21-09-2025 04:19:06 PM

**CLOUD ADMINISTRATION AND MANAGEMENT** **Course Code : 316008**

**Programme Name/s : Cloud Computing and Big Data**

**Programme Code : BD**

**Semester : Sixth**

**Course Title : CLOUD ADMINISTRATION AND MANAGEMENT**

**Course Code : 316008**

## I. RATIONALE

As businesses shift their operations to the cloud, the demand for skilled Cloud Administrators is on the rise. Cloud administration involves managing, configuring, and maintaining cloud services. Cloud administration and management has become a critical component of every organization's infrastructure, covering everything from cloud architecture to security practices. It also helps to cover the skills required in MLOps and AIOps.

## II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the students to attain the following Industry Identified Outcome through various Teaching Learning experiences: Manage Cloud platforms.

## III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Configure cloud services for given problem statement.
- CO2 - Manage cloud operations.
- CO3 - Implement cloud data security.
- CO4 - Evaluate cost-effectiveness of given cloud operations.
- CO5 - Deploy a simple machine learning model using cloud platform.

## IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Actual Contact Hrs./ Week | | | SLH | NLH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | Total Marks |
| | | | | | | | | | | | | | | | Practical | | | | | | |
| | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | |
| | | | | | | | | | | | Max | Max | Max | Min | Max | Min | Max | Min | Max | Min | |
| 316008 | CLOUD ADMINISTRATION AND MANAGEMENT | CAM | AEC | 2 | - | 4 | - | 6 | 3 | - | - | - | - | - | 25 | 10 | 25@ | 10 | - | - | 50 |

**Total IKS Hrs for Sem. :** 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

## V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 1 | TLO 1.1 Explain cloud service model.<br>TLO 1.2 Explain cloud deployment models.<br>TLO 1.3 Setup given cloud service. | **Unit - I Introduction to Cloud Administration**<br>1.1 Cloud Architecture – Cloud Service Models – IaaS, PaaS, SaaS. Cloud Deployment Models – Public, Private, Hybrid<br>1.2 Cloud Administration Basics - Importance of Cloud administration, Cloud service provider-side administration, User/ Organization's-side administration, Roles and responsibilities of Cloud Administrator<br>1.3 Setup and configuration of Cloud Services<br>1.4 Case study on configuring cloud services – Amazon Web Services (AWS) such as Core Services (EC2, S3, RDS, Lambda), Microsoft Azure Core Services such as Virtual Machines, Blob Storage, SQL Database, Google Cloud Platform (GCP) Core Services such as Compute Engine, Cloud Storage, BigQuery | Lecture Using Chalk-Board<br>Video Demonstrations<br>Case Study<br>Flipped Classroom<br>Demonstration |
| 2 | TLO 2.1 Explain cloud data services.<br>TLO 2.2 Explain network connectivity in cloud platform.<br>TLO 2.3 Monitor cloud services.<br>TLO 2.4 Setup given cloud service automatically using scripts. | **Unit - II Cloud Operations Management**<br>2.1 Cloud Storage and Databases - Data Storage, DBaaS, Data security, Data services<br>2.2 Networking and Connectivity in Cloud Environments - Virtual Networking (VPCs, Subnets, NAT, VPNs), DNS Services (Route 53, Azure DNS), Hybrid Cloud Networking<br>2.3 Service provisioning and Management - Deployment Strategies (Manual vs. Automated), Infrastructure as a Code(IaC), Automation and Scripting using various CLIs, Monitoring and Logging of service provided, Cloud Management Platforms (CMP) | Lecture Using Chalk-Board<br>Video Demonstrations<br>Flipped Classroom<br>Demonstration |
| 3 | TLO 3.1 Explain cloud security risks.<br>TLO 3.2 Demonstrate IAM for given scenario.<br>TLO 3.3 Explain AAA model.<br>TLO 3.4 Describe incident response in given cloud application. | **Unit - III Cloud Infrastructure Security and Compliance**<br>3.1 Cloud Security Fundamentals - cloud security risks, Operating systems security, Virtual machine security, Security of virtualization<br>3.2 Identity and Access Management (IAM)<br>3.3 AAA model for cloud resources (Authentication, Authorization, and Accounting), AAA Protocols<br>3.4 Compliance and Regulatory Standards such as GDPR, HIPAA, SOC 2), Security Best Practices (Audits, Incident Response)<br>3.5 Backup and Recovery | Lecture Using Chalk-Board<br>Video Demonstrations<br>Flipped Classroom<br>Demonstration |
| 4 | TLO 4.1 Elaborate cost-effectiveness in cloud computing.<br>TLO 4.2 Apply load balancing technique for given problem statement.<br>TLO 4.3 Apply cloud performance optimization technique for given scenario. | **Unit - IV Cloud Performance Optimization and Cost Management**<br>4.1 Aspects of Cloud performance optimization – cost-effectiveness, performance, reliability, security<br>4.2 Load balancing in Cloud computing – static, dynamic<br>4.3 Cloud optimization best practices – Right-sizing computing services, Making use of spot instances, Investing in Reserved instances, Identifying Unused Resources and Removing Them, Merging Idle Resources | Lecture Using Chalk-Board<br>Video Demonstrations<br>Flipped Classroom<br>Demonstration |
| 5 | TLO 5.1 Describe Containerization in cloud computing.<br>TLO 5.2 Enlist advantages of cloud computing in machine | **Unit - V Advanced Cloud Computing Concepts**<br>5.1 Serverless Computing, Function as a Service (FaaS)<br>5.2 Containerization and Orchestration (such as Docker, Kubernetes)<br>5.3 Data analysis using cloud computing<br>5.4 Uses of AI in Cloud computing | Lecture Using Chalk-Board<br>Case Study<br>Demonstration<br>Flipped Classroom |

**CLOUD ADMINISTRATION AND MANAGEMENT** **Course Code : 316008**

| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| | learning.<br>TLO 5.3 Apply MLOps services for given problem statement. | 5.5 Introduction to MLOPs and AIOPs | |

## VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 1.1 Install virtualization tool.<br>LLO 1.2 Configure given service in the cloud platform. | 1 | * Implement Infrastructure as a Service using any open-source cloud platform | 4 | CO1 |
| LLO 2.1 Install virtualization tool.<br>LLO 2.2 Configure customer-side service in the cloud platform. | 2 | * Setup and configure given cloud service on Oracle Cloud at Customer side | 4 | CO1 |
| LLO 3.1 Create a service account.<br>LLO 3.2 Setup the console.<br>LLO 3.3 Configure cloud shell.<br>LLO 3.4 Create folder hierarchy. | 3 | Configure GCP (Google Cloud Platform) to upload web pages: - Setup and access cloud console - Setup Cloud Shell - Create folder hierarchy for web pages | 4 | CO1 |
| LLO 4.1 Identify data model.<br>LLO 4.2 Create given database.<br>LLO 4.3 Create the table for given database.<br>LLO 4.4 Import data into cloud table from local disk. | 4 | * Create structured database using any opensource cloud platform for given problem statement. - Create database - Create table structures in the database - Import data from local tables to cloud database created | 4 | CO2 |
| LLO 5.1 Create custom mode network.<br>LLO 5.2 Create subnet.<br>LLO 5.3 Apply firewall rules.<br>LLO 5.4 Create the network. | 5 | Setup VPC (Virtual Private Cloud) using GCP(Google Cloud Platform) | 4 | CO2 |
| LLO 6.1 Register a domain name using cloud.<br>LLO 6.2 Create a virtual machine.<br>LLO 6.3 Configure web server.<br>LLO 6.4 Set up domain cloud DNS. | 6 | Demonstrate DNS services in any open-source cloud platform | 4 | CO2 |
| LLO 7.1 Identify roles and its scope.<br>LLO 7.2 Assign permissions to role. | 7 | * Implement enterprise governance strategies including role-based access control, Azure policies and resource locks | 4 | CO3 |

**CLOUD ADMINISTRATION AND MANAGEMENT** **Course Code : 316008**

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 7.3 Set the scope of resource.<br>LLO 7.4 Lock the resource. | | | | |
| LLO 8.1 Filter the network traffic.<br>LLO 8.2 Configure Firewall Policies.<br>LLO 8.3 Setup Azure key vault. | 8 | Implement perimeter security strategies including Azure Firewall | 4 | CO3 |
| LLO 9.1 Grant permission to trail.<br>LLO 9.2 Create a trail to log event. | 9 | * Setup CloudTrail to view event history in AWS | 2 | CO3 |
| LLO 10.1 Grant permission to trail.<br>LLO 10.2 Create S3 bucket. | 10 | Setup CloudTrail in AWS to create an event data store for S3 data events | 2 | CO3 |
| LLO 11.1 Split up incoming traffic among several instances.<br>LLO 11.2 Configure back-end service to route traffic effectively.<br>LLO 11.3 Perform network health checks and establish forwarding rules. | 11 | Set up a load balancer (LB) on the GCP (Google Cloud Platform) for given problem statement | 4 | CO4 |
| LLO 12.1 Split up incoming traffic among several instances.<br>LLO 12.2 Configure back-end service to route traffic effectively.<br>LLO 12.3 Perform network health checks and establish forwarding rules. | 12 | * Configure a load balancer in Azure cloud | 4 | CO4 |
| LLO 13.1 Setup the event on cloud.<br>LLO 13.2 Configure the service for the created event. | 13 | * Monitor compute engine instance with resource monitoring in any cloud platform | 4 | CO4 |
| LLO 14.1 Identify parameters for CSP (Cloud Service Provider) selection.<br>LLO 14.2 Estimate the cloud service cost for given problem statement.<br>LLO 14.3 Setup pricing service on cloud for selected resources. | 14 | (a) Setup Google Pricing Calculator For given cloud services<br>(b) Identify best cloud platform (based on pricing) for given problem statement. (e.g. identify which cloud platform among those available in the market, will provide cost-effective services for web application hosting, etc.). Prepare a comparative report for the same | 4 | CO4 |
| LLO 15.1 Build the ML model using any programming language for given problem statement.<br>LLO 15.2 Train the model on sample data.<br>LLO 15.3 Deploy trained | 15 | * Build, train, and deploy a sample machine learning model using SageMaker | 4 | CO5 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| model using cloud environment. | | | | |
| LLO 16.1 Design data analysis solution.<br>LLO 16.2 Deploy the solution using cloud services. | 16 | * Implement a cloud – based simple data analytics solution for given problem statement | 6 | CO5 |

**Note : Out of above suggestive LLOs -**

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

## VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

**Self learning**

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Demonstrate load balancing techniques available in various open-source cloud platforms. Prepare a sample SLA for a given project. And suggest a best suited cloud service provider for the project. Demonstrate Cloud network security in any open-source cloud.

**Micro project**

- The micro project has to be Industry Application Based, Internet-based, Workshop-based, Laboratory-based or Field-based as suggested by Teacher.

1. Deploying a Web Application - Deploy a scalable web application using a cloud service provider like AWS, Azure, or Google Cloud. (Set up and configure virtual machines or container instances. Deploy a web application using services like AWS Elastic Beanstalk, Azure App Service, or Google App Engine. Implement load balancing and auto-scaling features. Monitor and manage application performance using cloud-native tools.)

2. Building a Serverless Architecture - Create a serverless application using cloud functions and event-driven services. (Develop and deploy serverless functions using AWS Lambda, Azure Functions, or Google Cloud Functions. Integrate with other cloud services, such as storage (e.g., S3, Azure Blob Storage) and databases (e.g., DynamoDB, Azure Cosmos DB). Configure triggers and event sources to invoke the functions. Monitor and manage the serverless application using cloud tools.)

3. Implementing Cloud Security Measures - Apply security best practices to secure given cloud environment. – (Set up identity and access management (IAM) policies and roles to control access to resources. Implement encryption for data at rest and in transit using cloud encryption services. Configure security groups, firewalls, and network access controls to protect resources. Conduct a security audit and vulnerability assessment using cloud security tools.)

5. Migrating an On-Premises Application to the Cloud - Plan and execute the migration of an existing on-premises application to a cloud environment. (Assess the application and create a migration plan, including choosing a cloud service model (IaaS, PaaS) and deployment model. Use cloud migration tools and services (e.g., AWS Migration Hub, Azure Migrate) to move the application. Address any compatibility issues and optimize the application for the cloud environment. Test the migrated application and validate its performance and functionality.)

6. Developing a Multi-Cloud Strategy - Design a strategy for utilizing multiple cloud providers to enhance resilience and flexibility. (Set up and integrate services across different cloud providers (e.g., AWS and Azure). Implement data synchronization and workload distribution across clouds. Manage cross-cloud networking and security. Evaluate the benefits and challenges of a multi-cloud approach.)

7. Building a Cloud-Native Microservices Application - Develop a cloud-native application using a microservices

architecture. (Design and implement microservices using containerization technologies like Docker and orchestration tools like Kubernetes. Deploy the microservices on a cloud platform and manage their lifecycle. Implement service discovery, API gateways, and inter-service communication. Monitor and scale the microservices application using cloud-native tools.)

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

## VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|---|---|---|
| 1 | Computer system with -<br>Hardware Requirement:<br>Processor - 3.5GHz or higher, 12th generation onwards, RAM - 16 GB or above DDR4 or higher, Storage - 512 GB or higher, 1 or 10 Gigabit Ethernet network equipment<br>Software Requirement:<br>Any web browser, Any Web server, Java /Python, Virtualization Software, Internet Connectivity | All |

## IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|---|---|---|---|---|---|---|---|---|
| 1 | I | Introduction to Cloud Administration | CO1 | 4 | 0 | 0 | 0 | 0 |
| 2 | II | Cloud Operations Management | CO2 | 6 | 0 | 0 | 0 | 0 |
| 3 | III | Cloud Infrastructure Security and Compliance | CO3 | 6 | 0 | 0 | 0 | 0 |
| 4 | IV | Cloud Performance Optimization and Cost Management | CO4 | 8 | 0 | 0 | 0 | 0 |
| 5 | V | Advanced Cloud Computing Concepts | CO5 | 6 | 0 | 0 | 0 | 0 |
| **Grand Total** | | | | **30** | **0** | **0** | **0** | **0** |

## X. ASSESSMENT METHODOLOGIES/TOOLS

**Formative assessment (Assessment for Learning)**

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering

1) 60% weightage is to process
2) 40% weightage is to product

**Summative Assessment (Assessment of Learning)**

- End semester examination, Lab performance, Viva voce

**CLOUD ADMINISTRATION AND MANAGEMENT** **Course Code : 316008**

## XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | 2 | 2 | 2 | - | 2 | 1 | | | |
| CO2 | 2 | 3 | 2 | 1 | - | 3 | - | | | |
| CO3 | 2 | 3 | 2 | 2 | - | 2 | 2 | | | |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | | | |
| CO5 | 3 | 1 | 2 | 1 | - | 2 | 1 | | | |

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

## XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|---|---|---|---|
| 1 | Thomas A. Limoncelli, Strata R. Chalup, Christina J. Hogan | The Practice of Cloud System Administration | Addison-Wesley Professional • ISBN-10: 032194318X • ISBN-13: 978-0321943187 |
| 2 | Ranjit Singh Thakurratan | Google Cloud Platform Administration: Design highly available, scalable, and secure cloud solutions on GCP | Packt ISBN-13 :9781788624350 |
| 3 | Gareth Eagar | Data Engineering with AWS: Learn how to design and build cloud-based data transformation pipelines using AWS | Packt ISBN3 - 9781800560413 |
| 4 | John Arundel, Justin Domingus | Cloud Native DevOps with Kubernetes | O'Reilly Media, Inc, USA • ISBN-10 : 1492040762 • ISBN-13 : 978-1492040767 |

## XIII . LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|---|---|---|
| 1 | https://onlinecourses-archive.nptel.ac.in/noc18_cs44/course | Cloud computing architecture |
| 2 | https://docs.aws.amazon.com/ec2/index.html?nc2=h_ql_doc_ec2 | AWS service: EC2, S3 |
| 3 | https://www.udemy.com/course/cloud-management/?couponCode=ST10MT30325G2 | Cloud management course |
| 4 | https://aws.amazon.com/getting-started/?nc2=h_ql_le | AWS services |
| 5 | https://www.openstack.org/software/start/ | OpenStack tutorial |
| 6 | https://cloudswit.ch/blogs/what-is-aaa-authentication-authorization-accounting/ | AAA model |

**CLOUD ADMINISTRATION AND MANAGEMENT** **Course Code : 316008**

| Sr.No | Link / Portal | Description |
|---|---|---|
| 7 | https://spot.io/resources/cloud-optimization/cloud-optimization-the-4-things-you-must-optimize | Performance optimization in cloud computing |
| 8 | https://spot.io/resources/cloud-cost/9-free-cloud-cost-management-tools/ | cost optimization tools |
| 9 | https://aws.amazon.com/what-is/load-balancing/ | load balancing in cloud |
| 10 | https://www.cloudflare.com/learning/serverless/what-is-serverless/ | serverless computing |
| 11 | https://aws.amazon.com/what-is/container-orchestration/ | container orchestration |
| 12 | https://www.oracle.com/in/artificial-intelligence/ai-cloud-computing/#change-business | Roles and benefits of AI in cloud computing |
| 13 | https://k21academy.com/google-cloud/google-professional-cloud-architect-step-by-step-hands-on-guide/#3 | GCP Tutorial |
| 14 | https://docs.aws.amazon.com/awscloudtrail/latest/userguide/cloudtrail-tutorial.html | CloudTrail hands-on |
| 15 | https://youtu.be/8xFYaWjaDRE | Azure load balancer |
| 16 | https://youtu.be/T7XU6Lz8lJw | Azure load balancer |

**Note :**

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

**MSBTE Approval Dt. 04/09/2025** **Semester - 6, K Scheme**