

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	BTech CSE, Integrated BTech (CSE)-MBA, BTech CSE (Artificial Intelligence & Machine Learning)
Course Code:	XXXX
Course Title:	Cloud Computing
Course Type:	Core / Department Elective-II
Year of Introduction:	2024-25

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Course Learning Outcomes (CLO):

At the end of the course, the students will be able to:

1. explain the core concepts of cloud computing, its services, and models (BL2)
2. select systems, hardware, and application virtualization and outline their role in enabling cloud services (BL3)
3. assess the issues related to cloud computing and its application (BL5)
4. build cloud applications using fundamental concepts of cloud infrastructures. (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	Cloud Fundamentals and Virtualization: Introduction and understanding of cloud computing, concepts, and models, Cloud enabling technologies and fundamental cloud security and requirements, virtual machines and virtualization of clusters and data centers, Applications of Virtual Machines, Implementation levels of virtualization, Virtualization structures/Tools and Mechanism, Virtualization of CPUs, Memory, and I/O devices.	09
Unit-II	Cloud Services and their design: IaaS, PaaS, and SaaS, Cloud delivery model with the perspective of the cloud provider and the cloud consumer. Data-Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Cloud Security and Trust Management: an overview.	09
Unit-III	Cloud Computing Mechanisms: Cloud Infrastructure, Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Specialized Cloud Mechanisms, Load Balancer, SLA Monitor, Failover System, Hypervisor, Automated Scaling Cloud Management Mechanisms, Resource Management System, SLA Management System, CASE STUDY examples.	09
Unit-IV	Cloud Computing Architecture: Fundamental cloud architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, advanced cloud architecture, Zero Downtime Architecture, Resource Reservation Architecture, Dynamic Failure Detection and Recovery Architecture, Storage Workload Management Architecture.	08
Unit-V	Cloud metrics and its security: Cost metrics and pricing models, Cloud usages cost metrics and SLAs, service quality metrics, Case	08

Study examples. Data Security in Cloud Computing, Security Concerns, Legal Issues and Aspects, Securing the Private and Public Cloud Architecture.

Unit-VI **Achieving production readiness for cloud services:** Industry Standards Organizations, Mapping Mechanisms to Characteristics, Cloud-Adapted Risk Management Framework, Cloud Business Case Template 02

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, Zaigham Mahmood, and Ricardo Puttini, Cloud Computing Concepts, Technology & Architecture, Prentice Hall
3. Hwang, Kai, Jack Dongarra, and Geoffrey C. Fox. Distributed and cloud computing: from parallel processing to the internet of things. Morgan Kaufmann, Elsevier Science
4. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media
5. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly
6. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press
7. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing Foundations and Applications Programming, McGraw-Hill

Laboratory Work:

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of Laboratory work.

Sr. No.	List of Experiments/Exercises	Hours
1	Getting acquainted with the simulator, such as cloud analyst and cloud report, to analyse its result based on the response time, scheduling, tasks, and the number of data centers available and distance. Useful links: http://cloudsim-setup.blogspot.com/2013/01/running-and-using-cloud-analyst.html#:~:text=Cloud%20Analyst%20is%20a%20tool,of%20users%20and%20data%20centers. http://www.cloudbus.org/reports/CloudAnalyst2009.pdf	02
2	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.	02
3	Learning the basic overview of launching, resizing, managing, and monitoring an Amazon EC2 instance. Launch a web server (using Putty) with termination protection enabled, Monitor Your EC2 instance, Modify the security group that your web server is using to allow HTTP access, resize	02

- your Amazon EC2 instance to scale, Explore EC2 limits, Test termination protection, and terminate your EC2 instance.
- 4 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. 02
- 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. 02
- 6 Learning the basic Autoscaling services to load balance the infrastructure. Create an Amazon Machine Image (AMI) from a running instance. Create a launch template and an Auto Scaling group. Automatically scale new instances. Create Amazon CloudWatch alarms and monitor performance of your infrastructure. 02
- 7 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 Management (IAM) role, granting it the necessary permissions to stop an Amazon Elastic Compute Cloud (Amazon EC2) instance within the associated Amazon Web Services (AWS) account. The other triggering Lambda function will also be analyzed (any five). 04
- 8 To create and understand the Amazon Elastic Block Store (Amazon EBS), a key underlying storage mechanism for Amazon EC2 instances. To create an Amazon EBS volume, attach it to an instance, apply a file system to the volume, and then take a snapshot backup. 04
- 9 To create and learn about the AWS Honeycode, a no-code development platform for building web and mobile applications. Creating databases, tables, and data modeling in Honeycode. Building simple web and mobile apps using Honeycode's no-code interface. To automate processes and workflows in the apps. To explore further Honeycode features for application development. 04
- 10 To learn and understand the Amazon Relational Database Service (Amazon RDS), which makes it easy to set up, operate, and scale a relational database in the cloud. It provides cost-efficient and resizable capacity while managing time-consuming database administration tasks, which allows to focus on the applications and business hosted in the Cloud. To Launch an Amazon RDS DB instance with high availability. To Configure the DB instance to permit connections from your web server. To Open a web application and interact with your database. 04
- 11 *Optional 02
- * 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.