ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

COMPUTER SCIENCE / COMPUTER APPLICATIONS

Course Structure and Syllabi for Pre Ph.D Programme

SUBJECT – 1

S.No	Course Code	Title of the Course
1	26CPHY01T	Research Methodology for Sciences

SUBJECT - 2

S.No	Course Code	Title of the Course
1	26CMGT02T	Research and Publication Ethics for Sciences and Humanities

Core Subjects
Choose any Two subjects from the following list

S.No	Course Code	Title of the Course
1	26CCSA01T	Software Engineering
2	26CCSA02T	Computer Networks
3	26CCSA03T	Database Management Systems
4	26CCSA04T	Computer Organization
5	26CCSA05T	Operating Systems
6	26CCSA06T	Artificial Intelligence
7	26CCSA07T	Machine Learning
8	26CCSA08T	Data Science
9	26CCSA09T	Block Chain Technologies
10	26CCSA0AT	Cryptography And Network Security
11	26CCSA0BT	Service Oriented Architecture
12	26CCSA0CT	Cloud Computing
13	26CCSA0DT	Mobile Computing
14	26CCSA0ET	Internet of Things
15	26CCSA0FT	Data Warehousing and Mining
16	26CCSA0GT	Software Testing Methodologies
17	26CCSA0HT	Big Data Analytics
18	26CCSA0IT	Deep Learning
19	26CCSA0JT	Neural Networks

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Software Engineering
Course Code	**:**	26CCSA01T
Course offered to	**:**	Computer Science/ Computer Applications
Credits	**:**	4

Course Objectives

1 To understand software fundamentals, WebApp characteristics, software engineering principles and various software process models.
2 To understand requirements engineering, types of requirements, and system modeling techniques.
3 To understand software architecture, architectural styles, design methods, and evaluation techniques.
4 To understand WebApp design quality, goals, structure, content, and navigation principles.
5 To understand software testing fundamentals and apply various software testing techniques.

Course Outcomes

1 Explain software fundamentals, WebApp characteristics, software engineering principles, processes, and myths.
2 Explain requirements engineering activities and system modeling techniques.
3 Apply component-level design techniques to develop software components.
4 Analyze WebApp design quality, content, structure, and navigation principles.
5 Apply various testing techniques to evaluate software quality.

Unit 1 **11**

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, Evolutionary Process Models, The Unified Process.

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

Unit 2 **11**

UNDERSTANDING REQUIREMENTS: Requirements Engineering, Establishing the Ground work, Eliciting Requirements, Building the requirements model, Negotiating Requirements, Validating Requirements.

SOFTWARE REQUIREMENTS & ENGINEERING PROCESS: Functional and Non-Functional Requirements, Requirements elicitation and analysis, Requirements validation Requirements management.

SYSTEM MODELING: Context models, Behavioral models, Data models, Object models.

Unit 3 **10**

DESIGN CONCEPTS: Design with Context of Software Engineering, The Design Process, Design Concepts, Modular decomposition styles, Design Evolution.

ARCHITECTURAL DESIGN: Software Architecture, Architecture Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow.

COMPONENT-LEVEL DESIGN: Component, Designing Class-Based Components, Conducting Component-level Design, Component Level Design for WebApps, Designing Traditional Components

Unit 4 **9**

USER INTERFACE DESIGN: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design.

WEBAPP DESIGN: WebApp Design Qualit y, Design Goal, A Design Pyramid for WebApps, WebApp Interface Design, Content Design, Navigation Design.

Unit 5 **10**

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, Test-Case Design.

Prescribed Textbook:

1. Roger S. Pressman, Software engineering A Practitioner's Approach, 7th Edition, McGraw Hill International Education.

Reference Books:

1. Ian Sommerville, Software Engineering, 9th Edition, Pearson Education.
2. Pankaj Jalote, Software Engineering, A Precise Approach, 2nd Edition, Wiley India

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Computer Networks
Course Code	**:**	26CCSA02T
Course offered to	**:**	Computer Science/ Computer Applications
Credits	**:**	4

Course Objectives

1 To know the concepts of the Reference Models and understand the fundamentals of Computer Networks.
2 To understand various techniques of data link layer.
3 To know various issues of routing, quality of service and congestion control.
4 To understand various transport protocols.
5 To understand software testing fundamentals and apply various software testing techniques.

Course Outcomes

1 Summarize the concepts of computer networks.
2 Apply the different data link layer techniques.
3 Apply various routing algorithms..
4 Analyze various transport protocols.
5 Comprehend the cryptography and network security techniques.

Unit 1 **11**

INTRODUCTION: Networks, Types of Computer Networks, Network Protocols, Reference Models: The OSI Reference Model, The TCP/IP Reference Model.

THE PHYSICAL LAYER: Guided Transmission Media: Persistent Storage, Twisted Pairs, Coaxial Cables, Power Lines, Fiber Optics, Switching.

Unit 2 **11**

THE DATA LINK LAYER: Data Link Layer Design Issues: Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error detection and Correction: Error-Correcting Codes, Error-Detecting Codes.

MEDIUM ACCESS CONTROL SUB-LAYER: Multiple Access Protocols: ALOHA, CSMA Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols.

Unit 3 **10**

THE NETWORK LAYER: Network layer design issues. Routing Algorithms in a Single Network: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing. The Network Layer in the Internet**:** IPV4 Addresses, IPV6, Internet Control Protocol.

Unit 4 **9**

THE TRANSPORT LAYER: The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives. Elements of Transport Protocols**:** Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing. The Internet Transport Protocols: UDP, TCP.

Unit 5 **10**

THE APPLICATION LAYER: The Domain Name System, Electronic Mail, World Wide Web.

NETWORK SECURITY: Cryptography: Introduction, Two Fundamental Cryptographic Principles, Substitution Ciphers. Symmetric-Key Algorithms: The Data Encryption Standard, The advanced Encryption Standard.

Prescribed Textbook:

1. Andrew S. Tanenbaum, Nick Feamster, David J.Wetherall Computer Networks, 6th Edition, Pearson Education.

Reference Books:

1. Behrouz A. Forouzan, Data communications and networking, 5th Edition, Mc GrawHill Education.
2. Douglas E. Comer, Internetworking with TCP/IP – Principles, protocols and architecture, 5th Edition, PHI.
3. Behrouz A. Forouzan, Data communications and networking, 5th Edition, Mc GrawHill Education.
4. Douglas E. Comer, Internetworking with TCP/IP – Principles, protocols and architecture, 5th Edition, PHI.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Database Management Systems
Course Code	**:**	26CCSA03T
Course offered to	**:**	Computer Science / Computer Applications
Credits	**:**	4

Course Objectives

1 To Comprehend database concepts, ER diagrams, and relational models.
2 To Summarize relational algebra, calculus, and SQL queries.
3 To Summarize functional dependencies and normalization techniques.
4 To understand transactions, concurrency control, and recovery methods.
5 To understand file organization, B+ trees, and hashing techniques.

Course Outcomes

1 Explain database concepts, ER diagrams, relational models, and integrity constraints.
2 Apply relational algebra, calculus, and SQL to retrieve and modify data.
3 Analyze functional dependencies and normalization techniques to improve database design.
4 Analyze transactions, concurrency control, and recovery methods.
5 Apply and compare indexing and hashing techniques for efficient data access.

Unit 1 **12**

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 Database 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 2 **12**

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 Databases.

Unit 3 **10**

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 4 **10**

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 5 **10**

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.

Prescribed Textbook:

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education.

Reference Books:

1. A.Silberschatz, H.F. Korth, S.Sudarshan , Data base System Concepts, 7th Edition, McGraw Hill Education.
2. Ramez Elmasri, Shamkat B. Navathe, Database Systems, 7th Edition, Pearson Education.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Computer Organization
Course Code	**:**	26CCSA04T
Course offered to	**:**	Computer Science / Computer Applications
Credits	**:**	4

Course Objectives

1 To understand computer fundamentals, data representation, number systems, Boolean algebra, logic gates, and digital circuit design.
2 To apply memory hierarchy, memory technologies, associative memory, and cache mapping techniques.
3 To understand CPU organization, registers, stack operations, instruction formats, addressing modes, and data manipulation.
4 To analyze parallel processing, pipelining, vector processing, pipeline hazards, and array processors.
5 To analyze computer systems, microprogrammed control, interconnection networks, and I/O organization, including interrupts and DMA

Course Outcomes:

1 Explain computer organization, functional units, and data representation.
2 Apply Boolean algebra and design basic digital circuits.
3 Analyze memory organization, CPU architecture, and addressing modes.
4 Analyze pipelining, vector processing, and parallel processing techniques.
5 Eplain microprogrammed control, interrupts, DMA, and I/O processors.

Unit 1 **12**

BASIC STRUCTURE OF COMPUTER: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.

DATA REPRESENTATION: Data Types – Number Systems, Octal and Hexadecimal Numbers, Decimal Representation, Complements – (r-1)'s Complement, (r)'s Complement, Subtraction of Unsigned Numbers, Floating-point representation, BCD codes, Gray codes.

DIGITAL LOGIC CIRCUITS AND DIGITAL COMPONENTS: Digital Computers, Logic Gates, Boolean algebra – Complement of a Function, Map Simplification – Product-of-Sums Simplification, Don't-Care Conditions, Combinational Circuits – Half-Adder, Full-Adder, Flip-Flops – SR Flip-Flop, D Flip-Flop, JK Flip-Flop, T Flip-Flop, Sequential Circuits – Flip-Flop Input Equations, State Table, State Diagram, Integrated Circuits, Decoders, Encoders, Multiplexers.

Unit 2 **9**

MEMORY ORGANIZATION Memory Hierarchy, Main Memory – RAM and, ROM Chips, Memory Address Map, Memory Connection to CPU, Memory Technology, ROM PROM, EEPROM, Flash Memory, RAM Technologies, Auxiliary Memory – Magnetic Disk, Magnetic Tape, Associative Memory-Hardware Organization, Match Logic, Read Operation and Write Operation, Cache Memory-Associative Mapping, Direct Mapping, Set-Associative Mapping.

Unit 3 **10**

BASIC CENTRAL PROCESSING UNIT ORGANIZATION: Introduction, General Register Organization – Control Word, Examples of Micro operations, Stack Organization – Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expressions, Instruction Formats – Three-address Instructions, Two-address Instructions, One-address Instructions, Zero-address Instructions, Addressing Modes, Data Transfer and Manipulation – Data Transfer Instructions, Data Manipulation Instructions, Arithmetic Instructions, Logical and Bit Manipulation Instructions, Shift Instructions.

Unit 4 **9**

PIPELINE AND VECTOR PROCESSING: Parallel Processing – Loosely Coupled and tightly Coupled Computers, Amdahl's Law and Example, Pipelining – General Considerations, Arithmetic Pipeline, Instruction Pipeline – Example: Four-Segment Instruction Pipeline, Pipeline Hazards, RISC pipeline - Example: Three-Segment Instruction Pipeline, Delayed Load, Delayed Branch, Vector Processing, Vector Operations, Matrix Multiplication, Memory Interleaving, Supercomputers, Array Processors – Attached Array Processor, SIMD Array Processor.

Unit 5 **11**

LARGE COMPUTER SYSTEMS: Forms of Parallel Processing, Array Processors, The Structure of General Purpose, Interconnection Networks.

MICRO PROGRAMMED CONTROL: Control Memory, Address Sequencing – Conditional Branching, mapping of Instruction, Subroutines, Micro program Example – Computer Configuration, Microinstruction Format, Symbolic Microinstructions, The Fetch Routine, Design of Control Unit – Micro program Sequencer.

INPUT-OUTPUT ORGANIZATION: Peripheral Devices – ASCII Alphanumeric Characters, Modes of Transfer – Example of Programmed I/O, Interrupt-Initiated I/O, Priority Interrupts – Daisy-Chaining Priority, Parallel Priority Interrupt, Direct Memory Access (DMA) – DMA controller, DMA Transfer, Input- Output process or (IOP) - CPU-IOP Communication.

Prescribed Textbook:

1. M. Morris Mano, Computer System Architecture, 3rd Edition, Pearson Education.

Reference Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 6th Edition, McGrawHill.
2. William Stallings, Computer Organization and Architecture, 7th Edition, Pearson Education.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Operating Systems
Course Code	**:**	26CCSA05T
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1 To Comprehend operating system concepts, types, and system calls.
2 To Understand process management, CPU scheduling, and synchronization techniques.
3 To Understand deadlock handling techniques.
4 To Summarize memory management, file systems, and disk scheduling techniques
5 To Understand system protection principles and security mechanisms.

Course Outcomes

1 To Explain operating system types and system calls.
2 To Analyze CPU scheduling algorithms and apply process synchronization techniques.
3 To Apply deadlocks and their prevention, avoidance, detection, and recovery methods.
4 To Analyze memory management techniques and apply file allocation and disk scheduling algorithms.
5 To Explain protection methods and firewall mechanisms.

Unit 1 **10**

OPERATING SYSTEM INTRODUCTION: Operating System Definition, Evolution of Operating Systems- Simple, Batch, Multi Programmed, Time-Shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System Calls, Types of System Calls.

Unit 2 **10**

PROCESS AND CPU SCHEDULING: Process Concepts- The Process, Process State, Process Control Block.

PROCESS SCHEDULING: Scheduling Queues, Schedulers, Context Switch, Preemptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling Algorithms,

PROCESS COORDINATION: Process Synchronization, the Critical-Section Problem, Semaphores, Classic Problem of Synchronization

Unit 3 **10**

DEADLOCKS: System model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

Unit 4 **10**

MEMORYMANAGEMENT: Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms.

FILE SYSTEM INTERFACE: The Concept of a File, Access methods, Directory Structure, Allocation methods, Disk Scheduling algorithms.

Unit 5 **10**

PROTECTION: System Protection- Goals of Protection, Principles of Protection, Access Matrix

SECURITY:-The Security Problem, Program Threats, System and Network Threats, user authentication, Firewalling.

Prescribed Textbook:

1. Abraham Silberchatz, Peter B. Galvin, Operating System Principles, 8th Edition, Wiley Student Edition.

Reference Books:

1. Andrew S Tanenbaum. Modern Operating Systems. 3rd Edition, Pearson/ PHI.
2. W. Stallings, Operating Systems-Internal and Design Principles, 6th Edition, Pearson Education.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Artificial Intelligence
Course Code	**:**	26CCSE02T
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1 To Summarize the fundamentals of artificial intelligence, intelligent agents, and rational behavior.
2 To Understand problem-solving techniques using uninformed and informed search strategies.
3 To Understand knowledge representation, categories, objects, and reasoning techniques.
4 To Summarize machine learning techniques, including supervised learning, regression, classification, and ensemble learning.
5 To Summarize statistical learning and probabilistic model learning techniques.

Course Outcomes

1 To Explain AI concepts, agent structures, and environmental characteristics.
2 To Apply search algorithms and heuristic functions to solve AI problems
3 To Apply knowledge representation methods reasoning techniques to AI problems.
4 To Apply machine learning models to solve prediction and classification problems.
5 To Analyze learning with complete data and EM algorithms.

Unit 1 **10**

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 2 **10**

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

Unit 3 **9**

KNOWLEDGE REPRESENTATION: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World

Unit 4 **10**

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 5 **9**

LEARNING PROBABILISTIC MODELS: Statistical Learning, Learning with Complete data, Lear1qning with Hidden variables: The EM Algorithm.

Prescribed Textbook:

1. Stuart J. Russell & Peter Norvig, Artificial Intelligence A Modern Approach, 1st Edition, Pearson Education

Reference Books:

1. Kevin Knight, Elaine Rich & Shivashankar B Nair, Artificial Intelligence, 1st Edition, McGraw Hill Education.
2. Nils J. Nilsson: Principles of Artificial Intelligence, 1st Edition, Elsevier.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Machine Learning
Course Code	**:**	26CCSA07T
Course offered to	**:**	Computer Science/ Computer Applications
Credits	**:**	4

Course Objectives

1 To understand learning problems, concept learning, and decision tree algorithms.
2 To study neural networks, backpropagation, and genetic algorithms.
3 To understand Bayesian learning, Naïve Bayes classifiers, and the EM algorithm.
4 To learn K-Nearest Neighbor, Locally Weighted Regression, and Radial Basis Functions.
5 To study rule-based, analytical, and explanation-based learning techniques.

Course Outcomes

1 Summarize the fundamental concepts and principles of machine learning.
2 Apply neural networks and genetic algorithms to solve learning problems.
3 Apply Bayesian learning techniques and probabilistic models for classification and prediction.
4 Analyze instance-based learning algorithms such as K-Nearest Neighbor and Locally Weighted Regression.
5 Apply advanced learning techniques and analytical learning methods to solve complex problems.

Unit 1 **10**

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

Unit 2 **10**

NEURAL NETWORKS AND GENETIC ALGORITHMS: 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 3 **10**

BAYESIAN AND COMPUTATIONAL LEARNING: 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.

Unit 4 **9**

INSTANCE BASED LEARNING: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Bases Functions – Case Based Learning.

Unit 5 **10**

ADVANCED LEARNING: 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

Prescribed Textbook:

1. Tom M. Mitchell, Machine Learning, 1st Edition, McGraw Hill Education.

Reference Books:

1. Stephen Marsland, Taylor & Francis, Machine Learning: An Algorithmic Perspective, 2nd Edition, CRC Press.
2. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, Machine Learning, 2nd Edition, Pearson Education

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Data Science
Course Code	**:**	26CCSA08T
Course offered to	**:**	Computer Science / Computer Applications
Credits	**:**	4

Course Objectives

1 To understand the fundamentals, types, processes, and applications of Data Science.

2 To develop skills in data collection, cleansing, integration, transformation, and unsupervised learning.

3 To understand and apply supervised learning algorithms for prediction and classification.

4 To understand competency in data preprocessing and exploratory data analysis.

5 To develop practical skills in data visualization tools and real-world Data Science applications

Course Outcomes

1 Explain the fundamental concepts, processes, data types, and applications of Data Science.

2 Apply data collection, cleansing, transformation, and unsupervised learning techniques.

3 Analyze and apply supervised machine learning algorithms for prediction and classification.

4 Analyze data preprocessing and exploratory data analysis, including visualization, clustering, and anomaly detection.

5 Apply data visualizations using R, ggplot2, Matplotlib, and Seaborn and apply Data Science techniques to real-world applications

Unit 1 **10**

FUNDAMENTALS OF DATA SCIENCE: Introduction, History, Data Science and Related Terminologies, Fundamental Fields, Types of Analytics, Applications, data science process model, data science toolkit, Types of data, Supervised Versus Unsupervised Learning, Importance of Data Visualization, Linear and Logistic Regression.

Unit 2 **11**

DATA SCIENCE PROCESS: Defining Research goals, Retrieving data, Cleaning, Integrating and Transforming data**.**

UNSUPERVISED LEARNING: Introduction, Association Rule Mining, Conjoint Analysis, Clustering. K - Means Clustering. **TEXT ANALYTICS:** Unstructured Data, Word cloud, Sentiment Analysis, Web and Social Media Analytics.

Unit 3 **10**

SUPERVISED LEARNING: Linear Regression, Multiple Linear Regression, Logistic Regression, Decision Tree, Classification and Regression Techniques, Random Forest, KNN, Naïve Bayes Algorithm, Linear Discriminant Analysis. Support Vector Machines (SVM), Time Series Forecasting.

Unit 4 **9**

EXPLORATORY DATA ANALYSIS: Steps in Data Preprocessing, Understanding the data, Dealing with missing values, Standardizing Data, Looking at the data, Visualization the data: Histogram, Count Plot, Boxplot, Cluster Analysis, Anomaly Detection, Association Rules, Patterns.

Unit 5 **10**

DATA VISUALIZATION: Introduction, Techniques, Types: Data Visualization using R, Packages: Interactive Graphics, The latticist Pakage, The ggplot2 package, Ggplots, Matplotlib Library, Seaborn Library.

DATA SCIENCE-APPLICATIONS: Applications of Data Science, Applications of Analytics: Healthcare, Agriculture, Business, Sports and Governance.

Prescribed Textbook:

1. B. Uma Maheswari, R. Sujatha, Introduction to Data Science Practical Approach with R and Python, 1st Edition, Wiley.

Reference Books:

1. Dan Toomey, R for Data Science, 1st Edition, Packt Publications.
2. Davy Cielen, Arno Meysmen, Mohamed Ali, Introducing Data Science, Big Data, Machine Learning and more using Python tools, 1st Edition, Manning Publications.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Block Chain Technologies
Course Code	**:**	26CCSA09T
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1. To understand the basics, types, features, benefits, and limitations of blockchain, along with decentralization, smart contracts, DApps, and DAOs
2. To understand cryptography, encryption, public and private keys, hash functions, and Merkle trees
3. To describe about Bitcoin, its transactions, network, payments, and alternative crypto currencies
4. To understand smart contracts, Ethereum, and their working principles
5. To discuss about Hyperledger and other blockchain platforms such as Fabric, Sawtooth, Corda

Course Outcomes

1. Explain blockchain basics, features, types, uses, the CAP theorem, decentralization, smart contracts, DApps, and DAOs
2. Explain cryptography, encryption techniques, hash functions, and Merkle trees
3. Analyze Bitcoin transactions, Bitcoin networks, payments, and alternative cryptocurrencies
4. Explain smart contracts, Ethereum architecture, transactions, accounts, and Ether
5. Analyze the Hyper ledger and other blockchain platforms based on their features and applications

Unit 1 **10**

BLOCK CHAIN : Distributed systems, The history of block chain, Introduction to block chain, Features of Block chain, Applications of Block chain, Types of Block chain, CAP theorem and block chain, Benefits and limitations of block chain

DECENTRALIZATION: Decentralization using block chain, Methods of decentralization, Routes to decentralization, Block chain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications, Operations of Decentralized Applications, Platforms for decentralization

Unit 2 **9**

CRYPTOGRAPHY AND TECHNICAL FOUNDATIONS : Introduction, Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, DES, AES, Public and private keys, Hash Functions, Merkle trees, Financial markets and trading. Exchanges, Trade Life Cycle

Unit 3 **10**

BITCOIN : Bitcoin, Transactions, Types of Transactions, Bitcoin Block chain, Bitcoin network, Bitcoin payments, Bitcoin programming and the command- line interface, Bitcoin improvement proposals (BIPs). **Alternative Coins**: Theoretical foundations, Bitcoin limitations, Development of Altcoins, Name coin, Lite coin, Prime coin, Z-cash

Unit 4 **10**

SMART CONTRACTS : History, Ricardian contracts, The DAO.

Ethereum: Introduction, Ethereum block chain, Ethereum Transactions, Elements of the Ethereum block chain, Precompiled contracts, Accounts, Block, Ether, Etheruem network

Unit 5 **10**

HYPERLEDGER : Projects, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtoothlake, Corda, Alternative Block chains: Kadena, Stellar, Quorum, Maidsafe, Tendermint

Prescribed Textbook:

1. Imran Bashir, Mastering Blockchain, 2nd Edition, Packt Publishing Ltd.

Reference Books:

1. Josh Thompson, Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, 1st Edition, Create Space Independent Publishing Platform.
2. Melanie swan, Blockchain blueprint for a new economy, 1st Edition, O"REILLY

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Cryptography & Network Security
Course Code	**:**	26CCSA0AT
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1 To Comprehend network security concepts and classical encryption techniques.
2 To Understand symmetric encryption algorithms, block ciphers, and stream ciphers.
3 To Explore public-key cryptography and hash functions.
4 To Summarize message authentication, digital signatures, and key management.
5 To Understand network security protocols and secure communication.

Course Outcomes

1 Explain security concepts and classical encryption techniques.
2 Analyze DES, AES, and other encryption techniques.
3 Explain public-key algorithms and hash functions.
4 Analyze digital signatures, authentication, and key management.
5 Apply network security protocols and secure communication.

Unit 1 **8**

INTRODUCTION TO SECURITY: Security Concepts, Security Attacks, Security Services and Mechanisms, A model for network Security.

CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor machines, steganography.

Unit 2 **10**

BLOCK CIPHERS AND DES: Traditional Block Cipher Structure, DES, DES Example, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles. AES: Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Example, AES Implementation.

BLOCK CIPHER OPERATION: Multiple Encryption and Triple DES, electronic code book mode, cipher block chaining mode, cipher feedback mode, output feedback mode, counter mode, Pseudorandom Number Generation and Stream Ciphers: Principles and Pseudorandom Number Generation, Pseudorandom Number, Generators, Pseudorandom Number Generation using a Block Cipher, Stream, Ciphers, RC4.

Unit 3 **10**

PUBLIC-KEY CRYPTOGRAPHY AND RSA: Principles of Public-Key Cryptosystems, the RSA algorithm. Attacks and counter measure on RSA, Improvements on RSA.

OTHER PUBLIC-KEY CRYPTOSYSTEMS: Diffie-Hellman Key Exchange, ElGamal Cryptosystem, Elliptic Curve Arithmetic Elliptic Curve Cryptography, Cryptographic Hash Functions: Applications of Cryptographic Hash functions, Two Simple Hash Functions, Requirements and Security, Hash Functions based on Cipher Block Chaining, SHA.

Unit 4 **10**

MESSAGE AUTHENTICATION CODES: Requirements, functions, MACs, security of MACs, HMAC.

DIGITAL SIGNATURES: El Gamal Digital Signature, Schnorr digital signature, DSS.

KEY MANAGEMENT AND DISTRIBUTION: Symmetric key distribution using symmetric encryption, symmetric key distribution using asymmetric encryption, distribution of public keys, X.509 Certificates, Public-Key Infrastructure.

USER AUTHENTICATION PROTOCOLS: Remote User Authentication Principles, Remote User Authentication using Symmetric Encryption, Kerberos, Remote User Authentication Using Asymmetric Encryption.

Unit 5 **9**

TRANSPORT-LEVEL SECURITY: Web Security issues, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH), Electronic Mail.

SECURITY: Pretty Good Privacy, S/MIME, Domain Keys Identified Mail.

IP SECURITY: IP Security Overview, Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites.

Prescribed Textbook:

1. William Stallings, Cryptography and Network Security Principles and Practice, 7th Edition, Pearson Education.

Reference Books:

1. William Stllings, Network Security Essentials: Applications and Standards, 7th Edition, Pearson Education.
2. Bruce Schneier, Applied Cryptography: Protocols, Algorithms and Source Code in C, 2nd Edition, John Wiley & Sons, Inc.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Service Oriented Architecture
Course Code	**:**	26CCSA0BT
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1 To understand the fundamental concepts, characteristics, principles and architecture.
2 To explore web services, SOAP messaging, service descriptions, orchestration.
3 To understand service-oriented analysis, service modeling, service-oriented design.
4 To explore SOA platforms and technologies, including J2EE, JAX-WS, JAXB, JAXR.
5 To understand WS-BPEL, web service coordination, choreography, policies, and security.

Course Outcomes

1 Explain the fundamental concepts, characteristics, principles, and architecture.
2 Analyze web services, SOAP messaging, service layers, orchestration, and choreograph.
3 Apply service-oriented analysis, service modeling, and design principles.
4 Describe and utilize SOA platform technologies, including J2EE, JAX-WS, JAXB
5 Explain WS-BPEL, web service coordination, choreography, WS-Policy, and WS-Security.

Unit 1 **10**

INTRODUCTION: Origin of SOA- characteristics of SOA- Comparing SOA to client-server and distributed internet architectures- structure of SOA- interrelation of SOA components-principles of service orientation.

Unit 2 **10**

WEB SERVICES AND LAYERS: Service descriptions- messaging with SOAP- message exchange patterns- coordination- atomic transactions- business activities- orchestration-choreography- service layer abstraction-application service layer- business service layer-orchestration service layer

Unit 3 **10**

SOA DEVELOPMENT: Service oriented analysis- business-centric SOA- deriving business services- service modeling- service oriented design- WSDL basics- SOA composition guidelines- entity-centric business service design- application service design- task centric business service design

Unit 4 **10**

SOA PLATFORM BASICS: SOA support in J2EE- Java API for XML based web services (JAX-WS)- Java architecture for XML binding (JAXB)- Java API for XML registries (JAXR)-Java API for XML based RPC (JAX-RPC)- web services interoperability technologies (WSIT)-SOA support in .NET- common language runtime

Unit 5 **9**

WS-BPEL BASICS: WS-BPEL Language basics, WS-coordination overview- WS-choreography- WS-policy- WS-security

Prescribed Textbook:

1. Thomas Erl**,** Service-Oriented Architecture: Concepts, Technology, and Design, 1st Edition, Pearson Education.

Reference Books:

1. Thomas Erl, SOA Principles of Service Design, 1st Edition, The Prentice Hall Service-Oriented Computing Series
2. Newcomer, Lomow, Understanding SOA with Web Services, 1st Edition, Pearson Education.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Cloud Computing
Course Code	**:**	26CCSA0CT
Course offered to	**:**	Computer Science / Computer Applications
Credits	**:**	4

Course Objectives

1 To Comprehend cloud concepts, service models, and deployment models.
2 To understand cloud services and platforms.
3 To understand cloud application design and data storage methods.
4 To understand cloud security, data protection, and access control.
5 To Summarize cloud applications in different industries.

Course Outcomes

1 Explain cloud computing concepts, models, and applications.
2 Explain various cloud services and platforms.
3 Apply cloud design methods and data storage approaches.
4 Analyze cloud security and data protection methods.
5 Explain cloud computing applications in healthcare, energy, transportation, manufacturing, and education.

Unit 1 **10**

INTRODUCTION TO CLOUD COMPUTING : The Evolution of cloud computing, characteristics of Cloud Computing, Cloud Models: Service Models, Deployment Models, Cloud Services: IaaS, PaaS, SaaS. Cloud Based Services & Applications, Cloud Concepts & Technologies.

Unit 2 **10**

CLOUD SERVICES & PLATFORMS: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment & management Services, Identity & Access Management Services, Open Source Private Cloud Services.

Unit 3 **9**

DEVELOPING FOR CLOUD : Cloud Application Design, Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches: Relational Approaches, Non- Relational Approaches.

Unit 4 **10**

CLOUD SECURITY : Cloud Security Introduction**,** CSA Cloud Security Architecture, Authorization, Identity & Access Management, Data Security: Securing Data at Rest, Securing Data at in Motion, Key Management, Auditing.

Unit 5 **10**

CLOUD FOR INDUSTRY, HEALTHCARE & EDUCATION : Cloud Computing for Healthcare, Cloud Computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud Computing for Education.

Prescribed Textbook:

1. Arshdeep Bahga and Vijay Madisetti, Cloud Computing : A Hands-on Approach, 1st Edition, Universities Press Private Limited.

Reference Books:

1. Michael Miller, Cloud Computing, 1st Edition, Pearson Education India.
2. Dan C. Marinescu, Cloud Computing: Theory and Practice, 2nd Edition, Morgan Kaufmann Publishers.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Mobile Computing
Course Code	**:**	26CCSA0DT
Course offered to	**:**	Computer Science/ Computer Applications
Credits	**:**	4

Course Objectives

1 To Summarize mobile communication, architecture, devices, and mobility management.
2 To Understand GSM architecture, handover techniques, and security.
3 To Understand Mobile IP, network protocols, and packet delivery.
4 To Summarize MANETs, routing protocols, applications, and security.
5 To Comprehend WLAN, WAP, Bluetooth, and ZigBee technologies

Course Outcomes

1 Explain mobile communication, GSM, and wireless access methods.
2 Analyze Mobile IP, mobility management, and handover.
3 Analyze mobile databases, caching, and data processing.
4 Explain WLAN, WAP, and mobile Internet access.
5 Explain Bluetooth, ZigBee, and their security features

Unit 1 **10**

MOBILE COMMUNICATIONS : Mobile Communication, Mobile Computing (MC), Mobile computing architecture, Mobile devices, Data Dissemination, Mobile management.

GSM AND SIMILAR ARCHITECTURES: GSM services and System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Wireless Medium Access Control, Controlling Medium Access, SDMA, FDMA, TDMA.

Unit 2 **9**

MOBILE IP NETWORK LAYER: IP and Mobile IP Network Layers, packet delivery and Handover Management, Location management, registration, tunneling and encapsulation, Route optimization, Dynamic Host Configuration Protocol (DHCP).

MOBILE TRANSPORT LAYER: Conventional TCP / IP Transport Layer protocols, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Unit 3 **10**

DATABASES: Database Hoarding techniques, data caching, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

DATA DISSEMINATION: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

Unit 4 **9**

MOBILE ADHOC NETWORKS (MANETS): Introduction, Properties of a MANET, spectrum of MANET, Applications, routing and various routing algorithms, security in MANETs.

Unit 5 **10**

WIRELESS LAN, MOBILE INTERNET CONNECTIVITY AND PERSONAL AREA NETWORK: Wireless LAN (WiFi) Architecture and Protocol Layers, WAP1.1 and WAP2.0 Architectures, Bluetooth enable devices network, Security in Bluetooth Protocol, ZigBee.

Prescribed Textbook:

1. Raj Kamal, Mobile Computing, 3rd Edition, Oxford University Press.

Reference Books:

1. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson Education.
2. Reza Behravanfar, Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, 1st Edition, Cambridge University Press.

Title of the Course	**:**	Internet of Things
Course Code	**:**	26CCSA0ET
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1. To understand the basic concepts of IoT, connected devices, and internet protocols.
2. To discuss about IoT hardware, cloud services, and prototyping platforms such as Arduino, Raspberry Pi.
3. To understand physical prototyping methods such as 3D printing, laser cutting and milling.
4. To summarize embedded programming, memory management, battery optimization and debugging.
5. To understand IoT business models, product manufacturing, PCB design, software scalability and ethics.

Course Outcomes

1. Explain IoT concepts, connected devices, and internet communication protocols.
2. Describe and use suitable hardware and cloud platforms to develop IoT prototypes.
3. Apply physical prototyping techniques and integrate APIs into IoT systems.
4. Develop and debug embedded programs and improve device performance and battery life.
5. Explain IoT business models and apply product design, manufacturing, and ethical principles to IoT products.

Unit 1 **10**

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 2 **10**

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 3 **10**

PROTOTYPING THE PHYSICAL DESIGN: Laser Cutting, 3D Printing, CNC Milling, Repurposing and Recycling, Prototyping Online Components, New API, Real Time Reactions, Other Protocols.

Unit 4 **9**

TECHNIQUES FOR WRITING EMBEDDED CODE: Memory Management, Performance and Battery life, Libraries, Debugging .

BUSINESS MODELS : Models, Funding an Internet of Things Startup.

Unit 5 **10**

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

Prescribed Textbook:

1. Adrian McEwen and Hakim Cassimally, Designing The Internet of Things, 1st Edition, Wiley publications.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT.
2. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, A Press Publications.

Title of the Course : Data Warehousing And Mining
Course Code : 26CCSA0FT
Course offered to : Computer Science/Computer Applications
Credits : 4

Course Objectives

1 To Introduce the basic concepts and techniques of data mining and data pre-processing
2 To understand data warehouses, OLAP operations, and data cube computation.
3 To explore pattern mining, association rules, classification, and prediction.
4 To understand clustering methods and outlier detection techniques.
5 To explore data mining techniques for time series, streams, social networks, text, and web data

Course Outcomes

1 Explain data mining concepts and apply data pre-processing techniques
2 Explain data warehouses, OLAP operations, and data cube computation
3 Apply association rule mining, classification, and prediction techniques to datasets
4 Apply clustering methods to group data and detect outliers
5 Apply data mining techniques to streams, time series, social networks, text, and web data

Unit 1 **10**

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 2 **10**

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 3 **10**

MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS : Basic Concepts, Efficient and
Scalable Frequent Item set 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 Method

Unit 4 **9**

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 5 **10**

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

Prescribed Textbook:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publishers, Elsevier.

Reference Books:

1. Arun K Pujari, Data Mining Techniques, 2nd Edition, Universities Press.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, 2nd Edition, Pearson Education.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Software Testing Methodologies
Course Code	**:**	26CCSA0GT
Course offered to	**:**	Computer Science/ Computer Applications
Credits	**:**	4

Course Objectives

1 To understand the purpose, principles, and models of software testing.
2 To understand the concepts of flow graphs, path testing, predicates, path sensitizing, and path instrumentation.
3 To understand the fundamentals, strategies, applications, and tools of data-flow testing.
4 To understand path products, path expressions, regular expressions, and flow-anomaly detection techniques.
5 To understand state graphs, state testing, transition testing, and software testability.

Course Outcomes

1 Explain the purpose, principles, and models of software testing.
2 Explain flow graphs, path-testing concepts, predicates, and path instrumentation techniques.
3 Apply domain testing techniques to test input domains, interfaces, and software testability.
4 Apply logic-based testing techniques using decision tables, KV charts, and specifications.
5 Apply graph matrices, matrix operations, and node-reduction algorithms to analyze software structures.

Unit 1 **9**

INTRODUCTION: The Purpose of testing, Some Dichotomies, Model for Testing, Playing Pool and Consulting Oracles.

THE TAXONOMY OF BUGS: The Consequences of Bugs, Taxonomy for Bugs.

Unit 2 **10**

FLOW GRAPHS AND PATH TESTING: Basic Concepts of Path-Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing,

TRANSACTION-FLOW TESTING: Transaction flows, Transaction-Flow Testing Techniques, Implementation Comments

Unit 3 **10**

DATA FLOW TESTING: Basics of Dataflow testing, Data-Flow Testing Strategies, Application, Tools, Effectiveness.

DOMAIN TESTING: Domains and Paths, Nice Domains and Ugly Domains, Domain Testing, Domains and Interface Testing, Domains and Testability.

Unit 4 **9**

PATH, PATH PRODUCTS AND REGULAR EXPRESSIONS: Path Products and Path Expressions, A Reduction Procedure, Applications, Regular Expressions and Flow-Anomaly Detection.

LOGIC BASED TESTING: Motivational Overview, Decision Tables, Path Expressions, KV Charts, Specifications.

Unit 5 **10**

STATE, STATE GRAPHS AND TRANSITION TESTING: State Graphs, Good and Bad State Graphs, State Testing, Testability Tips.

GRAPH MATRICES AND APPLICATIONS: The Matrix of a Graph, Relations, The Powers of a Matrix, Node-Reduction Algorithm, Building Tools – Matrix Representation in Software, Matrix Operations, Node-Reduction Optimization.

Prescribed Textbook:

1. Boris Beizer. Software testing techniques, 2nd Edition, Dream tech.

Reference Books:

1. Edward kit, Software testing in the real world, 1st Edition, Addison-Wesley professional.
2. Dr.K.V.K.K.Prasad. Software Testing Tools, 1st Edition, Dream tech press.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Big Data Analytics
Course Code	**:**	26CCSA0HT
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1 To Comprehend Big Data concepts, types, and architecture.
2 To Understand Hadoop, HDFS, YARN, and MapReduce.
3 To Summarize Hive, Pig, and Spark for data processing.
4 To Comprehend machine learning and data stream mining techniques.
5 To Summarize graph analytics and social network analysis.

Course Outcomes

1 Explain Big Data concepts, types, and ETL processes.
2 Describe Hadoop tools for storing and processing big data.
3 Analyze Hive, Pig, and Spark for data analysis.
4 Apply machine learning techniques for data analysis.
5 Analyze graph analytics and social network analysis methods.

Unit 1 **9**

INTRODUCTION TO BIG DATA PLATFORM: characteristics, types, definitions, and classifications (3Vs, 4Vs), Challenges of conventional database management systems.

DATA CLASSIFICATION: Structuring of digital data (Structured, Semi-structured, Multi-structured, and Unstructured formats).

DATA ARCHITECTURE LAYERS: Data architecture design, managing data for analysis, ETL processes. Data sources, data quality metrics, pre-processing, and exporting data stores to the cloud platform.

Unit 2 **9**

HADOOP ARCHITECTURE & ECOSYSTEM: History, core components, and operational features of Apache Hadoop. Detailed design of the Hadoop Distributed File System (**HDFS**) for big data storage and command-line execution.

RESOURCE MANAGEMENT: Architecture and execution workflow of **YARN**.

MAPREDUCE PROGRAMMING MODEL: Execution mechanics of Map tasks and Reduce tasks, Grouping-by-keys, data partitioning, and combiners in the execution framework.

Unit 3 **10**

HIVE & PIG INFRASTRUCTURE: Hive architecture, workflows, data models, file formats, and comparisons with traditional RDBMS.

APACHE SPARK FOUNDATION: Spark cluster specifications, engine stack components, and deployment steps, data manipulation with Spark SQL, and using advanced Python features with Spark.

DATA ETL WITH SPARK: Constructing robust pipelines for Extract, Transform, and Load operations using built-in functions.

Unit 4 **12**

STATISTICAL CONCEPTS & ML IN BDA: Estimating data relationships using scatter plots, finding outliers, tracking variances, and correlation mechanics, Predictive modeling with Simple Linear Regression, Least Square Estimation, and Multiple Regressions.

CLASSIFICATION & CLUSTERING: Implementing K-Nearest-Neighbor (**K-NN**) regression/ classification, K-Means clustering, Hierarchical clustering, Stochastic Gradient Descent, Decision Trees, Naïve-Bayes theorem, Support Vector Machines (**SVM**), and Random Forest classifiers.

MINING DATA STREAMS: Introduction to stream data models, sources, queries, and architectural processing challenges. Stream computing constraints: sampling, filtering, counting distinct elements, estimating moments, counting 1's in a window, and decaying windows.

Unit 5 **9**

GRAPH ANALYTICS: Representing databases as graphs using triples, Resource Description Framework (**RDF**), Property Graph models, Implementing Apache **Spark GraphX** features and component frameworks.

WEB & SOCIAL NETWORK ANALYTICS: Text mining workflows, Web mining patterns, Computing PageRank iterations, identifying link spam, managing hubs/authorities, and clustering in social network graphs, Topological graph metrics using SimRank, clique/triangle counting, and community discovery.

Prescribed Textbook:

1. Raj Kamal, Preeti Saxena, Big Data Analytics: Introduction to Hadoop, Spark, and Machine-Learning, 1st Edition, McGraw Hill Education.

Reference Books:

1. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'Reilly Media.
2. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & Sons, 1st Edition, Wiley.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Deep Learning
Course Code	**:**	26CCSA0IT
Course offered to	**:**	Computer Science / Computer Applications
Credits	**:**	4

Course Objectives

1 To Summarize mobile communication, architecture, devices, and mobility management.
2 To Understand GSM architecture, handover techniques, and security.
3 To Understand Mobile IP, network protocols, and packet delivery.
4 To Summarize MANETs, routing protocols, applications, and security.
5 To Comprehend WLAN, WAP, Bluetooth, and ZigBee technologies

Course Outcomes

1 Explain mobile communication, GSM, and wireless access methods.
2 Analyze Mobile IP, mobility management, and handover.
3 Analyze mobile databases, caching, and data processing.
4 Explain WLAN, WAP, and mobile Internet access.
5 Explain Bluetooth, ZigBee, and their security features.

Unit 1 **12**

INTRODUCTION TO DEEP LEARNING: Artificial intelligence, Machine Learning, and Deep Learning, Research Domains and Industry Applications, Tools in Technologies

NECESSARY MATHEMATICS FOR DEEP LEARNING: Linear Algebra – Matrix, Vector, Transpose, Tensor, Operations on the elements. **Statistics:** Probability, Random variables, Binomial , Poisson, Normal , Sampling distributions, sampling, Central Limit theorem, x- square distribution, t – test distribution, f-distribution, hypothesis testing.

Unit 2 **10**

FUNDAMENTALS OF NEURAL NETWORK: Introduction, Understanding the Biological Neuron, Exploring the Artificial Neuron, Early implementation of ANN, types of activation functions, Architectures of Neural Network.

TRAINING DEEP NEURAL NETWORK: Mathematics Behind Back propagation, Deep L -Layer Neural Network, Understanding the Notion of Forward and Backward, Initializing Weights in Neural Network, Batch , Mini-batch and Stochastic Gradient Descent, Other Optimization Algorithms, Regularization – Gradient descent with momentum, Adagrad , Adadelta, RMSprop, Adam.

Unit 3 **10**

COMPUTER VISION USING CONVOLUTIONAL NEURAL NETWORK: Introduction to computer vision, how the Computer See the world, Building Blocks of Convolutional Neural Network, Building Convolutional Network, Popular CNN Architectures, Object Detection, Essential Pre-processing Tasks in Computer Vision.

Unit 4 **9**

REPRESENTATION LEARNING: Traditional Representation Learning, Autoencoder Fundamentals, Regularization and Autoencoders.

DEEP LEARNING ARCHITECTURES: Encoder – Decoder Architecture, Transfer Architecture, Generative Adversarial Network (GAN).

Unit 5 **9**

DEEP LEARNING FRAMEWORKS: Introduction, Refresher of Python Programming, Review of Python scikit-learn Library, Tensorflow2.0 with Keras Programming, Pytorch Programming.

Prescribed Textbook:

1. Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti , Deep Learning, 8th Edition, Pearson Education.

Reference Books:

1. M. Gopal, Deep Learning Core Concepts, Methods and Applications, 1st Edition, Pearson Education.
2. Nikhil Buduma , Fundamentals of Deep Learning,1st Edition, O'REILLY.

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, YSR District, AP – 516126, INDIA

Title of the Course	**:**	Neural Networks
Course Code	**:**	26CCSA0JT
Course offered to	**:**	Computer Science/Computer Applications
Credits	**:**	4

Course Objectives

1 To understand the fundamental concepts, history, structure, and functioning of biological and artificial neural networks.
2 To explore different neural network architectures, learning methods, learning laws.
3 To understand single-layer and multilayer neural networks, support vector machines.
4 To explore unsupervised learning techniques, including competitive learning.
5 To understand associative memory models and apply neural networks to optimization.

Course Outcomes

1 Explain the fundamental concepts, architectures, learning methods, and applications.
2 Apply perceptron learning algorithms and support vector classification techniques.
3 Analyze multilayer neural networks and implement backpropagation.
4 Apply unsupervised learning algorithms, including competitive learning, LVQ, ART.
5 Apply associative memory models and neural network techniques to solve optimization.

Unit 1 **10**

INTRODUCTION: History of Neural Networks, Structure and function of biological and artificial neuron, models of a neuron, Neural network architectures, Neural learning, Learning laws Applications of neural networks to solve tasks such as clustering and pattern association, Evaluation of Networks.

Unit 2 **10**

SUPERVISED LEARNING-I: Single layer networks: Supervised and unsupervised learning, Perceptron's, Linear separability, Perceptron training algorithm, Guaranty of success, Modifications, Support vector classification

Unit 3 **10**

SOA DEVELOPMENT: Service oriented analysis- business-centric SOA- deriving business services- service modeling- service oriented design- WSDL basics- SOA composition guidelines- entity- centric business service design- application service design- task centric business service design

Unit 4 **10**

UNSUPERVISED LEARNING: Winner - Take - all networks, Learning vector quantizes, Counter propagation networks, Adaptive Resonance Theory, topologically organized networks, Distance based learning, principal component analysis networks

Unit 5 **10**

ASSOCIATIVE MEMORIES: Non iterative procedures for association, Hopfield networks, Boltzmann Machines, Hetero-associators, Applications of Neural Networks: Optimization, Travelling salesperson, Applications in Pattern recognition and image processing.

Prescribed Textbook:

1. Kishan Mehrotra, Chelkuri K. Mohan, Sanjeev Ranka – Elements of Artificial Neural Networks Penram, 1st Edition, The MIT Press.

Reference Books:

1. J.M. Zurada - Introduction to Artificial Neural Systems, 1st Edition, Jaico Publications.
2. Rajasekharan and Pai - Neural Networks, Fuzzy Logic and Genetic algorithms: Synthesis and Applications, 1st Edition, PHI Publication.