

**COURSE PLAN**

Academic Year: 2024-2025

Program: B.E., Computer Science & Enginnering

Year& Semester: II/IV

Course Code & Title: U23IT402 - Cloud Computing

Faculty Name(s):

|  |  |  |
| --- | --- | --- |
| Sl. No | Name | Designation & Dept |
| 1. | Dr. S. K. Harikarthik | Associate Professer Department of CSE |

Course Type: **T**/TP/TPJ/P/PJ/I

Course Pre-requisites: Computer Networks

Course Co-requisites to: Integrated Lab with U23IT451- Cloud Computing Lab

**1. Course Description:**

The fundamentals of cloud computing and virtualization are covered in this course. This course offers a comprehensive introduction to Amazon Web Services (AWS), the world's leading cloud platform. It is designed for individuals and professionals who want to understand the core concepts of cloud computing and gain hands-on experience with AWS services. The course covers foundational knowledge, practical applications, and advanced features of AWS, helps learners to develop the skills needed to implement cloud solutions.

**2. Course Objectives:**

* To understand the fundamentals of cloud computing and virtualization
* To learn the core concepts of cloud computing and gain hands-on experience with AWS services.
* To learn the foundational knowledge, practical applications, and advanced features of AWS, helps learners to develop the skills needed to implement cloud solutions.

**3. Course Outcomes:**

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

|  |  |  |
| --- | --- | --- |
| **Course Outcome No.** | **Course Outcome Statement** | **RBTL** |
| U23IT402.1 | Utilize the fundamental ideas of the cloud computing paradigm, including the features, benefits, and drawbacks of the many cloud computing models and services. | K3 |
| U23IT402.2 | Understand secure scalable network architectures on AWS, applying best practices for cloud networking and security management. | K3 |
| U23IT402.3 | Get practical exposer on fundamental components of the global infrastructure within the AWS Cloud and its services. | K3 |
| U23IT402.4 | Understand and implement AWS storage and database services to design scalable, secure, and efficient data solutions in the cloud. | K4 |
| U23IT402.5 | To create, manage, scale and deploy containerized applications using Docker and Kubernetes | K5 |

**4a. CO-PO and CO-PSO mapping:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Outcome No.** | **ProgrammeOutcomes** | | | | | | | | | | | **PSO** | |  |
| **PO-01** | **PO-02** | **PO-03** | **PO-04** | **PO-05** | **PO-06** | **PO-07** | **PO-08** | **PO-09** | **PO-10** | **PO-11** | **PSO-01** | **PSO-02** | **PSO -03** |
| CO 1 | 1 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 1 | 1 | - |
| CO 2 | 1 | 2 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | - |
| CO 3 | 2 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | - |
| CO 4 | 1 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 1 | 2 | - |
| CO 5 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 3 | - |

**4b.Program Outcomes:**

**PO1:** **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of **complex engineering problems**.

**PO2:** **Problem Analysis**: Identify, formulate, review research literature and analyze **complex engineering problems** reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

**PO3:** **Design/Development of Solutions:** Design creative solutions for **complex engineering problems** and design/develop systems/components/processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

**PO4:** **Conduct Investigations of Complex Problems:** Conduct investigations of **complex engineering problems** using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5:** **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve **complex engineering problems**. (WK2 and WK6)

**PO6:The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving **complex engineering problems** for its impact on sustainability with reference to the economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

**PO7:** **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**PO8**: **Individual and Collaborative Teamwork:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9:** **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

**PO10**: **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one’s own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

**PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

**4C. Program Specific Outcome:**

**PSO1:** Demonstrate knowledge in open source technologies

**PSO2:** Develop innovative solutions by adapting emerging technologies for industry oriented applications

**PSO3:** Implement SDLC principles for project/product development.

4D.

**WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences

**WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

**WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

**WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

**WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

**WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

**WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

**WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

**WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

**5. Course Assessment Plan (Theory)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Evaluation Components** | | | | | | |
| **Internal Assessment Tool** | | | | **SEE** | | |
| **Classroom Instruction (CI)** | **Lab Instruction (LI)** | **Notional Hours (NH)** | |
| **CIA** | **CIA** | **TW (List All Activities)** | **SL (List All Activities)** | **CI** | **LI** | **NH** |
| CIAI | - | Assignment | **NPTEL Course on ‘Cloud Computing” Starting from Jan 2025** | SEE | - | - |
| CIAII | **-** | Case Study |
| CIAIII | - | Quiz |
| - | - | Presentation |
| - | **-** | **-** |
| - | **-** | **-** |

**6. Teaching-Learning-Assessment Scheme**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Type** | **Internal Assessment Marks** | | | | | | | | | |  | **SEE Marks** | | | **Total Marks** |
| CI | | | LI | NH | | | | | |  | CI | LI | NH |  |
| CIA-  I | CIA-  II | CIA-  III | P | TW  A1 | TW  A2 | TW  A3 | | P | Q | SL | T | P | J |  |
| U23IT402 - Cloud Computing | 60 | 60 | 80 |  | 50 | 50 | 50 | | 50 | 60 |  | 100 | - | - | 460 |
| Reduced to | 8 | 8 | 8 |  | 5 | | | 5 | | 6 |  | 60 | - | - | 100 |

**7. Lesson Plan (Theory)**

| **L. No.** | **Planned Date of Lecture** | **CO** | | **Topic** | **The actual date of the lesson delivered** | **Learning**  **Pedagogy Used** | **References** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UNIT I:** | | | | | | | |
| **1** | 10.02.2025 | CO1 | | ; Introduction to Cloud Computing, History and Characteristics of Cloud Computing |  | Interactive | T1 |
| **2** | 10.02.2025 | CO1 | | Cloud computing Technologies: Virtualization, Service Oriented Architecture |  | Lectures & Readings | T1,R1 |
| **3** | 12.02.2025 | CO1 | | Grid Computing, Utility Computing |  | Group Discussion | T2 |
| **4** | 13.02.2025 | CO1 | | Cloud Computing Infrastructure |  | Group Discussion | R2 |
| **5** | 17.02.2025 | CO1 | | Cloud Deployment Models: Public, Private, Hybrid, Community |  | Comparison Analysis | T2 |
| **6** | 17.02.2025 | CO1 | | Cloud Service Models: Infrastructure-as-a-Service |  | Comparison Analysis | W1 |
| **7** | 24.02.2025 | CO1 | | Platform-as-a-Service, Software-as–a-Service |  | Comparison Analysis | T2,R2 |
| **8** | 24.02.2025 | CO1 | | Identity as a Service |  | Comparison Analysis | R2 |
| **9** | 26.02.2025 | CO1 | | Network as a Service; Challenges |  | Interactive | W2,W3 |
| **10-TW/SL 01** | 3 | | | **Suggested Term Work Activity and Assessment Methods**  **Suggested Activity**: Explore real-world applications of cloud via case studies  **Suggested Assessment Method**: Case study analysis reports to evaluate comprehension and application of cloud providers. | | | |
| **UNIT II:** | | | | | | | |
| **11** | 27.02.2025 | CO2 | | Virtual Private Cloud (VPC) – Subnets |  | Interactive | T2,R3 |
| **12** | 03.03.2025 | CO2 | | Routing tables |  | Group Discussion | T2 |
| **13** | 03.03.2025 | CO2 | | NAT gateways |  | Interaction | T2,T3 |
| **14** | 05.03.2025 | CO2 | | VPC Security: Security Groups |  | Lectures & Readings | T2 |
| **15** | 17.03.2025 | CO2 | | Network Access Control Lists (NACLs) |  | Group Discussion | T2,R3 |
| **16** | 17.03.2025 | CO2 | | Cloud Computing Security: Planningtypes and importance of Cloud Security |  | Comparison Analysis | T1,T3 |
| **17** | 19.03.2025 | CO2 | | Cloud Security Standards |  | Interactive | T1 |
| **18** | 27.03.2025 | CO2 | | Best Practices for Cloud Security |  | Interactive | T1 |
| **19** | 02.04.2025 | CO2 | | Common Cloud Security Standards |  | Interactive | T1 |
| **20-TL/SL 02** | 3 | | | **Suggested Term Work Activity and Evaluation Methods**  **Suggested Activity**: Create security groups for the web server and database server and configure network access control lists (NACLs) to control inbound and outbound traffic to implement VPC security  **Suggested Evaluation Method**: Lab-based evaluation to verify inbound and outbound traffic to ensure security | | | |
| **UNIT III:** | | | | | | | |
| **21** | 07.04.2025 | CO3 | | Cloud Providers -Introduction to AWS, |  | Interactive | T2, R4 |
| **22** | 07.04.2025 | CO3 | | Future of AWS, AWS Services |  | Interactive | T2,R4 |
| **23** | 09.04.2025 | CO3 | | AWS Console, billing and cost management |  | Hands-on Learning | T2,R4 |
| **24** | 11.04.2025 | CO3 | | EC2-: Instances, AMIs, key pairs,security groups |  | Hands-on Learning | T2,R4 |
| **25** | 11.04.2025 | CO3 | | Auto Scaling - Elastic Load Balancing (ELB) |  | Hands-on Learning | T2,R4 |
| **26** | 11.04.2025 | CO3 | | IAM - AWS Security, Working of IAM |  | Hands-on Learning | T2,R4 |
| **27** | 11.04.2025 | CO3 | | Cloud Front Working, Benefits |  | Hands-on Learning | T2 |
| **28** | 12.04.2025 | CO3 | | Cloud Watch: Monitoring metrics, alarms, logs |  | Hands-on Learning | T2 |
| **29** | 12.04.2025 | CO3 | | CloudTrail: Logging AWS account activity |  | Hands-on Learning | T2 |
| **30-TW/SL 03** | 3 | | | **Suggested Self Learning Activity and Evaluation Methods**  **Suggested Self Learning Activity**: Monitor CloudFront metrics with Amazon CloudWatch  **Suggested Evaluation Method**: Certification-based assessment to evaluate tool proficiency | | | |
|  | | | |
| **UNIT IV:** | |  | |  |  | | |
| 31. | 12.04.2025 | CO4 | | Storage: Simple Storage Service (S3) |  | Hands-on Learning | T2, R3 |
| 32. | 12.04.2025 | CO4 | | Buckets, objects, permissions |  | Hands-on Learning | T2, R3 |
| 33. | 16.04.2025 | CO4 | | lifecycle policies, S3 storage classes |  | Hands-on Learning | T2, R3 |
| 34. | 17.04.2025 | CO4 | | Elastic Block Store (EBS): Volumes, snapshotsbackup strategies |  | Hands-on Learning | T2, R3 |
| 35. | 28.04.2025 | CO4 | | Elastic File Storage Databas |  | Hands-on Learning | T2, R3 |
| 36. | 28.04.2025 | CO4 | | Relational Database System (RDS) |  | Hands-on Learning | T2, R3 |
| 37. | 30.04.2025 | CO4 | | Managed relational databases |  | Hands-on Learning | T2, R3 |
| 38. | 05.05.2025 | CO4 | | DynamoDB - Serverless: Lambda |  | Hands-on Learning | T2, R3 |
| 39. | 05.05.2025 | CO4 | | AWS services vs Azure and GCP |  | Hands-on Learning | T2, R3 |
| **40-TW/SL 04** | 3 | | | **Suggested Self Learning Activity and Evaluation Methods**  **Suggested Self Learning Activity:** Create static website using S3  **Suggested Evaluation Method:** Console Report with website homepage | | | |
|  | | | |
| **UNIT V:** | |  | |  |  | | |
| 41 | 07.05.2025 | CO5 | | Docker - Containers, Usage of containers - Terminology |  | Hands-on Learning | T4, R5 |
| 42 | 08.05.2025 | CO5 | | Docker Run Static sites |  | Hands-on Learning | T4, R5 |
| 43 | 12.05.2025 | CO5 | | Docker Images |  | Hands-on Learning | T4, R5 |
| 44. | 12.05.2025 | CO5 | | Docker File - Docker on AWS |  | Hands-on Learning | T4, R5 |
| 45. | 14.05.2025 | CO5 | | Docker Network - Docker Compose |  | Hands-on Learning | T4, R5 |
| 46. | 15.05.2025 | CO5 | | Development Workflow |  | Hands-on Learning | T4, R5 |
| 47. | 15.05.2025 | CO5 | | Amazon Elastic Container Service (ECS) |  | Hands-on Learning | T4, R5 |
| 48. | 16.05.2025 | CO5 | | Kubernetes- Amazon Elastic Kubernetes Service |  | Hands-on Learning | T4, R5 |
| 49 | 16.05.2025 | CO5 | | Fargate |  | Hands-on Learning | T4, R5 |
| **50-TW/SL 05** | 3 | | | **Suggested Self Learning Activity and Evaluation Methods**  **Suggested Self Learning Activity:** Web Application using Docker  **Suggested Evaluation Method:** Presentation (P) to assess communication and data storytelling abilities. | | | |
| **51** | 16.05.2025 | | - | **Revision** | | | |
| **52** | 16.05.2025 | | CBS | **Creating Virtual machine in Azure** | | | |

**8. Term Work and Self Learning - Plan and Outcome:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Name of the TW/SL Activity and its problem statement** | **RBTL** | **Skill Development through TW and SL and its Level of Skill Development(1 to 3)**  **(3-Excellent, 2- Good, 1-Average, -- Not Applicable** | | | | | | **Mapping** | |
| Critical Thinking | Time Management | Research Skills | Opportunity for Self-Improvement | Preparation for Exams | Others (Specify) | **COs** | **POs** |
| Explore real-world applications of cloud via case studies | K2 | NA | 1 | 2 | 2 | 2 | - | CO1 | PO5 |
| Create security groups for the web server and database server and configure network access control lists (NACLs) to control inbound and outbound traffic to implement VPC security | K5 | 3 | 2 | 2 | 3 | 2 | - | C02 | PO5 |
| Monitor CloudFront metrics with Amazon CloudWatch | K2 | 3 | 3 | 3 | 3 | 3 | - | CO3 | PO5 |
| Create static website using S3 | K5 | 3 | 3 | 3 | 3 | 3 | - | CO4 | PO5 |
| Web Application using Docker | K5 | 3 | 3 | 3 | 3 | 3 | - | CO5 | PO5 |

**9. ProposedDates of Assessments (as per the Department Academic Calendar):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No** | **Name of the Assessment\*** | **Proposed Date** | **Actual Date** | **Reason for change, if any** |
| 1 | CIA I | 04.03.2025 |  |  |
| 2 | CIA II | 04.04.2025 |  |  |
| 3 | CIA III | 12.05.2025 |  |  |
| 4 | Assignment 1 | 28.02.2024 |  |  |
| 5 | Assignment 2 | 27.03.2025 |  |  |
| 6 | Assignment 3 | 25.04.2025 |  |  |
| 7 | Presentation 1 | 10.05.2025 |  |  |
| 8 | Quiz | 12.05.2025 |  |  |

**10. Text and References:**

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| --- |
| Text Books: |
| 1. Rittinghouse, John W, and James F. Ransome, ― Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.  2. Mike Rossie, “AWS 2024: From Beginner to Advanced AWS The Complete Guide”, Kindle Edition, 2024.  3. Mark Wilkins, “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud”, 2019.  4. NisargVasavada, Dhwanisametriya “Craking Containers with Docker and Kubernetes: The Definitive Guide to Docker, Kubernetes, and the Container Ecosystem Across Cloud and On-premises”, First Edition 2022. |
| References: |
| Reference Books:   1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, ―Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, Morgan Kaufmann Publishers, 2012. 2. David E.Y. Sarna, ―Implementing and Developing Cloud Application‖, CRC press 2011. 3. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, ―Draft cloud computing synopsis and recommendation‖, May 2011. 4. George Reese, ― Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), OReilly, 2009. 5. Ardian, “Using Docker: Developing and Deploying Software with Containers”, O’Reilly Media Inc, 2015.   Journals:   1. Journal of Cloud Computing   Magazines:   1. <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4914218> 2. <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4963387>   Web Resources:   1. <https://www.geeksforgeeks.org/cloud-computing-infrastructure/?ref=header_ind> 2. <https://www.geeksforgeeks.org/network-as-a-service/> 3. <https://www.cloudflare.com/learning/network-layer/network-as-a-service-naas/> 4. <https://www.geeksforgeeks.org/introduction-to-amazon-web-services/#aws-fundamentals> 5. <https://www.geeksforgeeks.org/introduction-to-amazon-web-services/> 6. <https://www.geeksforgeeks.org/what-is-elastic-compute-cloud-ec2/> 7. <https://www.geeksforgeeks.org/amazon-vpc-introduction-to-amazon-virtual-cloud/> 8. <https://www.geeksforgeeks.org/introduction-to-aws-simple-storage-service-aws-s3/> 9. <https://www.geeksforgeeks.org/amazon-rds-introduction-to-amazon-relational-database-system/> 10. <https://www.geeksforgeeks.org/cloud-computing-security/> 11. <https://www.geeksforgeeks.org/cloud-security-standards/> 12. <https://www.7mileadvisors.com/Whitepaper/advancements-of-cloud-technology/#:~:text=Cloud%20technology%20offers%20on%2Ddemand,and%20DevOps%20functions%20and%20processes>. 13. <https://www.simplilearn.com/cloud-technologies-article> |

**Name and Signature of course Faculty Members with Date**

**1)**

**Name:** Dr. S. K. Harikarthik **Signature with Date**

**Reviewed by Approved by**

**Signature of the Module Coordinator Head of the Dept.**

**Date: Date:**

**For use of Office of Academics:**

**Dean (Academics)**

**Date:**