and Computer Forensics
- CS514 Business Information System
- CS515 Advanced Algorithms

**THIRD SEMESTER**

Course Code	Course Title	Study Scheme			Lecture Hours	Tutorial Hours	Practical Hours	Credits
		L	T	P				
	Elective – III	3	1	0	3	2	0	4
	Elective – IV	3	1	0	3	2	0	4
CS528	Dissertation-I	0	0	6	0	0	12	6
CS524	Seminar	4	0	0	4	0	0	4
	Total	10	2	6	10	4	12	18

Elective – III

- CS517 Web Mining
- CS518 Software Engineering Methodologies
- CS519 Natural Language Processing

Elective – IV

- CS520 Neural Networks and Fuzzy Logics
- CS521 Parallel Computing
- CS522 Distributed System

**FOURTH SEMESTER**

Course Code	Course Title	Study Scheme			Lecture Hours	Tutorial Hours	Practical Hours	Credits
		L	T	P				
CS529	Dissertation-II							18



M.Tech C.S.E

1st SEMESTER



L	T	P
3	1	0

CS 501: Advanced Computer Architecture

Course Objectives	• Understand the Concept of Parallel Processing and its applications. • Implement the Hardware for Arithmetic Operations. • Analyze the performance of different scalar Computers. • Develop the Pipelining Concept for a given set of Instructions. • Distinguish the performance of pipelining and non-pipelining environment in a processor.
Course Outcomes	At the end of this course student will: • Understand the Concept of Parallel Processing and its applications • Implement the Hardware for Arithmetic Operations • Analyze the performance of different scalar Computers • Develop the Pipelining Concept for a given set of Instructions • Distinguish the performance of pipelining and non-pipelining environment in a processor

DETAILED CONTENT

Module 1:

RTL, Bus and memory transfer, Arithmetic micro operations, Logic micro operations, Shift micro operations, Arithmetic Logic Shift unit

Instruction codes, Computer registers and instructions, Timing and control, Instruction cycle, MRIs, I/O and Interrupts, Complete computer description, Design of basic computer, Design of Accumulator logic

Module 2:

Control memory, Address sequencing, Computer configuration, Microinstruction format, Symbolic microinstructions, Design of control unit

Introduction to CPU, General Register and stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, RISC, CISC

Module 3:

Parallel Computer Models: The state of computing, Multiprocessors and multicomputer, Multivector and SIMD Computers, PRAM and VLSI models

Program and Network Properties: Conditions of Parallelism, Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures

**Module 4:**

Principles of Scalable Performance: Performance metrics and measures, Parallel processing applications, Speedup Performance laws, scalability analysis and approaches.

Processor and Memory Hierarchy: Advanced processor technology, Superscalar and vector processors

Text Books:

M. Morris Mano, “Computer System Architecture”, Pearson Education, 2004. Kai Hwang, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, McGraw Hill, 1993.

Reference Book:

Kai Hwang and Faye A. Briggs, “Computer Architecture and Parallel Processing. McGraw Hill, 1985.



L	T	P
3	1	0

CS 502: Advanced Software Engineering

Course Objectives	The primary objective of these courses is to train CS majors with skills in programming to become information technology professionals able to undertake complex development projects in a modern distributed computing environment.
Course Outcomes	The students should be able to • Understand and adhere to professional ethical standards in the system development and modification process, especially by accepting responsibility for the consequences of design decisions and design implementations • The ability to build and configure major operating system components • The ability to analyze and implement solutions to complex problems involving computers and networks • The ability to work effectively in teams • A solid understanding to the methods of modern software engineering

DETAILED CONTENT

Module 1:

Introduction: Life cycle models, Requirement Analysis and specification, Formal requirements specification.

Fundamental issues in software design: Goodness of design, cohesions, coupling. Function-oriented design: structured analysis and design. Overview of object –oriented concepts.

Module 2:

Unified Modeling Language (UML). Unified design process. User interface design. Coding standards and guidelines. Code walkthrough and reviews. Unit testing. Black box and white box testing. Integration and system testing. Software quality and reliability.

Module 3:

Process Improvement Framework, Requirements and Design Engineering, Software Architecture Component based Software Engineering, Applying Design Patterns, Aspect Oriented Programming, Application Frameworks

Module 4:

Agile software Methodologies and Test Driven Development, Service Oriented Architecture and Development, Software Metrics and Software Reliability, Software Cost Estimation.



Reference:

1. Ian Sommeriele, “Software Engineering” , Addison Wesley.
2. C.Easteal and G.Davis, Software Engineering Analysis and Design, Tata McGraw Hill.
3. R.S. Pressman, “Software Engineering: A Practitioner's Approach”, 6th Edition, McGraw Hill, 2006
4. Richard Fairley ,SoftwareEngineering Concepts ,Tata McGraw Hill.
5. PankajJalote , An Integrated Approach to Software engineering, Narosa Publication.
6. John Hunt, “Agile Software Construction”, Springer, 2006
7. Len Bass, “Software Architecture in Practice”, 2nd Edition., Addison Wesley, 2003



L	T	P
3	1	0

CS 503: Network Security Techniques

Course Objectives	- To understand basics of Network Security. - To be able to secure a message over insecure channel by various means. - To learn about how to maintain the Confidentiality, Integrity and Availability of a data. - To understand various protocols for network security to protect against the threats in the networks.
Course Outcomes	After successful completion of the course, the learners would be able to - Provide security of the data over the network. - Do research in the emerging areas of cryptography and network security. - Implement various networking protocols. - Protect any network from the threats in the world.

DETAILED CONTENT

Module 1:

Foundation of Security & Cryptography: OSI security architecture, Security Policy, Classical encryption techniques (Substitution Techniques, Transposition Techniques and Steganography).

Module 2:

Mathematical Tools for Cryptography: Finite fields, number theory.

Design Principle of Block Ciphers: DES, Block Cipher Algorithms: AES.

Pseudo Random Numbers & Stream Ciphers: Multiple Encryptions, Block Cipher modes of operation, stream ciphers, Confidentiality.

Module 3:

Public Key Cryptography: RSA, Key management.

Hashes & Message Digest: Authentication functions, Message authentication codes, Hash functions and their security.

Module 4:

Digital Signature, Certificates & standards, Authentication: X.509 Authentication service.

Electronic Mail Security: S/MIME.



Module 5:

IP and Web Security Protocols:IPSec, Secure socket layer and transport layer security, secure e-transaction.

System Security: Computer Virus, Firewall & Intrusion Detection, Trusted systems, Security Investigation/Audit

Text Book:

“Cryptography & Network Security” by Stallings, William (Fourth Edition or later).



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CS 504: Advanced Data Structure

Course Objectives	• The fundamental design, analysis, and implementation of basic data structures. • Basic concepts in the specification and analysis of programs. • Principles for good program design, especially the uses of data abstraction. • Significance of algorithms in the computer field. • Various aspects of algorithm development.
Course Outcomes	• Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class. • Master a variety of advanced abstract data type (ADT) and data structures and their implementations. • Master different algorithm design techniques (brute-force, divide and conquer, greedy, etc). • Ability to apply and implement learned algorithm design techniques and data structures to solve problems

DETAILED CONTENT

Module 1:

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation- BigOh, Omega and Theta notations, Complexity Analysis Examples, Divide and Conquer Greedy Approach, Dynamic Programming, and Introduction to Intractable Problems.

Data structures-Linear and nonlinear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, Search operations, doubly linked lists-insertion, deletion operations and circular lists.

Module 2:

Searching-Linear and binary search methods, Sets, Dictionary ADT, Heaps, Tries, Priority Queues, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining. Sorting -Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.

Module 3:

Trees- Ordinary and Binary trees terminology, Binary search tree ADT, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees - Definition and examples only, B-Trees-definition, insertion and searching operations, Comparison of Search trees, recursive and non-recursive traversals, Threaded binary trees, RED BLACK Tree.

**Module 4:**

Graphs- Graphs terminology, Graph ADT, representations, graph traversals/search methods- DFS, BFS, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

Text Book(s):

1. Cormen et al, *Introduction to Algorithms*, The Massachusetts Institute of Technology, Cambridge, Massachusetts
2. Aho, Hopcraft and Ullman: *Data Structures and Algorithms*
3. Weiss: *Data Structures and Algorithm Analysis in C/C++*

Reference Book(s):

1. Kruse, Tonso, Leung: *Data Structures and Program Design in C*
2. Sahani: *Data Structures, Algorithms and Applications in C++*
3. Knuth: *The Art of Computer programming Vol I, Vol III*
4. Standish: *Data Structures in Java*



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CS 505: Advanced Database Management System

Course Objectives	- To provide a strong foundation in advanced database concepts from an industry perspective. - To covers advanced data modeling concepts. - To learn query processing and transaction management concepts for object-relational database and distributed database.
Course Outcomes	After completion of this course, student will be able to: - Identify advance database concepts and database models. - Apply and analyze various terms related to transaction management in centralized and distributed database. - Produce data modeling and database development process for object – oriented DBMS.

DETAILED CONTENT

Module 1:

Introduction of DBMS: Basic Concepts, Need, Advantages, Drawbacks, Architecture, Data Independence, Data Models, Introduction of RDBMS, Database Languages, Functional Dependence, Fully functional Dependence , Transitive Dependence, Normalization, SQL queries

Module 2:

Database Security: Types, Threats, Control Measures

Distributed Databases Concepts: Distributed Concept, Component Architectures of Distributed Databases, Advantages of DDBMS, Disadvantages of DDBMS, Distributed Database Design

Module 3:

Trigger: Introduction, Use, Parts of a Trigger, Types of a trigger, Syntax for creating a trigger

SQL Joins, Indexes, Database Views, Cursors

Module 4:

Data warehousing Fundamentals: Introduction, Architecture, Dataflows, Applications, Benefits, Issues, Data Mart Concept, Data Mining & Online Analytical Processing

Spatial & Multimedia Databases, Mobile Computing & Mobile Databases

Textbooks:-



- 1) Elmasri, Navathe, "Fundamentals of Database Systems", Pearson Education.
- 2) Henry F. Korth, A Silberschatz, "Database Concepts", Tata McGraw Hill.
- 3) Thomas Connolly, Carolyn Begg, "Database Systems", Pearson Education.
- 4) Alexis Leon, Mathews Leon, "Database Management Systems".
- 5) C.J.Date, "An Introduction to DBMS", Narosa Publishing House.

SAMPLE



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0	0	2

CS 506: Advanced Database Management System Lab

Course Objectives	This lab work will enhance database handling, data manipulation and data processing skills through SQL Server, which will help them in developing data centric computer applications.
Course Outcomes	• Design database schema for a given application and apply normalization • Acquire skills in using SQL commands for data definition and data manipulation. • Develop solutions for database applications using procedures, cursors and triggers.

The laboratory work will be based on contents of course material.



M.Tech C.S.E

2nd SEMESTER



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CS 507: Image Processing Techniques

Course Objectives	- To study the image fundamentals and mathematical transforms necessary for image processing. - To study the image enhancement techniques - To study image restoration procedures. - To study the image compression procedures
Course Outcomes	- Review the fundamental concepts of a digital image processing system. - Analyze images in the frequency domain using various transforms. - Evaluate the techniques for image enhancement and image restoration. - Categorize various compression techniques. - Interpret Image compression standards. - Interpret image segmentation and representation techniques.

DETAILED CONTENTS

Module 1:

Introduction: Review of Filter design. Linear phase FIR filters. Methods of FIR filter design. Methods of IIR filter design. Applications of FIR & IIR filters in speech, image, seismic, medical and other areas.

Module 2:

Speech Processing: Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing-the phasor mode, Fourier transfer, DFT, FFT. The hardware use of FIR & IIR filters. Software, Elements of speech Synthesis-speech Recognition-speech in the computer-human interface.

Module 3:

Image Processing: Characterization of images as two-dimensional discrete fields, unitary transforms— DFT. Hadamard, slant and cosine transforms, compression schemes-KarhunenLoeve compression predictive coding schemes. Image enhancement-gray scale modification, edge enhancement, restoration-Wiener filtering, constrained deconvolution, recursive filtering. Segmentation, edge detection, thresholding, textural properties, geometry and shape description.

**Textbooks:-**

- 1) Digital Image Processing - by Rafael Gonzalez and Richard E. Woods, Pearson Education Society
- 2) Speech and Audio Processing for multimedia PC's - by Iain Murray.

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CS 508: Advanced Operating System

Course Objectives	To explore programming language and operating system facilities essential to implement real-time, reactive, and embedded systems.
Course Outcomes	After learning the course the students should be able to: • General architecture of computers. • Understand and analyses theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files • Understand and use advanced concepts in operating systems

DETAILED CONTENTS**Module 1:**

Introduction: Definition Of The Operating System, Functions Of An Operating System, Different Types Of Systems - Simple Batch System, Multi- Programmed Batched System, Time Sharing System, Personal Computer Systems, Parallel Systems, Distributed Systems, Real Time Systems.

Process Management: Process- Process Concept, Process Scheduling, Operation On Processes, Cooperating Processes, Threads, Inter-Process Communication, CPU Scheduling—scheduling criteria, scheduling algorithms – FCFS, SJF, priority scheduling, round robin scheduling, multilevel queue scheduling, multilevel feedback queue scheduling, multiple processor scheduling, real time scheduling.

Module 2:

Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions.

Deadlocks: Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock.

Module 3:



Memory Management: Logical & physical address space, Swapping, Continuous Allocation (single partition, multiple partition), internal , external fragmentation, Paging, Segmentation, Segmentation With Paging, Virtual Memory, Demand Paging, Performance Of Demand Paging, Page Replacement, Page Replacement Algorithms– FIFO, optimal, LRU, LRU approximation algorithms, counting algorithms Thrashing, Demand Segmentation.

Module 4:

File System Interface: File Concept, Access Methods–sequential, direct, index, Directory Structure–single-level, two-level, tree-structured, acyclic graph, general graph.

Security: problem, authentication–passwords, program threats, system threats- worms, viruses, threat monitoring, encryption.

Text Book:

1. Silberschatz, Galvin “Operating System Concepts”, Addison Wesley Publishing Company, 1989.

Reference Books:

1. William Stallings, “Operating Systems”, Macmillan Publishing Company.
2. Deitel H.M., “An Introduction To Operating System”, Addison Wesley Publishing Company, 1984.
3. Tanenbaum, A.S., “Modern Operating System”, Prentice Hall of India Pvt. Ltd. 1995.



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3	1	0

CS 527: Research Methodology

Course Objectives	• Demonstrate the ability to choose methods appropriate to research aims and objectives. Understand the limitations of particular research methods. • Develop skills in qualitative and quantitative data analysis and presentation. Develop advanced critical thinking skills.
Course Outcomes	• To familiarize participants with basic of research and the research process. • To enable the participants in conducting research work and formulating research synopsis and report. • To impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the business/Research problem.

DETAILED CONTENTS

Module 1:

Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process

Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis – Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

Module 2:

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.

Module 3:

Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.



Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

Module 4:

Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

Use of Tools / Techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

Reference Books :-

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.

Text Books:-

1. Research Methodology – C.R.Kothari
2. Select references from the Internet



L	T	P
3	1	0

(Elective –I) CS 510: Network Management

Course Objectives	To understand the principles of network management, different standards and protocols used in managing complex networks. To understand the Automation of network management operations and making use of readilyavailable network management systems.
Course Outcomes	After the completion of course, the student will able to • Acquire the knowledge about network management standards (OSI and TCP/IP) • Acquire the knowledge about various network management tools and the skill to use them in monitoring a network • Analyze the challenges faced by Network managers • Evaluate various commercial network management systems and open network management systems. • Analyze and interpret the data provided by an NMS and take suitableactions.

DETAILED CONTENTS

Module 1:

Data Communications and Network Management Overview.

Review of Computer Network Technology.

Basic Foundations of Network management, standards, models and languages.

Module 2:

SNMP v1 Organization and Information models.

SNMP v1 Communication and functional Models.

SNMP v2

SNMP v3

SNMP management RMON

Module 3:



Broadband Network Management: ATM Networks, Broadband Network Management:

Module 4:

TMN, Network Management Tools and systems and applications.

Network Management applications

Web Based Management

Textbook:

Mani Subramanian., Pearson Education, Network Management Principles and Practices

SAMPLE



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3	1	0

(Elective –I) CS 511: Data Warehouse and Data Mining

Course Objectives	Students undergoing this course are expected to: • Differentiate Online Transaction Processing and Online Analytical processing • Learn Multidimensional schemas suitable for data warehousing • Understand various data mining functionalities • Inculcate knowledge on data mining query languages. • Know in detail about data mining algorithms
Course Outcomes	After undergoing the course, Students will be able to understand. • Design a data mart or data warehouse for any organization. • Develop skills to write queries using DMQL. • Extract knowledge using data mining techniques. • Adapt to new data mining tools. • Explore recent trends in data mining such as web mining, spatial-temporal mining.

DETAILED CONTENTS

Module 1:

Introduction to Data Warehousing: The need for data ware housing, Operational Data Stores Informational Data Stores, Data Ware house definition & Characteristics, Data Warehouse Architecture.

Data Warehouse Components: Overall architecture, Data Warehouse database, Sourcing, acquisition, cleanup and transformation tools, Metadata, Access tools, Data Marts, Data Warehouse Administration and management, Information delivery System.

Building a Data Warehouse: Considerations - business, design, technical & implementation, integrated solutions, Benefits of Data Warehousing. Mapping Data Warehouse to a Multiprocessor Architecture: Relational database technology, Database architectures for parallel processing, Parallel RDBMS features, Parallel DBMS Vendors.

Module 2:

DBMS Schemas for Decision Support: Data layout for best access, Multidimensional data models, Star schema. Data Extraction, Cleanup & Transformation Tools: Tool requirements, Vendor approaches, Access to legacy data, Transformation Engines.



Metadata - definition, interchange initiative, repository, trends. Reporting and Query Tools and Applications: Tools – Categories.

OLAP: Need, Multidimensional data model, guidelines, Multidimensional Vs multirelational OLAP, Categorization of OLAP tools.

Module 3:

Introduction to Data mining, Measuring Data Mining effectiveness, Discovery Vs prediction, Overfitting, Comparing the Technologies. Decision trees, where to use them, General idea, how do they work, Strengths and Weaknesses. Techniques and Algorithms: Neural networks - uses, making predictions, different kinds, Kohonen feature map, their working.

Module 4:

Nearest Neighbour & Clustering – uses, predictions and differences, their working. Genetic Algorithms – uses, cost minimization, cooperative strategies, their working, Rule Induction – uses, evaluation of rules, rules Vs decision trees, their working, Using the right technique, Data mining & business process

Text Book:

1. Alex Berson Data Warehousing, Data Mining, and Olap, Tata Mcgraw Hill
2. George M Marakas, Modern Data Warehousing, Mining & Visualization Core Concepts, Pearson Education

Other Specific Book:

1. M.Kamber, Data Mining: Concepts and Techniques
2. (Berry, Michael) Data Mining Techniques
3. (Sharma, Gajendra) Data Mining, Data Warehousing and OLAP
4. (Gupta GK) Data Mining with Case Studies



L	T	P
3	1	0

(Elective –I) CS 512: Object Oriented Analysis and Design using UML

Course Objectives	• Explain OOAD concepts and various UML diagrams. • Select an appropriate design pattern. • Illustrate about domain models and conceptual classes. • Compare and contrast various testing techniques
Course Outcomes	At the end of this course, the participant will know: • The importance of modeling in the software development life cycle • The UML notation and symbols • The object-oriented approach to analyzing and designing systems and software solutions • How to Employ the UML notation to create effective and efficient system designs.

DETAILED CONTENT

Module 1:

Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modeling, principles of modeling, object oriented modeling.

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

Module 2:

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

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

Module 3:

Collaboration Diagrams and Sequence Diagrams, Terms, concepts and depicting a message in collaboration diagrams. Terms and concepts in sequence diagrams. Difference between collaboration and sequence diagram. Depicting synchronous messages with/without priority call back mechanism.

Module 4:

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



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

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

Text Book:

1. GradyBooch, James Rumbough, Ivar Jacobson. ' The Unified Modeling Language User Guide. Pearson Education 2002.
2. Ian Sommerville, ' Software Engineering Sixth Edition' 2003.
3. Meilir Page Jones, ' Fundamentals of Object Oriented Design in UML' , Addison Wesley, 2000



L	T	P
3	1	0

(Elective –II) CS 513: Cyber Crime and Computer Forensics

Course Objectives	It enables the students to gain in-depth knowledge in the field of Computer forensics & Cyber Crime.
Course Outcomes	After completion of the course the students will be able to learn investigation tools and techniques, analysis of data to identify evidence, Technical Aspects & Legal Aspects related to cyber crime

DETAILED CONTENT

Module 1:

Computer and Cyber Forensic Basics- Introduction to Computers, Computer History, Software, Hardware, Classification, Computer Input-Output Devices, Windows, DOS Prompt Commands, Basic Computer Terminology, Internet, Networking, Computer Storage, Cell Phone / Mobile Forensics, Computer Ethics and Application Programs, Cyber Forensic Basics- Introduction to Cyber Forensics, Storage Fundamentals, File System Concepts, Data Recovery, Operating System Software and Basic Terminology.

Cyber Forensics Investigation- Introduction to Cyber Forensic Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail

Module 2:

Cyber Crimes and Cyber Laws- Introduction to IT laws & Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security.

Module 3:

Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking

Module 4:

Cyber Security- Introduction to Cyber Security, Implementing Hardware Based Security, Software Based Firewalls, Security Standards, Assessing Threat Levels, Forming an Incident Response Team, Reporting Cybercrime, Operating System Attacks, Application Attacks, Reverse Engineering & Cracking Techniques and Financial Frauds.



Textbooks

1. Cyber Crime Investigations, Anthony Reyes
2. Computer and Intrusion Forensics: George Mohay, Alison Anderson, Byron Collie, Olivier de Vel, Rodney McKemmish, Publication: ArtechHouse 2.

Other Specific Books

1. Insider Attack and Cyber Security, Beyond the hacker , Springer publication.
2. Digital Crime and Forensic science and cyberspace, PanagiotisKanellis.

SAMPLE



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3	1	0

(Elective –II) CS 514: Business Information System

Course Objectives	The students will be able to • To understand the basic principles and working of information technology. • Describe the role of information technology and information systems in business. • To contrast and compare how internet and other information technologies support business processes. • To give an overall perspective of the importance of application of internet technologies in business administration.
Course Outcomes	After completing the course, the students will be able to • Understand and apply the fundamental concepts of information systems. • Develop the knowledge about management of information systems. • Interpret and recommend the use information technology to solve business problems. • Apply a framework and process for aligning organization's IT objectives with business strategy.

DETAILED CONTENT

Module 1:

Basic concepts - understanding information and information systems, Hardware, Software, Networks, telecommunications and the Internet.

Module 2:

E-business applications, Acquiring and developing BIS, Initiating systems development, BIS project management.

Module 3:

Systems analysis, Systems design, System builds, implementation and maintenance, BIS strategy, managing e-business.

Module 4:

Managing information security, End-user computing - providing end-user services, Ethical, legal and moral constraints on information systems.

Text Books :



1. Business Information Systems Technology, development and management for the e-business
2nd Edition Paul Bocij, Dave Chaffey, Andrew Greasley, Simon Hickie.

L	T	P
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(Elective –II) CS 515: Advanced Algorithms

Course Objectives	The main objective of this course is to concerned with the study of algorithms for solving practical problems efficiently, and the theoretical analysis of their behavior. There will also be a brief introduction to complexity theory, the formal study of algorithm performance.
Course Outcomes	By the end of the course, the student must be able to: • Use a suitable analysis method for any given algorithm. • Prove correctness and running-time bounds. • Design new algorithms for variations of problems studied in class. • Select appropriately an algorithmic paradigm for the problem at hand. • Define formally an algorithmic problem.

DETAILED CONTENT

Module 1:

Analysis of Algorithms: computational models, order notation, time and space complexities, worst-case and expected complexities, lower and upper bounds.

Module 2:

Techniques for designing efficient algorithms: recursion, divide-and-conquer, dynamic programming, balancing and backtracking.

Module 3:

Problems on sets and sequences: merging, sorting, searching, and selection, String matching algorithms.

Matrix and Boolean matrix algorithms.

Module 4:

Graph algorithms, Computational geometry, Tractable and intractable problems: The classes of P, NP and NP-Complete problems, Approximation algorithms, Introduction to parallel algorithms.

References:



1. A. V. Aho, J. E. Hopcroft and J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley, USA.
2. T. Cormen, C. Leiserson and R. Rivest, Introduction to Algorithms, MIT Press/McGraw-Hill, NY.
3. R. Sedgwick, Algorithms, Addison-Wesley, USA.
4. P. Chaudhuri, Parallel Algorithms: Design and Analysis, Prentice-Hall, Australia.

SAMPLE



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CS526: Image Processing Techniques Laboratory

Course Objectives	• To explore and evaluate the role of different components of a digital image processing. • To introduce students to the multidimensional digital signal processing in the field of images (2D) and video (3D). • To analyze and implement different techniques of coding and image compression.
Course Outcomes	Student will be able to : • To identify the problems of image processing as signal problems of linear systems. • Understanding the image analysis using methods of image segmentation and mathematical morphology. • Understanding the wide range of present and future applications of digital image processing, both for the visible spectrum images such as those from other sensors (Radar, Ultrasonic, etc.).

The laboratory work will be based on contents of course material.



M.Tech C.S.E

3rd SEMESTER



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(Elective –III) CS 517: Web Mining

Course Objectives	- The main objective of this course is to collect information about the user navigation patterns. - Introduce students to the basic concepts and techniques of Information Retrieval, Web Search, Data Mining, and Machine Learning for extracting knowledge from the web. - Develop skills of using recent data mining software for solving practical problems of Web Mining. - Gain experience of doing independent study and research.
Course Outcomes	On successful completion of this module the learner will be able to: - Investigate a variety of web mining techniques, and identifying their practical applicability to various problem domains. - Investigate how web search engines crawl, index, rank web content, how the web is structured.

DETAILED CONTENT

Module 1:

Basic Search Engines, Architecture of a SearchEngine, Basic Building Blocks(Text Acquisition, Text Transformation,Index Creation, User Interaction, Ranking Evaluation).Crawls and Feeds, Crawling the Web, DirectoryCrawling, Document Feeds, Storing the Documents,Detecting Duplicates, Removing Noise.

Module 2:

Processing Text, From Words to Terms, Text Statistics, VocabularyGrowth, Estimating Database and Result Set Sizes, Document Parsing,Overview, Tokenizing, Stopping, Stemming, Phrases and N-grams,Document Structure and Markup, Link Analysis, Anchor Text, Page Rank,Link Quality, Information Extraction.

Module 3:

Semantic Web, Semantic Web techniques and itsarchitecture, Web search and information retrieval, Recall and precision, vector space model, supervised and unsupervised learning, Compression, Web usage mining, hyperlink-based ranking, Page rank and Weighted Page rank

Module 4:

Classification and Clustering, Classification and Categorization, NaïveBayes, Support Vector Machines, Evaluation, Classifier and FeatureSelection, Spam, Sentiment, and Online Advertising, Clustering,Hierarchical andK-Means Clustering, K Nearest Neighbor Clustering,Evaluation.



Text Book(s):

1. Mining The Web, SoumenChakraborty.
2. Modern Information Retrieval, Cristofer Manning, PravakarRaghaban

SAMPLE



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(Elective –III) CS 518: Software Engineering Methodologies

Course Objectives	The program will prepare our students to be successful professionals in the field with solid fundamental knowledge of software engineering. • Be successful professionals in the field with solid fundamental knowledge of software engineering • Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams • Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes.
Course Outcomes	After studying this course students will be able to: • describe the essential characteristics, and identify, using examples, the connections between the characteristics of a good software system • describe the elements of a basic software development process and illustrate the variety of different life cycles • understand the motivation for, and best practices of, an agile approach to software development • explain the benefits of the Unified Modeling Language (UML) as a standard notation for modeling • Identify the different kinds of model used in the development of software and describe the relationship between models, viewpoints and software development.

DETAILED CONTENT

Module 1:

Software life cycle -- important steps and effort distribution.

Aspects of estimation and scheduling. Software evaluation techniques-modular design: coupling and cohesion, Software and complexity measures.

Module 2:

Issues in software reliability. System Analysis: Requirement analysis. Specification languages. Feasibility analysis. File and data structure design, Systems analysis tools.

Module 3:



Software design methodologies, Data flow and Data. Structure oriented design strategies. Software development, coding, verification, and integration. Issues in project management-team structure, scheduling, software quality assurance.

Module 4:

Object oriented methodology: object oriented paradigm, Object Oriented analysis and design, examples of methodologies.

Text/References :

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



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(Elective –III) CS 519: Natural Language Processing

Course Objectives	Students will learn how to process written text from basic of fundamental knowledge starts with Finite automata, Regular expression and probabilistic model with n-grams. Recognizing Speech and parsing with grammar. This course also covers basis of semantic analysis and discourse analysis and drives it to machine translation.
Course Outcomes	After completion of this course, student will be able to • Understand Natural Language Processing. • Probabilistic model of defining language and techniques. • Applying Hidden Markov model and Speech Recognition. • Application of context free grammar and language parsing. • Implement probabilistic and language parsing.

DETAILED CONTENT

Module 1:

Goals of NLP: Survey of applications, Levels of linguistic processing: morphology, syntax, semantics, Language processors: recognizers, transducers, parsers, generators, Language as a rule-based system, Language understanding as an inferential activity.

Module 2:

Resources for NLP: lexicons and knowledge bases, Elements of formal language theory: alphabet, string, language, grammar, productions, symbol vocabulary, generator, recognizer, procedure.

Module 3:

Types of grammar: the Chomsky Hierarchy, Computational morphology: lemmatization, Part-of-Speech Tagging, Finite-State Analysis. Parsing: definition of a parser; derivations, basic parsing strategies for context free grammars, determinism and non-determinism; decidability, data structures and algorithms for parsing, unification based grammar formalisms.

Module 4:

Ambiguity and its resolution: Syntactic ambiguities and heuristics, lexical ambiguities and selection restrictions, indeterminacy of reference, Generation and Dialogue: Syntactic generation algorithms and reversibility, text planning, modeling dialogue agents.

Text Book :

1. Allen, J., *Natural language understanding*. 2nd edition. Redwood City, CA: 1994. Benjamin/Cummings. ISBN 0805303340.



References:

1. Grosz, B.J., Sparck Jones, K. & Webber, B.L. (eds) *Readings in natural language processing*. Los Altos, CA, 1986: Morgan Kaufmann.
2. Jurafsky, D. & J. Martin. 2000. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition* Prentice Hall.

SAMPLE



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(Elective –IV) CS 520: Neural Networks and Fuzzy Logics

Course Objectives	The main objectives of this course are to: • Introduce students to the various neural network and fuzzy systems models. • Reveal different applications of these models to solve engineering and other problems. • Introduce the theory and applications of artificial neural network and fuzzy systems to engineering applications with emphasis on image processing and control. • Discuss neural networks and fuzzy systems, architectures, algorithms and applications, including Back-propagation, BAM, Hopfield network, • Competitive Learning, ART, SOFM, Fuzzy inference methods and expertsystems.
Course Outcomes	After completion of the course students are expected to: • Identify different neural network architectures, their limitations and appropriate learning rules for each of the architectures. • Select appropriate neural network architectures for a given application (i.e. they shall recognize the class of applications and relate it to specific architectures). • Demonstrate knowledge and understanding of fuzzy system as they apply in engineering and science.

DETAILED CONTENT

Module 1:

Neural networks : introduction, neural networks, supervised or unsupervised learning, feedforward network, Hopfield network. Neural network models: neural network models, layers in neural network and their connections. Instar, out star, weights on connections, threshold function, application- Adaline and madaline

Module 2:

Back propagation: feed forward back propagation network- mapping, layout, training, BPNAplications. Learning and training: objectives of learning, Hebb's rule, delta rule, supervised learning, unsupervised networks, learning vector quantizes, associative memory models , one-



shotlearning, resonance, stability, training and convergence, Fuzzy Logic: Introduction, fuzzy sets, fuzzy operations, fuzziness in neural networks, neural, trained fuzzy system.

Module 3:

BAM- bidirectional associative memory, inputs and outputs, weights and training. FAM- fuzzyassociative memory, association, FAM neural networks, encoding

Module 4:

Adaptive Resource theory- network for ART , processing in ART.Kohen Self Organizing Map- Competitive learning , lateral inhibition, training law for Kohennetwork, implementation, applications to pattern recognition, Application of fuzzy Logic: Fuzzy databases and quantification, fuzzy control , designing fuzzy logic controller

Text Books:

1. Rao, VallinuB.,andRao, Hayagriva . Neural networks and fuzzy Logic, second edition, BPB Publication.
2. Berkan C. Riza, Trubatch L, Sheldon, Fuzzy Systems design Principlea.IEEE Press , standard publishers distributors.
3. Freeman A. James, Skapura M. David- neural networks algorithms, applications and programming Techniques, Pearson Education.



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(Elective –IV) CS 521: Parallel Computing

Course Objectives	This course will describe different techniques used to solve the above problems, in order to develop efficient parallel algorithms for a variety of problems. We will also pay much attention to practical aspects of implementing parallel code that actually yields good performance on real parallel machines
Course Outcomes	• Define and describe terminology, different parallel architectures; interconnect networks, programming models, and algorithms for common operations. • Given a problem, develop an efficient parallel algorithm to solve it, analyze its time complexity as a function of the problem size and number of processors. • Given a parallel code, analyze its performance, determine computational bottlenecks, and optimize the performance of the code. • Given a parallel code, debug it and fix the errors.

DETAILED CONTENT

Module 1:

Introduction: Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm. Hardware taxonomy: Flynn's classifications, Handler's classifications. Software taxonomy: Kung's taxonomy, SPMD.

Module 2:

Abstract parallel computational models: Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism

Module 3:

Performance Matrices: Laws governing performance measurements. Matrices - speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks.

Parallel Processors: Taxonomy and topology - shared memory multiprocessors, distributed memory networks. Processor organization - Static and dynamic interconnections. Embedding's and simulations.

Module 4:

Parallel Programming: Shared memory programming, distributed memory programming, object oriented programming, data parallel programming, functional and dataflow programming.

Scheduling and Parallelization: Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs. Parallel programming support environments.



Text Books:

1. M. J. Quinn. *Parallel Computing: Theory and Practice* , McGraw Hill, New York, 1994.
2. T. G. Lewis and H. El-Rewini. *Introduction to Parallel Computing* , Prentice Hall, New Jersey, 1992.
3. T. G. Lewis. *Parallel Programming: A Machine-Independent Approach* , IEEE Computer Society Press, Los Alamitos, 1994.

SAMPLE



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(Elective –IV) CS 522: Distributed System

Course Objectives	This course is an introduction to the design of distributed systems and algorithms that support distributed computing. It aims to provide a practical exposure into the design and functioning of existing distributed systems
Course Outcomes	At the end of the course the students will be able to • Understand the design principles in distributed systems and the architectures for distributed systems. • Apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, voting etc. • Analyze fault tolerance and recovery in distributed systems and algorithms for the same. • Analyze the design and functioning of existing distributed systems and file systems. • Implement different distributed algorithms over current distributed platforms.

DETAILED CONTENT

Module 1:

Characterization of Distributed Systems: Introduction, system models –Architectural and fundamental models. Inter process communication: API for internet protocol, Marshalling. Client server communication, group communication case study: Unix.

Module 2:

Distributed objects and remote invocation: communication between Distributed objects, RPC, events and notification case study: Java RMI Operating System Support: Operating System layer. Protection , processes and threads, operating system architecture.

Module 3:

Distributed File System: File service architecture, network file system, Sun network file system, Andrew file system Case Study: Unix

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

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

Module 4:



Distributed transaction: Flat and nested distributed transactions. Atomic Commit protocol, Distributed dead locks, Distributed Multimedia systems; characteristics of multimedia, multimedia data. Quality of service management, resource management, stream adaptation. Case study; Tiger video file server. Distributed shared memory: design and implementation issues, sequential consistency and Ivy and Release Consistency in Munin.. Case Study of distributed systems: CORBA

Text Books :

1. G. Coulouis, et al. Distributed Systems: Concepts and design, Pearson Education Asia,2004
2. A.S. Tanenbaum, **Modern operating Systems, Prentice Hall**