COMPUTER SCIENCE AND ENGINEERING

Course Structure and Syllabi for Pre Ph.D. Programme

SUBJECT-1

S. No	Course Code	Title of the Course
1	24CMGT01T	Research Methodology

SUBJECT-2

S. No	Course Code	Title of the Course
1	24CMGT02T	Research and Publications ethics

CORE SUBJECTS

Choose any Two subjects from the following list

S. No	Course Code	Title of the Course
1.	24CCSE01T	Software Engineering
2.	24CCSE02T	Artificial Intelligence
3.	24CCSE03T	Database Management Systems
4.	24CCSE04T	Advanced Data Structures & Algorithms
5.	24CCSE05T	Computer Organization & Architecture
6.	24CCSE06T	Software Testing
7.	24CCSE07T	Ethical Hacking
8.	24CCSE08T	Advanced Computer Architecture
9.	24CCSE09T	Human Computer Interaction
10.	24CCSE0AT	Machine Learning
11.	24CCSE0BT	Natural Language Processing
12.	24CCSE0CT	Mobile Computing
13.	24CCSE0DT	Data Warehousing and Mining
14.	24CCSE0ET	Data Analytics
15.	24CCSE0FT	Internet of Things
16.	24CCSE0GT	Cloud Computing
17.	24CCSE0HT	Computer Networks
18.	24CCSE0IT	Design Patterns
19.	24CCSE0JT	Information Security
20.	24CCSE0KT	Block Chain and its Applications

ANNAMACHARYA UNIVERSITY

EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: SOFTWARE ENGINEERING
Category: Ph.D.
Couse Code: 24CCSE01T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives

- To understand the software life cycle models.
- To understand the software requirements and SRS document.
- To understand the importance of modeling and modeling languages.
- To design and develop correct and robust software products.
- To understand the quality control and how to ensure good quality software.
- To understand the planning and estimation of software projects.
- To understand the implementation issues, validation and verification procedures.
- To understand the maintenance of software

Course Outcomes

- Define and develop a software project from requirement gathering to implementation.
- Ability to code and test the software
- Ability to plan, Estimate and Maintain software systems

Unit I

Software and Software Engineering: The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology, Product and Process.

Agile Development: Agility, Agility and the Cost of Change, Agile Process, Extreme Programming, Other Agile Process Models.

Unit II

Understanding Requirements: Requirements Engineering, Establishing the groundwork, Eliciting Requirements, Developing Use Cases, Building the requirements model, Negotiating Requirements, Validating Requirements.

Requirements Modeling (Scenarios, Information and Analysis Classes): Requirements Analysis, Scenario-Based Modeling, UML Models that Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling.

Requirements Modeling (Flow, Behavior, Patterns and WEBAPPS): Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modeling, Requirements Modeling for WebApps.

Unit III

Design Concepts: Design with Context of Software Engineering, The Design Process, Design Concepts, The Design Model.

Architectural Design: Software Architecture, Architecture Genres, Architecture Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Mapping UsingData Flow.

Component-Level Design: Component, Designing Class-Based Components, Conducting Component-level Design, Component Level Design for WebApps, Designing Traditional Components, Component-Based Development.

Unit IV

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design, Design Evaluation.

WebApp Design: WebApp Design Quality, Design Goal, A Design Pyramid for WebApps, WebApp Interface Design, Aestheic Design, Content Design, Architecture Design, Navigation Design, Component-Level Design, Object-Oriented Hypermedia Design Method(OOHMD).

Unit V

Software Testing Strategies: A strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging.

Testing Conventional Applications: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, basic Path testing, Control Structure Testing, Black-Box Testing, Model-based Testing, Testing for Specialized Environments, Architectures and Applications, Patterns for Software Testing. Testing Object-Oriented Applications: Broadening the View of Testing, Testing with OOA and OOD Models, Object-Oriented Testing Strategies, Object-Oriented Testing Methods, Testing Methods Applicable at the Class level, Interclass Test-Case Design.

Text Book:

1. “Software engineering A practitioner’s Approach”, Roger S. Pressman, McGraw HillInternational Education, Seventh Edition, 2016.

Reference Books:

1 Fundamentals of Software Engineering, Fourth Edition, Rajib Mall, PHI,

2 Software Engineering, Ninth Edition, IAN Sommerville, Pearson, Ninth edition.

3 Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.

4 Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

5 Software Engineering: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.

6 Software Engineering: Specification of systems and languages, Diner Bjorner, SpringerInternational edition, 2006.

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Title of the Course: ARTIFICIAL INTELLIGENCE
Category: Ph.D.
Couse Code: 24CCSE02T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objective:

- To learn the difference between optimal reasoning Vs human like reasoning
- To understand the notions of state space representation, exhaustive search, heuristic search alongwith the time and space complexities
- To learn different knowledge representation techniques
- To understand the applications of AI namely, Game Playing, Theorem Proving, Expert Systems,Machine Learning and Natural Language Processing

Course Outcome:

- Possess the ability to formulate an efficient problem space for a problem expressed in English
- Possess the ability to select a search algorithm for a problem and characterize its time and spacecomplexities.
- Possess the skill for representing knowledge using the appropriate technique
- Possess the ability to apply AI techniques to solve problems of Game Playing, Expert Systemsand Machine Learning.

Unit I

Foundations of AI: What is AI, History of AI, Strong and weak AI, The State of the Art.

Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit II

Solving Problems by Searching: Problem – Solving Agents, Example Problems, Searching for Solutions, uniformed search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

Unit III

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The InternetShopping World.

Unit IV

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Learner Models, Nonparametric Models, Support Vector Machines, Ensemble Learning, Practical Machine Learning.

Unit V

Learning Probabilistic Models: Statistical Learning, Learning with Complete data, Lear1qning with Hidden variables: The EM Algorithm.

Text Books:

1. "Artificial Intelligence: A Modern Approach", Stuart J. Russell & Peter Norvig – Pearson.
2. "Artificial Intelligence", Elaine Rich, Kevin Knight & Shivashankar B Nair – McGrawHill Education.

Reference Book:

1. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier

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(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: DATABASE MANAGEMENT SYSTEMS
Category: Ph.D.
Couse Code: 24CCSE03T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- To understand the relational database design principles.
- To become familiar with the basic issues of transaction processing and concurrency control.
- To become familiar with database storage structures and access techniques.

Course Outcomes:

- Demonstrate the basic elements of a relational database management system,
- Ability to identify the data models for relevant problems.
- Ability to design entity relationship and convert entity relationship diagrams into RDBMS andformulate SQL queries on the respect data.
- Apply normalization for the development of application software.

Unit I

Introduction-Database System Applications, Purpose of Database Systems, View of Data - Data Abstraction, Instances and Schemas, Data Models, Database Languages - DDL, DML, Database Architecture, Database Users and Administrators, History of Data base Systems.

Introduction to Data base design, ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises. Relational Model: Introduction to the Relational Model
- Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views Destroying/ altering Tables and Views.

Unit II

Relational Algebra and Calculus: Relational Algebra - Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus - Tuple relational Calculus-Domain relational calculus - Expressive Power of Algebra and calculus.

Form of Basic SQL Query - Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set - Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values - Logical connectives - AND, OR and NOT - Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.

Unit III

Introduction to Schema Refinement - Problems Caused by redundancy, Decompositions - Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST, SECOND, THIRD Normal forms - BCNF - Properties of Decompositions - Loss less join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design - Multi valued Dependencies - FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.

Unit IV

Transaction Management - Transaction Concept - Transaction State - Implementation of Atomicity and Durability - Concurrent - Executions - Serializability - Recoverability - Implementation of Isolation - Testing for serializability.

Concurrency Control - Lock - Based Protocols - Timestamp Based Protocols - Validation - Based Protocols - Multiple Granularity.

Recovery System-Failure Classification-Storage Structure-Recovery and Atomicity - Log - Based Recovery - Recovery with Concurrent Transactions - Buffer Management - Failure with loss of nonvolatile storage - Advance Recovery systems - Remote Backup systems.

Unit V

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing - Clustered Indexes, Primary and Secondary Indexes, Index data Structures - Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.

Tree Structured Indexing: Intuitions for tree indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendible vs. Linear Hashing.

Text Books:

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, McGrawHill Education,3rd Edition, 2003.
2. Data base System Concepts, A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw Hill, VI edition,2006.

Reference Books:

1. Database Systems, 6th edition, Ramez Elmasri, Shamkat B. Navathe, Pearson Education, 2013.
2. Database Systems Concepts, Peter Rob & Carlos Coronel, Cengage Learning, 2008.
3. Introduction to Database Systems, C.J. Date, Pearson Education.
4. Database Management Systems, G.K. Gupta, McGrawHill Education.

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(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: ADVANCED DATA STRUCTURES AND ALGORITHMS
Category: Ph.D.
Couse Code: 24CCSE04T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- To teach efficient storage mechanisms of data for an easy access.
- To design and implementation of various basic and advanced data structures.
- To introduce various techniques for representation of the data in the real world.
- To develop application using data structures.
- To teach the concept of protection and management of data.
- To improve the logical ability.

Course Outcomes:

- Upon completion of this course students will be able to:
- Choose appropriate data structure to specified problem definition.
- Handle operations like searching, insertion, deletion, traversing mechanism etc. on various datastructures.
- Apply concepts learned in various domains to implement new data structures.
- Use linear and non-linear data structures like stacks, queues, linked list etc.

Unit I

Overview of Data Structures - Arrays, Stacks, Queues, linked lists , Linked stacks and Linked queues, Applications

Algorithm Analysis - Efficiency of algorithms, Asymptotic Notations, Time complexity of an algorithm using O notation, Polynomial Vs Exponential Algorithms, Average, Best, and Worst Case Complexities, Analyzing Recursive Programs.

Unit II

Trees and Graphs – Basics of trees and binary trees, Representation of trees and Binary trees, Binary tree Traversals, Threaded binary trees, Graphs, representation and traversals.

Binary Search Trees, AVL Trees and B Trees - Binary Search Trees: Definition, Operations

and applications. AVL Trees: Definition, Operations and applications. B Trees: Definition, Operations and applications.

Unit III

Red – Black Trees, Splay Trees and Hash Tables - Red–Black Trees, Splay Trees and their applications, Hash Tables, Hash Functions and various applications, File Organizations.

Unit IV

Divide – and – Conquer & Greedy Method - General Method, Binary Search, Finding Maximum and Minimum, Quick Sort, Merge sort, Strassen‟s Matrix Multiplication, Greedy Method- General Method, Minimum Cost Spanning Trees, Single Source Shortest Path.

Back Tracking and Branch – and – Bound - General Method, 8 – Queen‟s Problem, Graph Coloring. Branch – and – Bound: The Method, LC Search, Control Abstraction, Bounding, 0 / 1 Knapsack Problem.

Unit V

Dynamic Programming - General Method, All Pairs Shortest Path, Single Source Shortest Path, 0 /1 Knapsack problem, Reliability Design, Traveling Sales Person‟s Problem.

Text Book:

1. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,2nd edition, University Press.

Reference Books:

1. Data Structures and Algorithms Using C++ by Ananda Rao Akepogu and Radhika Raju Palagiri,Pearson Education, 2010.
2. Classic Data Structures by D. Samanta, 2005, PHI
3. Data Structures and Algorithms by G.A.V. Pai, 2009, TMH.
4. Design and Analysis of Computer Algorithms by Aho, Hopcraft, Ullman 1998, PEA.
5. Introduction to the Design and Analysis of Algorithms by Goodman, Hedetniemi, TMG
6. Design and Analysis of Algorithms by E. Horowitz, S. Sahani, 3rd Edition, Galgotia.
7. Data Structures and Algorithms in C++ by Drozdek 2nd Edition, Thomson.

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Title of the Course: COMPUTER ORGANIZATION & ARCHITECTURE
Category: Ph.D.
Couse Code: 24CCSE05T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- To learn the fundamentals of computer organization and its relevance to classical andmodern problems of computer design
- To make the students understand the structure and behavior of various functional modules ofa computer.
- To understand the techniques that computers use to communicate with I/O devices
- To study the concepts of pipelining and the way it can speed up processing.
- To understand the basic characteristics of multiprocessors

Course Outcomes:

- Ability to use memory and I/O devices effectively
- Able to explore the hardware requirements for cache memory and virtual memory
- Ability to design algorithms to exploit pipelining and multiprocessors

Unit I

Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.

Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.

Unit II

Arithmetic: Addition and Subtraction of Signed Numbers, Design and Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.

Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, Multi programmed Control.

Unit III

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

Unit IV

Input/output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct MemoryAccess, Buses, Interface Circuits, Standard I/O Interfaces.

Unit V

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets.

Large Computer Systems: Forms of Parallel Processing, Array Processors, The Structure of General-Purpose, Interconnection Networks.

Text Book:

1. "Computer Organization", Carl Hamacher, Zvonko Vranesic, Safwat Zaky, McGraw Hill Education, 5th Edition, 2013**.**

Reference Books:

1. Computer System Architecture, M.Morris Mano, Pearson Education, 3rd Edition.
2. Computer Organization and Architecture, Themes and Variations, Alan Clements, CENGAGELearning.
3. Computer Organization and Architecture, Smruti Ranjan Sarangi, McGraw Hill Education.
4. Computer Architecture and Organization, John P.Hayes, McGraw Hill Education.

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Title of the Course: SOFTWARE TESTING
Category: Ph.D.
Couse Code: 24CCSE06T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course objectives:

- Study the significance of testing
- Study the testing to be done at various levels
- Understand the procedure for designing test cases

Course Outcomes:

- Ability to systematically test the applications
- Ability to write test cases
- Ability to use testing tools effectively

Unit I

Control flow graph – basic blocks, flow graphs, paths, basic paths, path conditions and domains, Dominators and post-dominators; Program dependence graph – data dependence, control dependence, callgraph,

Tests generation - Test selection Problem, equivalence partitioning, Equivalence class partitioning, boundary value analysis and category partitioning method.

Unit II

Finite state machines (FSM) - properties of FSM, Conformance testing, test generation, test optimization, Fault detection. **Combinatorial designs** – combinatorial test design process. **Pairwise design**: Binary factors and multi-valued factors. **Orthogonal arrays** and multi-level orthogonal arrays.

Unit III

Test Adequacy: Basics, measurement of test adequacy, infeasibility and test adequacy. Adequacy criteria based control – statement, block, conditions and decisions coverage

techniques. Basics of Junit tool for Java.

Metrics

Importance of Metrics in Testing - Effectiveness of Testing – Defect Density – Defect Leakage Ratio – Residual Defect Density – Test Team Efficiency – Test Case Efficiency.

Unit IV

Regression Testing

What is Regression Testing? Regression test process. Regression test selection techniques: Test all, Random selection, modification traversing tests, using execution trace. Test minimization and prioritization.

Unit V

Non-functional testing

Load testing, performance testing, GUI testing, Security testing techniques and tools.

Automation: Case studies functional test automation using Selenium.

Text Books:

1. Aditya P Mathur, Foundations of software testing, 2nd edition, Pearson , 2013.
2. Boris Beizer, “Software Testing Techniques”, 2nd Edition, Dream tech press, 2003.

Reference Books:

1. M G Limaye, “Software Testing – Principles, Techniques and Tools”, Tata McGraw Hill, 2009.
2. Edward Kit, “Software Testing in the Real World - Improving the Process”, Pearson Education,2004.
3. William E. Perry, “Effective methods for software testing”, 2nd Edition, John Wiley, 2000.

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Title of the Course: ETHICAL HACKING
Category: Ph.D.
Couse Code: 24CCSE07T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course objectives:

1. Understand cybersecurity principles and the role of ethical hacking in safeguarding systems.
2. Master tools and techniques for vulnerability assessment and penetration testing.
3. Learn legal, ethical, and regulatory frameworks guiding ethical hacking practices.
4. Develop skills to identify, exploit, and mitigate security vulnerabilities in IT infrastructure.
5. Enhance incident response capabilities and strategies for preventing cyberattacks.

Course Outcomes:

After learning the course, the students should be able to:

- Describe and understand the basics of the ethical hacking
- Perform the foot printing and scanning
- Demonstrate the techniques for system hacking
- Characterize the malware and their attacks and detect and prevent them
- Determine the signature of different attacks and prevent them
- Detect and prevent the security attacks in different environments

Unit 1

An Introduction to ethical Hacking: Security Fundamental, Security testing, Hacker and Cracker, Descriptions, Test Plans-keeping It legal, Ethical and Legality the Technical Foundations of Hacking: The Attacker’s Process, The Ethical Hacker’s Process, Security and the Stack.

Unit 2

Foot printing and scanning: Information Gathering, Determining the Network Range, Identifying Active Machines, Finding Open Ports and Access Points, OS Fingerprinting Services, Mapping the Network Attack Surface Enumeration, System Hacking.

Unit 3

Malware Threats: Viruses and Worms, Trojans, Covert Communication, Keystroke Logging and

Spyware, Malware Counter measures, Sniffers, Session Hijacking and Denial of Service: Sniffers, Session Hijacking, Denial of Service and Distributed Denial of Service

Unit 4

Web Server Hacking, Web Application Hacking, Database Hacking, Wireless Technologies, Mobile Device Operation and Security, Wireless LANs.

Unit 5

IDS, Firewalls and Honeypots: Intrusion Detection Systems, Firewalls, Honeypots, Physical Security, Social Engineering, Cloud Computing, Botnets.

Text Book:

1. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws": Dafydd Stuttard and Marcus Pinto: 2nd Edition

Reference Books:

1. Certified Ethical Hacker, Version 9, Second Edition, Michael Gregg, Pearson IT Certification
2. Hacking the Hacker, Roger Grimes, Wiley
3. The Unofficial Guide to Ethical Hacking, Ankit Fadia, Premier Press

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Title of the Course: ADVANCED COMPUTER ARCHITECTURE
Category: Ph.D.
Couse Code: 24CCSE08T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives: This course will able to

- Learn Program, Network Properties of various parallel computer models.
- Know about new trends in Operating and designing various parallel computers

Course Outcomes: Student will be able to

1. Calculate performance measures of different parallel computers.
2. Find the difference between parallel computer with and without shared-memory organization.
3. Analyze Instruction Pipeline and message passing techniques.
4. Find out differences between properties of Data Flow Architectures and other types.
5. Know about design issues of a processor and the parallelism used in various advanced processors

Unit 1

Parallel Computer Models: - The state of computing-Multiprocessors and Multi computers-Multi vector and SIMD Computers-PRAM and VLSI Models. Program and Networks Properties: - Conditions of Parallelism- Program Partitioning and Scheduling- Program Flow Mechanisms-System Interconnect Architectures. Principles of Scalable Performance: - Performance Metrics and Measures- Parallel Processing Applications Speedup Performance Laws-Scalability Analysis and Approaches, Architectural Development Track.

Unit 2

Processors and Memory Hierarchy: - Advanced Processor Technology-Superscalar and Vector Processors Memory Hierarchy Technology. Bus, Cache and Shared Memory: - Bus Systems-Cache Memory Organizations-Shared-Memory Organizations.

Unit 3

Pipelining and Super Scalar Techniques: - Linear Pipeline Processors-Nonlinear Pipeline Processors-Instruction Pipeline Design. Multiprocessors and Multi computers: -Multiprocessor System Interconnects-Cache Coherence and Synchronization Mechanisms-Message-Passing Mechanisms.

Unit 4

Multi vector and SIMD Computers: - Vector Processing Principles-Multi vector Multiprocessors-Compound Vector Processing-SIMD Computer Organizations-The Connection Machine CM-5. Scalable, Multithreaded, and Dataflow Architectures: - Latency –Hiding Techniques-Principles of

Multithreading Scalable and Multithreaded Architectures- Dataflow and Hybrid Architectures.

Unit 5

Instruction Level Parallelism: - Introduction-Basic Design Issues-Problem Definition-Model of a Typical Processor- Operand Forwarding-Reorder Buffer-Register Renaming-Tomasulo ‘s Algorithm- Branch Prediction Limitations in Exploiting Instruction Level Parallelism-Thread Level Parallelism. Trends in Parallel Systems: - Forms of Parallelism-Case Studies: AMD Opteron, Intel Pentium Processors.

Text Book:

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

Reference Book:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013

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Title of the Course: HUMAN COMPUTER INTERACTION
Category: Ph.D.
Couse Code: 24CCSE09T

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives: This course will able to

- Understand the procedures, principles and significance of graphical user interfaces.
- Design, implement and evaluate graphical user interfaces.
- Learn patterns and modes of human computer interaction.
- Know how to use tools for human centered information system development.
- Learn the working of various components in the field of human computer interaction.

Course Outcomes: After completing of the course, the student will be able to:

- Describe key design principles of human computer interfaces.
- Apply and compare selected design methods at a basic level of competence.
- Discuss HCI issues in different environments.
- Define good user interfaces.
- understand the working of interaction devices

Unit 1

Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

Unit 2

Design process – Human interaction with computers, importance of human characteristics, human considerations in design, Human interaction speeds, and understanding business junctions. Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition– information retrieval on web – statistical graphics – Technological consideration in interface design.

Unit 3

Windows – New and Navigation schemes selection of window, selection of devices based

and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors

Unit 4 Tools & Methods

Software tools – Specification methods, interface – Building Tools.

Unit 5 Interaction Devices

Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamaTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia

Reference Books:

1. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education.
2. Interaction Design PRECE, ROGERS, SHARPS. Wiley Dreamtech
3. User Interface Design, Soren Lauesen, Pearson Education.
4. Human- Computer Interaction, D. R. Olsen, Cengage Lerning.
5. Human- Computer Interaction, Smith – Atakan, Cenage Learning

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Title of the Course: MACHINE LEARNING
Category: Ph.D.
Couse Code: 24CCSE0AT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to differentapplications.
- To understand a range of machine learning algorithms along with their strengths andweaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes:

- Ability to understand what is learning and why it is essential to the design of intelligentmachines.
- Ability to design and implement various machine learning algorithms in a wide range ofreal-world applications.
- Acquire knowledge deep learning and be able to implement deep learning models forlanguage, vision, speech, decision making, and more

Unit I

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

Unit II

Neural Network Representation – Problems – Perceptron's – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming– Models of Evaluation and Learning.

Unit III

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Unit IV

K- Nearest Neighbor Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

Unit V

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Text Book:

1. Machine Learning – Tom M. Mitchell, - MGH

Reference Book:

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

ANNAMACHARYA UNIVERSITY

EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: NATURAL LANGUAGE PROCESSING
Category: Ph.D.
Couse Code: 24CCSE0BT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- able to explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
- Understand approaches to syntax and semantics in NLP.
- Understand current methods for statistical approaches to machine translation.
- Understand language modeling.
- Understand machine learning techniques used in NLP.

Course Outcomes:

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

- Understanding the syntactic and semantics of NLP
- Use appropriate grammars and parsers to communicate the problems and their solutions
- Understand the grammars in NLP
- Describe the semantic interpretation and language modelling
- Understand and apply machine learning translation and retrieval in NLP

Unit 1

Introduction to Natural language -The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax

Unit 2

Grammars and Parsing 9 Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks

Unit 3

Grammars for Natural Language 9 Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers

Unit 4

Semantic Interpretation and Language Modelling 9 Semantic Interpretation: Semantic & Logical form, Word senses & ambiguity, the basic logical form language, encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory. Language Modeling: Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross-lingual Language Modeling.

Unit 5

Machine Translation: Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Multilingual Information Retrieval: Introduction, Document Preprocessing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. Multilingual Automatic Summarization: Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets

Text Books:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education

2. Daniel M.Bikel and ImedZitouni “Multilingual Natural Language Processing Applications : From Theory To Practice” Pearson Publications.

Reference Books:

1. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall of India

2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993

3. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008

4. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: MOBILE COMPUTING
Category: Ph.D.
Couse Code: 24CCSE0CT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objective:

1. introduce students to mobile computing, covering its applications, the evolution of mobile communication technologies.
2. focusing on GSM and UMTS architectures, services, protocols, connection establishment, frequency allocation.
3. familiarize students with Mobile IP, DHCP, and ad-hoc networking, covering proactive, reactive, and hybrid routing protocols, multicast routing.
4. with an understanding of Mobile TCP and WAP architecture, including the protocols WDP, WTLS, WTP, WSP, and components such as WAE, WTA architecture, and WML.

Course Outcome:

Students will gain an understanding

1. mobile computing concepts, including the applications, evolution of mobile communication technologies, and various multiplexing and MAC protocols
2. the fundamentals of cellular systems, including GSM and UMTS architectures, services, protocols, connection establishment, frequency allocation.
3. principles and protocols of mobile IP, DHCP, and ad-hoc networks, including proactive, reactive, and hybrid routing protocols, as well as multicast routing.
4. Mobile TCP and WAP architecture, including protocols such as WDP, WTLS, WTP, WSP, and the components of WAE, WTA architecture, and WML.
5. the characteristics and constraints of mobile device operating systems, explore commercial mobile OS platforms and their development kits, and analyze the structure, advantages.

Unit I

Introduction to Mobile Computing — Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing — Spread spectrum -MAC Protocols — SDMA- TDMA- FDMA- CDMA

Unit II

Introduction to Cellular Systems — GSM — Services & Architecture — Protocols — Connection Establishment — Frequency Allocation — Routing — Mobility Management — Security — GPRS- UMTS — Architecture — Handover — Security

Unit III

Mobile Network Layer-Mobile IP — DHCP — AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols — DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET — Security.

Unit IV

Mobile Transport And Application Layer-Mobile TCP– WAP — Architecture — WDP — WTLS — WTP –WSP — WAE — WTA Architecture — WML

Unit V

Mobile Platforms And Applications-Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

Text Book:

1. Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing‖, PHI Learning Pvt.Ltd, New Delhi – 2012

Reference Books:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.

2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ―Principles ofMobile Computing‖, Springer, 2003.

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: DATA WAREHOUSING AND MINING
Category: Ph.D.
Couse Code: 24CCSE0DT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- To know the basic concepts and principles of data warehousing and data mining
- Learn pre-processing techniques and data mining functionalities
- Learn and create multidimensional models for data warehousing
- Study and evaluate performance of Frequent Item sets and Association Rules
- Understand and Compare different types of classification and clustering algorithms

Course Outcomes:

- Understand the basic concepts of data warehouse and data Mining
- Apply pre-processing techniques for data cleansing
- Analyze and evaluate performance of algorithms for Association Rules
- Analyze Classification and Clustering algorithms

Unit I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Unit II

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

Unit III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and ScalableFrequent Itemset Mining Methods, Mining various kinds of Association Rules,

From Association Mining to Correlation Analysis, Constraint-Based Association Mining, Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods

Unit IV

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

Unit V

Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multi relational Data Mining, Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

Text Books:

1. Data Mining: Concepts and Techniques, Jiawei Han and Micheline Kamber, MorganKaufmann Publishers, Elsevier, Second Edition, 2006.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, PearsonEducation.

References Books:

1. Data Mining Techniques, Arun KPujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory& Dennis Murray Pearson EdnAsia.
3. Insight into Data Mining, K.P.Soman, S.Diwakar,V.Ajay, PHI,2008.

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: DATA ANALYTICS
Category: Ph.D.
Couse Code: 24CCSE0ET

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- To learn to analyze the big data using intelligent techniques.
- To understand the various search methods and visualization techniques.
- To learn to various techniques for mining data stream.
- To understand the applications using Map Reduce Concepts.

Course Outcomes:

On completion of this course the student will able to

- Analyze the big data analytics techniques for useful business application.
- Design efficient algorithms for mining the data from large volumes.
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
- Explore on big data applications using Pig and Hive.

Unit I

Introduction to Big Data Platform – Challenges of Conventional System – Intelligent data analysis – Nature of Data – Analytic Processes and Tool – Analysis vs Reporting – Modern Data Analytic Tool – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Prediction Error.

Unit II

Introduction To Stream Concepts – Stream Data Model and Architecture - Stream Computing –Sampling Data in a Stream – Filtering Stream – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) Applications – Case Studies – Real Time Sentiment Analysis, Stock Market Predictions.

Unit III

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop – Analyzing the Data with Hadoop – Scaling Out – Hadoop Streaming – Design of HDFS- Java interfaces to HDFS Basics- Developing a Map Reduce Application – How Map Reduce Works – Anatomy of a Map Reduce Job run – Failures – Job Scheduling – Shuffle and Sort – Task Execution – Map Reduce Types and Formats – Map Reduce Features.

Unit IV

Setting up a Hadoop Cluster – Cluster specification – Cluster Setup and Installation –Hadoop Configuration – Security in Hadoop – Administering Hadoop – HDFS – Monitoring – Maintenance
– Hadoop Benchmarks – Hadoop in the Cloud.

Unit V

Applications on Big Data Using Pig and Hive – Data Processing operators in Pig – Hive Services – HiveQL – Querying Data in Hive – fundamentals of HBase and Zookeeper – IBM Info Sphere Big Insights and Streams. Visualization - Visual data analysis techniques, interaction techniques; Systems and applications.

Text Books:

1. Michael Berthold, David J.Hand, Intelligent Data Analysis, Spingers, 2007.
2. Tom White, Hadoop: The Definitive Guide Third Edition, O‟reilly Media, 2012.

Reference Books:

1. Bill Franks, Taming the big Data tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data , John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O‟Reilly, 2011.
3. Jiawei Han, MichelineKamber, Data Mining Concepts and Techniques, Second Edition.
4. Elsevier, Reprinted 2008. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, Intelligent Data Mining, Springer, 2007.

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: INTERNET OF THINGS
Category: Ph.D.
Couse Code: 24CCSE0FT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives

- Makes clear view over physical computing, ubiquitous computing, or the Internet of Things, it's a hot topic in technology.
- It discusses design concepts that will make IOT products eye-catching and appealing.

Course Outcomes

- Ability to combine sensors, servos, robotics, Arduino chips, and more with various or the Internet, to create interactive, cutting-edge devices.
- Better idea of the overview of necessary steps to take the idea of IOT concept through production.

Unit I

Introduction - Internet of Things – Design Principles for Connected Devices – Web Thinking for Connected Devices – Internet Principles – IP – TCP – IP Protocol Suite – UDP – IP Address – MAC Address – TCP and UDP Ports – Application Layer Protocols.

Unit II

Prototyping – Prototypes and Production – Cloud – Open Source vs Closed Source – Tapping into the Community – Prototyping Embedded Devices – Electronics – Embedded Computing Basics – Ardunio – Raspberry Pi – Beagle Bone Black – Electronic Imp.

Unit III

Prototyping the Physical Design – Laser Cutting – 3D Printing – CNC Milling – Repurposing and Recycling – Prototyping Online Components – New API – Real Time Reactions – Other Protocols.

Unit IV

Techniques for writing Embedded Code – Memory Management – Performance and Battery life – Libraries – Debugging – **Business Models** – Models – Funding an Internet of Things Startup.

Unit V

Moving to Manufacture – Designing Kits – Designing Printed Circuit Boards – Manufacturing Printed Circuit Boards – Mass Producing the case and other Fixtures – Scaling up Software – **Ethics** – Characterizing the Internet of Things – Control – Environment – Solutions.

Text Book:

1. Adrian Mcewen and HakinCassimally, “Designing The Internet of Things” Wiley Publications , 2015

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1stEdition, VPT, 2014.
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: CLOUD COMPUTING
Category: Ph.D.
Couse Code: 24CCSE0GT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives

- To introduce the basis of Cloud Computing
- To educate the cloud working function
- To allow computer system resources to be used in an efficient manner
- Makes the environment to the cloud.

Course Outcomes

On successful completion of the course, students will be able to:

- Understand the concepts of cloud computing and its related techniques.
- Provide a pleasant and effective user interface.

Unit I

Introduction to cloud computing – The Evolution of cloud computing – Hardware Evolution-Internet Software Evolution – Server Virtualization – Web Services Deliver from the cloud–Communication-as-a-service–Infrastructure-as-a-service–Monitoring-as-a-service–Platform- as-a-Service - Software-as-a-service – Building Cloud Network.

Unit II

Federation in the cloud – presence in the cloud – Privacy and its Relation to cloud-Based Information Systems– Security in the cloud – Common Standards in the cloud-End-User Access to the cloud Computing.

Unit III

Introduction – Advancing towards a Utility Model – Evolving IT infrastructure – Evolving Software Applications – Continuum of Utilities- Standards and Working Groups- Standards Bodies and Working Groups- Service Oriented Architecture- Business Process Execution Language- Interoperability Standards for Data Center Management – Utility Computing Technology- Virtualization – Hyper Threading – Blade Servers- Automated Provisioning- Policy Based Automation- Application Management – Evaluating Utility Management Technology – Virtual Test and development Environment – Data Center Challenges and Solutions – Automating the Data Center.

Unit IV

Software Utility Application Architecture – Characteristics of a SaaS – Software Utility Applications – Cost Versus Value – Software Application Services Framework – Common

Enablers – Conceptual view to Reality – Business profits – Implementing Database System for Multitenant Architecture.

Unit V

Other Design Consideration – Design of a Web Services Metering Interface – Application Monitoring Implementation – A Design for an update and Notification Policy – Transforming to Software as a Service – Application Transformation Program – Business Model Scenarios – Virtual Services for Organizations – The Future.

Text Book:

1. Guy Bunker and Darren Thomson, Delivering utiliy Computing, John Wiley & Sons Ltd, 2012.

Reference Books:

1. John W. Rittinghouse and Ames F. Ransome, Cloud Computing Implementation , Management and security, CRC press & Francis Group, Boca Raton London New York. 2010.

2. Alfredo Mendroza, Utility Computing Technologies, Standards, and Strategies Artech House INC, 2007.

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: COMPUTER NETWORKS
Category: Ph.D.
Couse Code: 24CCSE0HT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- Study the evolution of computer networks and future directions.
- Study the concepts of computer networks from layered perspective.
- Study the issues open for research in computer networks.

Course Outcomes:

- Ability to choose the transmission media depending on the requirements.
- Ability to design new protocols for computer network.
- Ability to configure a computer network logically.

Unit I

Introduction: Networks, Network Types, Internet History, Standards and Administration, Network Models: Protocol Layering, TCP/IP Protocol Suite, The ISO Model.

The Physical layer: Data and Signals, Transmission impairment, Data rate limits, Performance, Transmission media: Introduction, Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet switching.

Unit II

The Data Link Layer: Introduction, Link layer addressing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction, Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol, Media Access control: Random Access, Controlled Access, Channelization, connecting devices and virtual LANs: Connecting Devices.

Unit III

The Network Layer: Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking, The network layer in the Internet: IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.

Unit IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.

Unit V

The Application Layer: Introduction, Client Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

Text Books:

1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012.
2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2010.

Reference Books:

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. "Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1, Douglas E. Comer, 5th edition, PHI
3. "Computer Networks", 5E, Peterson, Davie, Elsevier.
4. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.
5. "Computer Networks and Internets with Internet Applications", Comer.

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: DESIGN PATTERNS
Category: Ph.D.
Couse Code: 24CCSE0IT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- Introduction to the fundamentals of software architecture.
- To understand various architectural patterns of software systems.
- To understand design patterns and their underlying object-oriented concepts.
- Software architecture and quality requirements of a software system
- Identifying the appropriate patterns for design problems.

Course Outcomes:

The student will be able to:

- Design and motivate software architecture for large scale software systems
- Recognize major software architectural patterns, design patterns, and frameworks
- Know the underlying object-oriented principles of design patterns.
- Understand the context in which the pattern can be applied.
- Understand how the application of a pattern affects the system quality and its tradeoffs.

Unit I

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

Creating an Architecture - Quality Attributes, achieving qualities, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

Unit II

Introduction to Patterns - What is a Pattern? What makes a Pattern? Pattern Categories, Relationshipsbetween Patterns, Pattern Description, Patterns and Software Architecture.

Architectural Patterns-Layers, Pipes and Filters, Blackboard, Broker, Microkernel, MVC, PAC, Reflection.

Unit III

What is Design Pattern, organizing catalogs, Role in solving design problems, Selection and Usage,
Creational Patterns - Abstract factory, builder, factory method, prototype, singleton

Unit IV

Structural Patterns - Adapter, bridge, composite, decorator, façade, flyweight, Proxy, Decorator, façade,flyweight, Proxy.

Unit V

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

Case Studies – Designing a Document Editor - Design issues of Lexi Editor in Deign Patterns, TheWorld Wide Web - a case study in interoperability

Text Books:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman,Pearson Education,2003.
2. Pattern-Oriented Software Architecture", A System of Patterns, Frank Buschmann Regine Meunier,Hans Rohnert, Peter Sommerlad and Michael Stal, WlLEY.
3. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, PearsonEducation.

Reference Books:

1. AntiPatterns: Refactoring Software, Architectures, and Projects in Crisis, by William J. Brown,Raphael C. Malveau, Hays W. "Skip" McCormick , Thomas J. Mowbray (Author) 1st Edition,
2. Java testing patterns, John Thomas etc, wiley.
3. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR,2001
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

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course: INFORMATION SECURITY
Category: Ph.D.
Couse Code: 24CCSE0JT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

- Extensive, thorough and significant understanding of the concepts, issues, principles and theories of computer network security
- Identifying the suitable points for applying security features for network traffic
- Understanding the various cryptographic algorithms and implementation of the same at software level
- Understanding the various attacks, security mechanisms and services

Course Outcomes:

- Protect the network from both internal and external attacks
- Design of new security approaches
- Ability to choose the appropriate security algorithm based on the requirements.

Unit I

Computer Security concepts, The OSI Security Architecture, Security attacks, Security services and Security mechanisms, A model for Network Security

Classical encryption techniques- symmetric cipher model, substitution ciphers, transposition ciphers, Steganography.

Modern Block Ciphers: Block ciphers principles, Data encryption standard (DES), Strength of DES, linear and differential cryptanalysis, block cipher modes of operations, AES, RC4.

Unit II

Introduction to Number theory – Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence, Algebraic Structures, GF(2^n) Fields, Primes, Primality Testing, Factorization, Chinese remainder Theorem, Quadratic Congruence, Exponentiation and Logarithm.

Public-key cryptography - Principles of public-key cryptography, RSA Algorithm, Diffie-Hellman Key Exchange, ELGamal cryptographic system, Elliptic Curve Arithmetic, Elliptic curve cryptography

Unit III

Cryptographic Hash functions: Applications of Cryptographic Hash functions, Requirements andsecurity, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA)

Message Authentication Codes: Message authentication Requirements, Message authentication functions, Requirements for Message authentication codes, security of MACs, HMAC, MACs based on Block Ciphers, Authenticated Encryption

Digital Signatures-RSA with SHA & DSS

Unit IV

Key Management and distribution: Symmetric key distribution using Symmetric Encryption, Symmetric key distribution using Asymmetric, Distribution of Public keys, X.509 Certificates, Public key Infrastructure.

User Authentication: Remote user Authentication Principles, Remote user Authentication using Symmetric Encryption, Kerberos, Remote user Authentication using Asymmetric Encryption, Federated Identity Management, Electronic mail security: Pretty Good Privacy (PGP), S/MIME.

Unit V

Security at the Transport Layer(SSL and TLS) : SSL Architecture, Four Protocols, SSL MessageFormats, Transport Layer Security, HTTPS, SSH

Security at the Network layer (IPSec): Two modes, Two Security Protocols, Security Association, Security Policy, Internet Key Exchange.

System Security: Description of the system, users, Trust and Trusted Systems, Buffer Overflow and Malicious Software, Malicious Programs, worms, viruses, Intrusion Detection System(IDS), Firewalls

Text books:

1. “Cryptography and Network Security”, Behrouz A. Frouzan and Debdeep Mukhopadhyay, McGraw Hill Education, 2nd edition, 2013.

2.“Cryptography and Network Security: Principals and Practice”, William Stallings, Pearson Education , Fifth Edition, 2013.

Reference Books:

1. “Network Security and Cryptography”, Bernard Menezes , Cengage Learning.

2. “Cryptography and Security”, C.K. Shymala, N. Harini and Dr. T.R. Padmanabhan, Wiley-India.

3. “Applied Cryptography, Bruce Schiener, 2nd edition, John Wiley & Sons.

4. “Cryptography and Network Security”, Atul Kahate, TMH.

5. „Introduction to Cryptography”, Buchmann, Springer.

6. „Number Theory in the Spirit of Ramanujan”, Bruce C.Berndt, University Press

7. “Introduction to Analytic Number Theory”, Tom M.Apostol, University Press

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EXCELLENCE IN EDUCATION; SERVICE TO SOCIETY

(ESTD, UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

Title of the Course:	**BLOCK CHAIN AND ITS APPLICATIONS**
Category:	Ph.D.
Couse Code:	24CCSE0KT

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	-

Course Objectives:

Students will be able to

- Understand how Blockchain systems (mainly Bitcoin and Ethereum) work.
- Learn how to interact with the system securely.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from Blockchain technology into their own projects.

Course Outcomes:

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

1. Understand the distributed systems and various cryptography techniques
2. Demonstrate the importance of Blockchain & its applications in real world
3. Understand Nakamoto consensus & operate the network based on Energy utilization
4. Identify the importance of Bitcoin protocols & Ethereum
5. Summarize the importance of Crypto-Currency in Global economy

Unit 1

Basics-Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero, and Knowledge Proof.

Unit 2

Block chain-Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Unit 3

Distributed Consensus-Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate

Unit 4

Crypto currency-History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin

Unit 5

Crypto currency Regulation-Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Text Book:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System

3. DR. Gavin Wood, ―ETHEREUM: A Secure Decentralized Transaction Ledger,‖Yellow paper.2014.

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