NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	MTech CSE / MTech CSE (Data Science)
Course Code:	6CS273ME25
Course Title:	Cloud Computing
Course Type:	Core / Department Elective-III
Year of Introduction:	2025-26

L	T	Practical Component				C
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Course Learning Outcomes (CLO):
At the end of the course, the students will be able to:

1. explain the hardware and software concepts and architecture of cloud computing — BL2
2. examine the importance of virtualization technology in support of cloud computing — BL5
3. explore the basic ideas and principles in data center design, cloud management techniques and cloud software deployment considerations — BL6
4. discuss the issues related to cloud computing data centres. — BL6

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Fundamentals of Cloud Computing**: Cloud Computing characteristics, private, public, and hybrid cloud. Cloud types, IaaS, PaaS, SaaS, Benefits and challenges of cloud computing, public vs private clouds, Performance, Security, and Energy Efficiency	08
Unit-II	**Virtual Machines and Virtualization**: Levels of virtualization and mechanisms, Virtualization of resources, virtual clusters and resource management, Full and Para virtualization. VM level introspections	05
Unit-III	**Cloud Platform Architecture over Virtualized Data Centers:** Data-Center Design and Interconnection Networks, Architectural Design, Inter-cloud Resource Management, Cloud Security and Trust Management. High availability design, Serverless computing, Hadoop, Map-Reduce, Continuous Integration /Continuous Deployment Pipeline	06
Unit-IV	**Service quality metrics and SLAs (service level agreements):** Service scalability and resiliency metrics, SLA Guidelines, cloud usage monitor, Case study example for SLA monitor. Federation in cloud computing, related case study examples.	08
Unit-V	**Advanced cloud architecture:** Zero downtime, Cloud balancing architecture, resource reservation, dynamic failure detection and recovery architecture, cloud bursting architecture, Emerging technologies: Autonomic computing, Introduction to Edge and Fog Computing, Introduction to Dev-Ops	10
Unit-VI	**Cloud security mechanism:** cloud security threats, public key architecture, SSO, IAM, cloud-based security groups, Introduction to	08

Quantum Computing in the Cloud: Potential use cases and current advancements.

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References:

1. Rajkumar Buyya, James Broberg, Andrzej M Goscinski, Cloud Computing: Principles and Paradigms, Wiley
2. Thomas Erl, Z Mahmood and Ricardo Puttini, Cloud computing concepts, technology and architecture, Prentice Hall
3. Kai Hwang, Jack Dongarra and Geoffrey C. Fox, Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future Internet, Elsevier
4. Gautam Shroff, Enterprise Cloud Computing: Technology, Architecture, and Applications, Cambridge University Press
5. Toby Velte, Anthony Velte, Cloud Computing, A Practical Approach, McGraw-Hill Osborne Media, McGraw Hill.

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1	Getting acquainted with the simulator, such as cloud analyst and cloud report, to analyze its result based on the response time, scheduling, tasks, and number of data centres available and distance. Also, work on the other performance matrices	04
2	Learning the basic overview of launching, resizing, managing, and monitoring an Amazon EC2 instance. Monitor Your EC2 instance, Modify the security group that your web server is using to allow HTTP access, resize your Amazon EC2 instance to scale, Explore EC2 limits, Test termination protection, and terminate your EC2 instance	04
3	Exploring pre-created IAM Users and Groups, Inspecting IAM policies as applied to the pre-created groups, following a real-world scenario, adding users to groups with specific capabilities enabled, Locating and using the IAM sign-in URL, and Experimenting with the effects of policies on service access. Analyze the policy and its various keywords.	04
4	To use the Amazon Virtual Private Cloud (VPC) to create the VPC and add additional components to produce a customized network. Also, create a security group. Configure and customize an EC2 instance to run a web server and launch the EC2 instance to run in a subnet in the VPC	04
5	Learning the basic Elastic Load Balancing (ELB) services to load balance the infrastructure. To create an Amazon Machine Image (AMI) from a running instance. Create a load balancer. Automatically scale new instances. Create Amazon CloudWatch alarms and monitor the performance of your infrastructure	04

| 6 | To create an AWS Lambda function and setting up an Amazon EventBridge event to trigger the function at one-minute intervals. The Lambda function will also utilize an AWS Identity and Access | 06 |
| 7 | Configure a complete CI/CD pipeline using AWS CodePipeline for the dev-ops environment. Automate build and deployment processes using AWS CodeBuild. Deploy a sample web application to an EC2 instance. | 04 |