



School of Computer Science & IT Devi Ahilya Vishwavidyalaya

SYLLABUS

M. Tech (Computer Science) 2 years

Program Educational Objectives (PEOs)

- PEO 1:** Acquire theoretical and practical knowledge in Computer Science to pursue career in industry or academia.
- PEO 2:** Develop analysis, design, and implementation skills to solve real-life problems using modern tools and technologies.
- PEO 3:** Carry out research and development work leading to entrepreneurial activities.

Program Specific Outcomes (PSOs)

- PSO 1:** Design and implement solutions in emerging areas such as AI&ML and Data Science.
- PSO 2:** Develop expertise in cloud computing and enhance ability to undertake cloud-based projects.

II - SEMESTER

CS-5319: AGILE SOFTWARE ENGINEERING

Course Outcomes (COs):

- CO1:** Interpret the concept of agile software engineering and its advantages in software development.
- CO2:** Analyze the core practices behind several specific agile methodologies.
- CO3:** Identify the roles and responsibilities in agile projects and their difference from projects following traditional methodologies.
- CO4:** Familiarizing the students with basic Agile Estimation & Planning.
- CO5:** Facilitate students in understanding the Tracking Agile Projects, differentiating tools and testing.
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Course Contents

UNIT-I

No. of Hours: 8

Agile Software Development: The History and Value of Agile Software Development, The Agile Manifesto, Principles of Agile, Organizational Culture Considerations with Agile, What Is Organizational Culture, and Why Does It Matter? The Team Members' Viewpoint, A Manager's Viewpoint, An Executive's Viewpoint, Success and Failures.

UNIT-II

No. of Hours: 8

Understanding the Different Types of Agile: Introduction to Extreme Programming (XP), Pair Programming, Scrum, Feature-Driven Development, Dynamic Systems Development Method, Lean Software Development and Kanban. Describing the Different Roles: Deep Dive into Scrum Roles, Product Owner, Scrum Master, The Team, Extended Team Members, Roles in Other Methodologies: Project Sponsor, Requirements Gatherer, Agile Coach.

UNIT-III

No. of Hours: 8

The New Way to Collect and Document Requirements: Old Form of Requirements Gathering, Agile Requirements in Scrum, Enhancing Requirements, From User Stories to Deliverables, Case Study.

UNIT-IV

No. of Hours: 8

Grooming and Planning: Product Backlog (Scrum and XP), Prioritization of Stories, Estimating, Scrum: Sprint Planning, Extreme Programming: XP Planning Game, Triple Constraints.

UNIT-V

No. of Hours: 8

Testing, Quality, and Integration: Creating a Quality-Focused Culture, Test-Driven Development (Unit Testing), Refactoring. Tracking and Reporting: Kanban Board, Work in Progress (WIP) Limit, Burn Charts, Feature-Driven Development (FDD) Parking Lots. Meetings or Ceremonies: Daily Stand-Up Meeting, Sprint Review or Demo, Retrospectives.

Text Books:

1. Introduction to Agile Methods- Sondra Ashmore, Kristin Runyan, Addison Wesley, 2015.
2. Agile Software Engineering- Orit Hazzan, Yael Dubinsky, Springer, 2008

Reference Books:

1. Software Engineering: Concepts & Practices- Ugrasen Suman, Cengage Learning Publications, 2nd Ed., 2022.

Online Resources:

CS-5319: AGILE SOFTWARE ENGINEERING - PRACTICAL

Course Outcomes (COs):

CO1: Understand the Agile Manifesto and its principles, and create and manage an Agile Product Backlog.

CO2: Able to write User Stories and Acceptance Criteria.

CO3: Implement Sprint Planning, Daily Stand-ups, and Retrospectives.

CO4: Able to use Tools for Agile Management.

CO5: Able to apply Test-Driven Development.

Course Contents

UNIT-I

No. of Hours: 4

Agile Project Inception & Requirements Analysis

Topic: Project Charter Creation & User Story Development

Focus Areas: Introduction to Agile & Scrum, Project Charter (Scope, Goals, Stakeholders), User Roles & Personas, User Story Writing, Story Point Estimation.

Deliverable: Product Backlog document with user stories & story points.

UNIT-II

No. of Hours: 4

Sprint Planning & Agile Tool Configuration

Topic: Sprint Planning and Kanban Board Setup

Focus Areas: Scrum roles & ceremonies, Sprint Planning, Product Backlog vs Sprint Backlog, Agile tools (Trello / Jira), Kanban workflow

Deliverable: Screenshot of configured board, Sprint Backlog with selected stories.

UNIT-III

No. of Hours: 4

Iterative Development & Agile Communication

Topic: Daily Stand-ups & UI Prototyping

Focus Areas: Daily Stand-up meetings, Incremental development, Agile communication, UI/UX basics & wireframing

Deliverable: Stand-up log (3–5 days), UI mock-up screenshots, Updated Scrum board showing progress.

UNIT-IV

No. of Hours: 4

Agile Testing & Test-Driven Development (TDD)

Topic: Implementing TDD for Checkout Functionality

Focus Areas: Agile testing principles, Test-Driven Development (Red–Green–Refactor), Unit testing, Code refactoring

Deliverable: TDD report including: Test cases, Code snippets, Test results (pass/fail).

UNIT-V**No. of Hours: 4**

Sprint Review, Retrospective & Agile Metrics

Topic: Sprint Evaluation and Continuous Improvement

Focus Areas: Sprint Review, Sprint Retrospective, Agile metrics (Velocity, Burndown), Continuous improvement

Deliverable: Final Sprint Report including: Completed user stories, Velocity chart, Retrospective summary, Improvements planned for next sprint.

Text Books:

1. Introduction to Agile Methods- Sondra Ashmore, Kristin Runyan, Addison Wesley, 2015.
2. Agile Software Engineering- Orit Hazzan, Yael Dubinsky, Springer, 2008.

Reference Books:

1. Software Engineering: Concepts & Practices- Ugrasen Suman, Cengage Learning Publications, 2nd Ed., 2022.

Online Resources:

CS-5618: NETWORK SECURITY

Course Outcomes (COs):

CO1: Explain basic communication networks, security goals, and network attacks.

CO2: Analyze mechanisms for message integrity, authentication, and non-repudiation.

CO3: Describe authentication frameworks, PKI, and digital certificates.

CO4: Apply network, transport, wireless, and perimeter security mechanisms.

CO5: Evaluate emerging security technologies and future cybersecurity challenges.

Course Contents

UNIT-I

No. of Hours: 8

Fundamentals of Network Security: Introduction to communication networks and their role in modern information systems. Review of basic networking concepts and architectures. Introduction to network security: objectives, principles, and security goals. Classification of network threats and vulnerabilities. Types of attacks on networks including passive and active attacks. Common network attacks such as eavesdropping, spoofing, replay attacks, man-in-the-middle attacks, denial-of-service, and distributed denial-of-service attacks. Impact of network attacks on confidentiality, integrity, and availability.

UNIT-II

No. of Hours: 8

Message Protection and Data Integrity Mechanisms: Message integrity and data authentication concepts. Cryptographic hash functions and their properties. Secure message digest generation and verification. Digital signatures: concept, working principles, and applications in secure communication, electronic transactions, and authentication systems. Role of integrity and non-repudiation in secure networked environments.

UNIT-III

No. of Hours: 8

Authentication and Key Management Infrastructure: Introduction to authentication and access control. Authentication principles and security requirements. Entity authentication and message authentication mechanisms. Role of trust in secure systems. Public Key Infrastructure (PKI): architecture and components. Digital certificates and their purpose. Certificate authorities and trust models. Certificate issuance, validation, renewal, and revocation. Role of PKI in secure electronic transactions and communications.

UNIT-IV

No. of Hours: 8

Network and Wireless Security Mechanisms: Introduction to security at different network layers. Transport Layer Security (TLS): objectives and basic working principles. Network layer security mechanisms. Virtual Private Networks (VPNs): concepts, types, and applications. Security issues and solutions in Wireless Local Area Networks (WLANs). Wireless cellular network security and associated challenges. Firewalls: types, architectures, and deployment strategies. Intrusion

Detection Systems (IDS) and Intrusion Prevention Systems (IPS): concepts, types, and operational principles.

UNIT-V

No. of Hours: 8

Emerging Security Technologies and Advanced Topics: Introduction to cryptocurrencies and blockchain technology. Fundamental concepts of blockchain architecture and security features. Cloud computing security: threats, vulnerabilities, and protection mechanisms. Security challenges in the Internet of Things (IoT). Hardware security concepts and trusted hardware components. Anonymous communication systems and privacy preservation. Onion routing and anonymous network communication. Introduction to post-quantum cryptography and future challenges in cryptographic security.

Text Books:

1. Network Security: Private Communication in a Public World, C. Kaufman, R. Perlman, M. Speciner, R. Perlner, Pearson Education, 3rd Edition, 2024.
2. Computer Networking: A Top Down Approach, J. Kurose, K. Ross, Pearson Education, 8th Edition, 2022.

Reference Books:

1. Cryptography, Network Security, and Cyber Laws, B. L. Menezes, R. Kumar, Cengage Learning India Pvt. Ltd., 2018.
2. Real 802.11 Security: Wi Fi Protected Access and 802.11i, J. Edney, W. A. Arbaugh, Pearson Education, 2004.
3. Cryptography and Network Security: Principles and Practice, W. Stallings, Pearson Education, 8th Edition, 2023.
4. Computer Networks: A Systems Approach, L. Peterson, B. Davie, Morgan Kaufmann, 6th Edition, 2021.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc26_ee20/preview

CS-5618: NETWORK SECURITY- PRACTICAL

Course Outcomes (COs):

CO1: Analyze network traffic and identify common network attacks.

CO2: Implement data integrity and non-repudiation using cryptographic tools.

CO3: Apply authentication mechanisms and manage digital certificates.

CO4: Configure and evaluate network, wireless, and perimeter security solutions.

CO5: Explore emerging cybersecurity technologies through case studies and projects.

Course Contents

UNIT-I

No. of Hours: 6

Fundamentals of Network Security:

1. Study of basic network configurations using TCP/IP tools.
2. Packet capturing and analysis using Wireshark.
3. Identification and analysis of common network attacks (e.g., sniffing, spoofing, DoS) in a controlled environment.
4. Demonstration of network vulnerability scanning using standard tools.

UNIT-II

No. of Hours: 6

Message Protection and Data Integrity Mechanisms:

1. Generation and verification of cryptographic hash values using standard hash algorithms.
2. Demonstration of digital signature creation and verification.
3. Integrity checking of transmitted files using hash-based techniques.
4. Case study–based analysis of integrity and non-repudiation failures.

UNIT-III

No. of Hours: 6

Authentication and Key Management Infrastructure:

1. Study of authentication mechanisms used in networked systems.
2. Creation and verification of digital certificates using a certificate authority tool.
3. Demonstration of certificate validation and revocation checking.
4. Analysis of PKI-based secure communication scenarios.

UNIT-IV

No. of Hours: 6

Network and Wireless Security Mechanisms:

1. Configuration and analysis of Transport Layer Security (TLS) connections.
2. Setup and testing of Virtual Private Network (VPN).
3. Configuration of firewall rules and traffic filtering.
4. Demonstration of Intrusion Detection System (IDS) alerts and logs.
5. Study of security mechanisms in WLANs and wireless networks.

UNIT-V**No. of Hours: 6**

Emerging Security Technologies and Advanced Topics:

1. Study of blockchain structure and transaction validation.
2. Case study on cloud security threats and mitigation strategies.
3. Analysis of security issues in IoT environments.
4. Demonstration of anonymous communication concepts using onion routing tools.
5. Seminar or mini-project on post-quantum cryptography or emerging security trends.

Text Books:

1. Network Security: Private Communication in a Public World, C. Kaufman, R. Perlman, M. Speciner, R. Perlner, Pearson Education, 3rd Edition, 2024.
2. Computer Networking: A Top Down Approach, J. Kurose, K. Ross, Pearson Education, 8th Edition, 2022.

Reference Books:

1. Cryptography, Network Security, and Cyber Laws, B. L. Menezes, R. Kumar, Cengage Learning India Pvt. Ltd., 2018.
2. Real 802.11 Security: Wi Fi Protected Access and 802.11i, J. Edney, W. A. Arbaugh, Pearson Education, 2004.
3. Cryptography and Network Security: Principles and Practice, W. Stallings, Pearson Education, 8th Edition, 2023.
4. Computer Networks: A Systems Approach, L. Peterson, B. Davie, Morgan Kaufmann, 6th Edition, 2021.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc26_ee20/preview

CS-6226: ADVANCED ALGORITHM DESIGN

Course Outcomes (COs):

CO1: Understand complexity representation in terms of asymptotic notations.

CO2: Apply different algorithm design paradigms such as divide-and-conquer, greedy and dynamic programming for effective problem-solving

CO3: Understand and analyse major graph algorithms.

CO4: Apply string matching algorithms.

CO5: Understand design paradigms such as backtracking, branch & bound and concept of complexity class.

Course Contents

UNIT-I

No. of Hours: 8

Introduction to Algorithms, Time & Space Complexity, Sorting: Merge Sort, Quick Sort, Heap Sort; Searching: Linear Search, Binary Search, Hashing.

UNIT-II

No. of Hours: 8

Greedy Techniques & its Applications: Fractional Knapsack, Activity Selection Problem
Dynamic Programming & its Applications: Fibonacci Computation, 0/1 Knapsack Problem, Longest Common Subsequence Problem, Edit Distance Problem; Matrix Chain Multiplication. Edit distance, All pair shortest paths – Warshal's and Floyd's algorithms.

UNIT-III

No. of Hours: 8

Graph Algorithms, Traversal: BFS, DFS; Shortest Path: Dijkstra's Shortest Path Algorithm; Computation of Minimum Spanning Trees: Prim Algorithm, Kruskal Algorithm.

UNIT-IV

No. of Hours: 8

String Matching Algorithms: Naïve Algorithm, KMP Algorithm, Rabin-Karp Algorithm.

UNIT-V

No. of Hours: 8

Backtracking: n-Queen Problem, Sum of Subset, Branch and Bound: Travelling Salesman Problem, Introduction to P, NP, NP-complete, NP-Hard.

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest (2022), Introduction to Algorithms, Fourth edition, Prentice Hall of India.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran (2008), "Fundamentals of Computer Algorithms", Orient Longman Pvt. Ltd.

Reference Books:

1. Gilles Brassard Paul Bratley (1996), "Fundamentals of Algorithms", Prentice Hall.
2. Anany Levitin (2009), "An Introduction to Design and Analysis of Algorithms", Pearson.

Online Resources:

1. NPTEL Course Video Lectures on "Design and Analysis of Algorithms" - By Prof. Abhiram G Ranade, Prof. Ajit A Diwan, Prof. Sundar Viswanathan IIT Bombay
2. NPTEL Course Video Lectures on "Design and Analysis of Algorithms" - Prof. Madhavan Mukund, Chennai Mathematical Institute.

CS-6226: ADVANCED ALGORITHM DESIGN - PRACTICAL

Course Outcomes (COs):

CO1: Compare and analyse different data structures and sorting algorithms.

CO2: Analyse major graph algorithms.

CO3: Implement different algorithm design paradigms such as greedy, dynamic programming, backtracking, branch and bound for effective problem-solving.

CO4:

CO5:

Course Contents

UNIT-I

No. of Hours: 8

Implement the following sorting algorithm for a given set of elements and determine the time required to sort the elements. The elements can be read from a file or can be generated using the random number generator.

1. Quick sort
2. Merge sort
3. Heap Sort
4. Counting Sort

Implement the following Searching algorithm for a given set of elements and determine the time required to sort the elements. The elements can be read from a file or can be generated using the random number generator.

1. Linear Search,
2. Binary Search,
3. Hashing

UNIT-II

No. of Hours: 8

Write programs to find the optimal solution for the following problems using the Greedy Method

1. Fractional Knapsack
2. Activity Selection Problem.
3. Minimum Spanning trees – Prim's and Kruskal's algorithms.
4. Single-source shortest paths - Dijkstra's algorithms

UNIT-III

No. of Hours: 8

Write programs to find the optimal solution for the following problems using the Dynamic Programming approach

1. 0/1 Knapsack
2. Longest Common Subsequence (LCS)
3. Matrix Chain Multiplication

4. Edit distance
5. All pair shortest paths – Warshal’s and Floyd’s algorithms

UNIT-IV

No. of Hours: 8

Write programs to print all the nodes reachable from a given starting node in a graph using the following traversal methods

1. Breadth First Search (BFS)
2. Depth First Search (DFS)

Write programs to implement the following string matching algorithms:

1. Naïve Algorithm
2. KMP Algorithm,
3. Rabin-Karp Algorithm

UNIT-V

No. of Hours: 6

Write programs to find the optimal solution for the following problems using the Backtracking approach

1. Graph Coloring
2. Sum of Subset

Write a program to find the optimal solution for the following problems using the Branch and Bound method

1. Travelling Salesman Problem

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest (2022), Introduction to Algorithms, Fourth edition, Prentice Hall of India.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran (2008), “Fundamentals of Computer Algorithms”, Orient Longman Pvt. Ltd.

Reference Books:

Online Resources:

1. NPTEL Course Video Lectures on “Design and Analysis of Algorithms” - By Prof. Abhiram G Ranade, Prof. Ajit A Diwan, Prof. Sundar Viswanathan IIT Bombay
2. NPTEL Course Video Lectures on “Design and Analysis of Algorithms” - Prof. Madhavan Mukund, Chennai Mathematical Institute.

CS-6313: SOFTWARE TESTING & QUALITY ASSURANCE

Course Outcomes (COs):

CO1: Develop the tester's perspective resulting in software quality improvement

CO2: Learn modern techniques of manual and automated testing

CO3: Acquire skills of creating, managing and tracking the test cases.

CO4: Define and comply with custom specific quality process in the company.

CO5: Acquire proficiency in tools for configuration management, test case management and automated testing.

Course Contents

UNIT-I

No. of Hours: 10

Software Testing: Introduction and background, Big picture of software development process and testing component in every phase of the process, Software testing terms and definitions: Black box & white box testing, static and dynamic testing, unit, integration, system, validation, acceptance, regression testing. Unit test Automation with JUnit, Techniques of black box testing: Preparing tests-to-pass and tests-to-fail, equivalence partitioning, data and state testing, White box testing: formal reviews of the code, programming standards and guidelines, preparing code review checklists, Data & Code coverage techniques

UNIT-II

No. of Hours: 10

Configuration and Compatibility testing: Isolating configuration bugs, identifying requirements of hardware, software and network, identifying platform and application versions, backward and forward compatibility, Data sharing compatibility, Foreign Language testing: Translation issues, ASCII, EBCDIC, Hotkeys and shortcuts, extended characters, computation on characters, localisation, compatibility and configurability issues, Documentation testing, Types of documentation testing, preparing checklists before documentation testing, Security testing, Website testing: Web page fundamentals.

UNIT-III

No. of Hours: 5

Automation Testing: Techniques and methods, Seminar on popular tools like Winrunner and Rational ROBO, Hands on experience on these tools.

UNIT-IV

No. of Hours: 5

Test Planning: Test Phases, Resource, manpower requirements, test strategy, test schedule, bug reporting mechanisms, metrics and statistics writing and tracking test cases, Introduction to automated bug tracking and test case management systems.

UNIT-V

No. of Hours: 10

Usability: Importance and Impact on SDLC, Generations of User Interfaces, The Usability Engineering Lifecycle, Usability Heuristics, Usability Testing, Usability Assessment Methods beyond Testing, Interface Standards, International User Interfaces. CMM: Process, Need for Process Improvement & Standards, Assessment, Improvement and Compliance against Matured Processes, Software Quality tradeoffs, Introduction: CMM Level I to V, Case Studies.

Text Books:

1. Software testing Ron Patton SAMS Publishing
2. CMM Level 5 unleashed

Reference Books:

1. Effective methods of software testing' Wiley Publishers, William E. Perry

Online Resources:

CS-6313: SOFTWARE TESTING & QUALITY ASSURANCE - PRACTICAL

Course Outcomes (COs):

CO1: Develop the tester's perspective resulting in software quality improvement

CO2: Learn modern techniques of manual and automated testing

CO3: Acquire skills of creating, managing and tracking the test cases.

CO4: Define and comply with custom specific quality process in the company.

CO5: Acquire proficiency in tools for configuration management, test case management and automated testing.

Course Contents

UNIT-I No. of Hours: 8

1. To Test a basic data structure programs
2. To Test a Sample Website Using LoadRunner

UNIT-II No. of Hours: 8

3. To Perform Automation Testing on a Sample Website using Selenium and JMeter
4. To Test a Sample Android Application Using Bitbar

UNIT-III No. of Hours: 4

5. To Perform Functional Testing and Usability Testing on a Website

UNIT-IV No. of Hours: 2

6. To Perform Automation Testing on a Desktop Application

UNIT-V No. of Hours: 2

7. To Manage Defects using a Defect Management Tool

Text Books:

1. Software testing Ron Patton SAMS Publishing
2. CMM Level 5 unleashed

Reference Books:

1. Effective methods of software testing' Wiley Publishers, William E. Perry

Online Resources:

CS-6518: CLOUD COMPUTING

Course Outcomes (COs):

- CO1:** Understand the concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- CO2:** Understand the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, multicloud.
- CO3:** : Developing In-depth Knowledge of Cloud Service Models and Virtualization and design cloud computing solutions according to the application domain.
- CO4:** Implement IaaS, SaaS, PaaS through AWS, Google Cloud, Salesforce and other service providers.
- CO5:** Learn the core issues and latest trends and technologies of cloud computing.
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Course Contents

UNIT-I

No. of Hours: 10

Cloud Computing definition, Types of cloud, Evolution of Cloud Computing, Applications cloud computing, Cluster Computing, Major Players in Cloud Computing, Issues and challenges in Cloud, Cloud stakeholders, SLAs, Economics of the Cloud
Cloud Models: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud. Advantages, disadvantages and applications of the deployment models.

UNIT-II

No. of Hours: 8

Basics of Virtualization, Types of Virtualization, Virtualization using virtualbox, Virtualization Tools and Mechanisms, Creating virtual machines in AWS, Virtualization for Data-center Automation, Scalability, Load balancing, Server Management, Fault Tolerance.

UNIT-III

No. of Hours: 12

Types of Cloud services: Infrastructure as a Service: Compute Services, clusters, HPC, Data Storage services and its categories- File storage, Block storage, Object storage, applications utilizing cloud storage, Network Services.
Platform as a Service: Understand and develop application using PAAS. Software as a Service: Applications, working, development methodology, advantages and disadvantages.

UNIT-IV

No. of Hours: 8

Database as a Service, Functions as a service-Serverless Computing, Microservices Introduction to MapReduce, HDFS, Hadoop Framework. Devops, Containers, Kubernetes.

UNIT-V

No. of Hours: 8

Security issues in cloud, AI and Machine Learning in Cloud, Fog Computing, Edge Computing, Green Cloud.
Case Studies:

Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.

Cloud Service Providers- AWS, Microsoft Azure, Github, Google Workspace, Salesforce

Text Books:

1. Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. Mastering cloud computing: foundations and applications programming. Newnes, 2013.
2. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012

Reference Books:

1. Cloud Computing “A Practical Approach” Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGraw-Hill.
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
3. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach”, TMH, 2009.
5. Kumar Saurabh, “ Cloud Computing – insights into New -Era Infrastructure”, Wiley India,2011.

Online Resources:

1. <https://www.mygreatlearning.com/cloud-computing/free-courses>
2. <https://aws.amazon.com/training/digital/>
3. <https://www.simplilearn.com/introduction-to-cloud-computing-basics-skillup>
4. <https://www.geeksforgeeks.org/>
5. <https://www.javatpoint.com/>

CS-6518: CLOUD COMPUTING - PRACTICAL

Course Outcomes (COs):

- CO1:** Understand the concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
- CO2:** Understand the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, multicloud.
- CO3:** Developing In-depth Knowledge of Cloud Service Models and Virtualization and design cloud computing solutions according to the application domain.
- CO4:** Implement IaaS, SaaS, PaaS through AWS, Google Cloud, Salesforce and other service providers.
- CO5:** Learn the core issues and latest trends and technologies of cloud computing.
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Course Contents

UNIT-I

No. of Hours: 6

1. Install Virtualbox/VMware Workstation with different flavor of linux or windows OS on top of windows.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. Create a free account in AWS and create a virtual machine, configure it and run program on VM.

UNIT-II

No. of Hours: 4

1. Explore data storage, server management, cloud watch and load balancing tools of AWS. Attach data storage to VM.
2. Create account and explore the applications of GitHub.
3. Explore cloud platforms for Web Application development and Mobile App development.

UNIT-III

No. of Hours: 4

1. Create a website using Wordpress and host it on cloud.
2. Explore Google workspace.
3. Create a free account in Salesforce (if available) and explore its functionalities.

UNIT-IV

No. of Hours: 6

1. Develop a SAAS application in team and deploy it on cloud.
2. Explore microservices and serverless computing.
3. Understand DevOps concepts and implementation details. Write complete note on steps required for developing CI/CD pipelines.

UNIT-V

No. of Hours: 4

1. Explore security solutions in cloud.
2. Install Hadoop single node cluster and run simple applications like wordcount.
3. Study scalability through containerized applications and kubernetes.

Text Books:

1. Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. Mastering cloud computing: foundations and applications programming. Newnes, 2013.
2. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012

Reference Books:

1. Cloud Computing "A Practical Approach" Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGraw-Hill.
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
5. Kumar Saurabh, " Cloud Computing – insights into New -Era Infrastructure", Wiley India,2011.

Online Resources:

1. <https://www.mygreatlearning.com/cloud-computing/free-courses>
2. <https://aws.amazon.com/training/digital/>
3. <https://www.simplilearn.com/introduction-to-cloud-computing-basics-skillup>
4. <https://www.geeksforgeeks.org/>
5. <https://www.javatpoint.com/>

CS-6718: BIG DATA ANALYTICS

Course Outcomes (COs):

CO1: Learn the basic concepts of Big data, its processing, storage, analysis and analytics.

CO2: Implement MapReduce programs to process big data.

CO3: To realize storage and processing of Big data using MongoDB, Pig, Hive, and Spark.

CO4: To analyze Big data using machine learning techniques.

CO5: To get an insight into data stream, text, web content, link, and social network analytics.

Course Contents

UNIT-I

No. of Hours: 8

Introduction: Classification of data, Evolution and definition of Big data, Big data characteristics, Big data classification, scalability and parallel processing, Big data – handling techniques, design architecture, sources, quality, pre-processing, storage, analysis, analytics and applications.

UNIT-II

No. of Hours: 8

Introduction to Hadoop: Hadoop and its ecosystem, Hadoop Distributed File System, Mapreduce framework and programming model, Hadoop YARN(Yet Another Resource Negotiator), and ecosystem tools.

UNIT-III

No. of Hours: 8

NoSQL Big data Management: Introduction to MongoDB, NoSQL data store, data architecture patterns, MongoDB database and query language, Cassandra database and query language.

Introduction to Hive: Hive architecture, data types, file formats, data model, and query language.

Introduction to Pig: Applications, features, architecture, Installation, Pig Latin data model, Pig Latin scripts, data types in Pig, execution modes, commands, relational operations, piggy bank, and user-defined function.

UNIT-IV

No. of Hours: 8

Spark and Big Data Analytics: Spark, Introduction to data analysis with Spark, analytics, reporting and visualization.

Machine learning algorithms for Big data analytics: estimating the relationships, outliers, variances, probability distributions, correlation, regression analysis, finding similar items, similarity of sets, collaborative filtering, frequent itemsets, association rule mining, cluster analysis, classification and recommendation system.

UNIT-V

No. of Hours: 8

Data stream mining and Spark streaming: Data stream concepts and management, real-time analytics platform – SparkStreaming. Text, web content and link analytics: Introduction, text mining, web mining, web content and web usage analytics, page rank, structure of web and analyzing a web graph, social network analytics.

Text Books:

1. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019
2. M Sudheep Elayidom, Sarith Divakar M, Lija Mohan, Tanmay Kumar Pandey and Shubham Agrawal, "Cloud Computing & Big Data: From the Basics to Practical Use Cases", Cengage Publication, 2024..

Reference Books:

1. Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
3. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
4. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
5. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

Online Resources:

CS-6718: BIG DATA ANALYTICS - PRACTICAL

Course Outcomes (COs):

CO1: Understand and practice working with Hadoop and HDFS for distributed storage and data processing.

CO2: Understand the basics of Apache Spark, run Spark jobs and how to perform data processing using RDDs and DataFrames.

CO3: Learn about NoSQL databases and specifically MongoDB as a widely used NoSQL database.

CO4: Learn to apply machine learning algorithms to big data using Spark's MLlib.

CO5:

Course Contents

UNIT-I

No. of Hours: 4

Introduction to Hadoop and HDFS

1. Setting Up Hadoop Cluster:
2. Working with HDFS:
 - o Create directories in HDFS
 - o Upload data from local filesystem to HDFS
 - o Read a file from HDFS
3. Write a basic MapReduce program in Java (e.g., word count).
4. Run the program on your Hadoop cluster

UNIT-II

No. of Hours: 5

Introduction to Apache Spark

1. Installing Apache Spark:
 - o Install Apache Spark on your local machine or a cluster.
 - o Create a Spark session using Python
2. RDD Operations:
 - o Create an RDD from a local collection and perform basic operations:
3. DataFrame Operations:
 - o Load a CSV file into a Spark DataFrame and perform filtering and aggregation:

UNIT-III

No. of Hours: 4

NoSQL and MongoDB

1. Installing MongoDB:
 - o Install MongoDB on your local machine or use MongoDB Atlas for a cloud-based solution.
 - o Start the MongoDB server and connect to it via the MongoDB shell
2. Basic CRUD Operations:
 - o Create a database and collection
 - o Insert documents into the collection

- o Retrieve documents
3. Updating and Deleting Data:
- o Update a document
 - o Delete a document

UNIT-IV

No. of Hours: 4

Machine Learning with Spark MLlib:

1. Installing Spark MLlib:

Make following Programs: An open source dataset of the New Car Sales in Norway is available at www.kaggle.com. The dataset contains monthly car sales for 2007–2017 by make and most popular models. Explore the dataset to solve the following problems for analysis, prediction and visualization using Sklearn and PySpark:

1. Print year-wise total car sales and visualize the output (Hint: use bar chart for Year vs. total car sales).
2. Print monthly total car sales and visualize for a specified year.
3. Calculate the total amount of the sales for each manufacturer from 2007 to 2017. Find the top 10 manufacturers based on the total sale and visualize the output. (Hint: Sort make-wise total car sales and visualize them using bar chart).
4. Draw pie chart for the sales of all the models of “Toyota” in year 2012.

UNIT-V

No. of Hours: 5

Machine Learning with Spark MLlib:

1. Predict (forecast) the car sales for all the months of 2020 using the month-wise car sales quantity from the Jan 2007 to Jan 2017.
2. Calculate year-wise share of diesel car sales in total sales.
3. Compare year-wise average consumption of CO2 emission of all cars sold with year-wise average consumption of CO2 emission in benzene-fuelled cars sold and diesel-fuelled cars sold.
4. Calculate and visualize year-wise new and used (import) car sales to compare the statistics.
5. Rank top 10 car brands. Visualize the year-wise result using line graph.

Text Books:

1. Rajkamal and Preeti Saxena, “Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning”, McGraw Hill Publication, 2019.

Reference Books:

1. M Sudheep Elayidom, Sarith Divakar M, Lija Mohan, Tanmay Kumar Pandey and Shubham Agrawal, “Cloud Computing & Big Data: From the Basics to Practical Use Cases”, Cengage Publication, 2024.
2. Seema Acharya and Subhashini Chellappan “Big data and Analytics” Wiley India Publishers, 2nd Edition, 2019.

Online Resources:

1. SWAYAM NPTEL: Big Data Computing – Course, available at: https://onlinecourses.nptel.ac.in/noc20_cs92/preview
2. Dirk Deroos et al., Hadoop for Dummies, Dreamtech Press, 2014.
3. Sahil Sharma, How to Set Up Hadoop on Windows: A Step-by-Step Guide, available at: <https://medium.com/@DataEngineeer/how-to-set-up-hadoop-on-windows-a-step-by-step-guide-37d1ab4bee57>